

# 2013 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

The landscape for the College of Agricultural, Consumer and Environmental Sciences is incredibly promising. Many of the most fundamental challenges of our day require solutions informed by knowledge that is central to the identity of the college, and opportunities abound in ACES' domains of interest for our scientists, educators, students, and partners. In ACES, we are discovering, advancing and integrating new knowledge to ensure nutritious and safe food, sustainable and innovative agriculture, strong families and communities, and environmentally sound use of natural resources to benefit the people of Illinois and the world.

It is clearer than ever that ACES is in a vital position to take on imperatives identified by our principal stakeholders in their strategic thinking, including the themes of **Visioning Future Excellence at Illinois**, the critical challenges to agriculture posed by the **President's Council of Advisors on Science and Technology**, or the concepts surfaced at the recent **Illinois Food and Agriculture Summit**. In fact, across the nation and around the world, it is commonly understood that scientific knowledge and innovation are urgently needed to resolve pressing issues related to food, water, energy, and health. Our faculty, staff and students are eager to pursue these opportunities, as are colleagues and rivals among our leading peers.

Reduction to our state permanent base budget in FY 2014 was modest compared to previous years, during which ACES had experienced significantly disproportionate cuts relative to other units on campus. For the current year, the college was assessed permanent reductions of 0.25% for campus programs and administration and 1.25% for common costs. Most of the \$723,000 assessment was distributed to departments and Extension using internal guidelines accounting for revenue generation. Under the agreement with the campus to institute new campus-wide Extension initiatives, base funding for Extension was to remain at a prescribed level. However, Extension was still required to bear common cost assessments. For FY 2014, the campus implemented a 2.75% salary program and provided 0.5% on the filled faculty base for compression, market, equity, and retention issues. ACES received \$75,000 of additional salary support for deficits observed in the salary study, and the college benefitted from approximately \$1 million of incremental growth from the tuition and indirect cost recovery distribution model. The outlook for accelerated incremental growth from these sources is less optimistic.

#### University of Illinois Extension

Although Illinois is the most populous state in the north central region, Illinois's Extension faculty capacity is less than that of any peer land-grant university in the region, fewer than 18 FTE of state Extension specialists [tenure-system faculty with Extension appointments]. As Extension has markedly reduced its educator footprint in the field, the optimal strategy is to use more synchronous and asynchronous distance delivery methods to reach the public with Extension education. Research translation and program delivery from campus-based specialists has become even more important, which

requires a critical mass of campus-based specialists to provide the educational content for programs. That is the impetus for both the initiative to add several non-tenure track specialists in strategic areas with non-state funding and the campus initiative to build relevant Extension programs that explore new areas of Extension education with faculty from non-traditional units. Three non-tenure track positions were created by the college with non-state funding contributions from U of I Extension and the Illinois Agricultural Experiment Station.

Overall expenditures attributed to the college's Extension, outreach, and service activities in FY 2013 recovered by \$2.1 million [2.7%] to \$70,705,444, following an \$18.4 million drop [21.1%] the previous two years, due to budget reductions, consolidation and related factors. Over the past five years, FY 2009 to FY 2014, the total budgeted funding from local, state, and federal sources for the U of I Extension field organization fell by \$12.9 million, most of which came from 22% aggregate reduction of state appropriated funds in FY 2011 and significantly lower grant and fee activity. Base funding allocated to academic and support units within the college for Extension purposes has also declined \$1.79 million, about 35%, during the same period.

University of Illinois Extension's multi-county structure experienced stability as 42 staff positions were filled, and in some cases, additional educator positions were established based on available multi-county funds. Staffing turnover was at a low level furthering capacity to develop new programs and expand delivery of additional programs. An expanded total of 160 educator positions continued to connect in groups with like specialty titles to explore program needs and opportunities and develop new programs. The experienced staff played an important role in mentoring the significant number of newly hired colleagues, many with limited or no Extension experience. County Directors met regularly to continue building their knowledge and skills in handling personnel and fiscal responsibilities and mastering new online systems and regulations. They also continued to focus attention on maintaining contact with local funders to assure them that dollars invested in the new multi-county structure were still warranted and were able to garner a slight increase of 2% in local funds for Extension. However, the state deficit continues to be a serious concern.

The direct teaching contacts for FY13 numbered 962,486 as compared to 881,155 in FY12 and likely reflect the additional filling of 32 of the 160 established Extension Educator positions. Adoption of Lync technology by the entire campus during the past year provided a learning challenge, but also a new venue for conducting and recording online educational webinars. Few publications were produced. Instead, energy was placed on creating web-based communication of educational information. Daily hits on Extension's websites averaged 189,356, a figure comparable to the previous year.

### **Illinois Agricultural Experiment Station [Office of Research]**

The Office of Research aligns the research mission of ACES with the Illinois Agricultural Experiment Station [IAES], which operates as a statutory state-federal partnership, strategically promoting investment in research that is balanced between discovery and application, and between long-term and short-term outcomes, to increase fundamental knowledge and ensure relevance to the state's food, agricultural, environmental and human interests. This encompasses research projects in ACES and in other academic units, including the Colleges of Veterinary Medicine, Engineering, LAS, and Law and the Prairie Research Institute. The IAES also supports research with partners in other institutions and cooperates with the USDA's Agricultural Research Service, which has permanently assigned a number of scientists to the Urbana campus.

From all sources, the combined research activities of IAES/ACES accounted for \$61,132,108 [38%] of the FY 2013 expenditures in the college. The portfolio of external funding has shifted in recent years 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. The

portfolio of the IAES includes mission-oriented research to support stakeholders in Illinois, in partnership with USDA and industry entities in the state. The research infrastructure maintained by the IAES and the College of ACES includes the statewide system of field research and education centers. These centers, operated on the south farms and in several strategic locations around the state, provide essential capacity for field scale research that takes advantage of various environmental conditions represented in Illinois. Operational management of the field research and education centers is generally delegated to the respective academic departments where the programs reside, but the Office of Research participates as necessary in the effective operation and maintenance of these critical field-scale laboratories. As new development occurs on the south campus, particularly related to expansion of the research park and to accommodate the needs of the Division of Intercollegiate Athletics, the college cooperates with such units to both facilitate development and maintain excellent south farm research facilities. The Office of Research also manages central research support units on campus, such as the plant care facility.

### **Changes in the College of ACES**

Associate Dean of Extension Dr. Robert Hoeft remained in his interim position while interviews and campus procedures were followed to name his successor, Dr. George Czapar, who assumed the Associate Dean of Extension and Outreach position shortly after the end of the 2013 federal year. Dr. Czapar received all three of his degrees in agronomy. During the 1980's Dr. Czapar was an Extension staff member in Iowa and Illinois, working in the areas of integrated pest management and weed science. From 1991 to 2010 he was an Extension Educator in Springfield, and during the past three years has served as Director of the Center for Watershed Science.

### **Changes in FTE Calculations**

Research - In past years FTE data was collected administratively as part of the AD 419 reporting process. With the release of REEport in 2013 the data is now being provided directly by researchers as they complete their annual and final reports.

Extension - 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. 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 to report total FTEs 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 0.3 FTE listed for the Human Health and Human Development planned program.

### **The Planned Programs:**

Agricultural and Biological Engineering- Activities in 2013 included the monitoring of bioaerosol concentrations at the air exhaust of CAFOs with the ultimate goal of developing cost-effective control strategies to reduce bioaerosol emissions, the development of a set of specifications, schematics and devices for interfacing biosensors with portable computers including modern smartphones, the testing of drift reduction nozzles and adjuvants, work to improve our understanding of the intrinsic structural, chemical and biological changes in corn kernels and soybean seeds during storage and processing, further development of the **Illinois Manure Management Plan** planning and recordkeeping tools and the IMMP website, and ongoing Extension **Illinois Certified Livestock Manager**, soil tile drainage, and pesticide applicator training.

Agricultural and Consumer Economics- Activities in 2013 included research into the legal aspects of bioenergy, invasive species, sustainable agriculture and regulatory barriers to small-scale farming, ongoing development of the MarketMaker platform, the use of functional benefits transfer to forecast the effects of toxic waste sites on property values surrounding Areas of Concern [AOCs] in the Great Lakes, coordination with crop scientists to complete a series of agronomic trials that examined the economics of strip-cropping corn and soybeans, and ongoing review of new Dodd-Frank rules issued by the CFTC for potential impact on agricultural producers. Extension agriculture economics programs focused on profitability outlook and management challenges, programs focused on consumer decision making and the impact on college and high school students, and a new program focused on money mentoring.

Animal Health and Production- Activities in 2013 included a project that resulted in a gain in knowledge with regard to the relationship between feed efficiency measures and other production traits, a basic research project with the goal of increasing the efficiency of lean meat production in domestic animals, work to quantify metabolic and molecular interactions that alter the synthesis of milk components, and a project assessing poultry feedback responses and laying hen preferences for cage furnishings, laying hen responses to atmospheric ammonia, and broiler and turkey responses to atmospheric carbon dioxide. Extension annual statewide programs addressed animal production and health for swine, beef, dairy, sheep, goats, poultry, and horses for owners, producers, and 4-H youth.

Community Resource Planning- Activities in 2013 included the development of a new protocol for increasing the news value of social movement activities [the protocol allows social movements to more effectively identify what activities will be covered and how favorable the publicity is likely to be] and the development of findings that fill a substantive gap in our understanding of health-promoting practices in low-income, African-American households, provide direction for government food assistance programs, and document how caregivers' strategies represent intervening processes in response to the built environment. Extension activities included providing data gathering and process management assistance to communities for engaging residents in decision making and planning, programs to encourage entrepreneurship, disaster education and preparedness, and a new program developed to build participants' skills in targeting and developing marketing approaches based on characteristics and preferences of various generations. A notable success related to the importance of supporting the local economy is featured in the Evaluation section.

Food Safety and Food Security- Activities in 2013 included an investigation into the effects of sonication, sanitizers and sodium dodecyl sulfate [SDS] on the quality of fresh-cut Iceberg and Romaine lettuce, the dissemination of up-to-date information that allowed growers and buyers to more efficiently meet market demands associated with organic production, food safety regulations, **Farm to School**, and extended seasons for production and marketing, and an investigation into the potential of zein to microencapsulate bioactive, health-enhancing food components. Extension activities focused on food safety training for employees of establishments and volunteers that prepare or serve food to the public and 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 all these food safety programs. Food security programming encompassed field crop and fresh produce management and production, hunger mediation for limited resource families, and included impact evaluation for fruit and vegetable schools, food safety programs, programming for small farms and local foods, and hunger remediation.

Human Health and Human Development- Activities in 2013 included research findings that will improve our understanding of the mechanisms of soy products that reduce colon cancer risk and facilitate the identification of molecular markers associated with colon cancer development, studies that contribute to our understanding of how low levels of genestein impact progression of estrogen-dependent breast cancer to estrogen-independent breast cancer in a well-established pre-clinical model of breast cancer, a study that contributes to existing empirical knowledge by teasing out the complexities of separating in the

context of violence versus no prior history of violence, and ongoing work under the **STRONG Kids 2**, **PONDER-G** and **Child Development Laboratory Research Database** programs. Extension activities included web-based parenting education resources, and workshops and resources addressing food choices and management of chronic diseases. Impact studies encompassed the chronic disease programs, programs on building a better memory, stress reduction, and youth knowledge of healthy eating habits and physical exercise.

Natural Resources and the Environment- Activities in 2013 included the **National Atmospheric Deposition Program's** ongoing work collecting and analyzing precipitation chemistry and atmospheric chemistry samples and the dissemination of collected data to support research and education, work to improve our understanding of the role urban agriculture plays in the conservation of species and the provisioning of ecosystem services, ongoing analysis of soil samples to assess phosphorus retention in a long-term wetland, and work to evaluate the efficacy of a fire-grazing model on grasslands in the upper Midwest in terms of improving conditions for grassland birds and potential benefits accruing to livestock producers. Extension activities encompassed soil and water management, forestry, environmental stewardship, and climate change addressed through workshops, conferences, **Master Naturalist** training, and youth conservation days. Impact evaluations conducted on commercial pesticide applicator training and the youth **I Think Green** curriculum documented knowledge and practice changes with respect to protecting the environment.

Plant Health, Systems and Production- Activities in 2013 included the development of new experimental lines that were tested for yield, agronomic traits and disease and pest resistance through the **University of Illinois Soybean Breeding Program**, a study conducted to assess the occurrence of bacterial spot in Illinois, research with the goal of determining if the use of cover crops in a corn-soybean rotation is effective for reducing disease severity levels in soybean, ongoing evaluation of the **Illinois Soil Nitrogen Test [ISNT]** as a basis for fertilizer N recommendations, and oilseed research that has focused on responses of soybeans to growth under elevated ozone and carbon dioxide. Extension activities encompassed a significant number of websites and webinars addressing horticulture topics, **Master Gardener** volunteer training and contributions to plant pest diagnosis programs, and an evaluation of the impact of plant pest first detector programs and online modules.

Sustainable Energy- Activities in 2013 included work to improve our understanding of enzyme and yeast behavior with the goal of improving ethanol plant productivity and reducing energy inputs during ethanol production, the development of baseline data on the implications of using different feedstocks for biofuel production, research to improve our understanding of components that accelerate fouling in maize processing evaporators, and the development of near-infrared [NIR] spectroscopy as an inexpensive and high-throughput method for evaluating quality characteristics of *Miscanthus* genotypes. Extension activities included presentations, demonstrations, tours, displays, surveys, and field days focused on biomass and nutrient management strategies, biomass heat and power with small farm applications, woody biomass systems, and biomass and cover crop strategies.

4-H Youth Development- Activities in 2013 included 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] Becoming physically fit; [3] Thinking green by engaging youth in investigations of living things and their environment; and [4] Engaging in science. Of note, three statewide data collection studies were initiated related to youth participants' interest in science, engineering, and technology. The studies focused on three specific programs: animal science, camping, and robotics. Impact results are included in the Evaluation section of this planned program. Programs and impacts related to health and the environment are noted in other planned program sections of this report.

**Total Actual Amount of professional FTEs/SYs for this State**

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	139.0	0.0	100.0	0.0
Actual	187.0	0.0	186.0	0.0

**II. Merit Review Process**

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

- Internal University Panel
- Expert Peer Review
- Other (Extension Staff Program Teams )

**2. Brief Explanation**

Hatch proposals are first peer reviewed at the department level before being submitted to the Office of Research and then final peer review through submission to NIFA via the REEport system. In the Department of Natural Resources and Environmental Sciences, faculty members submitting Hatch proposals are asked to provide the names of two or three individuals to conduct a peer review. While the majority of the reviewers are within the department, other university colleagues may serve as reviewers. Reviewers are asked to comment on the following six areas with recommendations and suggestions as well as a final remark on how the proposal could be improved: [1] Is the subject of the proposal important? Is the proposed research adequately justified?; [2] Are the objectives well-focused and subject to easy measurement of progress?; [3] Can the objectives be attained within the proposed duration of the research?; [4] Are the best sources of fruitful collaboration, within and outside of the department, identified?; [5] Does the proposed research duplicate other projects of which you have knowledge? If so, is the duplication warranted?; and [6] Are the users of the results [clientele] identified? In the Department of Agricultural and Biological Engineering each proposal is reviewed by two peers [one internal and one external] with knowledge in the subject area and the reviewers' comments are used to help improve the proposal. In the Department of Animal Sciences all Hatch proposals are reviewed and evaluated by the standing Research Committee. The committee members are asked to review the proposals and questions are submitted to the committee chair who compiles the questions and submits them to the PI. The PI makes appropriate revisions and returns the proposal to the committee which determines approval or non-approval and send that decision to the committee chair. In the Department of Human and Community Development Hatch proposals are most typically reviewed by the Department Head. Under select circumstances [such as for a specialized field of study], the Department Head would request input or review by another full professor in the department. The review ensures that the proposed research addresses an issue of scientific and societal significance, uses appropriate research methods, includes some focus on rural populations, and would have applied or practical implications. The review also confirms that the scientist submitting the proposal is capable of conducting the proposed project and that the timeline is feasible. In the Department of Crop Sciences the merit review process is based on the review of the proposal by two faculty members [in addition, the Department Head reviews this process].

State Extension 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, encouraging the 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. Extension campus faculty [18.37 FTEs] and professional staff [3.35] are charged with leading statewide Extension programs. However, as the new organizational structure has 'settled' in, teams of educators have developed programs that have been reviewed by their peers and delivered in person or online across the state. State Program Leaders play an important role in communicating with and connecting campus and field staff with respect to educational needs and program development.

A new online performance appraisal system was created to provide an opportunity for Extension multi-county educators to self-assess their performance and provide stories about their successes in programming including its impact. County Directors reviewed and provided a merit assessment of the Extension Educators they supervised as did the appropriate State Program Leader. The County Directors also provided a performance self-assessment and their Regional Director provided a merit review assessment of the County Directors they supervised. A section of the monthly statewide staff reporting system provided an opportunity to document program impact and was accessible to staff supervisors and administrators. 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.

### **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 the general public
- Other (Department Advisory Committees)

#### **Brief explanation.**

The Dean of the College of Agricultural, Consumer, and Environmental Sciences [ACES; Robert Hauser] and Associate Deans for Research [Neal Merchen] and Extension [George Czapar] continue to be active in working with stakeholders external to the College of ACES. Stakeholders in our programs are diverse and represent many segments of the agri-food community and other units within the University of Illinois. Pertinent stakeholders who are informed and consulted about research in the AES include individual producers, commodity organizations, state and federal legislators, academic and corporate partners, and faculty and administrators at the University of Illinois. The Associate Deans also provide reports and seek input from the College of ACES External Advisory Committee; this is a diverse group of stakeholders from the agricultural production community, natural resources management groups, human sciences, and agribusiness. The annual meeting of this group creates a venue for input of the activities of the Illinois AES. The Department of Natural Resources and Environmental Sciences reaches out to stakeholders interested in improving the health and integrity of urban and natural ecosystems. Stakeholder needs are very important factors in guiding the development of mission-oriented projects in the Department of Agricultural and Biological Engineering. Investigators meet frequently with individual stakeholders in formal and informal settings as well as participating in meetings with broader

stakeholders of our college, the College of Engineering, the campus, and the university system. In the Department of Food Science and Human Nutrition the department seeks input on its research program from its External Advisory Committee which is made up of professionals in industry, government, and academia [as well as reviewing the NIFA priority areas which are based on national stakeholder input].

The college office of News and Public Affairs [NPA] also plays a crucial role in informing the public and its stakeholders about research and other activities in the college. NPA maintains an email list of almost 1,000 media outlets to which it selectively distributes approximately 400 news releases each year with over 2,000 placements in publications such as Men's Health, Reader's Digest, Shape, Parents, Prairie Farmer, Corn and Soybean Digest, Community Concierge, Farmweek, AgriNews, and Farm Journal. NPA stories also appear regularly in the Chicago Tribune, New York Times, USA Today, Huffington Post, St. Louis Post Dispatch, Boston Globe, the Globe and Mail, and locally in the Champaign-Urbana News Gazette. These placements are also due to memberships in subscription services with EurekaAlert and AlphaGalileo.

NPA also produces special printed publications. **ACES@Illinois** is a 28-page magazine that is delivered in print or electronically to ACES alumni, donors, potential students, and others who are interested in the college. The most recent issue is available at <http://aces.illinois.edu/sites/aces.illinois.edu/files/ACES%40IllinoisWinter2014.pdf>. In 2013, NPA also produced a 44-page full-color publication entitled **AdvanCES** to share research projects and findings with the public and invite feedback. The publication was also distributed at the 2013 Agronomy Day and at the Farm Progress Show. **AdvanCES** is available at <http://research.aces.illinois.edu/reports>. NPA also produces approximately 200 radio feature stories per year that are distributed to 60 outlets representing over 1,500 stations nationwide and locally on Illinois Public Media WILL-AM 580 and the website WILLAG.org.

County Directors were expected to seek input from Extension multi-county councils regarding identification of priority issues for educational programming. Eight of the twenty-seven County Directors formally reported seeking input from their councils regarding discussions of program needs, prioritizing issues to be addressed, and setting goals for the unit. This input was used to update local Plans of Work. Key informant interviews were conducted by staff to reach out to additional residents in two multi-county units. Staff in a third Extension unit issued invitations to stakeholders to attend one of three open meetings to gather information to guide the development of their local Plans of Work. A sub-committee of the Council in a fourth Extension unit was formed to discuss and identify that unit's program priority areas.

Educators and County Directors continued interactions with external groups and individuals in their Unit to stay abreast of emerging issues and programming opportunities. 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 resident participatory input. Examples of surveys distributed this past year included household needs assessment surveys intended to gather input for developing county and community plans and surveys related to supporting local foods systems, establishing a local pharmacy, establishing access to obtaining potential college coursework and degrees, interest regarding Broadband connectivity, and a survey used for making improvements in services provided by a local library. Results from these surveys initiated by community groups and leaders 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 regarding their 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
- Needs Assessments
- Use Surveys

**Brief explanation.**

The Illinois AES will seek to continue to expand stakeholder interactions in 2014. We will grow our discussions with Illinois commodity groups [such as the Corn Growers Association, Pork Producers Association, Beef Association, and Milk Producers Association]. It is expected that building corporate partnerships will continue to be emphasized and staff may be added to focus on this area. There will be greater participation in the activities of our six off-campus research and education centers. In the Department of Food Science and Human Nutrition, the fifteen members of the external advisor committee are selected with an eye toward representing a wide variety of disciplines [such as food science, human nutrition, dietetics, and hospitality management] and from industry, academic, and government institutions. In the Department of Natural Resources and Environmental Sciences, networks such as the **National Great Rivers Research and Education Center, Illinois-Indiana Sea Grant**, and the **Illinois Water Resource Research Center** have been utilized. Faculty participate in national and statewide events and committees throughout the year; in addition, local contact with organizations continues. In the Department of Agricultural and Biological Engineering, input is sought from faculty members who are in frequent contact with stakeholders. A Departmental External Advisory Committee also provides input to department programs including research. The development, corporate relations, and public engagement offices in our college and on campus also provide us assistance in engaging with stakeholders.

Extension Advisory Council members and local Extension volunteers remain as keys to providing 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 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 or 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)

- Meeting specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public

**Brief explanation.**

The Associate Dean for Research/Director of the AES engaged directly in 2013 with individuals and groups representing various stakeholders. Specific interactions include participation in the twice-annual Illinois Agricultural Legislative Roundtable sponsored by the Illinois Farm Bureau, meetings with the Board of the Illinois Soybean Association, and the Advisory Committee of the Dixon Springs Agricultural Center [our largest off-campus research and education center]. One of the greatest expansions of external interactions in 2013 involved cultivation of relationships with corporate partners. A good deal of time was invested in contacts and discussions with ADM, Kraft Foods, and General Electric in prospective partnerships with ACES and the AES. The Associate Dean also made visits to individual congressional representatives from Illinois in conjunction with the APLU/CARET meetings in Washington in February 2013. The Office of Research/Illinois AES was also represented at the Farm Progress Show in August 2013. The AES participated in inviting and arranging a visit to our campus from the Director of NIFA in December 2013. In the Department of Agricultural Engineering, stakeholder input is collected through direct interactions between faculty members and stakeholders as well as inviting stakeholders to provide their input through professional, technical, and social events. Methods utilized by the Department of Natural Resources and Environmental Sciences in 2013 included the use of webcrawlers to better understand connections from known stakeholders to those less known, free-listing protocols and social surveys, focus groups, annual meetings, and Internet-based video and follow-up surveys. In the Department of Animal Sciences, input is collected through faculty member's ongoing relationships with major commodity groups and industry partners as well as their participation as liaison or ex-official board members for the Beef, Swine, Dairy and Equine state associations. The department also has an external advisory committee of 8-12 members that represent various corporations, commodity groups and the general public.

As mentioned previously, the process most often used by Extension to collect input involved informal conversations proactively initiated by professional staff with current funders, key community leaders, Extension Council members, and Extension volunteers. Staff in a few units initiated more formal methods to seek input that included key informant interviews with agencies and invitations to attend meetings designed to seek input. Community and Economic Development Extension Educators assistance with survey distribution and analysis yielded information about needs that Extension could use in developing education responses, as well as uses the primary entity was seeking in sponsoring the survey. In addition, the majority of Extension programs included end-of-program surveys that sought suggestions for additional topics for future programs.

**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 Staff Hiring Process
- 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 research activities [and indirectly in promotion and tenure decisions for faculty].

In the Department of Natural Resources and Environmental Sciences, for example, input was used to reallocate resources and modify research questions to better address scientific and stakeholder needs. Specifically, input improved the quality of contractors used by community partners for garden installation by reporting feedback from residents. The input received from NRES stakeholders allows the department the opportunity to evaluate current programs within teaching, research and Extension. As an added benefit, stakeholder input provides a guideline for trends that impacts course content for undergraduate and graduate students. In the Department of Agricultural and Biological Engineering stakeholder input is discussed in department meetings and plays a significant role in the development of plans of action and ultimately the shaping of department activities. Stakeholder input [through recommendations from the External Advisory Committee] in the Department of Food Science and Human Nutrition influences the strategic planning process and has resulted in changes being made in the department.

Extension staff members were encouraged to involve Extension Council members in reviewing, and if warranted, revising the 3-5 priorities to be reflected in a FY 2013 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 of various methods of technology.

### **Brief Explanation of what you learned from your Stakeholders**

The Associate Dean for Research/Director of Illinois AES had many consultations with members of the agricultural and food sector in Illinois as well as with colleagues at other AES from throughout the U.S. Stakeholders from these groups continue to hold high value in the AES serving as the conduits for 'mission-based' research. Within Illinois, there is much interest and willingness to support activities at our research and education centers. One of our seminal research and outreach programs - the Farmdoc program [<http://www.farmdoc.illinois.edu/>] receives strong testimonial to its value in providing management and economic information.

The most systematic review by stakeholders associated with the Illinois AES was the continued visioning exercise led by the Illinois Farm Bureau. This was mentioned in our 2012 report in which we discussed the report [titled 'A Consensus Report of Illinois Agricultural Producer Leaders and University Agricultural Research Administration']. One of the fundamental recommendations in that report was a conclusion that the Illinois agricultural sector should collaborate to develop and agree upon a future-focused priority agricultural research agenda. Another stride in development of such an agenda occurred in 2013 with the conduct of a comprehensive survey of producers affiliated with eight producer organizations in Illinois. The

purpose of the survey was to compile thoughts regarding perceived areas of need in our research portfolio. Research needs identified by this survey fall into five broad categories: [1] Improve the environmental impact of agriculture in Illinois; [2] Advance crop genetics; [3] Improve nutrient management practices; [4] Expand market opportunities for Illinois agricultural products; and [5] Development of new products from Illinois commodities. Further activities in this exercise will include analysis of gaps in our research capacity to fulfill these needs and an assessment of the agricultural biosciences opportunities and impact in Illinois.

Key findings received from stakeholders through the Department of Animal Sciences focused on research findings related to beef cattle efficiency in response to various feedstuffs, genomic testing of cattle and dogs for recessive traits, immunological responses to stress in animals and humans, utilization of corn co-products by swine and poultry, and the impact of growth enhancers on meat quality in swine. Stakeholder input through the Department of Food Science and Human Nutrition found that interest was high in food processing and food safety [particularly related to sustainability in energy use during processing and the environmental impacts of producing a safe food supply], health and wellness [as nutrition is the intersection for health promotion and disease prevention], the use of trans-disciplinary clusters of researchers to attack societal grand challenges, and the translation of research findings from the laboratory to actions that can have a global impact.

Extension stakeholders who serve as Extension volunteers remain strong supporters for the **4-H Youth Development** program and **Master Gardener** program and for a local physical presence in each county and allocate financial resources to sustain that presence. Volunteers who completed a statewide volunteer survey in 2012 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

<b>1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)</b>			
<b>Extension</b>		<b>Research</b>	
<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
8884107	0	6307980	0

<b>2. Totaled Actual dollars from Planned Programs Inputs</b>				
<b>Extension</b>			<b>Research</b>	
	<b>Smith-Lever 3b &amp; 3c</b>	<b>1890 Extension</b>	<b>Hatch</b>	<b>Evans-Allen</b>
<b>Actual Formula</b>	6102692	0	6937204	0
<b>Actual Matching</b>	6102692	0	6937204	0
<b>Actual All Other</b>	37830657	0	38170360	0
<b>Total Actual Expended</b>	50036041	0	52044768	0

<b>3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous</b>				
<b>Carryover</b>				
	6102692	0	4496486	0

**V. Planned Program Table of Content**

S. No.	PROGRAM NAME
1	Agricultural And Biological Engineering
2	Agricultural And Consumer Economics
3	Animal Health And Production
4	Community Resource Planning And Development
5	Food Safety And Food Security
6	Human Health And Human Development
7	Natural Resources And The Environment
8	Plant Health, Systems And Production
9	Sustainable Energy
10	4-H Youth Development
11	Childhood Obesity
12	Climate Change
13	Food Safety

**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	20%		15%	
133	Pollution Prevention and Mitigation	5%		10%	
141	Air Resource Protection and Management	35%		10%	
401	Structures, Facilities, and General Purpose Farm Supplies	10%		15%	
402	Engineering Systems and Equipment	15%		25%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
404	Instrumentation and Control Systems	0%		10%	
405	Drainage and Irrigation Systems and Facilities	10%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	3.0	0.0
Actual Paid Professional	0.0	0.0	4.7	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
12205	0	314296	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
12205	0	314296	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
64027	0	1066437	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities in 2013 included ongoing characterization of plots for the purpose of DSSAT calibration [**Decision Support System for Agrotechnology Transfer** is a software application program that comprises crop simulation models for over 28 crops], the monitoring of bioaerosol concentrations at the air exhaust of CAFOs with the ultimate goal of developing cost-effective control strategies to reduce bioaerosol emissions, efforts to improve the efficiency of liquid agricultural chemical application systems, the development of a set of specifications, schematics and devices for interfacing biosensors with portable computers including modern smartphones, efforts to increase our knowledge base with regard to hydrothermal liquefaction and direct pyrolysis of specific high-impact agricultural residuals as well as for algae [which we are using to recycle waste nutrients from agricultural residuals into useful products], testing of drift reduction nozzles and adjuvants for use on Dicamba applications, work to improve our understanding of the intrinsic structural, chemical and biological changes in corn kernels and soybean seeds during storage and processing [this will lead to a better predictions of the nutritional value of delivered corn and soybeans and new food processing techniques to increase bioavailability and stability of micronutrients in fortified foods], further development of the **Illinois Manure Management Plan** planning and recordkeeping tools and the IMMP website [www.immp.uiuc.edu], the development of a machine for mechanical weeding for corn, new crop-based guidance mechanisms for our agricultural robot, several novel techniques to measure the yield of energy crops based on machine vision, and the improvement of techniques for low-cost micro-environment monitoring and control [these allow users to estimate how much water to use during mist or fogging in plant-propagating settings].

Conference presentations included the American Society of Agricultural and Biological Engineers, American Society of Chemistry, American Society of Chemical Engineers, Illinois Pork Expo, and Certified Livestock Manager Training workshops.

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

With limited Extension specialist FTE's, Extension has chosen to expand outreach through websites. The **Manure Central** website [www.immp.uiuc.edu] experienced over 150,000 web page views this past year and consists of several sections that include: [1] **Certified Livestock Management Training**

materials and the **Illinois Manure Management Plan** designed to help livestock producers in developing manure management plans that result in safer and more efficient use of manure. The website allows customization of the plan to meet a given producer's needs and facilitates any required annual updates. [2] **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. [3] The **Small Farms Manure Management** website for individuals with less than 300 animal units [4,000+ page views]. [4] **EZregs** for users who have established accounts to store their questions and Extension responses related to identifying environmental regulations that pertain to specific agricultural and horticultural operations and practices in Illinois. [5] **Compost Central** which features resources for composting of livestock manure, food scraps, and yard waste. Training was also provided for custom manure haulers in Illinois, providing certification and testing on a voluntary basis.

Two online modules for certified crop advisers on how tiling can be used to control water table levels and use of bioreactors to reduce nutrient loading into surface water were completed this year. 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 accurately applied and encompassed information related to spraying equipment. The **Corn and Soybean Classics** series included a presentation by an agricultural engineering Extension specialist on calibrating sprayer quality requirements for pesticide applicators. 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, there were 44,000 page views on the **Agriculture Safety and Health** website.

This year's **2013 4-H National Youth Science Day: Maps and Apps** reached more than 3,500 youth ranging from elementary school through high school who participated in a set of activities that involved designing their ideal park and using GIS mapping to solve community problems and contribute data about their community to the United States Geological Survey.

## 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, students and researchers in the areas of biosensors and nanotechnology as applied to agriculture, the asphalt industry, the wastewater treatment industry, aerial applicators, commercial ground rig applicators, private ground rig applicators, pesticide adjuvant manufacturers, pesticide registrants, custom manure haulers, state and federal regulatory agency representatives, livestock commodity group representatives, Extension field staff and educators, and the horticultural research community. 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

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	726	2672	1867	0

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

**Patent Applications Submitted**

Year: 2013

Actual: 2

**Patents listed**

TF 12087-PRO2 [Particle Tracking System] and TF 12087-US [Particle Tracking System and Method].

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	37	37

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

Year	Actual
2013	4

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number Of Subsurface Bioreactor Acres In Illinois
2	Producer Reported Changes/Improvement In Manure Management And Application Method To Reduce Odor
3	Producer Reported Knowledge Changes Related To Manure Management
4	Developing Cost-Effective Control Strategies To Reduce Bioaerosol Emissions
5	Turning The Residual Waste Products That Currently Cause Significant GHG Emissions Into A Carbon Sink
6	Maximizing Efficiency And Minimizing Drift For Agricultural Aerial Applications
7	Improving Emission Control Technologies For Livestock Buildings
8	Development And Use Of A Manure Management Plan

## **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**

<b>Year</b>	<b>Actual</b>
2013	0

### **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. 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. No new bioreactor acres were installed in Illinois in 2013. Rather, the Natural Resources Conservation Service has established a program for cost sharing on bioreactors and has held training sessions for field staff with program implementation scheduled for late 2014.

#### **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. The protocol has been adopted by the NRCS. This database is fully populated for

Illinois, Ohio, Indiana, North and South Dakota, Michigan, 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

Producer Reported Knowledge Changes Related To Manure Management

Not Reporting on this Outcome Measure

#### Outcome #4

##### 1. Outcome Measures

Developing Cost-Effective Control Strategies To Reduce Bioaerosol Emissions

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Mitigation of bioaerosol emissions from concentrated animal feeding operations [CAFOs] demands knowledge of bioaerosol concentrations feeding into an end-of-pipe air treatment process. Monitoring bioaerosol concentrations at the air exhaust of CAFOs can offer essential information for developing cost-effective control strategies to reduce bioaerosol emissions. As two often selected indicators for bioaerosol contamination, airborne endotoxin and [1-3]-b-D-glucan are associated with the occurrence of atopy and acute and chronic respiratory symptoms, such as pulmonary inflammation, nonallergic asthma, airway obstruction, and decreased lung function. Endotoxin is a cellwall component of gram-negative bacteria. They are released when bacterial cells are lysed or at the multiplication stage.

#### What has been done

In this study, samples of total suspended particulate [TSP] at the air exhaust of swine and poultry CAFOs were collected to determine total endotoxin and [1-3]-b-D-glucan concentrations using kinetic chromogenic Limulus amoebocyte lysate [LAL] assays. The aim of this preliminary study was to measure total endotoxin and [1-3]-b-glucan concentrations at the air exhaust of 18 commercial CAFOs and to examine their variability with animal operation type [swine farrowing, swine gestation, swine weaning, swine finishing, manure belt laying hen, and tom turkey] and season [cold, mild, and hot]. The measured airborne concentrations of total endotoxin ranged from 98 to 23,157 endotoxin units [EU]/m<sup>3</sup>, and the airborne concentrations of total [1-3]-b-D-glucan ranged from 2.4 to 537.9 ng/m<sup>3</sup>. Animal operation type in this study had a significant effect on airborne concentrations of total endotoxin and [1-3]-b-D-glucan but no significant effect on their concentrations in total suspended particulate [TSP]. Both endotoxin and [1-3]-b-D-glucan attained their highest airborne concentrations in visited tom turkey buildings. Comparatively, season had no significant effect on airborne concentrations of total endotoxin or [1-3]-b-D-glucan. Endotoxin and [1-3]-b-glucan concentrations in TSP dust appeared to increase as the weather became warmer, and this seasonal effect was significant in swine buildings. Elevated indoor temperatures in the hot season were considered to facilitate the growth and propagation of bacteria and fungi, thus leading to higher biocomponent concentrations in TSP.

#### Results

These findings suggest that endotoxin and [1-3]-b-D-glucan may attain their maximum emission rates in summer. It is therefore recommended that particular attention should be paid to further investigating summertime bioaerosol emissions from animal feeding operations and the emissions' impact on neighboring communities.

### 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
404	Instrumentation and Control Systems

## **Outcome #5**

### **1. Outcome Measures**

Turning The Residual Waste Products That Currently Cause Significant GHG Emissions Into A Carbon Sink

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The objectives of this project are: [1] To demonstrate integrated algal production systems that treat agricultural residuals. We will investigate and optimize the performance of mixed-algal treatment systems that provide water quality improvements and new biomass feedstocks derived from agricultural residuals and atmospheric carbon. The carbon capturing capabilities and efficiencies will be determined during this process. [2] To investigate the mechanisms of hydrothermal liquefaction [HTL] processes to produce valuable products. Bench and pilot-scale reactors will be used to investigate the novel treatment systems and to develop and quantify key process performance criteria including feedstock recipe, operating conditions, reaction rates, water usage, water quality improvements, yield of valuable products, and greenhouse gas reductions that can be used for scale-up in industrial applications.

#### **What has been done**

In 2013, effort has been focused on developing a new laboratory that will integrate HTL-ABT at the University Swine Research Center. This new lab will provide a one-stop visit of crude oil production, algae growing, wastewater treatment, nutrient recycling and carbon capture.

#### **Results**

Through this project, we are introducing a potential paradigm shift in the climate change impacts of agricultural activities by turning the residual waste products that currently cause significant GHG emissions into a carbon sink sufficient in size to offset all the other emissions of the agricultural enterprise. We will significantly increase our knowledge base on hydrothermal liquefaction and direct pyrolysis of specific high-impact agricultural residuals as well as for algae, which we are using to recycle waste nutrients from agricultural residuals into useful products. As a result, we will also improve the knowledge base for culturing fast-growing algae in wastewater treatment situations and the cleaning of these wastewaters provided by the algae.

#### 4. Associated Knowledge Areas

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

#### Outcome #6

##### 1. Outcome Measures

Maximizing Efficiency And Minimizing Drift For Agricultural Aerial Applications

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The primary objective of this project is to evaluate nozzle performance, both selection and usage, and with the inclusion of spray adjuvants. The goal will be to create recommendations for various application scenarios common to agriculture in Illinois, both aerial and ground, that maximize efficacy while minimizing drift.

###### **What has been done**

The following individual projects are being conducted to meet this objective: [1] Evaluation of various adjuvants for efficacy and drift control for low-volume aerial applications of fungicides on corn [adjuvants to be tested include deposition aids, surfactants, crop oils, and others]; [2] An investigation of how various pesticides and adjuvants impact the spray droplet size and pattern uniformity for aerial applications [pesticides will primarily be foliar fungicides commonly applied to corn in Illinois and adjuvants to be tested include deposition aids, surfactants, crop oils, and others]; [3] A study to determine how swath width, application height, and weather factors impact the uniformity of low-volume aerial applications on corn [the spray patterns will be measured using a monofilament line strung through a corn field at ear height]; [4] Measurement of the

differences in efficacy and drift reduction of various nozzle types used in aerial application; [5] Comparison of the efficacy of a low-volume aerial application and a high-volume ground application; [6] Determination of the impact the use of automatic spray rate controllers has on spray droplet spectrum and application uniformity [popular nozzle types and sizes will be examined at pressures throughout their pressure range to determine how the droplet size and pattern width changes and the pressure increases]; and [7] A study to determine the impact various pesticides, deposition aids, and surfactants have on the spray droplet spectrum of popular ground application nozzles.

**Results**

Testing of drift reduction nozzles and adjuvants for use on Dicamba applications was conducted on glyphosate-resistant waterhemp. Results confirmed past research that these tools can be successfully used. The project to evaluate swath width, application height, and how weather factors impact uniformity of applications of fungicide in corn was completed, as was the study to determine the impact of adjuvants on these applications.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 #7**

**1. Outcome Measures**

Improving Emission Control Technologies For Livestock Buildings

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Biofilter packing materials and an innovative trickling biofilter were evaluated for their effectiveness in controlling ammonia emissions from swine buildings.

#### **What has been done**

A new style of biofilter container was designed, constructed and demonstrated on the University of Illinois livestock farm. Instrumentation was installed on the new biofilter to monitor ammonia removal and concentrations of other gases. A biofilter demonstration site was developed for swine producer training on how to design, construct, and manage biofilters for ventilation air cleaning. We conducted studies of various biofilter media, especially airflow characteristics linking particle size distribution, moisture content, and other factors. Ammonia removal of biofilters was studied in relation to moisture content of target organic media. We now have a much better understanding of the ammonia removal process as related to moisture content of organic media. We are better able to predict ammonia removal based on media moisture content and ammonia loading history. We have an improved algorithm for the biofilter design process based on media airflow characteristics and particle sizing. Biofiltration technology for reduction of emissions from swine wean-to-finish confinement buildings was also tested. A set of five similar swine buildings on a single farm [one control and two sets of two buildings for treatments] were instrumented with continuous air sampling equipment. Final data analysis showed the effectiveness of the emission control systems.

#### **Results**

Biofilter experiments and demonstrations give livestock producers new information regarding the selection of, and investment in, emission control technologies for mechanically ventilated animal buildings. Research results have allowed us to develop new tools for teaching biofilter design and management to producers, contractors, consultants, agencies, and other stakeholders. We held two workshops for agency staff, farmers, and agribusinesses to demonstrate biofilter construction and maintenance.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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**

Development And Use Of A Manure Management Plan

##### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### 3a. Outcome Type:

Change in Condition Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	123

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Improper manure management has environmental consequences and livestock and poultry producers face challenges in understanding and minimizing these negative impacts.

#### What has been done

Educational efforts included: [1] Continued maintenance and updating of the Illinois Manure Management Planner website [<http://web.extension.illinois.edu/immmp/auth/login.cfm>] which is used by stakeholders to learn about manure management and to access resources to create Manure Management Plans for facilities; [2] Training, certification and testing programs were conducted for custom manure haulers [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]; [3] Annual training for the Certified Livestock Manager Training program was conducted at eight sites across the state. This state program requires livestock and poultry producers to attend training and become certified once every three years. The curriculum includes key information on best management practices, nutrient management information, and updates on regulations and associated information; [4] Input was provided for a Comprehensive Nutrient Management Plan [CNMPS] course curriculum being developed by another state similar to the one developed in Illinois to certify Technical Service Providers [TSPs] who act as consultants for livestock producers that must implement improvements to manure management plans on their farms. These TSPs specialize in developing comprehensive nutrient management plans for producers that are actively using conservation practices and implementing the latest best management practices.

#### Results

Results included: [1] The Illinois Manure Management Planner website received 7,115 accesses, with 65 new accounts created, and 58 plans updated and/or modified; [2] Forty-two 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. All 42 individuals passed the Level Two exam for custom applicator certification; [3] Two hundred seventy-four [274] individuals attended the Certified Livestock Manager Training programs. According to the survey data, 88% of attendees responded that they currently had manure management plans. Of these respondents, 50% updated and used their plan annually.

#### 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

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

##### Commercial Pesticide Applicator Training

A survey of practice changes was mailed to a random sample of 498 of the 5,874 participants in the 2011-12 Commercial Pesticide Applicator training program. The 295 completed surveys represented 59% of those who completed the survey. In response to the question asking them how much they had improved implementation of practices as a result of the training, 188 [65.7%] indicated improving calibration procedures [frequency, accuracy, and measurement], 154 [53.8%] improved equipment maintenance [inspecting, cleaning, and replacing worn nozzles], and 151 [52.8%] improved changing type, size, or materials for the nozzles used.

##### Key Items of Evaluation

**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	15%		15%	
603	Market Economics	0%		10%	
604	Marketing and Distribution Practices	10%		10%	
605	Natural Resource and Environmental Economics	0%		10%	
606	International Trade and Development	0%		10%	
607	Consumer Economics	50%		15%	
610	Domestic Policy Analysis	0%		10%	
801	Individual and Family Resource Management	25%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	11.0	0.0
Actual Paid Professional	0.0	0.0	6.9	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
122054	0	484307	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
122054	0	484307	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
640270	0	2108621	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities included an expansion of work on grain quality and grain loss in Brazil, research into the legal aspects of bioenergy, invasive species, sustainable agriculture and regulatory barriers to small-scale farming, ongoing development of the **MarketMaker** platform, a study that compares household finance between U.S. households and Chinese households with the goal of gaining a better understanding of the impact of mandatory saving for housing [the Housing Provident Fund program] on Chinese household's saving, investment, and consumption decisions, ongoing review of new Dodd-Frank rules issued by the CFTC for potential impact on agricultural producers, research findings that proposed policies for stormwater pollution mitigation underestimate the potential effects and economic benefits of low-impact alternatives for urban development, the use of functional benefits transfer to forecast the impact of toxic waste sites on property values surrounding areas of concern [AOCs] in the Great Lakes, the estimation of the value people in Illinois place on hypothetical restored grasslands with varying levels of biodiversity, the use of structural equation modeling to examine the reasons firms undertake proactive environmental management and the role of management attitudes in inducing adoption of environmental management and pollution prevention practices, the development of a theoretical model to predict the spatial spillover effects of forest protection, the development of a model of household foraging choice to simulate how much leakage occurs in response to protected areas placed in different parts of a forest landscape and how leakage impacts biodiversity and human welfare, work to identify when unilateral carbon policy is likely to improve or decrease total carbon emissions and the welfare of consumers, the coordination with crop scientists to complete a series of agronomic trials that examined the economics of strip-cropping corn and soybeans, and the organization of a series of large, long-term, internationally-coordinated and geographically-diverse on-farm fertilization and seed rate trials run with participating farmers using precision agriculture technology.

Conference presentations included the International Food and Agribusiness Management Association, Applied and Agricultural Economics Association, Lemann Institute for Brazilian Studies, Agricultural Law Symposium of the American Agricultural Law Association, European Congress on Rural Law, Agritourism and Organic Conference, Illinois State Bar Association Law Education Series Hot Topics in Agricultural Law, University of Arizona College of Law Faculty Seminar, University of Arizona Economics, Law, Environment and Governance Seminar, Food Distribution Research Society, National Value Added Agriculture Conference, MarketMaker State Partner Meeting, United Fresh Trade Show, Urban Affairs Association, and the Global Grain Chicago Conference.

Extension specialists conducted the annual **Illinois Tax Schools** in 30 locations throughout the state as well as 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 experience using **Crop Insurance Decisions**, **Balance Sheet**, and several risk management Microsoft Excel-based tools. A presentation on overall grain farm profitability and rotation impacts was also delivered at each of the seven **Corn and Soybean Classics**. Crop budgets and risk management through crop rotation were addressed at the four regional **Crop Management Conferences**.

The addition of two more Extension Educators with consumer economics as their area of expertise [for a total of four positions] supported expanded programs this past year that included the **Financial Wellness Peer Educator** program that involved 10-15 college student interns each semester in providing financial guidance to college students through Facebook, Twitter, YouTube, an e-newsletter with 1,200 subscribers and a webinar series entitled '**Get \$avvy: Grow Your Green Stuff**' focused on helping college students to manage their finances. Work continued on revising and updating **All My Money**, a train-the-trainer curriculum for working with limited resources audiences. Other outreach included the **Plan Well, Retire Well** blog [223,000 page views for the year] and e-newsletters sent to 2,296 subscribers and **America Saves** conducted during America Saves week that involved over 750 people in a friendly competition format that challenged them to set a savings goal. Topics on retirement financial tips, theft and identifying scams targeting seniors resulted in participants clearly gaining new knowledge and taking action based on their responses to an evaluation seeking their input. **Master Money Mentors**, a volunteer training program, was also initiated this year.

In the Chicago area, programming also focused on educating consumers through a smart solutions financial education series targeted for senior residents and another four-week workshop on smart investing. Other programs delivered in the Chicago area addressed reverse mortgages and financial recovery that included tools to start a plan for participants who have experienced a financial setback. Staff and volunteers in 14 multi-county units also 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 future income and expenses.

## 2. Brief description of the target audience

Members of the target audience included practicing lawyers and academic lawyers in the U.S. and abroad, government regulatory agencies, farmers, processors and retail distributors of agricultural products, private firms with agricultural interests, policy makers, industry managers, researchers in the areas of consumer economics and urban affairs [such as the American Council of Consumer Interest, the Asian Consumer and Family Economics Association, and the Urban Affair Association], major grain firms, input suppliers, and related agribusiness entities that deal directly with producers and have sufficient size to be classified as Eligible Contract Participants under CFTC regulations. 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?

Three Illinois individuals are members of the Financial Security for All eXtension Community of Practice.

## V(E). Planned Program (Outputs)

**1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	10372	2517	956	1760

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

**Patent Applications Submitted**

Year: 2013

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
<b>Actual</b>	0	53	53

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

Year	Actual
2013	2

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Page File Requests Made To Farmdoc
2	Number Of Web Hits On The Varietal Information Program For Soybeans Website
3	Number Making Decisions To Reduce Risk In Agriculture Production
4	Identification Of Strategies For Increasing Producer Value
5	Ongoing Development Of MarketMaker
6	Increased Knowledge And Skills In Managing Income And Expenses

## **Outcome #1**

### **1. Outcome Measures**

Page File Requests Made To Farmdoc

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Condition Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	9684612

### **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](http://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 2013 nearly 10 million page requests and 2 million visits 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 Condition Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	370518

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The main goal of this research is to disseminate soybean production research results on a varietal basis to soybean producers, academic researchers, and the agricultural industry. The VIPS database and website is unique in that it makes public information on production performance of soybean varieties planted throughout the state of Illinois. The information is updated at harvest each year giving users details on yield, disease, insect and pest resistance as well as key quality results such as protein and oil quantities and even amino acid profiles. This information is valuable to researchers as well as consumers. For soybean producers, it is a tool that allows them to make a more informed decision on what varieties to plant next season.

###### **What has been done**

A newly designed VIPS website, [www.vipsoybeans.org](http://www.vipsoybeans.org), was developed and refined. New reports were added and updated. The key to this redesign was incorporating information from discussions with users to make the interface easier and more approachable for the busy soybean producer. A mobile phone application for VIPS was also created as a result of discussions with soybean farmers and others in the agricultural industry on how they best access information. Having this new mobile portal allows users quicker access to the site regardless of their access to

a computer. Now growers can visit VIPS throughout the year whether they are home or in a tractor or harvester.

Increased emphasis was placed on highlighting the importance of quality traits in the soybean crop and how varietal selection plays a great role in achieving critical quality targets, especially for our export customers. Results of testing done on samples for protein and oil levels and even more information on the amino acid profiles found in the soybean samples are included. Tying all of this to value is also important and incorporating and updating the EPV [estimated processor value] figure in VIPS is another newer addition to the program.

### **Results**

The VIPS program has evolved to become more user friendly and more versatile through the website renovation and the new addition of the VIPS App. The program has been demonstrated at a number of industry meetings to showcase the redesign and the usability of the updated reports. A number of presentations were also developed and delivered to soybean producers as well as consumers from Illinois and around the world. As a result of the VIPS site, soybean producers have a unique one-stop tool that provides updated information on soy variety yield, disease and insect resistance, value, and quality traits. In an environment where growers have to make challenging decisions on what varieties to invest in, they need the best information available on how these varieties have performed to help them in their decision making process. Thousands of users visit the VIPS website each year, not just from Illinois, but from around the world to learn more about the options in soy varieties and to access information on soybean diseases, insects, pests, and weeds. This is truly a valuable on-stop location for anyone interested in soy production and quality.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation
603	Market Economics
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**

Identification Of Strategies For Increasing Producer Value

#### **2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

There is a fundamental policy issue for agricultural sectors in both developing and developed countries: How to create more value at the producer level. One thesis is that value creation and capture at the producer level will occur through value adding and differentiation. This is called value capture through differentiation. An alternative thesis holds that often agricultural production involves products that have entrenched commodity characteristics. Under such conditions value creation and capture will involve achieving economies of scale, structural shifts in demand, and broad-based production economies. This is called value capture through aggregate demand and supply shifters. The socio-economic and political implications of these differing policy alternatives are significant. The cost of an error in policy choice and implementation of a strategy is costly to developed countries, but is devastating to developing countries. This research provides scientifically-based insights and guidance about this very issue where the correct outcome differs by product, country, and industry structure, and often success does not entail a binary choice but measured balance of both approaches.

**What has been done**

Work has expanded on the subject of grain quality and grain loss in Mato Grosso, Brazil. Funding was requested and awarded to look at issues of grain quality, storage, and double crop production in the world's largest and fastest-growing agricultural state. Two articles have been submitted for review on post-harvest loss of grains. Recent presentations have been made at the annual meeting of the International Food and Agribusiness Management Association, the Applied and Agricultural Economics Association, the Lemann Institute for Brazilian Studies, and numerous industry audiences in the U.S., Brazil, and Argentina.

**Results**

This body of work on the industrial economics of tropical soybean production lead to a successful grant application with USAID. The PI of this project serves as the principal investigator for the five-year, \$25m Feed the Future Innovation Laboratory for Soybean Value Chain Research that commenced in the fall of 2013. Products developed included Global Food in 3D agricultural data visualization software for strategic decision making and an agro-industrial marketing curriculum [this is the only course in the nation that focuses on agro-industrial marketing, which underlies the buying and selling of grain and grain products].

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
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603	Market Economics
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
606	International Trade and Development
610	Domestic Policy Analysis

**Outcome #5**

**1. Outcome Measures**

Ongoing Development Of MarketMaker

**2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

**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, we piloted the Jobs Portal on Iowa MarketMaker in 2013 on the Buyers-Sellers forum. This new feature allows businesses to post available jobs, which are then swept by U.S. Jobs.com. This was a pilot project and we received job postings and feedback from businesses of all sizes, including large corporations. We will add this feature to all states before the 2014 growing season in an attempt to impact seasonal workforce movement. Second, the

new profile-to-profile connections allow farmers to link with others 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 new added feature here is that businesses can now send e-mail blasts to everyone they are connected to, or they can send targeted e-mail messages. During 2013 MarketMaker continued developing the working relationship with Feeding America, the nation's leading hunger relief organization and network of food banks. In January 2013 we launched a pilot project in Georgia in collaboration with Feeding America that better allows Georgia produce growers to share excess product. A great deal of knowledge was gained concerning how producers would like to utilize this technology; however weather conditions complicated the pilot.

### **Results**

MarketMaker partners are actively engaged in outreach, training, and education to farmers, consumers, and food-related enterprises on a broad variety of topics related to food production, processing, storage, distribution, and value added marketing of food. Such education is essential for new producers to become familiar with food safety best practices. This training also helps them get the full benefit of the internet by marketing through MarketMaker. MarketMaker partners have historically shared resources, best practices, and mentoring in an informal manner among the states. This has been a key component to MarketMaker's success. While the level of collaboration across all 20 states has varied, the expansion of the MarketMaker network is making it increasingly difficult to share resources. Providing additional incentive awards allows a new concentration on transmitting knowledge effectively. The best practices recognition program encourages states to carefully document and share their innovative efforts in outreach and marketing related to MarketMaker. Once documented in award applications, the winning best practices can be easily shared among MarketMaker partners. This allows all states the opportunity to extend MarketMaker to benefit their farmers.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
607	Consumer Economics
801	Individual and Family Resource Management

## **Outcome #6**

### **1. Outcome Measures**

Increased Knowledge And Skills In Managing Income And Expenses

### **2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	1312

**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.

**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.

**Results**

At the end of the Welcome to the Real World simulation, evaluation forms were completed and collected from 1,760 youth participants located across Illinois. The evaluation was designed to identify increased knowledge of financial management. The evaluation asked students to evaluate five money management skills choosing between 'learned how to do' or 'already knew how to do'. Of the 1,760 youth respondents, 1,312 [76.4%] indicated that they learned at least one of the five skills: [1] 1,083 [62.6%] reported learning how to balance income and expenses; [2] 936 [54.4%] learned how to open a savings account; [3] 834 [47.9%] gained skill in keeping track of savings; [4] 817 [47.2%] learned how to balance a checkbook; and [5] 407 [23.4%] learned how to write a check.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

### **Brief Explanation**

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

#### **Welcome to the Real World**

At the end of the **Welcome to the Real World** simulation, evaluation forms were completed and collected from 1,760 youth participants located across Illinois. The evaluation was designed to identify increased knowledge of financial management. The evaluation asked students to evaluate five money management skills choosing between 'learned how to do' or 'already knew how to do'. Of the 1,760 youth respondents, we found that: [1] 1,312 [76.4%] indicated that they learned at least one of the five skills; [2] 1,083 [62.6%] reported learning how to balance income and expenses; [3] 936 [54.4%] learned how to open a savings account; [4] 834 [47.9%] gained skill in keeping track of savings; [5] 817 [47.2%] learned how to balance a checkbook; and [6] 407 [23.4%] learned how to write a check.

Students were asked to indicate their awareness or knowledge of three items related to a future career after, as compared to before, they participated in **Welcome to the Real World** by checking 'Not Much', 'A Little', or 'A Lot'. Forty-five [69%] indicated increasing their awareness or knowledge for at least one of the three items after participating in the program. Levels of students who indicated increases for a given item follow. The numbers do not include those whose ratings remained the same after as compared to before the program or those who failed to provide both a 'before' or an 'after' rating. We found that: [1] 718 of 1,740 [41.2%] indicated increasing their awareness or knowledge of the relationship between education and job; 645 of 1,730 [37.3%] of the students indicating increasing their awareness or knowledge of the relationship between a job and money; and [3] 415 of 1,765 [23.9%] of the students indicated increasing their awareness or knowledge of the importance of getting more education after high school.

### **Key Items of Evaluation**

**Welcome to the Real World**

The simulations help youth 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	10%		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	25%		20%	
806	Youth Development	20%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	3.5	0.0	20.0	0.0
Actual Paid Professional	0.0	0.0	10.4	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
30513	0	1581488	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
30513	0	1581488	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
160068	0	9180697	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities included ongoing trials with the goal of determining the influence of different mixtures of biofuel co-products and low quality forage on nutrient availability, palatability, and utilization by beef cattle, a project that resulted in a gain in knowledge with regard to the relationship between feed efficiency measures and other production traits [by understanding the relationship between feed efficiency measures and other production traits, cow/calf operations will be able to improve profitability by improving efficiency through genetic selection], work that will determine whether there are significant differences in the motility and viability of frozen thawed boar semen from multiple boars extended in six different classes of extenders and that will also evaluate the effects of thaw temperature on the viability of frozen boar semen, and a study which found that, when fed an excess calorie, high fat/cholesterol/fructose diet, the Ossabaw pig manifests perturbations in steroidogenesis and folliculogenesis that may make it a good model animal for studying the effects of obesity on reproductive function.

Activities also included a basic research project with the goal of increasing the efficiency of lean meat production in domestic animals, research showing that movement of bovine oocytes between two countries was feasible to produce in vitro fertilized cattle embryos, findings that suggest a correlation between GI architecture, systemic inflammation, and obesity in high-fat, high-sugar fed Ossabaw pigs, work to quantify metabolic and molecular interactions that alter the synthesis of milk components, a project that is the first to examine the effects of early life infection on neuroinflammation and cognition in neonatal piglets [as the piglet has brain growth and development similar to humans, it is an important translational model], a project assessing poultry feedback responses and laying hen preferences for cage furnishings, laying hen responses to atmospheric ammonia, and broiler and turkey responses to atmospheric carbon dioxide, research identifying the factors and signaling pathways that are involved in the cross-talk between the oocyte and the ovarian granulosa cells [recent studies have indicated that a bi-directional communication between cells is critical for female reproductive function], and the identification of ASFV proteins associated with hemadsorption inhibition [HAI] serological group specificity [successful identification and characterization of an ASF protein[s] associated with ASFV sero-specificity will provide critical knowledge of ASFV diversity and the breadth of strain variability that will facilitate vaccine design, development and use].

Conference presentations included the Midwest Animal Science Meeting, Illinois Dairy Summit, Four-State Dairy Nutrition and Management Conference, Driftless Region Beef Conference, Dekalb Feeds Summer Seminar Series, Minnesota Nutrition Conference, Plant and Animal Genome XXI, International Embryo Transfer, Society for Molecular Biology and Evolution, Advances in Canine and Feline Genomics and Inherited Diseases, and the National Pork Board.

Drought management was a continuing focus for 2013 regarding pasture management/hay shortages and winter feed ration strategies. Two Extension educators located in research stations provided leadership for a number of programs that focused on beef production including **Beef Quality Assurance certifications**, the **Sire Selection and Management meeting**, **Illinois Performance Tested Bull Sale and Illinois Beef Exposition**, and producer production meetings. The **Southern Illinois Beef Conference** and inaugural **Driftless Area Beef Conference** were also held with the latter attended by over 160 participants from three states [Illinois, Iowa, and Wisconsin]. Educational workshops for sheep and goat producers were offered in the southern and northeastern parts of the state. Three **Dairy Summit** meetings were held throughout the state for dairy producers and included presentations on feeding drought-stressed forages, transition cow management, feeding updates, and calf and heifer management. 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. **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 helped conduct horse, poultry, dairy, meats, and livestock judging contests for 4-H members. Other 4-H activities included 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 311 classrooms that included 11, 368 youth during the 2012-13 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 included cattle producers and scientists, medical, veterinary, industrial and professional scientists and clinicians, breed associations, agricultural production staff, dairy nutritionists, members of the scientific community focusing on animal sciences and muscle biology, nutrition professionals, and veterinary communities focusing on swine infectious diseases. Extension programs targeted 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?

Ten 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

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2274	0	19759	5068

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

**Patent Applications Submitted**

Year: 2013

Actual: 1

**Patents listed**

TF 10122-US [Thermostable C. Bescii Enzymes]

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	53	53

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Research Projects

Year	Actual
2013	7

**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	Efforts To Improve Beef Production Efficiency
3	Increasing The Efficiency Of Lean Meat Production In Domestic Animals
4	Investigating The Biological Mechanisms Underlying Germ Cell And Embryonic Development For The Improvement Of Livestock
5	Efforts To Explain The Correlations Between Gut Microbes, Fermentative End-Products And Barrier Function In Growing Pigs
6	Identification Of The Factors And Signaling Pathways That Are Involved In The Cross-Talk Between The Oocyte And The Ovarian Granulosa Cells
7	Reducing The Threat Posed By African Swine Fever Virus
8	Increased Knowledge Of Humane Care Of Animals And Animal Science

## **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**

<b>Year</b>	<b>Actual</b>
2013	21

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Illinois has a number of areas where land is more conducive to grazing animals than row crop production. These are primarily located in Southern and Western Illinois. Priorities in beef cattle production focus on production management [addressing new issues involving health, feeding, reproduction, genetics, and management] that enhance producers profitability and provides quality meat products for consumption.

#### **What has been done**

Illinois has historically offered a number of Extension-sponsored beef production programs held annually to address issues facing beef producers and to share the latest research being carried out at the University of Illinois. This past summer the annual Southern Illinois Beef Conference focused on incorporation of cover crops and the implications of the loss of corn by-products on beef production. Afternoon topics addressed maximizing herd pregnancy rates, production regulations, and the National Resources Conservation Service new program for renovating endophyte-infected tall fescue pastures and related cost share opportunities. This last topic was also part of the agenda for the University of Illinois Dixon Springs Agricultural Center Field Day held one month later. Additional field day topics included evaluation of different grazing systems on fescue toxicosis, pyrethroid effects on beef cattle fertility, calf performance following supplementation of cows, and an update on beef cattle reproduction. Evaluations were distributed at the end of both events to the 44 Southern Illinois Beef Conference attendees and 132 Dixon Spring Agricultural Center Field Day attendees and completed by 60 producers.

#### **Results**

All eighteen [41% of the 44 attendees] who completed the evaluation of the Southern Illinois Beef Conference indicated that their knowledge of beef cow and calf management increased and also felt that the content of this conference met their expectations. On a scale of 1-5 [five being high], all speakers' scores averaged 4.3 or higher with the highest rating given to the session on

incorporation of cover crops and maximizing herd pregnancy rates. When asked to list one or more management techniques learned at this conference that they plan to implement, three-fourths of them addressed plans to respond to new cover crop opportunities. Other changes mentioned included using rye grass, establishing endophyte-free fescue, bull management, and increasing wean weight.

Twenty-nine [88%] of the 33 Dixon Springs Agricultural Center Field Day respondents indicated that their knowledge of beef cow and calf management increased and 93% thought the content of the field day met their expectations. When asked to list one or more management technique that they learned at the field day and plan to implement, five of the fifteen who responded planned to improve/renovate their pasture and three planned to change their fescue management with another indicating improving fescue management. Two producers are considering early weaning, and two will follow the researcher's advice with respect to providing feed supplements.

#### 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

#### Outcome #2

##### 1. Outcome Measures

Efforts To Improve Beef Production Efficiency

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

The future of a viable, sustainable beef industry in the U.S. depends on continued improvements in production efficiency. The National Cattlemen's Beef Association identified cost efficiencies as a major profitability driver for beef production in the U.S., with a focus on programs to improve production efficiency that use benchmarking systems which allow objective comparisons of

production costs and performance efficiencies among producers. Feed costs within an operation account for 40 to 70 percent of the total costs of the production of livestock. Therefore, obtaining a better understanding of feed efficiency across a spectrum of existing production operations can greatly impact overall feed costs. Approximately 60% to 70% of overall energy costs for beef production go into the cow herd. Of that amount approximately 70% goes for maintenance energy. This is the energy that a cow needs to just to stay alive. It does not include energy for growth, lactation, or gestation. Thus, 46% [ $0.7 \times 0.65 = .455$ ] of all energy required to produce a pound of beef is used to simply keep the cows alive and maintain their body weight. Identifying and understanding the nutritional, metabolic, genetic, and endocrinological differences among animals will aid in the determination of why certain animals are more feed efficient than others. This knowledge will allow producers to manage beef cattle production systems in a manner that minimizes feed consumption relative to output.

#### **What has been done**

Activities focused on improving our understanding of variation in efficiency of feed utilization as quantified by traits like residual feed intake, determining the relationships between RFI and efficiency of feed utilization in stocker, feedlot and cow-calf sectors, examining the effects of selection for RFI on other economically relevant traits, and developing expected progeny differences [EPDs], multi-trait selection indices and decision-support tools to facilitate selection for improved feed efficiency in beef cattle.

#### **Results**

The primary impact of this project was the gain in knowledge of the relationship of feed efficiency measures and other production traits. By understanding the relationship between feed efficiency measures and other production traits, cow/calf operations will be able to improve profitability by improving efficiency through genetic selection.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
305	Animal Physiological Processes
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection

#### **Outcome #3**

##### **1. Outcome Measures**

Increasing The Efficiency Of Lean Meat Production In Domestic Animals

##### **2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Choline, an essential nutrient, plays a key role in regulating growth and brain development. It is unclear, however, whether prenatal or postnatal deficiency in choline can alter skeletal muscle growth.

**What has been done**

Treatments were arranged in a 2x2 factorial design with factors of choline status [deficient vs sufficient] and timing of treatment [prenatal vs postnatal]. Sows were fed diets either deficient or sufficient in choline, and piglets were raised artificially on milk replacer deficient or sufficient in choline. Gene expression was analyzed in the longissimus dorsi muscle while cell size was measured in the semitendinosus muscle.

**Results**

Expression of IGF1, IGF2, and myogenin were unaffected by treatment, while postnatal choline deficiency increased the expression of MyoD. Both prenatal and postnatal choline deficiency resulted in an increase in myostatin expression. Furthermore, MHC1 gene expression was increased and MHC2b expression was decreased in postnatal choline-deficient animals. Expression of MHC2a and MHC2x were unaltered by treatment. Additionally, choline deficiency did not alter average muscle cell size.

**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**

Investigating The Biological Mechanisms Underlying Germ Cell And Embryonic Development For The Improvement Of Livestock

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

It has been previously demonstrated that Panama is applying the biotechnology of in vitro embryo production [IVP] into their bovine reproduction management systems. This present work demonstrates the ability to apply the IVP technology across two distant country borders. We here demonstrate that a country [Dominican Republic, DR] that does not have a bovine IVP lab can take advantage of fresh bovine IVP embryos for transfer using distant IVP facilities in another country [Panama, ~1,500km away]. The objective of this study was to demonstrate that a model system for large-scale commercial in vitro bovine embryo production for beef and dairy producers, that do not have IVP technology in their home country, could be developed producing comparable results. Since the same laboratory provides IVP services to both countries, a special sanitary protocol was developed in order to legalize the exchange of biological materials [oocytes/embryos].

**What has been done**

The data obtained in the Dominican Republic was compared to Panamanian client data because identical conditions were utilized for IVP. Cattle production systems were similar as Brahman [a Zebu type of cattle] is the most popular breed in both countries. Oocytes were collected from ten different herds in Panama and four different herds in the DR. The oocytes were transported in a oocyte transporter in both instances. However, oocytes from the DR were transported in InVitro Brasil maturation medium from 12-18 hours and in Panama from 6-12 hours before they were placed in a standard CO2 incubator. In both cases the oocytes were matured for 24 hours before fertilization with conventionally frozen Brahman semen in InVitro Brasil fertilization medium followed by culture up to 7 days in InVitro Brasil embryo culture medium. The embryos were transferred on day 7, either in Panama or the DR. They were transported by car in Panama and via airplane back to the DR. A comparison of oocyte number and quality, cleavage, embryo production, and pregnancy rate was made using the same in vitro production system for Brahman Donors from September 2012 until May 2013. The difference between sites in the relative number

of viable oocytes, relative number of cleaved oocytes among viable oocytes, relative number of embryos produced among cleaved oocytes and relative number of embryos produced among viable oocytes was tested using Fisher's exact test. Pregnancy rate was analyzed with X2.

**Results**

We realize that these results represent field data, however we believe the present work is a significant step in demonstrating the potential for wide commercial-scale dissemination of the IVP technology between distant countries. The number of embryos produced in Panama was slightly but significantly higher than those produced in the DR but this is likely due to the larger number of donors and oocytes from the Panama herds. However, the pregnancy rate was higher in the DR likely due to the health status of the DR recipients. These data illustrate that in vitro embryo production using Brahman donors could be used as a tool to improve and spread superior genetics. Furthermore, this technique can serve as a model for other Central American and Caribbean countries under similar management systems. We showed that movement of bovine oocytes between two countries was feasible to produce in vitro fertilized cattle embryos.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals
305	Animal Physiological Processes
307	Animal Management Systems

**Outcome #5**

**1. Outcome Measures**

Efforts To Explain The Correlations Between Gut Microbes, Fermentative End-Products And Barrier Function In Growing Pigs

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Intestinal health is critical to the health of growing pigs and the success of swine operations. Few mechanisms explaining the correlations between gut microbes, fermentative end-products and

barrier function, however, have been adequately described.

#### **What has been done**

A pilot study was undertaken to characterize gastrointestinal [GI] differences in obese Ossabaw pigs vs. lean controls. Ossabaw gilts [n=8] were fed a high-fat, high-sugar diet ad libitum until 12 months of age and compared to lean Yorkshire controls [n=9]. Plasma inflammatory markers [TNF-alpha, IL-6, and LPS-binding protein] and intestinal morphology, tight junction protein gene expression, and mucosal microbiota populations were assessed.

#### **Results**

Preliminary results indicate that LPS-binding protein concentrations tended to be greater [P=0.08] in obese vs. lean pigs. Blood TNF-alpha concentrations were numerically, but not significantly, increased in obese vs. lean pigs [39 vs. 29 ng/L; P=0.24]. Obese pigs had greater [P=0.03] cecal crypt depth [494 vs. 430 um] and tended to have greater [P=0.09] ileal villus height [477 vs. 400 um] compared to lean controls. Our findings suggest a correlation between GI architecture, systemic inflammation, and obesity in high-fat, high-sugar fed Ossabaw pigs.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
302	Nutrient Utilization in Animals
305	Animal Physiological Processes
315	Animal Welfare/Well-Being and Protection

#### **Outcome #6**

##### **1. Outcome Measures**

Identification Of The Factors And Signaling Pathways That Are Involved In The Cross-Talk Between The Oocyte And The Ovarian Granulosa Cells

##### **2. Associated Institution Types**

- 1862 Research

##### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

##### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

##### **3c. Qualitative Outcome or Impact Statement**

###### **Issue (Who cares and Why)**

In line with the goals of this project we proposed to identify the factors and signaling pathways

that are involved in the cross-talk between the oocyte and the ovarian granulosa cells. Our approach involved microarray-based gene expression profiling to identify factors that are expressed in the ovary prior to ovulation. For our experiments we used the well-characterized rodent superovulation model in which oocytes are released from the follicle in a controlled time-dependent manner. This allowed us to identify factors and signaling molecules that are involved in cell-cell communication between oocytes and ovarian granulosa cells immediately prior to ovulation. We injected mice with pregnant mare serum gonadotropin and 48 hours later with human chorionic gonadotropin [hCG]. Mice were euthanized at 0 hours and 12 hours post hCG treatment. Total RNA was isolated from the ovaries of cohorts of animals with pooling of the RNAs from each cohort. Each cohort represented a replicate for the microarray analysis. The RNA was labeled and hybridized to the Affymetrix arrays by the Functional Genomics Core Facility at the University of Illinois.

#### **What has been done**

This microarray analysis uncovered approximately three hundred genes whose expression was significantly altered in the ovaries 12 hours after hCG administration, at a time that shortly precedes follicular rupture. When these microarray-derived genes were classified according to their known biological functions, they were found to encode diverse molecules such as proteases, transcription factors, growth factors, cell-adhesion molecules, modulators of vascular activities, and regulators of inflammation. These pathways are, therefore, linked to diverse biological processes, reflecting the overall complexity at the cellular and molecular levels that governs ovulation. Among these diverse molecules, we focused our studies on signaling factors that might be potentially involved in oocyte-granulosa cell communication. We were particularly interested in several members of the IL-6-type cytokine family, including IL-6, interleukin-11, leukemia inhibitory factor, and endothelin 2, a vasoactive peptide. The expressions of these factors are dramatically induced in PMSG-primed ovaries at 12 hours following hCG treatment. We initially addressed the role of endothelin 2 in ovarian function.

#### **Results**

When we examined the spatial expression of ETR-A and ETR-B proteins in the ovary by immunohistochemistry, we found that the mural and cumulus granulosa cells and the ovarian blood vessels are the major sites of endothelin receptor expression. These expression profiles of endothelin receptors in the mural and cumulus granulosa cells present possible mechanisms of endothelin 2 action during ovulation. It is conceivable that endothelin 2 secreted by the granulosa cells of the preovulatory follicles acts on these cells in an autocrine manner. Although it is unknown how endothelins regulate follicular rupture, one can envision that increased permeability in response to endothelin signaling drives the exudation of serum proteins and allows transmigration of leukocytes out of the blood vessels, primarily neutrophils and macrophages, to the interior of the preovulatory follicles. In an inflamed tissue, migrating leukocytes secrete proteases, damaging tissue. In the same way, intrafollicular leukocytes may produce proteolytic enzyme that may contribute to disruption of the follicular wall at the time of rupture. Collectively, these ideas raise the interesting possibility that endothelin 2 and its receptor signaling may have a direct stimulatory effect on the rupture of ovarian follicle at the time of ovulation.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
301	Reproductive Performance of Animals
303	Genetic Improvement of Animals
305	Animal Physiological Processes
307	Animal Management Systems

**Outcome #7**

**1. Outcome Measures**

Reducing The Threat Posed By African Swine Fever Virus

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The objective of this study is to identify ASFV proteins associated with hemadsorption inhibition [HA] serological group specificity. Successful identification and characterization of an ASF protein[s] associated with ASFV sero-specificity will provide critical knowledge of ASFV diversity and the breath of strain variability that will facilitate vaccine design, development and use.

**What has been done**

We have used a collection of serologically-grouped ASFV isolates and a large and diverse collection of ASF viruses to identify genetic signature[s] for ASFV serologic group specificity and to further define ASFV strain variability. We have demonstrated through gene sequencing and comparative analysis of ASFV strains a correlation between the genotype of the ASFV CD2v gene and virus grouping based on serospecificity. Overall, the concordance between CD2v region phylogenetic data and serogroup-specific typing provides a predictive value of CD2v locus genotyping in predicting serologic, and potentially cross protective, virus groups.

**Results**

Results obtained will have a broad impact on vaccine-orientated approaches for ASF disease control, thus reducing the threat posed by this high-consequence viral disease. Knowledge of ASFV strain diversity and the breath of strain variation in nature as well as rapid genotyping methods to serotype viruses and to predict efficacy of a given vaccine to provide cross protection for a newly identified field isolate will facilitate vaccine design, development and emergency use.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
305	Animal Physiological Processes

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

## **Outcome #8**

### **1. Outcome Measures**

Increased Knowledge Of Humane Care Of Animals And Animal Science

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	7964

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Humane care of animals is as important a concern as insuring a safe food supply. Opportunities for youth to care for livestock allow them to gain knowledge to ensure humane treatment of animals, production of meat products that are safe for consumption, and the development of their social skills and interest in science.

#### **What has been done**

Training was provided to 4-H youth enrolled in livestock projects via an online module on ethical treatment of animals that also included 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. This past year all counties made completion of the training a requirement for those youth enrolled in dairy, swine, beef, horses, rabbits, sheep, goats, and poultry. In addition, a survey was distributed and collected from 446 youth participants in animal science events this past year that included fourteen questions related to interest in science now and in the future and the value of caring for and exhibiting livestock projects in 4-H. Youth were asked to respond to the 14 questions using a 1-4 scale with 1 being 'Strongly Disagree' and 4 being 'Strongly Agree'.

#### **Results**

Ninety-five percent or more of the 446 youth who responded to the surveys distributed and collected at 4-H Animal Science events this past year indicated that they agree or strongly agree that caring for and exhibiting livestock projects has: [1] Taught them responsibility and ethics; [2] Built confidence and social skills; and [3] Provided a better understanding of biological sciences.

In addition, with respect to other findings related to science, 94% affirmed that they get to do hands-on activities in the program/project and 88% or more: [1] Think that science, engineering, or technology will be important in their future job; [2] Think science is useful for solving everyday problems; and [3] Want to learn more about science. Additional information can be found in the 4-H Youth Development planned program Evaluation Section.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
315	Animal Welfare/Well-Being and Protection
806	Youth Development

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

Evaluations were distributed at the end of both events to the 44 **Southern Illinois Beef Conference** attendees and 132 **Dixon Springs Agricultural Center Field Day** attendees and completed by 60 producers.

All eighteen [41% of the 44 attendees] who completed the evaluation of the **Southern Illinois Beef Conference** indicated that their knowledge of beef cow and calf management increased and also felt that the content of this conference met their expectations. On a scale of 1-5 [with five being high], all speakers' scores averaged 4.3 or higher with the highest rating given to the session on incorporation of cover crops and maximizing herd pregnancy rates. When asked to list one or more management techniques learned at this conference that they plan to implement, three-fourths of them addressed plans to respond to new cover crop opportunities. Other changes mentioned included using rye grass, establishing endophyte-free fescue, bull management, and increasing wean weight. In addition, 29 [88%] of the 33 **Dixon Springs Ag Center Field Day** respondents indicated that their knowledge of beef cow and calf management increased and 93% thought the

content of the field day met their expectations.

### **Key Items of Evaluation**

When asked to list one or more management techniques learned at the **Southern Illinois Beef Conference** that they plan to implement, three-fourths of them addressed plans to respond to new cover crop opportunities [National Resources Conservation Service new program for renovating endophyte-infected tall fescue pastures and related cost share opportunities].

**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
602	Business Management, Finance, and Taxation	10%		0%	
608	Community Resource Planning and Development	35%		70%	
802	Human Development and Family Well-Being	5%		10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	10%		10%	
805	Community Institutions, Health, and Social Services	20%		10%	
806	Youth Development	20%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	15.0	0.0	3.0	0.0
Actual Paid Professional	0.0	0.0	1.1	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
988636	0	120084	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
988636	0	120084	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
5186191	0	116185	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities included the development of a new protocol for increasing the news value of social movement activities [the protocol allows social movements to more effectively identify what activities will be covered and how favorable the publicity is likely to be], research demonstrating that rural lesbian and bisexual mothers with low-incomes are not readily identifiable as sexual minorities in rural communities [many have a salient sexual minority identity while being either single or in heterosexual relationships] and that sexual minority mothers living under the conditions of rural poverty are affected by both poverty-related stress and minority stress [anti-gay stigma], and the development of findings that fill a substantive gap in our understanding of health-promoting practices in low-income, African-American households, that provide direction for government food assistance programs, and that document how caregivers' strategies represent intervening processes in response to the built environment.

Extension activities include a wide variety of methods and focus on community participatory planning, organizational development, community economic development, and community leadership development and education.

Programming for the year continued to include 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. A grant has been received this year to expand the **Connecting Generations** program to additional counties' library facilities where students who want to earn volunteer service hours teach senior citizens who need assistance with computer usage. Other community participatory planning education included continuing work to help communities use various planning processes to plan for and manage disasters, and work on municipal and regional development plans and economic development plans, often assisting with needs assessments surveys, public meetings, goal formation, and implementation monitoring that successfully garners diverse participants and stakeholders. A community was also engaged in **Community Matters**, a program initiative that provided an opportunity for a graduate student to experience and assist with a multigenerational planning process.

Extension Educators engaged in a myriad of programs related to economic development. A number of educators used the updated curriculum **On the Front Line** to educate employees of businesses, agencies and government entities, as well as students, on customer services best practices. A new curriculum titled **Consumer Age Matters** was developed to build participants skills in targeting and developing marketing approaches based on characteristics and preferences of various generations. Staff members also developed the **Social Marketing for Businesses** curriculum and collaborated with

Wisconsin to involve residents of four communities in the **Business Market Analysis Webinar** series. Of note, a study of the results of a retail analysis of 16 counties in Southern Illinois and regional economies in nearby states was widely shared by an Extension staff member with individuals [youth and adults] and group stakeholders through presentations, mass media, and an interactive 'shopping simulation' that resulted in a 'buy local' campaign.

**Building Entrepreneurial Communities** continued to be a focus area associated with economic development and workforce preparation. Several counties have formed and supported youth activities that include 4-H youth group projects, camps, and school-based classroom activities and workshops 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** and the **Clark County Business Expo** in collaboration with local schools. Participants in a dual county Fast Pitch Competition presented their ideas and won monetary awards in three categories: [1] Existing business; [2] Got an idea retail; and [3] Got an idea non-retail.

Extension Educators have been actively involved in interdisciplinary efforts focused on supporting youth workforce development. Working with their 4-H Youth Development colleagues they have facilitated opportunities to bring community colleges, schools, and business leaders together to identify and address youth workforce issues. Activities have included collecting inventories of employers and college courses, youth career expos and shadowing, and educational programs for youth on interviewing.

Community leadership development also included continued support for four youth or adult **Leadership Academies** often conducted in partnership with other community organizations. A former Leadership Academy location now opens programs to the entire county residency. A five-part series focused on leadership for high school youth over their four years of attendance was again led by a leadership team of student and adult advisory planning groups. Leadership programming for public officials included a statewide webinar on **Open Meetings and the Freedom of Information Act**.

## **2. Brief description of the target audience**

Members of the target audience included social movement activists [primarily in the food and agriculture sectors], scholars concerned with low-income African American families living in inner-city communities, and policy makers and service providers concerned with building strong communities and families. Community leaders, business leaders, agencies and organizations, and local government officials involved in community and economic development are key Extension target audiences that are large in scope. Other target audiences include youth and residents interested in starting small businesses.

## **3. How was eXtension used?**

Nine Extension staff are members of the eXtension Communities of Practice that include Entrepreneurs and Their Communities; Enhancing Rural Capacities; and/or Extension Disaster Education.

## **V(E). Planned Program (Outputs)**

### **1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	37689	101721	32737	0

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

**Patent Applications Submitted**

Year: 2013

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	3	3

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Research Projects

Year	Actual
2013	1

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number Of Individuals Reporting New Leadership Roles and Opportunities Taken
2	Number Of Plans Developed/Adopted/Adjusted By Communities Through Resident Engagement
3	Dollar Value Of Resources Leveraged/Generated [Includes Gifts, Grants, Private Investments, Equipment, Workforce Training, Budget Allocations, Etc.]
4	Percentage Of Community Plans/Goals Implemented
5	Number And Value of Volunteer Hours Invested In Community-Related Projects
6	Number Of Community/Organization Programs/Activities Initiated
7	Number Of Jobs Created By New Businesses
8	The Identification Of 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

**Outcome #1**

**1. Outcome Measures**

Number Of Individuals Reporting New Leadership Roles and Opportunities Taken

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

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

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	91335

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Revenue is declining in many rural communities and is affected by many factors related to overall state and national challenges, as well as local challenges to sustaining an economy such as the loss of businesses which in turn affect unemployment rates and out-population migration.

**What has been done**

In an effort to assist local residents, community leaders, and elected officials in understanding the importance of 'buying local' in sustaining both their local economies and Southern Illinois as a whole, a University of Illinois Extension Community Economic Development Educator [CED] completed a Retail MarketPlace Profile Study of the sixteen-county Southern Illinois region in the

fall of 2012 utilizing data obtained from ESRI Business Analyst to compare an analysis of consumer spending and business revenues resulting in the 'retail gap'.

The analysis indicated that a \$272 million net leakage for Southern Illinois existed in contrast to retail surpluses in the sections of neighbor states bordering Illinois. The leakage reflected not only loss of retail sales in the region, but also corresponding losses in sales tax revenues, retail sector jobs associated with those sales, and the multiplier effect lost which supports further retail sales in the market area. In addition, the study results suggested a correlation between the leakage and surpluses in retail shopping destinations in the neighboring states.

The educator then disseminated the study results through media, through some 40 presentations to and personal visits with key community groups, leaders, and elected officials, and through the development of a shopping simulation for events and classrooms that reached approximately 750 youth.

### **Results**

As a result of the dissemination of the results of the study to the Metropolis Chamber of Commerce, the Chamber was empowered to address the issue of retail leakage from their community and county by undertaking a Buy Local campaign. The campaign, entitled 'Think Local First', included posters, shopping bags distributed to customers and new residents moving in, coupons, newspaper ads, and buttons for business members to wear. The City of Metropolis also increased marketing efforts by adding radio spots and billboards to promote upcoming events that resulted in increased attendance and an increase in associated tax dollars.

The sales tax data from the Illinois Department of Revenue [comparing monthly collection since the campaign began to the same period from the year before] gathered by the CED educator indicated an increase in sales revenue of \$91,354 with funds going to both Metropolis and Massac County. The initial campaign as well as other ads and activities that followed have likely contributed to that increase.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

### **Outcome #4**

#### **1. Outcome Measures**

Percentage Of Community Plans/Goals Implemented

Not Reporting on this Outcome Measure

### **Outcome #5**

#### **1. Outcome Measures**

Number And Value of Volunteer Hours Invested In Community-Related Projects

Not Reporting on this Outcome Measure

### **Outcome #6**

#### **1. Outcome Measures**

Number Of Community/Organization Programs/Activities Initiated

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Condition Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	5

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Consumers are smarter and more discerning than ever and are demanding high-quality service. Skills in meeting the demands of customers are important for employees of private and public entities to ensure their employment, the health of their organization, and a thriving community.

##### **What has been done**

Programming to improve customer service primarily focused on workforce development and retention and has been a part of Extension's educational programming for many years. University of Illinois Extension Community and Economic Development [CED] educators with the assistance of a part-time recent Department of Urban and Regional Planning graduate completed a comprehensive update of the ten-module program. The modules address the value of customer service, generational and cultural differences in customers' needs and wants, creating positive first impressions, elements of communication, verbal language, and body language, telephone and online service techniques, dealing with unhappy customers, and keeping customers happy. The format includes opportunities for practicing skills, discussions, and the creation of a personal development plan.

This revised On the Front Line curriculum was used by five CED Extension Educators in settings

that included primarily public entity employees [health department, library, and county board]. An end-of-program evaluation was completed in four locations this past year by 106 respondents.

**Results**

On the Front Line program participants were asked to rate the usefulness of the information presented using a scale of 1-5 [1 = Not at all useful, 2 = Slightly useful, 3 = Somewhat useful, 4 = Moderately useful and 5 = Extremely useful]. Forty-two [40%] of the respondents circled 'Extremely useful', 51 [48%] circled 'Moderately useful', and 12 [11%] circled 'Somewhat useful'. Only one indicated the information was slightly useful and no one indicated not at all useful. The overall group average for usefulness of the information was 4.3.

The program participants were also asked to rate the amount of knowledge gained from attending the program using another 1-5 scale [1 = None, 2 = A little, 3 = Some, 4 = A good deal, and 5 = Very much]. Seventeen [16%] circled 'Very much', 47 [46%] circled 'A good deal', and 35 [34%] circled 'Some'. Only four indicated their amount of knowledge only increased a little and no one circled none. The overall group average was 3.7.

When asked what changes they plan to make, participants most frequently mentioned that they planned to consider generational differences when working with customers. Changes in approaches such as tone of voice, eye contact, and patience were also frequently mentioned, and some mentioned plans to add items for customer surveys and phone interviews regarding service, a mission statement for staff to see at the desk, and coffee, treats, and/or magazines in Spanish for their customers.

**4. Associated Knowledge Areas**

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

**Outcome #7**

**1. Outcome Measures**

Number Of Jobs Created By New Businesses

Not Reporting on this Outcome Measure

## **Outcome #8**

### **1. Outcome Measures**

The Identification Of 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

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The goal of the research is 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 is a response to theoretical discussions that argue that the compositional, social, institutional, and normative elements of impoverished inner-city communities undermine family organization and 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 ghetto-oriented value systems. In contrast, our research seeks to better understand how families raising children overcame the adversity of living in low-resource, high-risk neighborhoods. This research is informed by a family resilience framework. This approach focuses on family strengths, how families marshal resources to promote stability in the face of adversity, and the ecological context of coping.

#### **What has been done**

Qualitative data were collected and analyzed for publications. Key findings emerged on parental practices around child health and nutrition and child physical activity. Little research examines how families respond to the neighborhood food environment and family poverty barriers to children's nutritional health. Informed by a family strengths/resilience perspective that emphasizes agency, we used qualitative data from low-income African American caregivers to explore strategies that caregivers used to promote the nutritional health of their preschool-age children. We identified multiple restrictive and promotional strategies that caregivers utilized in the face of limited family resources and the poor quality of the neighborhood food environment. Monitoring was used as the key restrictive strategy to counter children's less healthy eating practices. Six promotional strategies which included selective food availability, cooking techniques, creative meal preparation and presentation, positive role-modeling, teaching and instruction, and media

reinforcement were used to enhance healthy nutritional patterns. These findings fill a substantive gap in our understanding of health promoting practices in low-income, African-American households, and provide direction for government food assistance programs.

### Results

We also used qualitative interviews with low-income African-American caregivers of preschoolers to explore neighborhood obstacles to children's physical activity and the strategies caregivers used against these challenges. Built environment barriers included social and physical disorder, crime and violence, speeding traffic, and stray dogs. Recreational settings were few, inaccessible, and poorly equipped and maintained. In addition to high facility fees and few organized activities, recreational settings had high levels of disorder and violence. Despite barriers, caregivers used strategies to promote physical activity, including environmental appraisal, boundary enforcement, chaperonage, collective supervision, and local- and extra-local resource brokering. These findings document how caregivers' strategies represent intervening processes in response to the built environment. The findings further provide place- and asset-based recommendations.

## 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

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

### Brief Explanation

## V(I). Planned Program (Evaluation Studies)

### Evaluation Results

#### Buy Local

The sales tax data from the Illinois Department of Revenue [comparing monthly

collection since the **Buy Local** campaign began to the same period from the year before] gathered by the CED educator indicated an increase in sales revenue of \$91,354 with funds going to both the city and county conducting the campaign. The initial campaign as well as other ads and activities that followed have likely also contributed to that increase. Additional information can be found in the Dollar Value Of Resources Leveraged/Generated [Includes Gifts, Grants, Private Investments, Equipment, Workforce Training, Budget Allocations, Etc.] State Defined Outcome indicator.

### **On the Front Line**

**On the Front Line** program participants were asked to rate the usefulness of the information presented using a scale of 1-5 [1 = Not at all useful, 2 = Slightly useful, 3 = Somewhat useful, 4 = Moderately useful, and 5 = Extremely useful]. Forty-two [40%] of the respondents circled 'Extremely useful', 51 [48%] circled 'Moderately useful,' and 12 [11%] circled 'Somewhat useful'. Only one indicated the information was slightly useful and no one indicated 'not at all useful'. The overall group average for usefulness of the information was 4.3.

The program participants were also asked to rate the amount of knowledge gained from attending the program using another 1-5 scale [1 = None, 2 = A little, 3 = Some, 4 = A good deal, and 5 = Very much]. Seventeen [16%] circled 'Very much', nearly one-half of the respondents circled 'A good deal', 47 [46%], and 35 [34%] circled 'Some'. Only four indicated their amount of knowledge only increased 'A little' and no one circled 'None'. The overall group average was 3.7

When asked what changes they plan to make, participants most frequently mentioned that they planned to consider generational differences when working with customers. Changes in approaches such as tone of voice, eye contact, and patience were also frequently mentioned, and some mentioned plans to add items for the customers, surveys and phone interviews regarding service, a mission statement for staff to see at the desk, and coffee, treats, and/or magazines in Spanish for their customers.

### **Key Items of Evaluation**

A Retail MarketPlace Profile Study by Extension led to a **Buy Local** campaign that contributed to a sales revenue increase in a rural county of \$91,345.

91% of the participants in newly updated **On the Front Line** program gained knowledge of effective customer service.

**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	2%		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	3%		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	10%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890

Plan	12.0	0.0	15.0	0.0
Actual Paid Professional	0.0	0.0	6.0	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
811658	0	638285	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
811658	0	638285	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
10074929	0	1692301	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities included research with the objective of defining the oligosaccharide fermentation patterns produced by ileal and colonic contents of sow-reared and formula-fed piglets [this knowledge will allow for the development of nutritional ingredients to improve the quality of infant formulas for babies who are not breast fed], the determination of bacterial populations within the insect vectors of *E. tracheiphila* [with the ultimate goal of controlling bacterial wilt disease of cucurbits], an investigation into the effects of sonication, sanitizers and sodium dodecyl sulfate [SDS] on the quality of fresh-cut Iceberg and Romaine lettuce, the development of standardized protocols for iron fortification using extrusion and for mixing and grinding fortified pellets and nixtamalized corn for the development and characterization of an in situ fortification technology for tortillas, work focusing on the measurement of critical odorants and their interactions in foods, food ingredients and other complex materials where odor is of concern, the dissemination of up-to-date information that allowed growers and buyers to more efficiently meet market demands associated with organic production, food safety regulations, Farm to School, and extended seasons for production and marketing, the design and fabrication of a pilot-scale continuous-flow washing system used to investigate the efficacy of ultrasound treatment for produce sanitization, an investigation into the potential of zein to microencapsulate bioactive, health-enhancing food components, and work to improve our understanding of the bacterial population within insect vectors [this will provide information for the potential source of microbial contamination for fresh produce].

Conference presentations included Experimental Biology 2013, 10<sup>th</sup> International Congress of Plant Pathology, Illinois Specialty Crops, Agritourism, and Organics Conference, Institute of Food Technologists, and the National Science Foundation Industry and University Cooperative Research Program.

Food safety training for employees of establishments and volunteers that prepare or serve food to the public was again delivered. 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] **Serve it Safely**, a food class for volunteers who serve food for fundraisers, community

organizations and family events; and [3] A new two-hour workshop titled **From Garden Gates to Dinner Plates** was developed this past year and attended by 22 individuals who were interested in information about the **Illinois Cottage Food Operation Law** regarding low-risk foods that can be prepared in the home and sold at Illinois farmers markets. A new online and supplemental program entitled **Yes, You Can--Preserve Food Safety** was reviewed and piloted. 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, seven **Enhancing Specialty Food Safety** programs were offered to specialty growers in Illinois and addressed safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illnesses. 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 at various locations 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 reached large numbers of corn and soybean producers with information on fertility and pest management. **Corn and Soybean Classics** [six regional-based meetings that featured eight faculty presentations on the latest research concerning crop production, pest management, economics, and the interactions among them] were attended by 938 producers and agricultural consultants. The multi-state **AGMasters Conference**, a two-day multidisciplinary conference, was attended by 155 who participated in one general session and 12 specialized sessions. **Regional Crop Management Conferences** were held in four locations in 2013. The primary audience was certified crop advisers. Extension of research to the public also included 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 were held on campus and throughout the state to showcase the results of research plots to producers.

The electronic **Pest Management and Crop Development Bulletin** series was issued weekly throughout the crop-growing season [20 issues from early April to mid-August] and five additional times in the off-season to report on current agricultural conditions based on pest management information provided by entomologists, agronomists, and plant pathologists. Of the 4,657 plant samples diagnosed by the **University of Illinois Plant Clinic**, the significant field crop disease issues evaluated were soybean cyst nematode and soybean vein necrosis virus. The clinic tested client-submitted samples, phytosanitary inspection samples, soybean cyst nematode egg extraction samples, and nematode samples for University researchers and private industry. Pesticide safety education was conducted using presentations at numerous locations that resulted in 9,203 commercial pesticide applicator certifications and 2,793 private pesticide applicator certifications. Information was also disseminated electronically via a quarterly multi-state newsletter focused on integrated pest management successes and activities.

Statewide Extension conferences related to produce production included several multi-state conferences: **Illiana Vegetable Growers Symposium, the Southern and Southwestern Tree Fruit School, Western Illinois Vegetable School, Stateline Fruit & Vegetable Conference**, and the **Southern Illinois Commercial Vegetable School**. Additional Illinois state or regional conferences focused specifically on growing horseradish, small fruits, and strawberries. Extension also provided leadership for the **Specialty, Agritourism and Organic Conference** and distributed issues of **Fruit and Vegetable News** approximately bi-weekly. More than 100 aspiring farmers and new growers and agriculture teachers participated in **Preparing a New Generation of Illinois Fruit and Vegetable Farmers**, a year-long program which features classroom, hand-on, and in-field instruction.

Several interdisciplinary efforts among Extension Educators with responsibility for local foods,

horticulture, foods and nutrition, community economic development, and/or 4-H development were targeted at supporting community gardens that raised produce to feed the hungry. Extension staff also facilitated community groups, forums, expositions, and tours to bring together those interested in identifying opportunities to support local foods systems including the potential conversion of an abandoned prison into a food hub, small farm incubator, or a Farm to School learning laboratory.

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. 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 also used by **SNAP-Ed** and **EFNEP** staff in elementary school classrooms. Curricula used to teach adults included **Eating Smart Being Active** and **Loving Your Family Feeding Your Future** that emphasized feeding your family on a budget and preparing meals safely. More than 569,000 teaching contacts were made through the **SNAP-Ed** program and 19,279 family members including 3,300 new families were reached through **EFNEP** this past year.

## 2. Brief description of the target audience

Members of the target audience included practitioners interested in improving child health and scientists interested in how early nutrition influences gut development, researchers in the fields of economics, public health, and nutrition, policymakers charged with improving the well-being of low-income Americans, program administrators overseeing food assistance programs, food producers, processors, ingredient manufacturers and flavor companies, food industry professionals who work with extruded snack and cereal products, farmers' market managers, produce packers, scientists from the fields of nutrition, bioengineering and immunology, industry and academic food science researchers and professionals engaged in the development of methods and processes to improve the safety and quality of foods, graduate and undergraduate students in food science and human nutrition, product development professionals in the food industry, food ingredients manufacturers, commodity groups, and the fruit and vegetable industries.

Extension targeted youth, certified food handlers, and 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 advisors, and limited resource audiences that are food stamp eligible.

## 3. How was eXtension used?

eXtension was not used in this program

## V(E). Planned Program (Outputs)

### 1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	171796	295935	470871	0

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

Year: 2013  
 Actual: 1

**Patents listed**

TF 13036 PRO [Stabilization Compositions and Methods of Manufacture].

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	20	20

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Research Projects

Year	Actual
2013	2

**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 Of Plant Variety Releases
3	Number Of Networks Prepared To Mitigate Biological And Abiotic Disruptions
4	Number Of Pounds Of Fresh Produce Donated For Consumption By Vulnerable Populations
5	Development Of Effective Methods For The Investigation Of Potent Odorants In Foods
6	Exploring The Use Of Power Ultrasound To Enhance The Microbial Safety Of Fresh Produce
7	Development Of The Proof-Of-Concept Of A Robust, Sensitive And Specific Diagnostic Platform To Test Micronutrient Status
8	Investigating The Potential Of Zein To Microencapsulate Bioactive, Health-Enhancing Food Components
9	Identification Of Methods That Extend The Shelf Life, Improve The Nutritional Quality, And Enhance The Safety Of Fresh Cut Produce
10	Number Of Fresh Food Producers Adopting Practices That Prevent Foodborne Illness Contamination
11	Number Monitoring Proper Temperatures Of Food Served/Sold To The Public To Prevent Food-Borne Illness
12	Increased Knowledge Of Fresh Fruit And Vegetable Production Practices
13	Increased Knowledge Of Small Farm Production Options

**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 Of Plant Variety Releases

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number Of Networks Prepared To Mitigate Biological And Abiotic Disruptions

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number Of Pounds Of Fresh Produce Donated For Consumption By Vulnerable Populations

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	4300

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Over 1.9 million Illinois residents are considered food insecure, which means they do not have regular access to nutritious food. Thirty-eight percent of food insecure households and 34 percent of children in Illinois exceed federal poverty guidelines that would qualify them for food assistance. Those individuals must rely on charities to feed themselves and their families.

#### **What has been done**

University of Illinois Extension's 4-H staff applied for and received a state grant through the National 4-H Council's administration of funds for Invest an Acre, a private foundation supported program. Vegetable Garden Challenge Grants were then offered and awarded to individual 4-H members, 4-H clubs, schools, churches, and community organizations who agreed to grow and donate extra produce to local food pantries/soup kitchens/organization. These groups received the 4-H: Empowering Youth to End Hunger in Their Communities Toolkit to guide them in carrying out various activities. Extension Master Gardeners and 4-H Teen Ambassadors were recruited to help youth conduct activities that included: [1] Planning, planting, maintaining, and harvesting products grown in community gardens; [2] Partnering with Illini Fighting Hunger in conducting four meal packaging events with meals consisting of a soy-fortified rice casserole mix; [3] Volunteering at food pantries; [4] Establishing a meal site and serving an evening meal for families receiving food from a newly organized pantry; [5] Providing a Harvest Lunch for farmers delivering grain that resulted in cash donations to support their local 4-H Club Food Pantry; and [6] Staffing booths at county fairs and the Farm Progress Show and distributing fliers explaining the process for farmer participation in fighting hunger through the Invest An Acre donation of grain.

#### **Results**

The 4-H Feeding and Growing Our Communities program engaged 1,118 youth and 384 adults who collectively contributed 12,252 hours of volunteer service and secured in-kind donations of \$18,150 to address community-based, culturally-relevant food security and hunger relief projects in twenty-four counties. Specific outcomes encompassed: [1] The establishment of 11 community gardens; [2] Harvesting over 4,000 pounds and then donating 2,000 pounds of fresh produce to local food pantries, senior centers, soup kitchens, and community housing sites serving families in need; [3] Collecting and donating over 2,300 pounds of canned and non-perishable food to local food pantries; [4] Purchasing and bagging 420 'snack packs' for elementary school children; [5] Partnering with Illini Fight Hunger in preparing 63,054 meals of a soy-fortified rice casserole mix through four meal packaging events which were distributed to food pantries and through direct outreach to families.

Illinois 4-H members and volunteers now have a better understanding of hunger in their communities and have developed strategic plans to improve the lives of residents in need through community gardens, food collection and distribution sites, food packaging events, and feeding the hungry meal programs.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
503	Quality Maintenance in Storing and Marketing Food Products
704	Nutrition and Hunger in the Population
806	Youth Development

## **Outcome #5**

### **1. Outcome Measures**

Development Of Effective Methods For The Investigation Of Potent Odorants In Foods

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The project will develop and employ effective methods for the investigation of potent odorants [aroma-active compounds] in foods, food ingredients and various other complex materials. Key to the success of the project is the development of efficient procedures for the isolation, separation and identification of trace volatile constituents [specifically odorants] from complex [nonvolatile] matrices. Modern analytical techniques, including high resolution gas chromatography-olfactometry [GCO] and GC-mass spectrometry [GC-MS] will be used for the analysis of the isolated components. A critical component of this project will be the development of accurate and precise GC-MS quantification methods based on the use of stable isotopes as internal standards, so called stable isotope dilution assays [SIDA]. The validation of the analytical data will be accomplished by sensory analysis of model 'aroma' systems based on the analytical results.

#### **What has been done**

The project has focused on the measurement of critical odorants and their interactions in foods, food ingredients and other complex materials where odor is of concern. It has also evaluated the interaction of flavors with food matrix components such as protein. Other studies relate to the development of accurate and precise methods for quantification of trace odorants by stable isotope dilution assays.

#### **Results**

Results of this project will allow for the development of higher quality food products and associated materials [ingredients and packaging materials] by evaluation of important flavor-related quality indices for product development/improvement and shelf-life estimation. These techniques may also lead to the identification of sources of off-flavors, taints or other odor-based issues.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
503	Quality Maintenance in Storing and Marketing Food Products
702	Requirements and Function of Nutrients and Other Food Components

**Outcome #6**

**1. Outcome Measures**

Exploring The Use Of Power Ultrasound To Enhance The Microbial Safety Of Fresh Produce

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The long-term goal of the proposed research is to explore the use of power ultrasound to enhance the microbial safety and minimize the food safety risk of fresh produce. The project objectives are: [1] To test ultrasound and sanitizer combined treatments with selected produce in a small wash tank in batch mode and in a pilot scale continuous ultrasonic washing system to examine the effect of sanitizer, washing time, and produce-to-sanitizer solution ratio on microbial reduction; [2] To conduct experiments to examine the effect of ultrasound on the quality of produce; [3] To conduct experiments on the combination of surfactants with sanitizer and ultrasound on the microbial count reduction, which will be based on surfactant screening and HLB values [also, emphasis will be given to the effect of sanitizer + surfactant + ultrasound on produce quality]; and [4] To investigate the distribution of acoustic energy in the washing tank and find means to improve the uniformity.

**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

In addition, we examined the individual and combined effects of sonication, two sanitizers [chlorine and Tsunami 100] and a surfactant [sodium dodecyl sulfate [SDS]] on the quality of fresh-cut Iceberg and Romaine lettuce. Lettuce samples were treated for 1 minute with and without ultrasound in a custom-designed ultrasonic tank containing one of the following treatment solutions: tap water; chlorine [100 mg L<sup>-1</sup> free chlorine]; Tsunami 100 [80 mg L<sup>-1</sup> peroxyacetic acid]; and a combination of Tsunami 100 with 0.1% [w/v] SDS. Washed samples were packed under modified atmosphere conditions and stored at 4° C for up to 14 days. Changes in headspace gases, texture, color, tissue damage, visual quality, populations of aerobic mesophile bacteria, and yeasts and molds were determined. The O<sub>2</sub> concentrations and CO<sub>2</sub> accumulation in Romaine lettuce were not significantly different among the treatments. In Iceberg lettuce, a lower O<sub>2</sub> and high CO<sub>2</sub> content in the headspace of samples treated with Tsunami 100 and Tsunami 100 + SDS were recorded. After 14 days of storage, the tissue damage expressed by electrolyte leakage rate [ECR], total color difference, firmness, and total aerobic plate counts were not significantly different for all the treatments in two types of lettuce samples [P>0.05]. Treatment of Iceberg lettuce with sonication in combination with Tsunami 100 or Tsunami 100 + SDS did not degrade quality compared to samples treated with chlorine alone, whereas for Romaine lettuce, chlorine-treated samples had a significantly higher overall quality score than that from the other treatments.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
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 #7

#### 1. Outcome Measures

Development Of The Proof-Of-Concept Of A Robust, Sensitive And Specific Diagnostic Platform To Test Micronutrient Status

#### 2. Associated Institution Types

- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Micronutrient undernutrition is a serious public health concern. It is associated with reduced childhood growth and social and mental development, increased risk and duration of illness and diminished work capabilities of an individual's lifetime. A major challenge to improving health in at-risk populations is the lack of current and reliable health and nutrition information. The high cost and inconvenience of current laboratory diagnostic technologies make this a very challenging problem. To address this challenge, we propose to apply photonic crystal [PC] technology to build a low-cost, easy-to-use, rough diagnostic device to assess real-time micronutrient status. Our overall goal is to develop the proof-of-concept of a robust, sensitive and specific diagnostic platform that will allow us to test micronutrient status.

**What has been done**

Photonic crystals [PC] are structures that reflect a narrow band of wavelength when illuminated by a broadband light source [such as LEDs and sunlight]. When biomolecules, such as antibodies and antigen complexes, absorb to the biosensor surface, it will cause a wavelength shift that is specific to the complexes bound, making a simple mechanism for biomarker detection. Also, PC biosensors are inexpensively manufactured from plastic materials and easily incorporated into simple test formats for disposable applications. In addition, our collaborator has developed a new optical attachment to convert a smartphone into a sensitive readout instrument, reducing the cost of reading PC platforms and maximizing its flexibility to any smartphone user in any household, clinic or region of the world.

**Results**

In this project our work was aimed at conducting proof-of-concept studies to establish a new application for the use of PC biosensors to micronutrient status biomarkers. The rationale for this research is that once populations suffering from micronutrient malnutrition are identified using low-cost diagnostic technologies, health- and nutrition-related problems can be better addressed through tailored nutrition strategies. In these studies, we designed, constructed and evaluated a PC biosensor application for detection of ferritin and soluble transferrin receptor, both biomarkers of iron deficiency anemia.

**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
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 #8**

### **1. Outcome Measures**

Investigating The Potential Of Zein To Microencapsulate Bioactive, Health-Enhancing Food Components

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The potential of zein to microencapsulate bioactive, health-enhancing food components will be investigated in this work. [1] Zein micro and nano scale encasing structures will be formed by manipulating experimental conditions including solvent composition, zein mass fraction, concentration of bioactive compounds, temperature, and the presence of additional surfactants. [2] Zein structures will be characterized by dynamic light scattering, scanning electron microscopy, focused ion beam electron microscopy, and atomic force microscopy. The long-term goal of this project is the production of stable food ingredients containing health enhancing/maintaining compounds.

#### **What has been done**

Zein, a corn protein, is a mixture of the polypeptides alpha-, gamma-, beta-, and delta-zein. Alpha-zein and gamma-zein comprise 70-85% and 10-20% of total zein mass, respectively. Both peptides have similar amino acid composition, except gamma-zein is rich in cysteine. The presence of cysteine has been associated with gelation of zein solutions. A common solvent for zein is aqueous ethanol. Preliminary results suggested that pH and ethanol content affect the rheology of zein solutions. Our objective was to investigate the effect of ethanol content [65-90%] and pH of the solvent [2, 6, and 12] on rheological properties of zein solutions [20% w/w] containing gamma-zein. Steady shear tests and oscillatory time sweeps were performed to determine flow behavior and gelation time of zein solutions.

#### **Results**

Results indicated that alpha-zein solutions were nearly Newtonian while those containing gamma-

zein showed shear thinning behavior. At high pH, gamma-zein increased the consistency index [K] and shortened gelation time. Results were attributed to the cysteine in gamma-zein. High pH promoted formation of disulfide bonds leading to higher K values and shorter gelation times. Results of this work are expected to be useful in the design of zein extraction processes and the development of new zein applications.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components

#### Outcome #9

##### 1. Outcome Measures

Identification Of Methods That Extend The Shelf Life, Improve The Nutritional Quality, And Enhance The Safety Of Fresh Cut Produce

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

Fresh-cut fruits and vegetables have become increasingly popular among consumers during the last two decades, because they are ready to consume and/or require minimal preparation for consumption. The challenge to producers is that fresh fruits and vegetables are living tissue with high water and sugar content. Damage during cutting often results in rapid loss in quality, storage life, and makes the products vulnerable to plant and human pathogen attacks. Identification of methods that extend the shelf life, improve the nutritional quality, and enhance safety of fresh cut produce will have a significant positive impact on consumers' acceptance of these products and improve the financial return to producers.

###### What has been done

We identified a new sanitizer composition that can achieve 5-log reductions in the survival count of E. coli on the produce surface. We tested a ultrasound and chlorine combined wash in a pilot

scale continuous flow to significantly enhance the efficacy of sanitation. Draft genome sequences for two strains of *Erwinia tracheiphila*, the causal agent of bacterial wilt of cucurbits, were obtained with both shotgun and pair-end libraries. A total of 620 million bases were obtained, which represents about 60 fold coverage of the genome at approximately 4.8 mbps. Initial assembly yielded about 42 scaffolds with about 400 contigs. We have determined the number of plasmid in the two strains of *E. tracheiphila*, generated an OpMap for both genomes based on restriction enzyme digestion, and aligned all the contigs and scaffolds to the map. We have also compared and aligned two genomes to define the difference, and closed 37 and 40 gaps, respectively. Bacterial populations within the insect vectors of *E. tracheiphila* were also determined.

**Results**

The outcomes of this project not only will provide new and long-due knowledge to the research community, but also benefits cucurbit growers and the fresh produce industry. Understanding the bacterial population within insect vectors will provide information for the potential source of microbial contamination for fresh produce, which is of great concern to the fresh produce industry.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
201	Plant Genome, Genetics, and Genetic Mechanisms
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
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 #10**

**1. Outcome Measures**

Number Of Fresh Food Producers Adopting Practices That Prevent Foodborne Illness Contamination

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	35

**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 horticultural 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.

Since the Food and Drug Administration introduced new rules to regulate production and handling practices for fresh produce, it is imperative that stakeholders in the food industry become proactive regarding both Good Agricultural Practices [GAPs] and Good Handling Practices [GHPs].

### **What has been done**

In response, six one-day and one online multi-session Extension educational programs were conducted in Illinois in the winter and early spring of 2013 to address safe food production and handling in order to ensure that fresh produce is free from contamination by microorganisms that cause foodborne illnesses. 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 recordkeeping. More than one hundred individuals participated in the training sessions representing specialty crop producers and others interested in food safety practices.

### **Results**

An end-of-meeting evaluation form was distributed and collected from 69 of the participants. A second evaluation was also mailed in November of 2013 to all attendees in the seven programs who provided an address [104] to identify any of 34 different practice changes resulting from their participation that were implemented during the growing season. Forty-eight evaluations were returned [46.1%]. Thirty-five of the 48 respondents [73%] identified practice changes implemented. Twenty-one [44%] of the respondents indicated implementing practice changes related to worker health and hygiene, e.g., training their workers about hand washing, posting hand washing signs, and stocking hand washing supplies. Twenty-one of the respondents [44%] also indicated implementing practice changes related to facilities and equipment sanitation such as cleaning harvesting bins/aids each day and sanitizing trucks and other transportation vehicles before loading. Nineteen [40%] of the respondents indicated implementing practice changes related to water usage for washing and cooling fresh produce and testing water quality. Sixteen [33%] implemented changes in their record-keeping and eleven [23%] made changes in manure handling and field application. Ten [21%] initiated a safety audit and twelve [25%] created a written food safety plan for their food production enterprise. In addition, 36 of 48 respondents [75%] indicated that they planned to implement at least one additional practice change.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 #11**

### **1. Outcome Measures**

Number Monitoring Proper Temperatures Of Food Served/Sold To The Public To Prevent Food-Borne Illness

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	66

### **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 a minimum of five hours of safety training or to complete a recertification exam to be eligible for re-certification to serve food every five years.

#### **What has been done**

Eight workshops on food safety [5-hour Refresher Course] have been conducted statewide by Extension Educators with nutrition and wellness assigned responsibility. Eight-eight [88] individuals involved in serving food to the public participated in the programs as a requirement to maintain their foodservice certification by the Illinois Department of Public Health. In addition, 33 food bank managers and staff members who are involved in distributing food to those in need participated in the program that was adjusted to address their unique food handling safety challenges.

A pre- and post-test consisting of eight multiple choice items focused on 2008 changes to the Illinois Food Sanitation Service code was distributed and collected from those in the certification course to measure knowledge change. Additional information and pre-test/post-test items were shared with food bank staff.

#### **Results**

Impact on knowledge of food safety measured by pre- and post-tests scores from participants in the 5-Hour Refresher Course revealed increases in one of more of the eight food safety practices by 84 of the 88 participants [94%]. All but two of the food bank staff members were able to answer at least one post-test question correctly that they were unable to answer correctly on the

pre-test. Specific to maintaining proper temperatures of food, 66 [75%] learned the temperature range [danger zone] when food is most susceptible to the growth of bacteria that cause foodborne illnesses, and 65 [74%] indicated learning that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than seven days. In addition, 11 of the 33 food bank staff members were able to identify the temperature zone when food is most susceptible to the growth of bacteria that causes foodborne illnesses. Based on results from a random follow-up study conducted in 2011, 33 of the 5-hour Refresher Course participants 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.

#### 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 #12

##### 1. Outcome Measures

Increased Knowledge Of Fresh Fruit And Vegetable Production Practices

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	123

##### 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 schools, fruit schools, 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, the two Southern Illinois Tree Fruit Schools, and the Stateline Fruit and Vegetable Growers Conference, a joint Extension program between Illinois and Wisconsin.

**Results**

The approximately 350 attendees at these schools were offered an option to rate the knowledge they gained for each of the individual topic sessions using a 1-5 scale with 1 = None/already knew and 5 = Learned a great deal. In addition, those attending the Stateline school were asked to comment on their overall knowledge gains regarding managing pest problems, produce safety, growing produce, and managing environmental/climate impacts. A total of 118 growers [34% of the attendees] completed the evaluation.

All of the 17 vegetable producers [14% of the attendees] who responded checked at least one topic as a 4 or 5, while 13 checked a 5 rating for at least one session topic. All of the 63 fruit producers [45% of the attendees] who responded checked at least one topic as a 4 or 5, while 54 checked a 5 rating for at least one session topic. For those attending the Stateline joint conference, all but two of the 38 respondents rated at least one session topic as a 4 or 5 and 26 checked a 5 rating for at least one topic session. Topics rated highest by vegetable school respondents were The Perfect Tomato Variety and How to Feed It [rated 4 or 5 by 82%] and Updates on Cucurbit Diseases and Insect Control in Vegetables [rated 4 or 5 by 47%]. Topics rated highest by fruit school respondents were Update in Insect Management in Peaches and Apples [rated 4 or 5 by 90%] and Impact of Drought on Fruit Trees [rated 4 or 5 by 79%]. When asked to share comments about their plans for using the information they gained, 74 attendees at the three programs listed specific planned actions. In addition, 31 respondents who attended the previous year's Southern Illinois schools indicated taking actions to control a pest based on recommendations shared by a presenter. Additional findings can be found in the Evaluation section of this planned program.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
216	Integrated Pest Management Systems
503	Quality Maintenance in Storing and Marketing Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

**Outcome #13**

**1. Outcome Measures**

Increased Knowledge Of Small Farm Production Options

**2. Associated Institution Types**

- 1862 Extension

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	188

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Owners of small acreages need assistance in determining how they can best put them to use.

#### What has been done

Extension Educators with assigned responsibility for small farms and local foods education developed Putting Small Acres to Work, a one-day program that addressed a variety of topics that were offered to help people who have a few acres learn ways that they can put them to use. Two hundred ninety [290] individuals attended one of six workshops held at various locations in the state. As planned, an end-of-workshop evaluation form was distributed and collected from 166 of the participants. In addition a series of 13 weekly one-hour webinars directed at small farm owners or operators was offered in the winter of 2013. Over 500 individuals representing 31 states and three countries registered for one or more of the sessions. A follow-up online evaluation was developed to collect information on the impact of this series [91 responded]. The survey questions were designed to gather information about participants' access to the series and knowledge gained and applied related to emerging topics in advancing local food production, management and marketing.

#### Results

Respondents to the Putting Small Acres to Work end-of-program evaluation were asked to identify the degree to which their knowledge, confidence and abilities were changed regarding putting their small acres to work. Using a scale from one to five [1 = No change and 5 = Greatly improved], the average score for 160 respondents was above a 3.4 for all the items. Responses to specific evaluation items addressed participants: [1] Ability to effectively find and access resources to support their small acreage systems [3.98 average group score with 116 of 158 [73.4%] choosing a rating of 4 or 5]; [2] Ability to develop goals for their property [3.84 average group score with 103 of 147 [70.1%] choosing a rating of 4 or 5]; and [3] Knowledge of concepts and principles of managing small acreage [3.78 average group score with 101 of 158 [63.9%] choosing a rating of 4 or 5].

More than half of the 91 Small Farms Webinar participants who responded to the follow-up survey indicated that they applied information they received through one or more of the 13 sessions. Three-fifths of the respondents indicated that they gained both answers to questions they had before attending the sessions and resource materials they can use to make more informed decisions. Nearly half reported gaining ideas they can try on their farm immediately. Approximately one-fourth [25] began production of vegetables, fruits, herbs, or flowers and more

than half added new varieties to their production of these commodities. Additional information is provided in the Evaluation section of this planned program.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
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

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

##### Good Agricultural Practices [GAPS] Training

An end-of-meeting evaluation form consisting of seven questions was distributed and collected from 69 of the participants in six one-day and one online multi-session **Enhancing Specialty Food Safety** programs. An evaluation was also mailed in November of 2013 to all attendees in the seven programs who provided an address [104] to identify any of 34 practice changes resulting from their participation that were implemented during the growing season. Respondents to the follow-up survey included a total of 48 of 104 attendees that included specialty crop producers and other individuals interested in food safety practices.

##### Knowledge Changes

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 and 5 = A great deal]. The average score for the 69 respondents was above a score of three for all topics. The areas of greatest learning were: [1] Preparing for a GAPs audit

[4.75 average group score with 56 of 69 [82%] checking 'a great deal']; [2] Keeping records [4.30 average group score with 36 of 69 [52%] checking 'a great deal']; [3] Minimizing risks during food production [4.13 average group score with 29 of 69 [42%] checking 'a great deal']; and [4] Minimizing risks during post-harvest handling [4.12 average score with 26 of 69 [38%] rating this a '5'].

### **Practice Changes Implemented**

Five questions encompassed 34 potential practice changes that were addressed in the programs. The focus areas of the five questions included: [1] Water usage and water quality testing; [2] Worker hygiene and health; [3] Facilities and equipment sanitation; [4] Manure handling and application; and [5] Recordkeeping. Respondents were presented with five options for each practice that included 'Did Prior', 'Done as a Result', 'Plan to Do', 'Don't Plan to Do', and 'Does Not Apply'.

A large number of the practices were checked 'Does Not Apply'. Most [60-80%] of the respondents checked this response in relation to manure handling and application practices. Approximately one-half of the respondents do not have employees, and thus, have no need to implement changes related to worker health and hygiene. However, 35 of the 48 respondents [73%] identified at least one practice change implemented: [1] Nineteen [40%] of the respondents indicated implementing practice changes related to water usage and water quality; [2] Twenty-one [44%] of the respondents indicated implementing practice changes related to worker health and hygiene; [3] Twenty-one [44%] of the respondents indicated implementing practice changes related to facilities and equipment sanitation; [4] Eleven [23%] of the respondents reported making changes in manure handling and field application; and [5] Sixteen [33%] of the respondents indicated implementing practice changes related to recordkeeping.

Specific practices most frequently marked as changes by the respondents included [followed by the number of individuals making the change]: [1] Providing training to help workers understand the importance of personal hygiene = 14; [2] Clean harvesting bins/aids daily = 14; [3] Clean and sanitize trucks and other transportation vehicles before loading = 13; [4] Post hand-washing signs emphasizing the importance of washing hands before work, after using the toilet facilities, and after lunch or smoking = 12; [5] Cover clean storage bins when not in use = 11; [6] Remove field soil from the outside of harvesting containers/bins prior to moving them into packing areas = 11; [7] Record worker training dates and content of training = 11; and [8] Regularly stock hand washing stations with liquid soap in dispensers, potable water [safe for drinking] and paper towels =10.

In addition, 36 of 48 [75%] of the respondents indicated that they planned to implement at least one additional practice change. However, all of the 34 practices were checked as 'Plan to Do' by at least two and as many as twenty-one respondents.

With respect to their involvement in an audit of their operation regarding risk management practices, ten indicated they conducted a self-audit and three engaged a third party in conducting the audit. Twelve respondents [25%] also indicated that they had created a written food safety plan for their food production enterprise.

### **Food Service Safety Evaluation**

University of Illinois Extension Nutrition and Wellness Educators conducted **Food Service Sanitation Management Certification Courses** in eight locations in 2012-2013. Eighty-eight 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, participants were asked 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. In addition, 33 food bank managers and staff members who are involved in distributing food to those in need participated in the program that was adjusted to address their unique food handling safety challenges and completed a multi-choice pre- and post-test set of questions that addressed the content of that training.

All but two of the participants in the certification courses 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. Approximately half of the participants who had answered each question incorrectly before the program answered it correctly at the end for the following items: [1] 66 [75%] learned that ready-to-eat potentially hazardous foods can be stored in the refrigerator for no more than seven days. In addition, all 88 participants were able to correctly answer this question at the end of the program; [2] 65 [74%] gained knowledge about how to correctly label prepared foods that are stored in the refrigerator or coolers; and [3] 62 [70%] learned the temperature range [danger zone] when food is most susceptible to the growth of bacteria that cause food borne illnesses.

With respect to five additional food handling requirements, participants were already knowledgeable as evidenced by their ability to answer the questions correctly at the beginning of the course. Nearly one half or more of the participants correctly answered the following questions correctly at the beginning of the course: [1] 71 [81%] could already distinguish between potentially hazardous and non-hazardous food. However, five of these individuals incorrectly answered this question at the end of the program; [2] 64 [73%] already knew the temperature and time needed to reheat potentially hazardous foods; [3] 60 [68%] already knew what jewelry is acceptable to wear when serving food to the public. An additional 27 were able to correctly answer the question after the program; [4] 49 [56%] learned only to drink from covered containers when involved in serving food. An additional 34 were able to correctly answer the question after the program; and [5] 43 [49%] already recognized the relationship of refrigerator shelf location with respect to variability of foodborne illness risk for various foods.

With respect to food bank staff responses to nineteen pre-post-test questions, 21 increasing their knowledge of temperatures for serving and storing foods: [1] 11 of 33 [34%] gained knowledge about the temperature zone [41 degrees Fahrenheit to 135 degrees Fahrenheit] when food is most susceptible to the growth of bacteria that cause foodborne illnesses; [2] 11 of 33 [34%] learned to always pack cold foods last when transporting food in a vehicle; [3] 8 of 33 [25%] learned that food and food contact equipment should be stored at least six inches off the floor; [4] 7 [22%] learned that when evaluating perishable food for safety, the most important characteristic is appearance; and [5] 6 [19%] learned to keep food frozen solid and freezers set at zero degrees Fahrenheit or below.

The attendees [350] at the two **Southern Illinois Commercial Tree Fruit Schools**, the

**Southern Illinois Commercial Vegetable School** and the **Stateline Fruit and Vegetable Conference** were offered an option to rate the knowledge they gained for each of the individual topic sessions using a 1-5 scale with 1 = None/already knew and 5 = Learned a great deal. One hundred twenty-three responded.

### **Fruit and Vegetable School Evaluation**

All of the 63 who responded checked at least one topic as a 4 or 5, while 54 checked a 5 rating for at least one session topic at the **Southern Illinois Fruit School**. All topics were rated 4 or 5 by over 65% of those who responded. The list of topics that follows are those that were rated a 4 or 5 in order of percentage of those who circled that rating regarding knowledge gained: [1] Update in Insect Management in Peaches and Apples was rated a 4 or 5 by 54 of 60 individuals who responded [90%]; [2] International: New Zealand Fruit Industry was rated a 4 or 5 by 39 of 44 individuals who responded [88%]; [3] Trends in the Nursery Industry was rated a 4 or 5 by 54 of 61 individuals [88%]; [4] New and Current Peach Cultivars was rated a 4 or 5 by 49 of 59 individuals who responded [83%]; and [5] FDA Update: Facility Registration and GAPS was rated a 4 or 5 by 49 of 56 individuals who responded [83%].

All 17 of the commercial vegetable growers who completed the evaluation checked at least one topic as a 4 or 5, while 13 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 rated the highest by percentage are as follows: [1] The Perfect Tomato Variety and How to Feed It was rated a 4 or 5 by 14 of 17 individuals who responded [82%]; [2] Portable Soil Sterilization System was rated a 4 or 5 by 12 of 16 individuals who responded [75%]; [3] The Process of Pollination/Fertilization & Factors That Impact Fruit Set--rated 4 or 5 by 9 of 12 individuals who responded [75%]; and [4] Disease Management of Cucurbits--rated 4 or 5 by 12 of 16 individuals who responded [75%].

All but two of the 38 responding participants in the **Stateline Fruit and Vegetable School** rated at least one session topic as a 4 or 5 and 26 checked a 5 rating for at least one topic session. Topics rated as best meeting respondents learning needs are as follows: [1] Cantaloupe Chaos, What Happens When Contamination Occurs was rated a 4 or 5 by 18 of 29 individuals [62%]; [2] Produce Safety Tips was rated a 4 or 5 by 16 of 29 individuals [55%]; and [3] Fruit Pest Management Plans was rated a 4 or 5 by 13 of 29 individuals [42%].

In addition, seven individuals provided comments regarding knowledge they gained related to Good Agricultural Practices [GAP]. Twenty-eight [28] individuals at the **Southern Illinois Fruit School** also provided comments related to knowledge they gained regarding Good Agricultural Practices [GAP]. The following were mentioned by several individuals: [1] New proposed regulations and required registration categories [9 individual comments]; [2] Website location for finding and commenting on proposed regulations [6 comments]; and [3] Required record-keeping [3 comments].

### **Practices Implemented by Individuals Who Attended the 2013 Southern Illinois Fruit Schools and 2013 Southern Illinois Vegetable School**

Attendees at the 2013 **Southern Illinois Fruit Schools** were asked to indicate practices that they implemented as a result of what they learned at last year's schools. Thirty-six individuals responded to this question, representing 57% of those who completed the evaluation. Thirty [30] of 36 [83%] controlled a fruit pest using

herbicide/fungicide recommendations shared by a presenter; 25 [60%] made adjustments in their spray schedule; 20 [55%] planted a new variety of peaches or apples; 14 [39%] evaluated and/or adjusted soil micro-nutrient levels; 13 [36%] surveyed their operation for correctable produce contamination risks; eight [22%] investigated or planted new rootstock or cultivars or found a substitute for cultivars; five [14%] registered as having a crop that is sensitive to spray drift; and four [11%] developed a GAP plan.

Attendees at the 2013 **Southern Illinois Vegetable School** were asked to indicate which of six practices they implemented as a result of what they learned at last year's school. Only five individuals responded to the question with four [80%] indicating that they improved field monitoring/scouting insects and disease; three controlled a vegetable pest using herbicide/fungicide recommendations shared by a presenter; and two adjusted their spray schedules and/or surveying their operation for correctable produce contamination risks.

### **Small Acres Evaluation**

An end-of-program evaluation was distributed to the 290 **Putting Small Acres to Work** participants and collected from 166. In addition, an online follow-up survey was distributed to 525 participants in the **Small Farms Webinar** series and collected from 91 respondents. Respondents were asked to identify the degree to which their knowledge, confidence and abilities were changed regarding putting their small acres to work. Using a scale from one to five [with 1 being no change and 5 being greatly improved], the average score for 160 respondents was above a 3.4 for all the items. [1] Ability to effectively find and access resources to support their small acreage systems [3.98 average group score with 116 of 158 [3.4%] choosing a rating of 4 or 5]; [2] Ability to develop goals for their property [3.84 average group score with 103 of 147 [70.1%] choosing a rating of 4 or 5]; [3] Knowledge of concepts and principles of managing small acreage [3.78 average group score with 101 of 158 [63.9%] choosing a rating of 4 or 5]; [4] Confidence in using small acreage management principles [3.66 average group score with 88 of 143 [61.6%] choosing a rating of 4 or 5]; [5] Knowledge about land stewardship and resource management [3.65 average group score with 79 of 142 [55.6%] choosing a rating of 4 or 5]; [6] Understanding about farming practices [3.52 average group score with 79 of 152 [52.0%] choosing a 4 or 5 rating]; and [7] Preparedness to start a farming enterprise [3.46 average group score with 75 of 157 [47.7%] choosing a rating of 4 or 5].

When asked if their personal objectives for attending this workshop were met, 153 respondents provided a rating using a five part scale [1 = Not met, 3 = Satisfactorily met and 5 = Extremely met]. All except nine participants [94%] chose a rating of 3 [Satisfactorily met] or above. Fifty-one [33.3%] marked a rating of 5, 62 [40.5%] marked a rating of 4, and 31 [20.3%] marked a rating of 3.

When asked to list the most important ideas they plan to put into practice as a result of participating in the workshop, 74 [44.5%] responded. Twenty-nine [39%] of the 74 participants listed specific planned actions. Most often mentioned [14 responses] were developing/writing a business or marketing plan and setting goals.

Fifty [59%] of the 85 **Small Farms Webinar series** participants indicated that they gained both answers to questions they had before attending the session and resource materials they can use to make more informed decisions. Thirty-seven [43%] reported

gaining ideas they can try on their farm immediately. Sixteen [19%] gained confidence in making management decisions. Other benefits mentioned included specific session topical information. One individual commented 'Just as importantly, I learned what not to do!'

An additional question asked **Small Farms Webinar** series participants to provide information on production changes in four commodity categories resulting from what they learned. Participants were asked to check all changes that apply to each of the categories. Options for checking included 'Did not raise any', 'Made no changes', 'Began production', 'Expanded production', or 'Tried a new variety, species, or technique'. Of those 54 who were involved in producing vegetables, 37 [69%] made one or more of the following changes in production: 21 tried a new variety or technique; 10 expanded production acreage; and 11 began production. Of the 33 who were involved in fruit production, 20 [61%] made one or more of the following changes in production: 11 tried a new variety or technique and 9 began production. Of the 34 who were involved in herb or flower production, 18 [53%] made one or more of the following changes in production: 12 tried a new variety or technique, three [3] expanded production acreage, and four [4] began production. Of the 14 who were involved in raising livestock, five [36%] made one or more of the following changes in production: two tried raising a new species and one began production.

## Key Items of Evaluation

### Good Agricultural Practices [GAPS] Training

Approximately half of the end-of-program evaluation respondents indicated they had learned a great deal about enhancing specialty food safety pertaining to preparing for an audit of implementation of safety practices, keeping appropriate records related to these practices, and manure handling and application. A follow-up evaluation evidenced food safety practice changes had been implemented by nearly three-fourths of the respondents primarily with respect to providing training for workers on personal hygiene and facilities and equipment sanitation [cleaning harvesting bins/aids daily and sanitizing trucks and other transportation vehicles before loading]. Ten of the respondents [21%] initiated an audit of their safety practices and one-fourth created a written food safety plan for their food production enterprise that will reduce their risk of food contamination by microorganisms that cause food borne illnesses.

These actions will position the program participants to be in compliance with rules and policies of the Food and Drug Administration to regulate the production and handling practices of fresh produce. Extension training is bringing about practice changes to prevent the spread of food contamination, and thus, reducing the risk of consumer foodborne illnesses and their associated health costs. In addition, these safe practices substantially reduce the financial risk to 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.

### Food Service Safety Evaluation

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 94% of the 88

participants gained knowledge in handling food safely. Most notably 66 [75%] 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 learned the temperature range [danger zone] during which food is most susceptible to the growth of bacteria that cause foodborne illnesses and how to correctly label prepared foods that are stored in the refrigerator or coolers. In addition, 21 food bank staff members [64%] gained knowledge regarding the temperature zone when food is most susceptible to the growth of bacteria that cause foodborne illness, to keep frozen food solid and freezers set at zero degrees, and/or to pack cold foods last when transporting them in a vehicle.

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 8,800 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 each time someone gets sick from food is \$1,850, this shared knowledge could represent a very significant contribution toward reducing healthcare costs.

### **Fruit and Vegetable School Evaluation**

Responses collected through the evaluation forms evidenced a high level of knowledge gained regarding all the topics for the **2013 Southern Illinois Commercial Tree Fruit School, Southern Illinois Commercial Vegetable School** and **Stateline Fruit and Vegetable Conference**. All topics offered at the **Southern Illinois Fruit School** received a 4 or 5 rating from 66% to 90% of those who completed the evaluation. Likewise, approximately 66% of those completing the evaluation listed something they planned to do with the information on implementing suggested practices.

With one exception, all 2013 **Southern Illinois Vegetable School** participants who completed an evaluation indicated that they learned new information about one or more topics covered by the presenters. Six individuals shared plans for using the information.

**Stateline Fruit and Vegetable Conference** attendees felt that their objectives for attending were met. Most notably, their responses to the end-of-program workshop indicated that more than half of them gained knowledge of concepts and principles in managing pest problems and produce safety, as well as confidence using management principles to improve produce safety and manage pest problems. In addition, more than half increased their ability to find and access new resources for production issues faced during the growing season. Ten of the participants indicated plans related to making changes in pest management and eight mentioned plans addressing food safety. Thirty-six participants reported specific practices changed or implemented as a result of what they learned at last year's school regarding pest control, variety selection, soil micro-nutrient levels, and safe food production.

### **Small Acres Evaluation**

An end-of-program evaluation was distributed to the 290 **Putting Small Acres to Work** participants and collected from 166. In addition, an online follow-up survey was distributed to 525 participants in the **Small Farms Webinar** series and collected from 91

respondents.

Respondents to the **Putting Small Acres to Work** evaluation were asked to identify the degree to which their knowledge, confidence and abilities were changed regarding putting their small acres to work. Using a scale from one to five [with 1 being no change and 5 being greatly improved], the average score for 160 respondents was above a 3.4 for all the items. For individual items: [1] Ability to effectively find and access resources to support their small acreage systems [3.98 average group score with 116 of 158 [73.4%] choosing a rating of 4 or 5]; [2] Ability to develop goals for their property [3.84 average group score with 103 of 147 [70.1%] choosing a rating of 4 or 5]; [3] Knowledge of concepts and principles of managing small acreage [3.78 average group score with 101 of 158 [63.9%] choosing a rating of 4 or 5]; [4] Confidence in using small acreage management principles [3.66 average group score with 88 of 143 [61.6%] choosing a rating of 4 or 5]; [5] Knowledge about land stewardship and resource management [3.65 average group score with 79 of 142 [55.6%] choosing a rating of 4 or 5]; [6] Understanding about farming practices [3.52 average group score with 79 of 152 [52.0%] choosing a 4 or 5 rating]; and [7] Preparedness to start a farming enterprise [3.46 average group score with 75 of 157 [47.7%] choosing a rating of 4 or 5].

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When asked to list the most important ideas they plan to put into practice as a result of participating in the workshop, 74 [44.5%] responded. Twenty-nine [39%] of the 74 participants listed specific planned actions. Most often mentioned [14 responses] were developing/writing a business or marketing plan and setting goals.

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An additional question asked **Small Farms Webinar** series participants to provide information on production changes in four commodity categories resulting from what they learned. Participants were asked to check all changes that apply to each of the categories. Options for checking included 'Did not raise any', 'Made no changes', 'Began production', 'Expanded production', or 'Tried a new variety, species, or technique'. Of the 54 who were involved in producing vegetables, 37 [69%] made one or more of the following changes in production: 21 tried a new variety or technique, 10 expanded production acreage, and 11 began production. Of the 33 who were involved in fruit production, 20 [61%] made one or more of the following changes in production: 11 tried a new variety or technique and 9 began production. Of the 34 who were involved in herb or flower production, 18 [53%] made one or more of the following changes in production: 12 tried a new variety or technique, three [3] expanded production acreage, and four [4] began production. Of the 14 who were involved in raising livestock, five [36%] made one or more of the following changes in production: two tried raising a new species and one began

production.

**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	20%		15%	
724	Healthy Lifestyle	10%		10%	
802	Human Development and Family Well-Being	20%		30%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		10%	
805	Community Institutions, Health, and Social Services	10%		0%	
806	Youth Development	20%		20%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	17.0	0.0	5.0	0.0
Actual Paid Professional	0.3	0.0	4.5	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
994739	0	1279095	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
994739	0	1279095	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
5218205	0	4776779	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities included an exploration into how Latino parents balance old and new ideas and ways as they raise adolescents in different contexts in the U.S., the collection of ethnographic and ethno-historical archive data for a study focusing on the impact of youth participation discourses, policies, and actual practices of youth participation, the optimization and validation of behavioral procedures for testing learning and memory in the pig and the development, optimization, and implementation of a set of three MRI sequences that permit structural and neurochemical characterization of the piglet brain [techniques that continue to deepen our knowledge about short- and long-term effects of early-life choline sufficiency], a study to determine the efficacy of dietary tomato and soy germ, alone and in combination, for the inhibition of prostate carcinogenesis in the transgenic adenocarcinoma of the mouse prostate [TRAMP] model, studies that contribute to our understanding of how low levels of genestein impact progression of estrogen-dependent breast cancer to estrogen-independent breast cancer in a well-established pre-clinical model of breast cancer, and utilization of the **Child Development Laboratory Research Database** by 21 research projects representing a diverse array of disciplines [including human development and family studies, advertising, anthropology, landscape architecture, art and design, nutritional sciences, communications, community health, and music education].

Activities also included efforts to improve the quality of programs for high-school-aged youth by gaining knowledge of the strategies used by effective program leaders in the varied challenging situations of their work [this information will be useful for training new leaders and provides a foundation for future research on youth practice], research focused on examining both the antecedents [marital quality, co-parenting, and parental physiological response to child cues] and outcomes [the child's pro-social behavior and peer competence] of child-mother and child-father-attachment security, a study that contributes to existing empirical knowledge by teasing out the complexities of separating in the context of violence versus no prior history of violence [the study also adds to our knowledge regarding the role of different types of violence in different post-divorce co-parenting experiences], activities supporting the **STRONG Kids2** program [with funding from the Dairy Research Institute, a birth cohort study of 400 families will be launched to examine the interactions between individual biology of the infant, mother, and home food environment to establish nutrition habits in the first three years of life] and the **Illinois Childhood Activity Program** [this interdisciplinary workshop series supported by the National Cancer Institute aims to identify new methods of assessing physical activity in preschool age children in their natural environments], research results that demonstrate the potential of apigenin and luteolin to protect against pancreatic carcinogenesis and provide the foundation for future studies in this area, and work to determine how socioeconomic factors including employment, income, and marital status impact early cognitive, behavioral and socio-emotional development [paying particular attention to the mediating role of maternal mental health and parenting behavior and to examine how work schedules including non-standard work hours

influence early development].

Activities also included continuation of the PONDER-G project [**Prevent Obesity and Nutrition-related Diseases: Environmental Resources and Genomics**] with the goal of establishing and recognizing the basis of predictive, preventive and personalized interventions in the context of obesity, continuing development of the **Healthy Outcomes for Teens [HOT]** interactive website, research findings that will improve our understanding of the mechanisms of soy products that reduce colon cancer risk and facilitate the identification of molecular markers, especially epigenetic markers, associated with colon cancer development, and a study aimed at investigating the effect of genistein on liver metastases derived from colon cancer and its molecular mechanisms.

Conference presentations included the Joint Council of Extension Professionals Galaxy Conference, National Training Webinar for Extension Professionals, National Council on Family Relations, Agricultural and Applied Economics Association, American Ethnological Society, Association for Political and Legal Anthropology, American Psychological Association, Implications of Research on the Neuroscience of Affect, Attachment, and Social Cognition Conference, Illinois Council on Family Relations Conference on Family Well-Being, Society for Research in Child Development, Institute of Food Technologists, Korean Society of Food Science and Technology, American Sociological Association, American Dairy Science, Experimental Biology, American Society for Nutrition, American Society for Biochemistry and Molecular Biology, and the Midwest Cancer Nanotechnology Training Center.

This past year saw increased delivery of programming that addressed brain health that was offered as a four-part series sequenced to provide information on strategies and techniques for building a better memory, learning about how brain health is directly related to body health and how to maintain that health, exploring and practicing several exercise strategies to challenge the brain, and partnering with the Alzheimer's Association to inform participants about memory loss, dementia and diagnosis of Alzheimer's. Each segment of the series [**Building a Better Memory for Everyday Life, FIT WITS, and Head Strong**] was also offered to meet the needs of various audiences. In addition, a four-part **Gardening for Your Brain** series was created representing an interdisciplinary format.

**Simplify Your Life: Clear the Clutter & Your Stress** workshops were developed and delivered at 16 locations in the state to Illinois Municipal Retirement Fund retirees as well as to other local audiences. Resources related to aging and retirement were also available through **Long-Term Care: Talking, Deciding, and 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**, a comprehensive program featuring a website, a blog, e-news, and monthly news articles. **Share Your Life Story**, a multi-week life series, provided a therapeutic approach to life renewal. Additionally, Extension educators [nutrition & wellness, family life, and consumer economics] reached out to all counties statewide by offering similar older adult focused 'healthy living' programs. For example, an interdisciplinary series of 101 programs titled **Learning is Timeless** was delivered at the Urban Leadership Center in Chicago to help 1,309 participants develop skills in health, family life, consumer economics and money management, and horticulture to reduce stress and promote better mental and physical health.

Extension Family Life educators also conducted multi-session programming on parenting and adult caregiving. **Parenting 24/7** is a one-stop source of 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 and set of customized

that help parents of infants and toddlers manage seven difficult stages and behaviors that are linked to child abuse and neglect and **Parenting Again** topic-based discussion guides for grandparents raising grandchildren. The **Intentional Harmony: Managing Work and Life** curriculum and web-based self-study focusing on nurturing adult relationships continued to be offered.

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. SNAP-Ed Extension staff members reached 443,000 youth who were taught healthy eating choices and 5,300 youth were reached through EFNEP in 2013. 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-2<sup>nd</sup> grade classrooms and by EFNEP staff in 3<sup>rd</sup> through 5<sup>th</sup> grade classrooms. Under the leadership of the 4-H Youth Development staff members, the **Health Jam** program was conducted for 5<sup>th</sup> graders and offered support related to exercise, wellness, nutrition, and health career information using an experiential learning approach. Additional information about the programs and their impact is included in the evaluation section of this planned program. **Healthy Hopping**, a website with more than 60,000 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, rhymes and games for youth are also available on this website. The site can now be accessed via a mobile app.

Extension programs also focused on chronic diseases including heart disease and diabetes. **I on Diabetes** was taught as a four-part [2 and 1/2 to three hours per part] Extension program that combined lectures, food demonstrations, activities, and samples of healthy foods. Two websites also made information available to the public. **Diabetes Lifelines**, a bi-monthly web-accessible newsletter provided information in both English and Spanish to clientele on a variety of diabetes-related topics [<http://www.urbanext.uiuc.edu/diabetes>] [more than 70,000 English page views and nearly 104,000 Spanish page views recorded for this past year along with more than 9,000 app connections]. Two additional websites, **Your Guide to Diet and Diabetes** and **Diabetes Recipes**, logged more than 263,000 English page views and more than 83,000 Spanish page views. The **Meals for a Healthy Heart** program 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 level and weight management information as well as food demonstrations, taste testing, and recipes were provided.

## 2. Brief description of the target audience

Members of the target audience included parents, faculty and graduate students engaged in leadership education research, biological chemists, professionals focusing on food science and human nutrition, students, commodity groups, breast cancer survivors, health care professionals, scientists in family social science, human development, human nutrition, and applied family work with a focus on child health and wellbeing, graduate and undergraduate students in training with an interest in child health and wellbeing, clinicians and practitioners focused on children and families, mothers who co-parent after separation [including those who do and do not experience intimate partner violence], faculty and postdoctoral researchers in human development and family studies, nutritional sciences, agricultural economics, community health, and biological sciences, daycare providers and practitioners in education [school administrators, principals, and teachers], and researchers, epidemiologists, and others concerned about health and food products. In addition, Extension is targeting youth, teachers, parents, grandparents, caregivers of adults, retirees, and working couples.

**3. How was eXtension used?**

Ten Extension faculty or 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**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	37081	32581	24341	0

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

**Patent Applications Submitted**

Year: 2013  
 Actual: 4

**Patents listed**

TF 11130-PRO [Plant Produced Immugens And Methods For Making]; TF 12004-PRO [Modulation of Immune Function by Dietary Bovine Lactoferrin]; TF 12192-PRO [Biosynthesis of an Oligosaccharide Using Escherichia Coli]; and TF 12209-PRO [Estrogen Receptor Alpha Inhibitors].

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
<b>Actual</b>	0	34	34

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

Year	Actual
2013	3

**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	Numbers Of Individuals Taking Recommended Actions To Manage Heart Disease And Diabetes Through Planning Menus/Choosing Foods Using The Food Guidance System
4	Delineating The Role Of Individual Nutrients, Especially Those Involved In A Multitude Of Biological Functions Such As Choline
5	Investigating The Ability Of Tomato Powder, Broccoli Powder And Soy Germ To Reduce The Progression Of Prostate Cancer
6	An Evaluation Of The Effect Of Dietary Botanical Estrogens On Breast Cancer Growth And Progression
7	Extension Of A Successful, Evidence-Based Approach For Strengthening Prosocial Sibling Relationships
8	Determining The Efficacy Of An Encapsulated Probiotics Delivery System In Selected Food Products Using Simulated GI Tract Models
9	An Examination Of How Family Conditions And Social Institutions Impact Early Developmental Processes
10	Development Of Dietary Strategies To Significantly Reduce Both The Incidence And Mortality Of Colon Cancer
11	Investigating The Effect Of Genistein On Liver Metastases Derived From Colon Cancer And Its Molecular Mechanisms
12	Implementation Of Practices That Build Brain Fitness And Memory
13	Knowledge Of Food That Is Low In Fat And High In Fiber And/Or The Importance Of Increasing Physical Activity Levels
14	Number Of Youth Planning To Adopt An Option For Responding To Bullying
15	Improved Emotional Health And Well-Being Through Actions Taken To Reduce Household Clutter And Accompanying Stress

## **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**

<b>Year</b>	<b>Actual</b>
2013	21

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The purpose of this project is for the continuation of the Child Development Laboratory [CDL] Research Database Project at the University of Illinois at Urbana-Champaign. This project has been designed to facilitate an interdisciplinary, longitudinal, and programmatic research agenda at the Child Development Laboratory in the areas of child development and family studies.

#### **What has been done**

A total of 21 research projects were conducted at the CDL during the current reporting period. Seventeen of the 21 studies accessed information from the CDL Research Database project as part of their data collection. These 21 projects represent a diverse array of disciplines [such as Human Development and Family Studies, Advertising, Anthropology, Landscape Architecture, Art & Design, Nutritional Sciences, Communications, Community Health, and Music Education] and are focused on various aspects of children's growth and development [social/emotional development, cognitive functioning, physical growth and health].

#### **Results**

Nine of the projects were investigations conducted by graduate students working under the direction of a faculty advisor, while 12 of the projects were faculty-led investigations. In addition to these 21 research projects, 3,927 student observations and 1,763 student class projects were implemented during the current reporting period that accessed information contained in the CDL Research Database. In facilitating these research projects, student observations and student class projects, the CDL Research Database project played a key role in supporting the academic activities of six of the Colleges on the UIUC campus [Agricultural, Consumer & Environmental Sciences, Applied Health Sciences, Communication, Education, Fine and Applied Arts, and Liberal Arts and Sciences] as well as the School of Social Work.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
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**

Numbers Of Individuals Taking Recommended Actions To Manage Heart Disease And Diabetes Through Planning Menus/Choosing Foods Using The Food Guidance System

#### **2. Associated Institution Types**

- 1862 Extension

#### **3a. Outcome Type:**

Change in Action Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	148

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Heart disease ranks as the number one cause of death, and diabetes ranks as the seventh leading cause of death in Illinois according to 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 program 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, 114 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. Meals for a Healthy Heart is a two-part face-to face series that focuses on increasing participant awareness of the major risk factors of coronary heart disease using methods that are similar to the diabetes programs. Evaluations are distributed at the end of the program, and one and three months after the program has ended.

### **Results**

All but two of the participants who completed all or sections of the I on Diabetes 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', 91 of 114 participants [80%] 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', 101 of 114 participants [89%] indicated that they improved their confidence in managing their diabetes in one or more areas. [3] Using a four-part scale ranging from 'never' to 'almost always', 110 of 114 participants [97%] reported increasing their frequency in taking at least one recommended action to manage their diabetes. All but one of the 36 who completed all or sections of the Meals for a Healthy Heart one-month follow up evaluation indicated taking at least one, and as many as six actions including 31 [83%] who read more food labels to help plan their meals, 30 [83%] who used less sodium to season food [a recommended practice to reduce the risk of heart disease], and 26 [72%] who took action to make a weekly meal plan. Additional information regarding specific areas of changes in skills, confidence, and practices related to participants' management of diabetes are included in the Evaluation Results section.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
724	Healthy Lifestyle

## **Outcome #4**

### **1. Outcome Measures**

Delineating The Role Of Individual Nutrients, Especially Those Involved In A Multitude Of Biological Functions Such As Choline

### **2. Associated Institution Types**

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Good nutrition is essential for proper growth and development during the first year of an infant's life. Specifically, decades of nutrition research have shown that adequate provision of nutrients during the gestation and early postnatal periods is necessary to support proper brain development. Thus, delineating the role of individual nutrients, especially those involved in a multitude of biological functions [such as choline], remains important not merely to characterize biological significance, but to determine how best to provide these nutrients to infants when breastfeeding is undesirable or impossible.

#### What has been done

We continue to feed sows either an insufficient or sufficient concentration of dietary choline [based on established dietary requirements] from day 60 of gestation through farrowing [day 114], and newborn piglets obtained from these sows subsequently receive milk replacer containing either insufficient or sufficient choline in a complete factorial arrangement of pre- and post-natal treatments. This experimental design has permitted us to assess how early-life choline influences systemic [metabolic] and central [brain structure, composition, and function] outcomes related to cognitive development. Data has now been collected both on short-term [4 weeks of age] and long-term [12 weeks of age] time points in order to elucidate whether permanent effects of choline deficiency exist. Ongoing studies continue with this type of behavioral testing, and we also added magnetic resonance imaging [MRI] as an imaging modality to determine growth and development of the brain as a result of choline deficiency.

#### Results

We have optimized and validated behavioral procedures for testing learning and memory in the pig, and over the past year we have used a plus-maze setup that relies on extra-maze cues to assess hippocampal-mediated cognitive function. Whereas changes to the experimental procedure are needed for 12-week-old pigs, this behavioral assay has served as a consistently important outcome for our research, and these data are perfectly complemented by our recently-developed MRI procedures.

We have developed, optimized, and implemented a set of three MRI sequences that permit structural and neurochemical characterization of the piglet brain, and these techniques continue to deepen our knowledge about short- and long-term effects of early-life choline sufficiency. Over the past year, we have semi-automated post-processing data collection and interpretation to ultimately create a rapid and repeatable technique to assess aspects of cognitive development in the pig. This was achieved by establishing a brain template for the domestic pig, and this tool will

soon be made available to the public to benefit other research programs.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
806	Youth Development

#### Outcome #5

##### 1. Outcome Measures

Investigating The Ability Of Tomato Powder, Broccoli Powder And Soy Germ To Reduce The Progression Of Prostate Cancer

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Our studies will investigate the ability of tomato powder, broccoli powder and soy germ, alone and in selected combinations, to reduce the progression of prostate cancer in a mouse model of PCa. In addition, we will evaluate potential mechanisms by which bioactives in these foods may reduce prostate tumor growth or metastasis. We will especially focus on anti-androgenic effects of lycopene and other carotenoids from tomato powder utilizing genetically modified mice that lack one of the two carotenoid cleavage enzymes. These studies should provide significant experimental support for, or against, the use of soy, broccoli and/or tomato products, or specific combinations of these foods, for prevention of PCa progression and metastasis.

###### **What has been done**

A study was undertaken to determine the efficacy of dietary tomato and soy germ, alone and in combination, for the inhibition of prostate carcinogenesis in the transgenic adenocarcinoma of the mouse prostate [TRAMP] model. At 4 weeks of age, male C57BL/6 x FVB TRAMP mice [n=119] were randomized to consume: AIN-93G control, 10% whole tomato powder [TP], 2% soy germ powder [SG] or 10% tomato powder with 2% soy germ powder [TP+SG] for 14 weeks. 100% of

mice fed the control diet had PCa, while PCa incidence was significantly lower in mice consuming TP [61%,  $p < 0.001$ ], SG [66%,  $p < 0.001$ ] and TP+SG [45%,  $p < 0.001$ ].

### Results

Although the protection offered by the combination of TP and SG was not synergistic, it was the most effective intervention. TP, SG and TP+SG increased apoptotic index [AI] and modestly reduced the proliferative index [PI] in the prostate epithelium of TRAMP mice exhibiting the same histopathologic grade. The dramatic reduction in the PI/AI ratio by the dietary interventions suggests a greater stimulus for malignant progression in the prostate microenvironment of the control group. Maximally effective and safe strategies for PCa prevention may result from optimizing combinations of nutrients and bioactives through an orchestration of dietary patterns.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

## Outcome #6

### 1. Outcome Measures

An Evaluation Of The Effect Of Dietary Botanical Estrogens On Breast Cancer Growth And Progression

### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	0

### 3c. Qualitative Outcome or Impact Statement

#### Issue (Who cares and Why)

Genistein [GEN] is the major isoflavone in soybeans well-known for its estrogenic properties through binding to estrogen receptors [ER], albeit with different affinities. Preclinical and in vitro studies indicate that GEN induces the transcriptional activation of several estrogen-responsive genes, preferentially through ER beta rather than ER alpha, at physiologically-relevant doses typical for adults consuming soy foods. Soy-containing foods and dietary supplements are the most significant dietary sources of isoflavones. The rise in popularity of products containing isoflavones has come from epidemiological studies in which soy foods, soy protein or isoflavones

were associated with health benefits related to menopause, cardiovascular disease and osteoporosis. These health claims have been only partially supported, and have been challenged by new evidence.

#### **What has been done**

In the present study, we utilized an experimental model of estrogen-dependent BC tumor growth. Feeding studies were conducted to determine the estrogenic effect of diets on MCF-7 tumor growth: [1] implantation [19 weeks] and withdrawal [6 weeks] of 17 $\beta$ -estradiol [E2]; [2] dietary GEN 500 and 750 ppm during treatment/withdrawal for 23/10 and 15/9 weeks, respectively; and [3] dietary soy protein isolate [SPI] containing GEN 180 ppm for 31/9 weeks of treatment/withdrawal. MCF-7 tumors grew rapidly in the presence of E2 implantation and abruptly regressed completely after E2 withdrawal. At different rates, dietary GEN alone [500 and 750 ppm] and GEN [180 ppm]-containing SPI stimulated MCF-7 tumor growth. After removal of the stimulus diet, tumors induced by 750 ppm GEN, but not 500 ppm GEN or SPI, regressed completely. The protein expression of epidermal growth factor receptor 2 [HER2] was higher in the GEN- and SPI-induced non-regressing [GINR] tumors compared to MCF-7 and E2 controls.

#### **Results**

These results are the first reported to indicate that long-term dietary exposure to low doses of GEN [500 ppm] or GEN-containing SPI [180 ppm] stimulates MCF-7 tumor growth, and that after withdrawal of stimulus, these luminal A subtype tumor cells are reprogrammed towards a luminal B subtype, a more aggressive phenotype.

Results demonstrated that estradiol accelerated BC metastasis as indicated by bioluminescent imaging. In addition, estradiol enhanced metastatic tumor colony formation and increased the size of tumor nodules in the lungs, which were due in part to the increase in proliferative cells in the metastatic tumors. In vitro, estradiol increased the motility and invasion of 4T1 cells, and the stimulatory effect on cell motility was not blocked by ICI 182, 780, confirming that ER was not involved in the process. Results from the present study suggest that estradiol plays a role in ER-negative BC metastasis in the whole animal.

In summary, low doses of GEN during long-term dietary treatment elicit changes in MCF-7 cells after stimulus withdrawal leading to a more aggressive and advanced tumor growth phenotype. In SPI-fed mice, tumor growth did not stop, even after diet withdrawal. Observed changes were accompanied with the modulation of BC biomarkers such as HER2, suggesting a potential molecular pathway that could explain the tumor stimulatory effects of GEN and GEN-containing SPI after prolonged treatment/withdrawal.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

## **Outcome #7**

### **1. Outcome Measures**

Extension Of A Successful, Evidence-Based Approach For Strengthening Prosocial Sibling Relationships

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Evidence is mounting that children who experience more positive relationships with a sibling are also more likely to enjoy better developmental outcomes. Conflicts among siblings are a prime source of dissatisfaction for most parents and children. Although a certain amount of conflict appears to be 'normal' for siblings, these disputes can be disruptive to family life due to both their frequency and qualitative characteristics. In addition to being the most common type of family strife, sibling conflicts may be quite aggressive and even violent. Intractable conflictual relations among young siblings have been shown to be predictive of later difficulties, such as antisocial and disturbed behaviors in adolescence. These factors have led some investigators to refer to sibling relationships as potential 'training-grounds' for violence and for establishing chronic coercive interactions with others. Longitudinal research has revealed that without intervention, the quality of sibling interactions tends to be relatively consistent over the course of childhood and adolescence, thereby leaving siblings with poor quality relationships at a disadvantage. Thus, a key challenge is to help siblings develop positive relationships so that they can more fully reap the advantages of sibling support.

#### **What has been done**

Attention was focused this past year on the development of an evidence-based parent training component for the Even More Fun With Sisters and Brothers curriculum, intended for families with siblings in the 8- to 12-year age range. Data collected through a previous Hatch-funded project on the Fun with Sisters and Brothers preventive intervention program [designed for siblings in the 4- to 8-year age range] served as the foundation for this work. These data included parents' reports of how they respond to their children's positive and negative interactions as well as their perceptions of the degree to which the effectiveness of their parenting behaviors were disrupted by their emotional reactions to sibling conflict.

**Results**

Results indicated that mothers' and fathers' reports of their emotional experiences during stressful interactions with their children were significantly correlated with the quality of their children's sibling relationship. Mothers' and fathers' abilities to more frequently engage in effective emotion regulation and coping strategies, such as cognitive reappraisal, were found to improve as a function of their family's participation in the preventive intervention. Furthermore, these improvements in parental emotion regulation were found to be associated with more positive sibling interaction at the end of the FWSB program. These results were used to develop a parent training module in which emotion regulation strategies, such as cognitive reappraisal, are taught as part of EM-FWSB.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
802	Human Development and Family Well-Being
806	Youth Development

**Outcome #8**

**1. Outcome Measures**

Determining The Efficacy Of An Encapsulated Probiotics Delivery System In Selected Food Products Using Simulated GI Tract Models

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Probiotics have been marketed due to possible health benefits. However, many probiotics containing food products fail to maintain the recommended probiotics concentration [ $10^6$  cfu/g] due to instability of probiotics in food matrices. The objective of this project is to encapsulate the target probiotic strains [*Lactobacillus acidophilus* and *Bifidobacterium infantis*] in protein-based wall materials. Microencapsulation using spray drying has been used as an effective method for protecting probiotics but the effect of atomization has not been thoroughly studied with evaluation on their effects on core materials such as probiotics.

**What has been done**

The effects of atomization methods on survivability of bacterial cells during microencapsulation process and storage were evaluated. Also, the effects of microencapsulation on viability of selected probiotics for storage and simulated gastrointestinal [GI] tract were evaluated. Bifidobacterium infantis ATCC 15697 and Lactobacillus acidophilus LA-5 were selected as probiotics for core materials. 10% [w/w] soy protein concentrate [SPC] or whey protein concentrate [WPC] solutions were prepared as the protein wall matrix. Probiotics dispersed in soybean oil were mixed with 10% SPC or WPC solution by a 1:9 ratio. Then the mixture was homogenized at 10,342 kPa with single path by a two-stage APV homogenizer. A centrifugal or a two-fluid nozzle atomization was used for atomization of the emulsion for the spray drying process. Viability of encapsulated probiotics was evaluated during the microencapsulation process, storage and simulated GI tract. Data were analyzed by ANOVA and Fisher's least significant difference.

### Results

Results showed that microencapsulation was significantly effective on viability of Bifidobacterium infantis ATCC 15697 compared to non-encapsulated during encapsulation process and storage. The viability of Bifidobacterium infantis ATCC 15697 encapsulated in soy protein was maintained during long-term storage [nine weeks] with as little as a three log reduction. In terms of atomization method, two-fluid nozzle atomization protected the Bifidobacterium infantis ATCC 15697 significantly better than centrifugal atomization during simulated GI tests. Effects of the wall matrices were not significant during encapsulation process and storage but whey protein showed significantly better protection of Bifidobacterium infantis ATCC 15697 during the GI test. Encapsulated Bifidobacterium infantis ATCC 15697 maintained viable counts significantly longer than non-encapsulated Bifidobacterium infantis ATCC 15697 during storage and simulated GI tract. Lactobacillus acidophilus LA-5 resulted in similar pattern in microencapsulation and GI tests as Bifidobacterium infantis ATCC 15697.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

## Outcome #9

### 1. Outcome Measures

An Examination Of How Family Conditions And Social Institutions Impact Early Developmental Processes

### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The two primary objectives of this work are to determine how socioeconomic factors including employment, income, and marital status impact early cognitive, behavioral and socio-emotional development [paying particular attention to the mediating role of maternal mental health and parenting behavior] and to examine how work schedules including non-standard work hours influence early development, particularly within the context of single-mother families.

**What has been done**

To meet these objectives, we conducted a statistical analysis and completed one study which examined the relationship between non-standard work schedules and children's well-being in single-mother families. In this study we also examined possible pathways [including parental stress and depression] through which work schedules may influence children's development. We utilized data from a national sample of children who were surveyed every two years from birth through kindergarten [Early Childhood Longitudinal Study Birth cohort]. This data was sponsored by the U.S. Department of Education and included survey instruments for children's behavioral and cognitive development, detailed survey data on mother's employment and job characteristics, as well as information on maternal stress and mental health.

**Results**

The results of our study suggest that non-standard work hours do play a role in young children's cognitive, social, and behavioral development within the context of single-mother households. Non-standard work is negatively associated with early literacy and math ability and increased internalizing of behavior problems among preschool children of single working mothers, even after controlling for income, child, and maternal characteristics such as maternal education. However, we find little evidence that the relationship between employment and early literacy is mediated by maternal depression which suggests that the mother's mental health may be only one of many factors to consider when trying to understand how non-standard work matters for single mothers. The results of our study suggest the need for future research to examine other ways non-standard work may affect child development.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 #10**

### **1. Outcome Measures**

Development Of Dietary Strategies To Significantly Reduce Both The Incidence And Mortality Of Colon Cancer

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Based on current knowledge of colon cancer development and beneficial actions of soy products, the present study is designed to test the hypothesis that dietary genistein modulates colon cancer development through epigenetic modifications on WNT signaling-related genes. Using a rat model for colon cancer development, we will be able to examine how genistein modifies the epigenetic codes so that the WNT signaling is maintained at a normal level when induced by a carcinogen and therefore chance of colon cancer development is greatly reduced. Moreover, we will compare the effects of dietary genistein at different stages of life to identify the best timing of exposure for achieving the maximal protection against colon cancer development. Findings from this project will improve our understanding of the mechanisms of soy products at their ability to reduce colon cancer risk and facilitate the identification of molecular markers, especially epigenetic markers, associated with colon cancer development. The proposed study will lead to the future development of dietary strategies to significantly reduce both incidence and mortality of colon cancer.

#### **What has been done**

A colon cancer model was established by splenic injection of a human cancer cell line, SW620, in athymic nude mice. Extract of Ginkgo Biboba [EGb] was subcutaneously injected into mice every week for six weeks after 8-week establishment of tumor in the mice. Tumor progression in liver was analyzed and the potential mechanism of action of EGb was investigated.

#### **Results**

Results showed a significantly increased rate of metastasis of colon cancer cells to the liver by EGb treatment than the control PBS group. EGb induced the proliferations of tumor cells in the metastasized liver significantly. The angiogenesis markers, CD31 and VEGF were not altered by EGb treatment in the metastasized mice liver, which suggests that the increased metastasis is primarily due to cell proliferation. EGb activated the MAPK/JNK cascades in the metastasized

liver, which is a stress-activated pathway.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle

#### Outcome #11

##### 1. Outcome Measures

Investigating The Effect Of Genistein On Liver Metastases Derived From Colon Cancer And Its Molecular Mechanisms

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

This study is aimed at investigating the effect of genistein [Gen] on liver metastases derived from colon cancer and its molecular mechanisms.

###### **What has been done**

Male athymic nude mice were randomized to three dietary groups, which were western diet [W: calories 11%, fat 39%, carb 50%], and W diet supplemented with either 100ppm Gen [GL] or 500ppm Gen [GH]. Animals were fed with different diets for 16 weeks before they were intra-splenically injected with metastatic human colon cancer cells SW620 and sacrificed 8 weeks later. The GL and GH groups have much lower liver metastasis rates [MR], which were 36% and 17%, respectively, compared to the W group with MR of 55%. Mean metastases size of the W group [4.7 mm<sup>2</sup>] is larger than the GL [2.1 mm<sup>2</sup>] and GH [2.0 mm<sup>2</sup>] groups.

###### **Results**

To understand the molecular mechanism of the anti-metastatic function of Gen, the expression of multiple metastasis-related genes were determined by real-time PCR. Importantly, mRNA of NDRG1 gene was greatly decreased by 50% and 60% in the GL [p=0.005] and GH groups [p=0.

001] compared to the W group. As NDRG1 has been reported as a biomarker for metastasis and poor prognosis in hepatocellular carcinoma, the down-regulation of NDRG1 by Gen supplementation was corresponding to decreased liver metastasis. In summary, our study indicated that dietary supplementation of Gen suppressed colon cancer metastasis, which is associated with altered expression of metastasis-related genes by the treatment.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population
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
2013	35

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

According to 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. With growth in this country's aging population, concerns about maintaining one's memory, as well as recognizing and managing brain disease, are issues of great interest to the aging and their families in maintaining quality of life.

###### **What has been done**

Drawing on research being done at the University of Illinois and other research institutions, a program series on brain health was conducted by Family Life Extension Educators in fifteen locations in Illinois this past year. The first session of the series addressed strategies and techniques for building a better memory. In the second session [Fit Wits] participants learned about how brain health is directly related to body health and how to maintain that health. In the third session [Head Strong: Exercise Strategies to Enhance Memory and Thinking], participants explored and practiced several exercise strategies to challenge the brain. The fourth session was offered in partnership with the Greater Illinois Chapter of the Alzheimer's Association and focused

on memory loss, dementia, and Alzheimer's disease and diagnosis. In addition, sessions were delivered as a stand-alone program to 44 groups throughout the state. At the end of each session, participants provided written feedback on changes in knowledge, plans for using the knowledge they gained, and activities they tried at home.

### **Results**

The following results were collected from participants in three of the series that were taught. Distribution and analysis of evaluations after the first three sessions of Brain Health revealed that all of the 46 participants learned something.

After the first session, 42 [91%] of the 46 participants mentioned learning facts about memory loss such as: [1] how memory is formed; [2] types of long-term memory; [3] how emotional, physical, and environmental factors affect memory; [4] by challenging the brain, memory will improve; and [5] not to worry about normal memory forgetfulness such as remembering names. After the second session, 29 [63%] participants shared comments that included learning about how the body and brain work including: [1] blood flow/oxygen's importance to the brain; [2] causes of cognitive decline; [3] the need to keep the brain active by learning new things that challenge the brain; and [4] that encouraging brain cell development can forestall the effects of dementia. They also mentioned learning one or more ways to stimulate the brain.

In addition, after the third session three-fourths [35] of the participants listed activities they had tried at home following the first two sessions. Activities most frequently mentioned included Sudoku, playing games, completing puzzles, association techniques, and using the left hand to complete tasks. This feedback suggests that the series successfully addressed ways to alleviate concerns about aging and stimulated participants to take action to keep the brain healthy to ensure their quality of life.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
724	Healthy Lifestyle
802	Human Development and Family Well-Being

### **Outcome #13**

#### **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
2013	703

**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 overweight/obese [21%]. Lack of proper nutrition and inadequate physical exercise are two of many interactive factors that lead to childhood obesity.

**What has been done**

University of Illinois Extension 4-H conducted the Health Jam program with more than 700 youth from seven counties participating in two-day camps and an eight-week 'Walk Across Illinois' that followed the camps. During the camps, young people 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. 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 healthy activity topics taught at each delivery site was used to identify knowledge increases. All but nine of the 712 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 one-third of the youth [83 of 243] at three Health Jam sites were able to recognize nutrient dense foods after participating in the program. At another site 31 of 68 youth [54%] learned that walking a mile and running a mile burns the same amount of calories after participating in Health Jam. A paired-samples t-test analysis indicated a statistically significant increase in the correct answers to these and other questions on the post-test as compared to the pre-test.

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 that 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 #14**

**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
2013	104

**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 focusing on bystanders that is 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 discussion program for junior high and senior high youth, supported by statistical research on bullying among teens in the U.S. Breaking the Code [BTC] program objectives are for 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; [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 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.

**Results**

Data from a subset of 318 students who completed both pre- and post-program evaluations in 2013 have continued to show increases in the number of students who definitely would: [1] Help a victim: 104 [33%] additional students checked this on the post-test [119 pre-test vs. 223 post-test]; [2] Confront a bully: 88 [28%] additional students checked this on the post-test [97 pre-test vs. 185 post-test]; [3] Understand a group can make a difference: 89 [27%] additional students checked this on the post-test [147 pre-test vs. 234 on the post-test]; [4] Ask an adult for help: 86 [26%] additional students checked this on the post-test [89 pre-test versus 175 post-test].

Sample responses when asked what they will do differently follow: 'I won't talk about people', 'I won't laugh at people', 'Not be mean to new students', 'Never spread rumors', and 'Do not call

names'.

#### 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 #15

##### 1. Outcome Measures

Improved Emotional Health And Well-Being Through Actions Taken To Reduce Household Clutter And Accompanying Stress

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Action Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	183

##### 3c. Qualitative Outcome or Impact Statement

###### **Issue (Who cares and Why)**

Excess stress and conflict can be a detriment to achieving a healthy lifestyle. One of the stresses may be living in a cluttered environment. Taking action to organize one's life is one way to help to reduce that stressor.

###### **What has been done**

University of Illinois Family Life Extension Educators developed and delivered a workshop for a statewide retiree group entitled Simplify Your Life: Clear the Clutter & Your Stress. The workshop was conducted in 16 locations throughout Illinois in the summer of 2013 and attended by 562 retirees, family and friends. The objectives of the workshop included helping participants to: [1] Understand how clutter can cause stress; [2] Identify their own reasons for the build-up of clutter; [3] Learn the barriers and benefits of dealing with clutter; and [4] Learn techniques to clean-up their clutter. As part of the program participants developed an action plan to get organized. Follow-up evaluations were developed to identify what steps were taken to complete participants' action plans. Evaluations were mailed to 383 participants who had provided addresses and completed and returned by 192 attendees. An additional 157 individuals were reached through workshops offered to community groups, child care providers and senior expo attendees.

## Results

Follow-up evaluations for Simplify Your Life: Clear the Clutter & Your Stress completed by 192 workshop participants [50% return rate] indicated that 134 had started or finished their plan to de-clutter. Nearly all [174 or 92%] had gained ideas they could try and 183 [95%] had used at least one of four de-cluttering strategies recommended during the workshop. Nearly four-fifths [147 or 78%] were motivated to do something about their clutter, and [162 or 88%] indicated they now think differently about de-cluttering after attending the workshop. With respect to experiencing a sense of relief/reduction of stress due to progress made from de-cluttering, nearly all 104 who answered the question indicated 'yes' [48%] or 'somewhat' [44%]. These and other responses to the evaluation completed by the Simplify Your Life: Clear the Clutter & Your Stress participants evidenced the impact this particular family life program had on improving residents' emotional health and well-being.

### 4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

### V(H). Planned Program (External Factors)

#### External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

#### Brief Explanation

### V(I). Planned Program (Evaluation Studies)

#### Evaluation Results

##### Chronic Disease Evaluation Results

In 2013, pre- and post-evaluations consisting of four sections of questions were collected from 114 participants at the beginning and again at the end of **I on Diabetes** programs conducted in ten counties in Illinois. **I on Diabetes** is a series of 2 ½ to 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 two of the 114 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-one [91] of 114 participants [80%] 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 disagree' to 'strongly agree' we found that: [1] 65 of 114 participants [57%] who completed the evaluations indicated they improved their ability to select healthier choices when dining out; [2] 60 [63%] reported they could now more easily prepare healthy foods; [3] 55 [48%] indicated they could easily select foods that fit their meal plan; [4] 49 of 114 [43%] increased agreement that healthy foods taste good; and [5] Only 32 of 114 [28%] 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 one [101] of 114 participants [89%] indicated that they improved their confidence in managing their diabetes. More than half of the 114 who answered these questions indicated an increased confidence in the following: [1] Estimating the amount of food you should eat [78 or 68%]; [2] Following a healthy diabetes meal plan [70 or 61%]; [3] Knowing which foods have carbohydrates [68 or 60%]; [4] Preparing foods that fit into their meal plan [64 or 52%]; [5] Selecting foods that will reduce the risk for heart disease [67 or 59%]; and [6] Only 42 [37%] 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', 110 of 114 participants [97%] reported increasing their frequency in taking at least one recommended action. More than half of the participants revealed increasing the following practices: [1] Setting goals to help manage their diabetes [73 or 64%]; [2] Using food labels to plan their meals [69 or 61%]; [3] Keeping track of the amount of foods with carbohydrates they eat each day [66 or 58%]; and [4] Following a meal plan to help manage diabetes [61 or 53%].

From one-fourth to one-half indicated increasing their frequency in taking the following actions: [1] Reading food labels [47 or 41%]; [2] Eating at least three regularly spaced meals a day [42 or 37%]; [3] Trying to limit fat intake [39 or 34%]; [4] Trying to be physically active [31 or 27%]; and [5] Trying to limit fat intake [28 or 25%].

In 2013, one-month and a three-month evaluations were sent to 40 participants in the University of Illinois Extension **Meals for a Healthy Heart** program. The program is a two-part face-to-face series that focuses on increasing participant awareness of the major risk factors of coronary heart disease. During the series participants received information on heart healthy foods, menu planning, healthy eating away from home, physical activity and weight management. All but one of the 36 participants who responded to an evaluation that was distributed one month after the program's completion indicated taking at least one, and as many as six, of the following actions: [1] Read more food labels to help plan their meals [31 or 86%]; [2] Used less sodium to season food [30 or 83%]; [3] Made a weekly meal plan [26 or 72%]; [4] Increased physical activity [23 or 64%]; [5] Checked their

cholesterol [19 or 53%]; and [6] Checked blood pressure more often [16 or 44%].

After receiving a follow-up evaluation mailed three months after the program ended, nineteen participants responded. Fifteen of the 19 participants made at least one and as many as six changes in the following eating habits since participating in the program: [1] Read more labels [14 of 19 reported doing so]; [2] Increased fiber intake [8 of 19 did with four others planing to do so]; [3] Decreased salt/sodium intake [8 of 19 did]; [4] Decreased intake of high fat foods [5 of 19 did with a sixth person planing to do so]; [5] Changed to monounsaturated fats in food preparation [5 of 19 did]; and [6] Ate a variety of foods based on MyPlate food guidance system [5 of 19 did with two more planing to do so]. It is worth noting that eleven of the nineteen respondents indicated that they had decreased their intake of high fat foods and use of mono-unsaturated fats before attending the program.

Three additional questions sought to elicit respondents' opinions about the following changes resulting from their participation in the program: [1] For 'more confident in planning and preparing heart healthy meals' thirteen checked 'yes' and two checked 'no' with four checking 'uncertain'. [2] For 'making more heart healthy food choices when eating away from home' sixteen checked 'yes' and two checked 'no' with one other who plans to do so. [3] For 'more aware of the relationship between diet and chronic diseases such as heart disease, diabetes and stroke' fifteen checked 'yes' and one checked 'no' with one other checking 'uncertain'.

### **Simplify Your Life: Clear the Clutter & Your Stress Evaluation Results**

Evaluations were mailed to 383 participants in **Simplify Your Life: Clear the Clutter & Your Stress** and completed and returned by 192.

With respect to completing an action plan to reduce their clutter that respondents had created as part of this workshop, nearly three fourths [140] indicated that they had started or finished their plan. Of the remaining one-fourth, 26 had established a plan but had not started it yet, and 21 had not made an action plan yet.

Respondents were asked to indicate their use of four strategies suggested during the training. The strategies included taking 5-15 minutes sporadically during the day to pick up and put away [Spurt Strategy], complete some tasks immediately rather than putting them off to avoid clutter build-up [Prompt Put Away], placing items in a donation/give away container or bag that is kept handy [Castaway Container], and doing de-clutter maintenance in many areas in the home on a regular basis [Good Riddance Routine]. Nearly all [183 of 192] indicated using one or more of the four strategies.

Respondents were also asked to select one or more of four answers regarding what they gained from the workshop. Nearly all [174 or 92%] checked 'ideas I can try'. Eighty-two [43.4%] discovered resource materials they could use, and one-third [65] received answers to their questions. Only five reported that they had not learned anything new.

In response to a second question, 147 [78.6%] reported being motivated to do something about their clutter, 111 [59.6%] were stimulated to think, and 56 [29.9%] were inspired to learn more about de-cluttering.

In response to a third question, 162 [88%] indicated they were now thinking differently

about de-cluttering after attending the workshop and 95 provided comments. The comments addressed facts such as the effects of clutter or techniques for dealing with clutter. Their other comments identified actions taken, being motivated, and improvements in their attitudes. A number of respondents' comments reflected what might be termed statements of self-talk such as 'the clutter is my clutter and I should take care of it'.

Respondents were also asked if they experienced a sense of relief/reduction of stress due to progress made toward de-cluttering. Eighty-nine [48.4%] checked 'Yes', 80 [43.5%] checked 'Somewhat', and 15 [8.2%] checked 'No'.

## **Key Items of Evaluation**

### **Chronic Disease Key Items of Evaluation**

All but two [98%] of the 114 participants who completed all or some of the sections of the **I on Diabetes** 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. Results included: [1] Using a four-part scale ranging from 'strongly disagree' to 'strongly agree', 91 or 114 participants [80%] 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', 101 of 114 participants [89%] 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', 110 of 114 participants [97%] 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.

Responses from the participants in **Meals for a Healthy Heart** indicated that all but one participant took at least one, and as many as six, recommended actions to reduce the risk of heart disease. Thirty-one [86%] took action to read more labels to help plan meals. Thirty [83%] took action to reduce their use of sodium [a recommended action to reduce the risk of heart disease], and 26 [72%] took action to make a weekly meal plan.

Approximately one-third to four-fifths of the 19 three month evaluation respondents are maintaining changes such as reading food labels or selecting healthy foods in order to reduce the risk of developing heart disease. In addition, more than three-fifths who responded to the questions feel more confident in planning and preparing heart healthy meals, making heart healthy choices when eating away from home, and increasing their awareness of the relationship between diet and heart disease.

### **Simplify Your Life Key Items of Evaluation**

Follow-up evaluations for **Simplify Your Life: Clear the Clutter & Your Stress** completed by 192 workshop participants [50% return rate] indicated that three-fourths had

started or finished their plan to de-clutter. Nearly all [92%] had gained ideas they could try and 183 [95%] had used at least one of four de-cluttering strategies recommended during the workshop. Nearly four-fifths [78%] were motivated to do something about their clutter, and 88% indicated they now think differently about de-cluttering after attending the workshop. With respect to experiencing a sense of relief/reduction of stress due to progress made from de-cluttering, nearly all indicated 'yes' [48%] or 'somewhat' [44%]. These and other responses to the evaluation completed by the **Simplify Your Life: Clear the Clutter & Your Stress** participants evidenced the impact this particular family life program had on improving residents' emotional health and well-being.

**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%		10%	
134	Outdoor Recreation	0%		10%	
135	Aquatic and Terrestrial Wildlife	5%		15%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
405	Drainage and Irrigation Systems and Facilities	5%		5%	
605	Natural Resource and Environmental Economics	0%		5%	
806	Youth Development	15%		0%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	6.0	0.0	9.0	0.0
Actual Paid Professional	0.0	0.0	5.0	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
262415	0	541221	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
262415	0	541221	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1376582	0	2669080	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities included the National Atmospheric Deposition Program's ongoing work collecting and analyzing precipitation chemistry and atmospheric chemistry samples and the dissemination of collected data to support research and education, ongoing analysis of soil samples to assess phosphorus retention in a long-term wetland, research conducted on the role of cultural ecosystem services in landscape decisions and regional well-being, brownfield reclamation at the U.S. Steel South Works plant site in Chicago, preliminary characterization and measurement of soils and sediment deposit at three locations that experienced recent natural and man-induced levee breaches to identify patterns of soil and crop damage, ongoing work on an online database of Empoasca species that resulted in 84 species being added to the online database and 47 new synonyms being recognized [approximately 6,500 new images were added to the online keys and database to illustrate diagnostic morphological features of various leafhopper species; data is available at <http://imperialis.inhs.illinois.edu/dmitriev/index.asp>], work to improve our understanding of the role urban agriculture plays in the conservation of species and the provisioning of ecosystem services, research that has generated data on non-target effects of agricultural use of pesticides on the ecology of vector mosquitoes [this data will aid public health agencies in development of policies on how to converge integrated pest management with integrated vector management to promote crop production while mitigating the risk of mosquito-borne diseases], and work to evaluate the efficacy of a fire-grazing model on grasslands in the upper Midwest in terms of improving conditions for grassland birds and potential benefits accruing to livestock producers.

Activities also included analysis and economic modeling of existing and potential groundwater management systems that showed that alternate policies can have very different impacts both on resource condition and on farm-level profitability [in particular, transferable permit systems, when designed to address instream flow and other local concerns, are often less costly than alternate policies to producers for any given level of required streamflow], an investigation into the relationships between plant community composition and soil microbial community composition in a prairie restoration which found that soil microbial community composition was more closely related to plant communities from five years ago than to the contemporary plant community [this suggests that invasive plant impacts on soil communities take some time to manifest], the statistical analysis of the results of a choice experiment survey regarding the values people in Illinois place on hypothetical restored grasslands with varying levels of biodiversity, the development of a model of the value to agriculture of improved biocontrol of pests in row crop agriculture, the demonstration of the applicability of a relatively new econometric methodology, the generalized method of moments, to take advantage of both stated preference and revealed preference data to estimate the value of economic losses from environmental contamination, and research to estimate the potential for water quality markets in the corn belt to yield cost savings in efforts to reduce nitrogen flows

into Midwestern waterways.

Conference presentations included the National Atmospheric Deposition Program Symposium, International Symposium for Society and Resource Management, An Intersection of Society and Nature [Uppsala, Sweden], Mid-American Landscaping, Illinois Mosquito and Vector Control Association, Indiana Dunes National Lakeshore Science Conference, International Association for Great Lakes Research, Ecological Society of America, Illinois State Academy of Science, 15th International Clay Conference, 50th Anniversary Annual Meeting of the Clay Minerals Society, Soil Science Society of America, Water Environment Federation, American Society of Agricultural and Biological Engineers, NADP 2013: Western U.S. Monitoring and Analysis: Progress and Current Issues, and the Association for Environmental Studies and Sciences.

Extension activities encompassed a variety of delivery methods to provide education regarding climate, soil and water management, forestry, and environmental stewardship. A description of some of the major areas of focus follows.

New programming included the development of a curriculum for the four-part **Weather Observer Course**, with one session consisting of which training for the volunteer precipitation monitoring program that is a part of the national volunteer precipitation monitoring program. YouTube videos on weather/climate topics were an additional educational effort to address climate and weather.

In addition, two new online self-study modules for Certified Crop Advisers were developed this past year to provide continuing education credits. The new modules address water table management and bioreactors. The latter module explores the effects on the reduction of nutrient loss through subsurface field tile drainage into local surface water sources. There are now 13 online CCA courses available in several subject areas including nutrient management, integrated pest management, and soil and water management. The annual **Soil and Water Management Workshop** for Certified Crop Advisers included topics on climate change, biomass crops, soil and water issues, cover crops/bioenergy crops, and drought.

The **Illinois Master Naturalist [ILMN]** program completed a sixth year of statewide implementation. Using the 20 chapter curriculum that included a chapter on weather and climate, training offered in 11 multi-county locations to certify new Master Naturalists has been completed or was in process. Slightly more than 500 individuals are actively engaged in a wide variety of projects as environmental stewards. A web-based reporting site is being used to collect information on all Master Naturalists' and Master Gardeners' training, volunteer hours, and projects.

This past year the **Soil Fertility Webinar** targeted for Certified Crop Advisers was hosted at 16 local Extension offices across the state in February of 2013 and included topics focusing on successful nutrient management, secondary and micronutrients, utilizing GPS and remote sensing, and phosphorus and potassium budgets. 'Nitrogen Management after the Drought' was a topic addressed at the six **Corn and Soybean Classics** that was presented by an Extension crop science specialist. Information about drought and crop management and the effects of the 2011 Ohio and Mississippi River flooding and induced levee breach on agricultural lands were also topics included in the four regional **Crop Management Conferences**.

Educational efforts carried out with respect to air quality addressed radon home testing and mitigation and recent requirements that impact day care facilities. Presentations are supported using grant dollars and through partnerships with the Illinois Department of Public Health with leadership provided by an Extension staff member with an engineering degree. This area of focus is also related to the Human Health and Human Development planned program.

Extension campus and field staff continued to conduct outreach focusing on the Emerald Ash Borer and other invasive pest identification and control practices. Six **First Detector** trainings were developed and delivered across the state this year to prevent the loss of shade trees that remove and sequester carbon from the atmosphere [also discussed in the Plant Health, Systems, and Production planned program]. The Extension pesticide training program reached 2,793 private [farmer] pesticide applicators and 9,203 commercial applicators this past year providing information on proper and safe use of pesticides that is vital to Illinois residents in terms of public health protection and environmental stewardship.

The majority of 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 by providing technical assistance through woodland owner conferences, seminars, workshops, field days, and Extension forestry bulletins. Many of the face-to-face programs included information on control of invasive plant species in woodlands. **Ask A Forester** is a key feature of the Extension forestry website. Iowa State University Extension forestry and University of Illinois Extension again partnered to offer the **Tri-State Extension Forest Stewardship Conference** that included 27 session choices related to tree diseases and pests, pruning and grafting, forest vegetation management, chainsaw sharpening, planting techniques, and timber sale contracts and marketing.

Youth conservation days with hands-on activities were held in many locations in the state and the **Think Green** curriculum [used to engage youth in investigating how living things interact with each other and with their environment] reached 1,245 3<sup>rd</sup> to 5<sup>th</sup> graders. In addition, a survey of 115 4-H youth campers indicates that 94% agreed or strongly agreed that they increased their understanding of how people can use but protect natural resources as a result of attending 4-H camp.

## 2. Brief description of the target audience

Members of the target audience included urban farmers, gardeners, planners and policy makers, professionals and academics focusing on natural resource management and landscape planning, natural resource managers and scientists involved with and concerned about optimal management of brownfields and other human-altered ecosystems, professional insect taxonomists, Extension specialists, professional insect diagnosticians, students, amateur naturalists, insect ecologists, public health agencies, mosquito abatement districts, scientists and conservation biologists at the state, regional, and national levels, USDA Forest Service scientists and staff, natural resource managers, agricultural producers, water managers of groundwater management districts, livestock producers, regulators, environmental scientists and environmental engineers, scientists and regulators working in the area of agricultural non-point pollution control, and federal, state, and local government agencies that make policy and management decisions regarding environmental quality and natural resource management. Extension activities also targeted pesticide applicators and youth.

## 3. How was eXtension used?

eXtension was not used in this program

## V(E). Planned Program (Outputs)

### 1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	23342	69791	68834	0

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

**Patent Applications Submitted**

Year: 2013

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	33	33

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

Year	Actual
2013	3

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number Of Individuals That Increased Knowledge Of Human Actions That Negatively Affect The Environment
2	Actions Taken By Program Participants To Protect The Environment [Water Quality, Air Quality, Soil Loss, Wildlife, And Natural Vegetation]
3	Dissemination Of Air Quality And Atmospheric Data Through Web Hits On The National Atmospheric Deposition Program Website
4	Reducing Nitrate And Sulfate Deposition
5	Reducing Contamination And Soil Damage Caused By Levee Breaches
6	Addition Of New Species And Synonyms To An Online Database For The Identification Of Empoasca
7	Improved Understanding Of How Agricultural Practices May Modify A Mosquito's Ability To Transmit Diseases
8	The Design And Evaluation Of Alternate Spatially-Targeted Resource Management Policies That Are Cost-Effective And Maintain Or Improve Environmental Conditions
9	The Removal Of Emerging Contaminants That Have Been Detected In Wastewater Discharges From Various Human And Livestock Sources
10	Number Of Youth Who Indicate Increased Knowledge About The Environment
11	Number Of Pesticide Applicators Making Decisions To Avoid Harming The Environment
12	Increased Knowledge About Weather Processes And Climate Change

**Outcome #1**

**1. Outcome Measures**

Number Of Individuals That Increased Knowledge Of Human Actions That Negatively Affect The Environment

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Actions Taken By Program Participants To Protect The Environment [Water Quality, Air Quality, Soil Loss, Wildlife, And Natural Vegetation]

Not Reporting on this Outcome Measure

**Outcome #3**

**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**

<b>Year</b>	<b>Actual</b>
2013	1250000

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Acidic atmospheric deposition continues to be a serious environmental concern. Sulfur and nitrogen oxides emitted from industrial and transportation sources, utilities, and metropolitan areas enter the atmosphere and are transformed into acidifying compounds. These pollutants are transported in the atmosphere and are removed, in part, as acidic wet deposition. Ecological impacts from this deposition include changes to lake and stream chemistry, reduced forest growth, reduced soil fertility, and increased weathering and corrosion of exposed structures. Aerosols resulting from the emissions reduce visibility and alter the radiative balance of the

climate system. Epidemiological studies link adverse human health impacts with fine particles containing sulfate and nitrate. Deposition of atmospheric mercury has been identified as an important negative input to many ecosystems. Mercury deposition is a concern as toxic methyl mercury can accumulate in the food chain and impact human health. The goal of the NADP is to monitor the nation's precipitation for these constituents to determine whether spatial and temporal trends in concentration and wet deposition are present.

#### **What has been done**

Since 1978, the National Atmospheric Deposition Program [NADP] has provided fundamental measurements to support informed decisions on environmental and agricultural issues related to the ambient concentration and wet deposition of atmospheric pollutants in North America. The NRSP-3 provides a framework for cooperation among State Agricultural Experiment Stations, the U.S. Department of Agriculture, and other cooperating governmental and non-governmental organizations.

#### **Results**

During 2013, NADP data were cited in over 200 peer-reviewed publications and book chapters. Data from the NADP's five monitoring networks, namely the National Trends Network [NTN], Mercury Deposition Network [MDN], Atmospheric Mercury Monitoring Network [AMNet], Ammonia Monitoring Network [AMoN], and Atmospheric Integrated Research Monitoring Network [AIRMoN] were downloaded over 28,000 times by over 39,000 registered data users. Each year, NADP data are used by policy makers to make informed decisions on agriculturally-important topics, including the impact of atmospheric pollutant fallout on the North American food supply. All data are available free of charge at <http://nadp.isws.illinois.edu>.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

#### **Outcome #4**

##### **1. Outcome Measures**

Reducing Nitrate And Sulfate Deposition

##### **2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

A better understanding of the chemical inputs resulting from atmospheric deposition is critical to understanding nutrient cycling in both crop and forest systems. This can lead to improved nutrient utilization in these systems. The comprehensive monitoring system that Illinois takes part in is also an early warning system for excessive nutrient loadings through atmospheric deposition, and provides an indication of the recovery from acidification in many ecosystems.

**What has been done**

Wet atmospheric deposition continues to be monitored at three sites in Illinois as part of this nationwide project. Data include weekly collection of precipitation with pH and complete chemistry measured. A long-term record [34 years] is now available at some of these sites, allowing an understanding of long-term changes in chemistry. These results continue to be part of a national program that leads to a complete understanding of atmospheric inputs of nutrients, and is needed to develop appropriate polices.

**Results**

Results continue to show a decline in both nitrate and sulfate deposition across the eastern U.S. in response to Clean Air Act regulations. This is one of the few projects that can show a clear environmental outcome to a change in national policies.

**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

## **Outcome #5**

### **1. Outcome Measures**

Reducing Contamination And Soil Damage Caused By Levee Breaches

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Whenever levees on the Ohio or Mississippi rivers are breached, there are soil damages in the flooded areas that impact agricultural management capacities and crop productivity. Floodwaters coat the entire flooded land surface with sediments which include a variety of pollutants, nutrients and contaminants. The nature of the sediments in floodwaters varies with the topographical and land use characteristics of the watershed. The soil types, hydro-geologic features, volume of flow, time of year, agricultural use of fertilizers, pesticides, and other chemicals as well as upstream point sources such as sewage treatment plants, storm sewer drainage and other urban land uses will affect the extent of the contamination and fine scale remediation needed.

#### **What has been done**

Preliminary characterization and measurement of soils and sediment deposit at three locations that experienced recent natural and man-induced levee breaches are analyzed to identify patterns of soil and crop damage. These findings provide guidance to the restoration of craters, gullies, land scoured areas and contaminated sediment depositional sites with a goal of improving decision making, risk analysis and remedial effectiveness.

#### **Results**

Recommendations include: [1] improve characterization and measurement of eroded soils and distribution of sediment contaminants after levee breaching; [2] assess contamination effects on soil productivity and long term agricultural production in order to understand the impacts of flooding on agricultural soils; and [3] evaluate reconstruction investments needed to repair levees based on return of the land to productivity and increased landscape resilience by reducing vulnerability to future flooding and levee-breaching stress.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 #6**

### **1. Outcome Measures**

Addition Of New Species And Synonyms To An Online Database For The Identification Of Empoasca

### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	131

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Empoasca is one of the most economically-important genera of leafhoppers, with the potato leafhopper and other polyphagous species causing substantial damage to field and horticultural crops annually. The current lack of reliable identification aids and doubts about the identities of numerous previously-described species hinders the ability of economic entomologists and quarantine officers to manage these potential pests and prevent accidental introductions of invasive species. Because few specialists are available to do routine identifications [there are only three full-time leafhopper taxonomists in North America] user-friendly identification tools that can be used by non-specialists are urgently needed. Because they require only a computer with internet connection and basic knowledge of insect morphology, online interactive keys provide the means for non-specialists to identify insects quickly and efficiently.

#### **What has been done**

The keys and associated data are being organized to provide a comprehensive resource accessible to anyone with access to the internet. Efforts are being made to include large numbers of illustrations and to provide tools for customized data exploration [creation of custom keys for

leafhoppers occurring in particular regions or host plants], which will make them easier to use for non-entomologists.

### Results

During the reporting period, 84 species were added to the online database and 47 new synonyms were recognized. Approximately 6,500 new images were added to the online keys and database to illustrate diagnostic morphological features of various leafhopper species. These images will make the keys easier to use. The project website received ~15,000 unique visitors and can be found at <http://imperialis.inhs.illinois.edu/dmitriev/index.asp>.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
134	Outdoor Recreation
211	Insects, Mites, and Other Arthropods Affecting Plants
605	Natural Resource and Environmental Economics

## Outcome #7

### 1. Outcome Measures

Improved Understanding Of How Agricultural Practices May Modify A Mosquito's Ability To Transmit Diseases

### 2. Associated Institution Types

- 1862 Research

### 3a. Outcome Type:

Change in Knowledge Outcome Measure

### 3b. Quantitative Outcome

Year	Actual
2013	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 non-target 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. We used a series of experiments to test how pesticides and nitrogen enhancement in the larval stages affect mosquito performance [adult life

span] and susceptibility to infection with disease agents [viruses]. Improved understanding of how agricultural practices may modify a mosquito's ability to transmit diseases has important considerations and applications for guiding decision making about mosquito control practices. Control efforts are intimately tied to benefits to society since their aim is to improve human health by minimizing disease risk. Thus, research results have the potential to provide information for policy formulation by Federal, State, and local agencies.

#### **What has been done**

We have generated new knowledge on the potential for pesticide use in agriculture to modify the quality of mosquito larval habitats and to influence epidemiologically-important life history traits of mosquito vectors of human and wildlife pathogens. We have shown that pesticides can influence the quality of mosquito larval habitats by changing the relative abundance and community structure of bacterial communities that serve as the main food base for mosquito larvae. Further, our results indicate that pesticides can interact with natural biotic and abiotic factors to influence mosquito survival, baseline immunity, body size, fecundity, and longevity, all of which have an impact on mosquito vectorial capacity.

#### **Results**

Pesticides are widely used around the world to control undesirable 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 agricultural use of pesticides on ecology of vector mosquitoes. This data will aid public health agencies in development of policies on how to converge integrated pest management with integrated vector management to promote crop production while mitigating the risk of mosquito-borne diseases. Among the audiences that were served by this study are public health agencies and mosquito abatement districts.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
134	Outdoor Recreation
135	Aquatic and Terrestrial Wildlife
211	Insects, Mites, and Other Arthropods Affecting Plants
405	Drainage and Irrigation Systems and Facilities

#### **Outcome #8**

##### **1. Outcome Measures**

The Design And Evaluation Of Alternate Spatially-Targeted Resource Management Policies That Are Cost-Effective And Maintain Or Improve Environmental Conditions

##### **2. Associated Institution Types**

- 1862 Extension
- 1862 Research

**3a. Outcome Type:**

Change in Action Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The project will design and evaluate alternate spatially-targeted resource management policies that are cost-effective and maintain or improve environmental conditions such as groundwater stocks and instream flows.

**What has been done**

Major activities conducted included workshops and one-on-one meetings with water managers and agricultural producers in Nebraska, Kansas, and Texas. The goals were to understand key stakeholder concerns, determinants of groundwater-fed irrigation behavior, and local variations in water regulations. Data on groundwater use and regulatory structure were collected. A particular focus was information on informal transfers of groundwater pumping rights in regions where such transfers were possible.

**Results**

Analysis and economic modeling of existing and potential groundwater management systems show that alternate policies can have very different impacts both on resource condition and on farm-level profitability. In particular, transferable permit systems, when designed to address instream flow and other local concerns, are often less costly than alternate policies to producers for any given level of required streamflow. We have been working with several Natural Resource Districts in Nebraska to try to implement functional streamlined transferable permit systems that reduce the transaction costs of reallocating water between producers while meeting regulatory requirements. If successful, such systems would provide quantified monetary benefits to producers as well as reduced impacts on adjacent stream flow.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
405	Drainage and Irrigation Systems and Facilities

## **Outcome #9**

### **1. Outcome Measures**

The Removal Of Emerging Contaminants That Have Been Detected In Wastewater Discharges From Various Human And Livestock Sources

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Work associated with this project looked at the removal of emerging contaminants [such as pharmaceuticals, steroids, surfactants, and plasticizers] that have been detected in wastewater discharges from various human and livestock sources. According to the Union of Concerned Scientists 70% of total annual antibiotics use in the U.S. [11,200 tons] are used for non-therapeutic purposes with cattle and swine, and a significant fraction [up to 75%] is excreted in an unaltered state. When released into the environment, these bioactive chemicals can exert selective pressures on microbial communities and cause them to develop antibiotic resistance as a defense mechanism. Antimicrobial-drug resistance has become a major concern with an estimated economic impact of \$4 to \$5 billion. A significant number of studies have been done on the removal of pharmaceuticals and antibiotic resistance in drinking water and wastewater, and although some removal of pharmaceuticals has been observed in conventional wastewater treatment processes, most are not effectively designed to remove micropollutants. Thus, there is a critical need to better understand the fate, transport and transformation of these emerging contaminants in water purification processes and to develop novel processes that cost-effectively reduce the risks associated with bioactive compounds in wastewaters. This study 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.

#### **What has been done**

Our recent work has shown that hydrothermal liquefaction [HTL] treatment of livestock manure can effectively destruct a range of bio-active compounds in manure including ceftiofur, florfenicol, and estrone. These results showed that extending HTL reaction time from 15 to 60 minutes provided additional removal of bioactive compounds when HTL was operated at temperatures

less than or equal to 250°C. However, when HTL was operated at a temperature of 300°C, the effect of HTL reaction time on bioactive compound removal was minimal and nearly complete removal was achieved for all reaction times. Thus, we confirmed that HTL can be successfully utilized to simultaneously produce valuable bio-crude oil and destruct bio-active compounds in animal manure.

**Results**

Our research also showed that HTL treatment of manure can produce some additional chemical compounds that have deleterious biological effects. Specifically, we showed that the aqueous organic mixture produced by HTL exhibited mammalian cell cytotoxicity with a lethal concentration of 50 at a dilution of 7.5%. Further, we showed that treatment with algal bioreactors reduced mamallian cytotoxicity by 30%, and subsequent adsorptive treatment with activated carbon could reduce cytotoxicity by 90%.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
405	Drainage and Irrigation Systems and Facilities
605	Natural Resource and Environmental Economics

**Outcome #10**

**1. Outcome Measures**

Number Of Youth Who Indicate Increased Knowledge About The Environment

**2. Associated Institution Types**

- 1862 Extension

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	634

**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 I Think Green curriculum was developed by 4-H and horticulture Extension specialists to engage 3rd through 5th 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 to 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] 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. The program was delivered by 4-H and Master Gardener trained volunteers and involved 1,245 youth this past year, tripling the previous year's participation.

In addition, a questionnaire was distributed and collected from 115 youth who attended 4-H camp this past year that included fourteen questions related to interest in science and the environment. Youth were asked to respond to the 14 questions using a 1-4 scale with 1 = Strongly disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly agree.

### **Results**

In responding to a ten-question evaluation given to the youth participants at the end of each of the three tracks, 94% [526] reported that the activities helped them learn how butterflies, worms, or insects contributed to the environment, 81% [483] reported being more excited about helping to care for the environment, 74% [416] reported having more ideas about ways they could help care for the environment, and 70% [395] 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, more than ninety percent of the 115 youth who responded to the questionnaires distributed and collected at 4-H camps this past year indicated that they agree or strongly disagree that attending 4-H Camp has increased their understanding of how people can use but protect natural resources and recognized that the quality of the water in the 4-H lake is important. In addition, with respect to other findings related to science, 98% affirmed that they get to do hand-on activities in the program/project, and 80% or more: [1] Think that science, engineering, or technology will be important in their future job; [2] Are encouraged to ask questions about science, engineering and technology; [3] Like science; and [4] Think they are good at science. Additional information can be found in the 4-H Youth Development planned program Evaluation section.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
134	Outdoor Recreation
211	Insects, Mites, and Other Arthropods Affecting Plants
806	Youth Development

## **Outcome #11**

### **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**

<b>Year</b>	<b>Actual</b>
2013	5657

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Use/application of pesticides has potential adverse impacts on 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 17 settings across the state to a total of 2,793 individuals in 2012-2013 that included agricultural producers, agriculture and horticulture sales associates, and Extension master volunteers. Commercial applicator training was offered by Extension staff through 56 clinics located in 27 settings across the state to a total of 5,894 individuals in 2012-2013 that included operators and applicators who apply pesticides to turfgrass, field crops, ornamentals, and road right-of-ways. Following the training, Illinois Department of Agriculture staff administered a certification test. This past year a survey of practice changes was mailed to a random sample [498] of the 5,874 individuals who participated in the 2011-12 commercial applicator trainings.

#### **Results**

Completed returned surveys numbered 295 for a return rate of 59%. In response to the question 'As a result of the training session, how much have you improved the following?' respondents could rate up to 12 practice changes. The 286 who responded could choose from the following response options: 1 = Could improve but have not, 2 = Made some improvement, 3 = Made great improvement, and 4 = Was already doing correctly.

Ninety percent [260] of the 286 respondents indicated improving one or more of the 12 actions after the training. More than sixty percent of the respondents to the question reported improving the following: [1] 188 [65.7%] improved calibration procedures [frequency, accuracy, and

measurements]; [2] 183 [64.0%] improved pest control decision-making [scouting and identifying pests]; [3] 178 [62.2%] improved mixing pesticides properly; and [4] 173 [60.5%] improved law compliance [licensing, record keeping, transporting]. Additional findings are provided in the Evaluation of Results section of this planned program. Based on the sample findings, 8,283 [90%] of the 9,203 2012-13 commercial pesticide operators and applicators have improved their practices.

In addition, based on findings from a survey of 16 practice changes that was conducted in 2010, 2011 and 2012 at the private applicators safety education programs, three fourths of this year's 2,973 private applicator training attendees will have likely: [1] Read and followed label directions for proper pesticide application; [2] Taken precautions to minimize spray drift when applying pesticides; [3] Scouted to determine proper identification of pest before determining if control is needed; and [4] Understand how pesticides can cause contamination and taking steps to prevent it. Using the average figure of \$11,000 from the three-year study regarding training participants' estimate of what they are able to save by being able to protect their production and apply appropriate pesticides when necessary, the total estimated dollars saved for the six percent [167] of the training attendees last year may well be nearly two million in dollars.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
211	Insects, Mites, and Other Arthropods Affecting Plants

#### Outcome #12

##### 1. Outcome Measures

Increased Knowledge About Weather Processes And Climate Change

##### 2. Associated Institution Types

- 1862 Extension

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	61

##### 3c. Qualitative Outcome or Impact Statement

**Issue (Who cares and Why)**

Swings in and severity of weather such as droughts, tornadoes, and floods are of concern to Illinois residents and create emotional, economic and health consequences to those who are affected. Weather monitoring systems have value in helping residents prepare for weather challenges that are forthcoming.

#### **What has been done**

A Weather Observer course, the first of its kind, was developed and conducted in 2013. The intent of the course was to teach participants basic weather processes, climate change processes, and provide training for a state/national volunteer precipitation monitoring program. Nineteen [19] participants attended four 2½ hour seminars. Topics included causes of seasons, composition of the atmosphere, wind and air pressure relationships, reading weather maps, violent weather and weather safety, and using weather observations to make basic weather predictions. In addition, climate change science was discussed, using information from a Nobel researcher in the atmospheric sciences department of the University of Illinois. One session was also devoted to training for the Community Collaborative Rain, Hail, and Snow volunteer precipitation monitoring program, an online national reporting system. This session was taught by a retired director of the Midwest Climate Center located on the University of Illinois campus. A short evaluation was distributed at the end of the series.

In addition, the 2013 West Central Illinois Extension Agronomy Day for the first time included a discussion of climate change for 80+ area farmers and landowners from 14 different counties. Research-based information was provided by campus-based staff. The combination of dry weather followed by extreme rain event data from the prior year growing season made this a timely educational activity.

#### **Results**

Evaluations showed that all Weather Observer participants increased their knowledge of basic weather processes and climate change. Eighteen [18] of the 19 participants completed the evaluation, using a 1-5 rating scale with five being the highest rating. The average group rating that reflects the respondents' self-reported level of knowledge gained was 4.6. Participants were asked to rate how comfortable they felt explaining basic weather processes, both before and after the course. When comparing the scores, the group average increased one full point from 2.9 to 3.9 [a 20% increase]. Likewise, when asked to rate their comfort level in explaining climate change to others before and after taking the course, the average group score increased from 3.1 to 4.1 [also a 20% increase]. When asked to list the most important things they learned in the course, eight of the eighteen mentioned clouds [their names and how to look at them to see the changes in weather]. Several also mentioned learning about storms/bad weather [how they are formed]. A final evaluation question sought to discover if the course changed their opinions on climate change. Six indicated no, one indicated maybe, three indicated it confirmed their belief, and six indicated their opinion had now changed. Plans are to conduct this new program again in other locations in the state.

Fifty-three of the West Central Agronomy Day participants completed an initial evaluation that day. Of those, 30% indicated they will use the climate information often, 51% will use the information, and 18% deemed it not useful. Follow-up telephone calls were made with 29 attendees 30-70 days later. Eighty-three percent [83%] indicated that weather conditions associated with climate change ranked third in the top three challenges these producer/owners face. Ninety-three percent [93%] indicated they would use more weather/climate information as agronomy day topics.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

##### Commercial Pesticide Applicator Training Evaluation Study [2012-2013]

This past year a survey of practice changes was mailed to a random sample [498] of the 5,874 individuals who had participated in the 2011-12 Commercial Pesticide Clinic trainings. Completed returned surveys numbered 294 for a return rate of 59%. In response to the question 'As a result of the training session, how much have you improved the following?' respondents could rate up to 12 practice changes. The 286 who responded could choose from the following response options: 1 = Could improve but have not; 2 = Made some improvement, 3 = Made great improvement, and 4 = Was already doing correctly. Ninety percent [260] of the 286 respondents indicated improving one or more of the 12 actions after the training.

More than sixty percent of the respondents to the question reported improving the following: [1] 65.7% [188] improved calibration procedures [frequency, accuracy, and measurements] with 89 indicating they made great improvement; [2] 64.0% [183] improved pest control decision-making [scouting and identifying pests] with 89 indicating they made great improvement; [3] 62.2% [178] improved mixing pesticides properly with 94 indicating they made great improvement; and [4] 60.5% [173] improved law compliance [licensing, record keeping, transporting] with 107 indicating they made great improvement.

Fifty to sixty percent of the respondents reported improving their implementation of seven of the other practices: [1] 57.3% [164] improved application procedures [proper wind speed, pressure, boom height] with 96 indicating they made great improvement; [2] 57.3%

[164] improved routine use of personal protective equipment [PPE] with 80 indicating they made great improvement; [3] 55.9% [160] improved including non-chemical methods of control [cultivation and mowing] in their pest control program with 89 indicating they made great improvement; [4] 53.8% [154] improved equipment maintenance [inspecting, cleaning, replacing worn nozzles] with 73 indicating they made great improvement; [5] 53.8% [154] improved referring to label information with 97 indicating they made great improvement; [6] 52.8% [151] improved changing type, size or material of the nozzles used with 73 indicating they made great improvement; and [7] 52.8% [151] improved proper pesticide storage [locked cabinet, PPE stored separately] with 80 indicating they made great improvement. The least reported improved practice was having MSDS's [Material Safety Data Sheets] available for use. Only 127 [44.4%] indicated having made improvement of which 72 reported making great improvement.

### **Youth Environmental Education [I Think Green and 4-H Camp]**

The **I Think Green** ten-question evaluation was completed by 559 youth comprised of 412 who participated in the butterfly track, 135 in the worm track, and 12 in the insect track. Response tallies for the six questions that were identical for all three groups follow.

#### Environment Related Questions

81% [483] reported being more excited about helping to care for the environment, 74% [416] reported having more ideas about ways they could help care for the environment, and 70% [393] 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

95% [533] reported that the **I Think Green** activities were fun to do, 87% [488] reported that they would like to do more activities like the ones in **I Think Green**, and 65% [363] reported that they would like to help with a community garden project.

#### Butterfly Track Specific Questions [n=412]

94% [387] reported that the activities helped them learn about butterflies and how they grow, 85% [352] reported that the activities help them to learn how butterflies interact with other living things, 85% [349] reported that the activities help them learn how butterflies contribute to the environment, and 77% [318] reported that they were encouraged to ask questions about butterflies and the environment.

#### Worm Track Specific Questions [n=135]

94% [127] reported that the activities helped them learn about worms and how they grow, 85% [115] reported that the activities help them to learn how worms interact with other living things, 85% [115] reported that the activities help them learn how worms contribute to the environment, and 73% [99] reported that they were encouraged to ask questions about worms and the environment.

#### Insect Track Specific Questions [n=12]

100% [12] reported that the activities help them to learn how insects interact with other living things, 92% [11] reported that the activities helped them learn about insects and how they grow, 92% [11] reported that the activities help them learn how insects contribute to the environment, and 75% [9] of the youth in this track reported that they were encouraged to ask questions about insects and the environment.

## **Key Items of Evaluation**

### **Commercial Pesticide Applicator Training Evaluation Study [2012-2013]**

Primarily motivated by the desire for help in preparing for the licensing exam, 294 commercial pesticide applicators and operators who attended the pesticide training conducted in 2011-12 responded to a mailed follow-up questionnaire that focused on practice changes made as a result of the training. Ninety percent [260] of the respondents indicated improving one or more of 12 practices after the training. More than three-fifths of the respondents reported improving calibration procedures [65.7%], pest control decision-making [64.0%], mixing pesticides properly [62.2%], and law compliance [60.5%]. When asked how often they calibrated their equipment, 96 respondents [35%] indicated an increase in frequency of calibration [daily, weekly, or monthly] after as compared to before the training.

At least half of those responding reported improvement in application procedures, routine use of personal protective equipment, including non-chemical methods of control, equipment maintenance, referring to label information, changing type, size or material of the nozzles, and proper pesticide storage. Most of the remainder of the respondents indicated that they were already following correct procedures related to a given practice with only 30 or fewer checking 'could improve but have not' for each of the 12 practices. These findings appear to indicate that Extension training has been effective in helping pesticide operators/applicators to engage in correct pesticide application practices that prevent adverse impacts on the environment, crops grown, and the pesticide applicator.

### **Youth Environmental Education [I Think Green and 4-H Camp]**

Nearly all 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 90% of those responding did report changes in one of the three questions related to the environment.

**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	5%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		10%	
205	Plant Management Systems	25%		10%	
206	Basic Plant Biology	25%		10%	
211	Insects, Mites, and Other Arthropods Affecting Plants	20%		10%	
212	Pathogens and Nematodes Affecting Plants	20%		10%	
213	Weeds Affecting Plants	0%		10%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	0%		10%	
216	Integrated Pest Management Systems	5%		10%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	13.0	0.0	14.0	0.0
Actual Paid Professional	0.0	0.0	13.0	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
518729	0	1224723	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
518729	0	1224723	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
2721150	0	13148829	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities conducted included work to determine the reproductive stage at which weeds can be terminated and still produce viable seed, research that reported [for the first time] the lysine acetylome of *Erwinia amylovora* [lysine acetylation has emerged as a major post-translational modification for non-histone proteins in both eukaryotes and prokaryotes, ranging from many transcriptional factors to cytoplasmic proteins], a project that has provided genotypic data on the genetic diversity of accessions of *Malus* conserved at the National Clonal Germplasm Repository for *Malus* in Geneva, New York and has allowed us to characterize the genetic relatedness of this material, the development of new experimental lines that were tested for yield, agronomic traits and disease and pest resistance through the University of Illinois Soybean Breeding Program, a study conducted to assess the occurrence of bacterial spot in Illinois, and pathogenic and genetic variation, host range, and seed transmission of *X. cucurbitae* [bacterial spot, caused by *Xanthomonas cucurbitae*, has become an important threat to pumpkin production in Illinois], the development of a new molecular-based test for a specific type of resistance to glyphosate in waterhemp [this test will allow us to more accurately evaluate waterhemp samples for glyphosate resistance], research with the goal of determining if the use of cover crops in a corn-soybean rotation is effective for reducing disease severity levels in soybean, efforts to determine if the introduction of cover crops into the typical corn-soybean rotation in Illinois and elsewhere is a worthwhile modification of conventional farming practices, and the development of a statistical method for prediction of performance given genomewide marker data to aid in choosing parents of new breeding populations and identifying outstanding new lines.

Activities also included tests which demonstrated that molecular engineering of soybean to enable plants to synthesize non-native phytoalexins has high potential to increase broad spectrum and durable innate immunity [this approach to improving innate soybean defense against diseases and pests through genetic engineering is novel and, to the best of our knowledge, is not being used by any other organizations, including major soybean biotech seed producers], research employing Chip-Seq [Chromatin Immunoprecipitation] to determine the genes regulated by two transcription factors in the cotyledons during seed germination [this is the first application of this technique in soybean], ongoing evaluation of the **Illinois Soil Nitrogen Test** [ISNT] as a basis for fertilizer N recommendations, research to develop sustainable ways to manage lepidopteran corn pests, a study of the genetic diversity of the soybean aphid in the U.S. [this information will lead to the development of an insect pest management strategy that will reduce damage to soybean plants and minimize costs of pesticide applications], a study showing that viruses can be detected in pooled nematode samples using a fairly simple technique, the evaluation of disease resistance of advanced breeding including Fusarium head blight and several foliar diseases, work under the **Illinois Long-Term Selection Experiment** [ILTSE] for grain protein and oil concentration that has produced populations with the known phenotypic extremes for these traits [the strains created from

this experiment provide an excellent genetic resource for studying the genetic basis for the response to phenotypic selection], results confirming that a more integrated weed management approach [one which does not rely exclusively on the same or similar herbicides] will be needed to effectively manage weed populations that contain resistance to herbicides from more than one site-of-action family, and oilseed research that has focused on responses of soybeans to growth under elevated ozone and carbon dioxide.

Conference presentations included the Albany 2013 Conversation Conference, Great Lakes Vegetable Working Group, Society for Invertebrate Pathology, Entomology Society of America, University of Illinois International Agronomy Day, Plant and Animal Genome Conference, Weed Science Society of America, North Central Weed Science Society, North Central Region American Pomological Society, Consortium for Plant Biotechnology Research Symposium, World Soybean Research Conference, American Society of Agronomy, Wilson Fertilizer Grower Conference, Heartland Agronomy Conference, National Association of Plant Breeders, Illinois Corn Breeder's School, Maize Genetics Conference, and the Institute of Food Technologists.

Extension activities focused on both food and non-food horticulture crops and pests. The **Ask Extension--Hort Corner** is comprised of 77 topics of which 17 are in Spanish that received some 60,000 page views during the past year. 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 eight horticulture distance education programs titled **Four Seasons Gardening** were offered at Extension offices throughout the state during the spring and fall with a total attendance of 2,159. Topics included growing tomatoes, pollinators, spruce problems, landscape design trends and winter protection, and drought effects on lawns.

**Extension Master Gardeners** gave countless hours in providing horticulture information to the public. There are currently over 3,300 active Master Gardeners in Illinois who contributed 195,000 volunteer hours. This past year, 586 new Master Gardeners completed training at various locations in the state and through an online course. Master Gardeners were involved in teaching audiences how to grow, preserve, and share or sell excess produce to enhance the consumption of food rich in required nutrients for good health. Pre- and post-tests indicated that 221 of the trainees who completed both tests increased their knowledge by 26%. Responsibilities assumed by the Master Gardeners this past year included growing an estimated 200,000 pounds of fresh produce for the hungry, making presentations, hosting a radio show, providing technical support and therapeutic assistance to individuals and facilities, and creating opportunities for children to learn about and grow food and to enjoy nature. The variety and scope of the gardening projects were impressive and included creating teaching opportunities related to rain gardens, sensory gardens, butterfly gardens, a heritage garden, native plant garden, children's exploration garden, and 'giving' gardens dedicated to growing food to donate to food pantries and soup kitchens.

A series of online training **Integrated Pest Management modules** which cover pertinent plant pests, weeds, and diseases are focused on pests that are newly emerging, exotic, or invasive. Each module includes information on how to identify the pest as well as current management options and stresses those methods which offer the best long-term control with minimal environmental impact. The 10 modules were developed for Master Gardeners but were available to home gardeners and green industry professionals. Master Gardeners throughout the North Central region have been using these modules as credit toward required continuing education hours and as a reference to answer client home gardening questions. Credit was awarded for some 700 modules that were completed this past year.

The **University of Illinois Plant Clinic** had a total of 5,149 client contacts [telephone inquiries, email requests, and walk-in consultations] in 2013 and diagnosed 4,657 plant samples. Clinic staff members also prepared news releases, articles for newsletters, and monthly e-mail blasts. Social media activities included website information, Facebook, blogs, and podcasts. In addition, this past year six YouTube videos were posted and a new **Plant Diagnostic Submission app** that provides an easy way to submit

digital images of plant problems or pest on the go had 1,677 downloads. The Extension **Digital Diagnostic System** provided outreach to homeowners and commercial producers in diagnosing and providing solutions for 383 samples of invasive and exotic species pests. In addition, 18 issues of the **Home Yard and Garden newsletter** were distributed.

The Extension pesticide training program reached 2,793 private [farmer] pesticide applicators and 9,203 commercial applicators this past year providing information on proper and safe use of pesticides that is vital to Illinois residents in terms of public health protection and environmental stewardship.

**2. Brief description of the target audience**

Members of the target audience included scientists in the fire blight research community and related enterobacterial areas, germplasm conservation curators, soybean growers and the soybean breeding research community, vegetable industry personnel, chemical industry personnel, students, Extension educators, researchers, personnel of the Illinois Department of Agriculture, the weed science community and practitioners of weed management [including farmers, retail herbicide applicators, and farm consultants], plant pathologists and crop scientists, plant and animal biologists, USDA Forest Service scientists, insect pathologists, scientists working in the area of alternative cropping systems, the scientific community involved in genetic crop improvement [especially those working with maize], corn producers and their advisers in Illinois, crop producers who make decisions on cropping systems and tillage practices, researchers who work with soybean aphid control, and scientists engaged in the study of plant evolution, genetics, and breeding. 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 are members of the Consumer Horticulture or Invasive Species eXtension Communities of Practice.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	61277	339963	29773	0

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

**Patent Applications Submitted**

Year: 2013  
 Actual: 4

**Patents listed**

TF 09121-US [A DNA Sequence That Confers Aphid Resistance in Soybean]; TF 09157-US [Soybean Aphid Resistance Gene Rag2]; TF 10105-US [RHG1 Mediated Resistance to Soybean Cyst Nematode]; and TF 11129-PRO2 [Methods and Systems for Pistil Development and Plants Made Therefrom].

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	58	58

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Research Projects

Year	Actual
2013	4

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	More Informed User Of Pesticides
2	Providing Management Information To Farmers With Regard To Managing Soybean Cyst Nematode Heteroda, Glycines
3	Choosing Plant Varieties That Are Known To Be Resistant To Insects And Diseases
4	Development Of New Strategies For Controlling Fire Blight
5	An Improved Understanding Of Protein Structure
6	Development Of New Soybean Breeding Lines
7	Research For Improved Weed Management
8	Use of Cover Crops To Reduce Disease Severity In Soybean
9	Evaluating The Value Of Cover Crops
10	Selecting Grain Corn Hybrids For Key Agronomic Performance Traits
11	Determining If Combinations Of HPPD Inhibitors Lead To Synergistic Activity On Broadleaf Weeds In Soybean
12	Evaluating The Illinois Soybean Nitrogen Test [ISNT] As A Basis For Fertilizer Nitrogen Recommendations
13	Improved Resistance To Western Corn Rootworm
14	Discovery Of New Viruses In Plant Parasitic Nematodes
15	Quantification And Documentation Of The Occurrence And Distribution Of Herbicide-Resistant Weed Populations In Illinois
16	Number Of Individuals Increasing Knowledge Related To Detecting And Managing Invasive Pests

## **Outcome #1**

### **1. Outcome Measures**

More Informed User Of Pesticides

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Action Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	416

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The demand for good horticultural information for homeowners frequently outstrips the supply.

#### **What has been done**

Master Gardener multi-county training sessions and online training was completed by 586 new volunteers in 2013.

#### **Results**

An online survey designed by the state coordinator of Master Gardeners was completed in 2012 by new [with 2-4 years of experience] Master Gardeners. The survey asked the respondents to indicate their use of 13 gardening practices before and after becoming a University of Illinois Master Gardener. Based on the resulting percentages of those survey respondents, 416 [71%] of the 586 past year's new Master Gardeners are now likely to correctly identify 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 disease.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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 #2**

**1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Development Of New Strategies For Controlling Fire Blight

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Fire blight, caused by the bacterial pathogen *E. amylovora*, is a destructive disease of apples and pears. In the United States, regional losses to fire blight and cost of control average over \$100 million annually. The use of streptomycin, an antibiotic that targets the blossom blight phase, has been recommended until recent years when the occurrence of streptomycin resistance has rendered this antibiotic ineffective. Moreover, this also raises concerns over the potential impact of agricultural use of antibiotics on human health. Without streptomycin, there are no other reliable fire blight disease control measures available. Thus, new strategies for controlling fire blight are critical for preventing severe losses in susceptible orchards in the near-term along with

pursuing strategies for long-term management of fire blight.

### **What has been done**

We analyzed the lysine acetylome in two strains of *Erwinia amylovora*, Ea273 and Ea1189, known to have differential virulence in plants, using two proteomics approaches. Proteomic analysis of lysine acetylation in two *E. amylovora* strains identified 141 LysAc sites in 96 proteins that function in a wide range of biological pathways. We generated several alternative sigma factor mutants in *Erwinia amylovora*, including nitrogen-limitation sigma factor *rpoN*, stationary sigma factor *rpoS*, ECF sigma factor *hrpL* and sigma 54 enhancer binding protein *hrpS*. We also generated mutants for small ribosome binding protein *yhbH*, which may work together with sigma 54. We initially characterized the role of sigma factors, including *RpoN*, *RpoS*, *HrpL*, and *HrpS* as well as *YhbH* in the virulence of *E. amylovora*. Lysine acetylation [LysAc] has emerged as a major post-translational modification [PTM] for non-histone proteins in both eukaryotes and prokaryotes, ranging from many transcriptional factors to cytoplasmic proteins. We, for the first time, reported the lysine acetylome of *Erwinia amylovora*. Immunoblots demonstrated that growth conditions strongly affected the LysAc profiles in *E. amylovora*. Differential LysAc profiles were also observed for two *E. amylovora* strains with differential virulence, indicating post-translating modification of proteins may be important in determining virulence of bacterial strains.

### **Results**

Consistent with previous reports, 44% of the proteins are involved in metabolic processes, including central metabolism, lipopolysaccharide, nucleotide and amino acid metabolism. Collectively, these results reinforce the notion that LysAc of proteins is widespread in bacterial metabolism and virulence. For the first time, several virulence-related type III secretion and exopolysaccharide proteins were found to be lysine-acetylated in bacteria, suggesting that LysAc may play a major role in bacterial virulence. Sigma factors, including alternative sigma factors, are essential transcription initiation factors that direct RNA polymerase to bind specific promoter regions. Our results suggest that a sigma factor cascade in *E. amylovora* exists in its regulatory networks and regulates important virulence factors.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology

## **Outcome #5**

### **1. Outcome Measures**

An Improved Understanding Of Protein Structure

### **2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Despite their importance, how sophisticated protein machinery are selected to carry biological functions, the rationale for molecular change, the mysterious origin of the 'vocabulary' that shapes genetics [the genetic code] and the evolutionary drivers of protein structure, have yet to be uncovered. These represent important omissions in biological knowledge that need to be urgently addressed.

**What has been done**

In a remarkable breakthrough, timelines derived from trees of domain structures reveal that the fundamental molecular principle lies conspicuously not in the nucleic acids but in the protein chemical bonds. We uncovered a new and more primitive code in pairs of amino acid constituents of proteins that enable protein folding and flexibility. These dipeptides were initially produced by archaic synthetases that with time transformed into a yin-yang of modern aminoacyl-tRNA synthetases, the modern safekeepers of the genetic code.

**Results**

The new structural code that we have uncovered appears responsible for molecular innovations. This changes the focus of molecular biology, from replicators and genetics to molecular dynamics, emergence and the chemistries of function.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
206	Basic Plant Biology

**Outcome #6**

**1. Outcome Measures**

Development Of New Soybean Breeding Lines

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Condition Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

This research is important because soybean is the most important protein and oilseed crop in the world. The U.S. is the largest producer of soybean internationally with a production of over 90 million metric tons in 2011. The demand for soybean is expected to grow and the U.S. must continue to improve its soybean production efficiency to compete in the global market. These improvements include increasing both the yield potential and pest resistance of cultivars. Although research efforts in soybean breeding and genetics are in progress in many states, these efforts are needed in Illinois because each state has its own unique production environments and pest problems. The ultimate beneficiaries of this research are soybean producers who receive the technology developed through this effort in publicly and privately developed varieties.

**What has been done**

The University of Illinois soybean breeding program developed new experimental lines and tested lines for yield, agronomic traits and disease and pest resistance during 2013. The program grew over 3,100 four-row yield test plots, over 5,102 two-row yield test plots, and over 10,000 plant row plots. These plots were planted in field locations that include the main South Farm on the University of Illinois campus, the Northern Illinois Agronomy Research Center near Shabbona, IL, the Brownstown Agronomy Research Center near Brownstown, IL and on land rented from farmers near Pontiac, IL and Arthur, IL.

**Results**

The most advanced lines from the program were evaluated in regional tests in locations throughout soybean-growing regions in the north central and eastern US. Data from these tests have been analyzed and selections are being made to decide what lines to test in experiments planned for 2014. Those lines with the greatest yield and resistance over the past few years were selected and eight new varieties were released to a cooperating seed producer for increase and potential commercialization. All eight are non-GMOs, and could be useful in filling the need for non-GMO soybean cultivars.

**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
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

## **Outcome #7**

### **1. Outcome Measures**

Research For Improved Weed Management

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Successful weed management depends on accurate knowledge of the weed species and weed biotypes [whether or not the weeds are resistant to certain herbicides] present in a given field. If a herbicide is applied to a weed population that is resistant to the herbicide, then money is lost, crop yield decreases, and herbicide is unnecessarily added to the environment.

#### **What has been done**

Research focused on utilizing DNA markers previously developed to document the occurrence of multiple herbicide resistance in waterhemp populations through both random surveys and testing of samples suspected of being herbicide resistant and the development of DNA-based tests for new mechanisms of herbicide resistance in waterhemp as they are identified.

#### **Results**

During the project period, we tested over a thousand individual waterhemp plants from over 200 fields for specific herbicide-resistance traits. Resultant information was provided back to weed management practitioners, enabling them to make site-specific weed management decisions. We also developed a new molecular-based test for a specific type of resistance to glyphosate [the active ingredient in Roundup herbicide] in waterhemp. This test will allow us to more accurately evaluate waterhemp samples for glyphosate resistance.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
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

### **Outcome #8**

#### **1. Outcome Measures**

Use of Cover Crops To Reduce Disease Severity In Soybean

#### **2. Associated Institution Types**

- 1862 Research

#### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	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 effective 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 problems.

##### **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 and rape-seed 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 several newly-discovered 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. The analysis of root systems following fungicide and nematicide treatments showed differences in root system characteristics of soybean seedlings associated with the chemical treatments.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants

**Outcome #9**

**1. Outcome Measures**

Evaluating The Value Of Cover Crops

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The introduction of cover crops into the typical corn-soybean rotation in Illinois and elsewhere awaits research supporting that modification of conventional farming practices. Recent interest in CC in the Midwest region has been gauged by promotions from companies which sell cover crops seeds and services and also by educational and promotional efforts from the USDA-NRCS. The inclusion of CC as a strategy to prevent soil erosion, manage nutrients, and safeguard water quality motivates the USDA-NRCS efforts. In Illinois, starting in 2012, NRCS will pay up to \$40 per acre [approximately \$99 per ha] for the inclusion of CC through the Environmental Quality

Incentives Program [EQIP] and the Conservation Stewardship Program [CSP]; these incentives are designed to boost adoption by offsetting seed, labor, and equipment costs associated with CC. Though the potential benefits from CC are multiple, the realization of that potential is highly dependent upon agronomic management, length of the growing season, plant species, subsequent cash crop, soil type, and weather conditions among many other factors. In the Midwest region specifically, planting dates and harvest schedules of crop production systems often create restricted periods to maximize the advantages of traditional CC use.

#### **What has been done**

Our goals were to assess the short-term ability of radish [*Raphanus sativus* L. var. *longipinnatus*] and companion cover crops to improve soil properties and soybean [*Glycine max* L. merr.] growth and yield following compaction and CC treatments under conventional systems. We used a 6 x 3 factorial arrangement of the CC and compaction treatments in a completely randomized design with two replications in two independent year-locations hereby referred as environments. Cover crop treatments included radish alone 'R', and with rye [*Secale cereale* L.] 'RR', triticale [*x* *Triticosecale* cv Presto] 'RTR', buckwheat [*Fagopyrum esculentum* L. Moench] 'RB', or hairy vetch [*Vicia villosa* Roth] 'RHV', and a control with no cover crop 'NCOV'. Compaction treatments were no compaction [Nc], and two levels of compaction achieved with a large tractor [LT] or a hauling truck [TK]. Compaction was temporary and disappeared after the CC growing season. Cover crop treatments significantly lowered soil NO<sub>3</sub>-N compared to NCOV yet no further effect was evident on soils. Soybean yield for CC treatments were not different from control plots. Results from this study showed that one growing season was not enough time to evidence changes in soil properties related to cover cropping, yet they were useful tools for retaining NO<sub>3</sub>-N in the system. In addition, following adequate management practices, CC should not affect soybean growth and yield.

#### **Results**

To investigate the long-term effects of cover cropping we have set up a network of research plots at several research centers around Illinois and established experimental plots in farmers' fields during the early fall of 2013. Based on the data provided by the early years of this project we want to measure the effect of cover crops in scavenging N and sequestering nutrients in their biomass, evaluate their impact on commercial crop stands, yields, and economic returns, and evaluate the effect of tillage on crop and soil responses to cover crops. I believe that by expanding the scope of the project we will be generating relevant and location-specific information that will address the range of soils and practices found among fields and farms. Likewise, performing this experiment on several farmers' fields across the state will allow a realistic assessment of the cover crop's ability to scavenge N at the landscape level.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
206	Basic Plant Biology

## **Outcome #10**

### **1. Outcome Measures**

Selecting Grain Corn Hybrids For Key Agronomic Performance Traits

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The corn dry milling industry produces a wide variety of yellow and white corn products. These finished milled products are produced to meet each individual customer's specification. The main product categories include corn grits, corn meal, corn flour, and corn bran. They are used in a variety of foods, including breakfast cereals, snack foods, baked goods, and beer. Approximately 3% of the total U.S. corn grain harvest channels into dry milling. In 2008, this involved approximately 363 million bushels of harvested corn, at a value of more than \$1.5 billion. Dry corn millers typically process corn grain using a method called 'tempering-degerming'. The first step in this process is to dry clean the corn, separating fines and broken from the whole corn. The clean corn is tempered to 20 percent moisture. While moist, the pericarp [seed coat], germ [embryo], and tip cap are removed, leaving the endosperm. The endosperm proceeds through the degerminator, is dried, cooled, and sifted. The materials are separated by size using roller mills, sifters, grinding tables, and aspirators. About 65 percent of the corn processed emerges as prime products and 35 percent as by-products. The coarsest product is grits, ranging in size from coarse grits to fine grits. The coarsest flaking grits, also known as hominy grits, are used for the manufacture of corn flakes. Other sizes of grits are sold separately or as a blend to the makers of breakfast cereals and snack foods and to brewers' as brewers grits. For grain corn utilized in human food, yield is measured not only in terms of 'bushels per acre' but also in terms of 'total pounds of #1 and #2 grits'. Thus, in addition to selection for agronomic performance, grain corn hybrids dedicated to the human food stream must be developed through selection for key agronomic traits as well as traits central to dry milling and processing, with the goal of maximizing efficiency and value based on the corn hybrids/grain itself.

#### **What has been done**

Field trials were conducted over three years to explore genetics underlying flaking efficiency [FE] and evaluate the relationship between FE and agronomic performance, with an aim to devise

breeding strategies to simultaneously improve FE and agronomic performance in the future. A broad-based set of 12 inbreds that represent parentage of heterotic subgroups utilized in current commercial maize hybrids were crossed in a diallel design to create 66 test hybrids which were evaluated for agronomic, dry milling, ear, and kernel properties. Estimates of heritability and combining ability indicated the importance of additive gene action. Overall, the results of this study indicated presence of genetic variation for FE in U.S. maize germplasm which could be exploited to develop new corn hybrids with improved FE and FGY. Furthermore, a moderate amount [31%] of the variation in flaking grit yield [FGY] was explained by multiple regression of several traits including grain yield as well as simple physical kernel characteristics such as test weight, kernel depth, and 100 kernel volume, but not enough to adequately predict performance for FGY. Towards this end, a statistical method for prediction of performance given genomewide marker data has been developed to aid in choosing parents of new breeding populations and identifying outstanding new lines. Referred to as pRKHS, the new method features a nonparametric approach combining supervised principal component analysis and reproducing kernel Hilbert spaces regression to overcome some key issues related to high dimensionality and multicollinearity with this type of marker data.

### Results

On the dry milling side, the development of a dry milling protocol based upon a 1 kg sample of grain is important because it opens the door for selection based on dry milling yields in plant breeding and cultivar improvement. Without the ability to generate data from small plot field samples on a fairly sizeable population of various lines, milling quality and yields cannot be considered in selecting among various genotypes, nor can data related to agronomics be factored into the overall assessment of yield of large grits on a per acre basis. This work provides a first insight into the inheritance of processing traits in corn and the extent to which these traits are influenced by the environment and cultural practices. The germplasm being evaluated also contributes to the impact of the analysis being conducted since it represents the current U.S. commercial corn germplasm base. This project lays the groundwork for strategic improvement through a more in-depth genetic analysis to locate chromosomal regions in maize that are associated with large grit yield. Given the marker data provided by Dr. Jeffrey Ross-Ibarra featuring genotypes for >40K SNPs, we will be able to identify a marker-aided selection strategy to improve dry milling yield in the future. Furthermore, this project has produced materials [grain and large grit samples] that are being used to support studies that explore changes to the corn materials from the field through the milling process, such as those associated with nutritional aspects of maize.

## 4. Associated Knowledge Areas

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

## **Outcome #11**

### **1. Outcome Measures**

Determining If Combinations Of HPPD Inhibitors Lead To Synergistic Activity On Broadleaf Weeds In Soybean

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

The overall goal of this research is to determine if combinations of HPPD inhibitors and other herbicides [such as PS II inhibitors or PPO inhibitors] lead to synergistic activity on broadleaf weeds in soybean, in particular multiple-resistant waterhemp [*Amaranthus tuberculatus*] biotypes. Experimental objectives will be achieved through a combination of field, greenhouse, and laboratory research as outlined below. Since most of these herbicides can be applied either PRE or early POST and have residual activity, all combinations of PRE only, sequential PRE-early POST, and early POST tank mixes will be examined for synergistic responses on waterhemp seedlings under field and greenhouse conditions.

#### **What has been done**

To address our experimental objectives, growth chamber, greenhouse, and laboratory experiments were conducted to determine if target-site or non-target-site mechanisms confer mesotrione resistance in MCR. In addition, the basis for atrazine resistance was investigated in MCR and in an atrazine-resistant, but mesotrione-sensitive, waterhemp population [ACR]. A standard sensitive population [WCS] was used for comparison in all experiments. Experiments were designed to determine if differential herbicide uptake or metabolism are the basis for mesotrione and atrazine resistance in the MCR waterhemp population. Mesotrione-resistant [MCR] and mesotrione-sensitive [ACR and WCS] populations of waterhemp were treated with radiolabeled mesotrione for analyses of uptake and metabolism during time course experiments. Metabolism studies using whole plants and excised leaves revealed that the time for 50% of absorbed mesotrione to degrade [DT50] in MCR was significantly shorter than in ACR and WCS, which correlated with the phenotypic responses to mesotrione previously reported. The cytochrome P450 inhibitors malathion and tetcyclacis significantly reduced mesotrione metabolism in MCR and corn excised leaves, but not in ACR. Furthermore, malathion increased mesotrione postemergence activity [but not atrazine] in MCR seedlings treated in greenhouse tank-mix studies. Our results indicate that enhanced metabolism in MCR contributes significantly

to mesotrione resistance, but further research is still needed to determine if additional non-target site mechanisms may also contribute to mesotrione resistance within the MCR population.

**Results**

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. 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 [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. These research findings are particularly significant and relevant to crop production and weed management with postemergence herbicides in maize 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 #12**

**1. Outcome Measures**

Evaluating The Illinois Soybean Nitrogen Test [ISNT] As A Basis For Fertilizer Nitrogen Recommendations

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Nitrogen is the most critical nutrient for growing corn and accounts for the largest fertilizer investment in modern agriculture. Since the 1970's, this investment has been viewed as a form of insurance against yield loss from N limitation, and there has been widespread reliance on yield-based N recommendations. In these recommendations, an expected yield goal is multiplied by 1.2 and the product is then corrected, if appropriate, by applying estimated credits for a previous legume or the use of manure for the current growing season. The usual result is overfertilization beyond what the crop needs, which not only reduces profitability for the farmer but also leads to air and water pollution and even degrades the soil itself. Clearly, the use of N fertilizers should be matched to crop N requirement, but in a humid region such as Illinois, this only becomes feasible if there is some means to estimate the soil's N-supplying power. The Illinois Soil Nitrogen Test [ISNT] was developed for precisely this purpose, and has been used successfully in several field trials to predict yield response by corn to N fertilization. There have, however, also been negative evaluations, suggesting the need to improve ISNT interpretations by accounting for other factors that can affect soil N availability or crop N requirement, such as soil series, cropping system [continuous corn versus corn-soybean], planting rate, tillage, residue management, and weather conditions. In the present project, these and other factors will be evaluated for improving the calibration of the ISNT in optimizing N fertilizer rates for corn. The expected outcome is a more accurate fertilizer N recommendation that enhances profitability for producers while reducing the adverse environmental effects of overfertilization.

**What has been done**

The project was expanded in its final year, after excluding one of the three original response studies where erratic corn stands caused by pheasant feeding had compromised yield data and reduced replication. Two other response studies were added, from 40-acre fields under a corn-soybean rotation. Yield data were measured with a combine yield monitor, and soil analyses included potentially mineralizable N estimated by the ISNT, pH, Bray-1 P, NH4OAc-extractable [exchangeable] K, soil organic and mineralizable C, and total N.

**Results**

Preliminary analysis indicates a strong interaction among crop N response, ISNT level, soil organic C, and plant population. No useful correlation was found to link other soil parameters with crop yield or N response. A case in point is exchangeable K, which was investigated through a four-year study that involved biweekly sampling for soil K testing. Test values fluctuated drastically, did not differentiate soil K buildup from depletion, and increased even in the complete absence of K fertilization. A meta-analysis of 774 K response studies in North America under grain production revealed that KCl fertilization was 93% ineffective for increasing grain yield. Rather, there were more instances of significant yield reduction, which can be attributed to the antagonistic effect of Cl- on plant uptake of soil- or fertilizer-derived NO3-.

**4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
206	Basic Plant Biology

## **Outcome #13**

### **1. Outcome Measures**

Improved Resistance To Western Corn Rootworm

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

In rotation with corn, soybean fields are critical locations for the monitoring and/or management of key corn pests like western corn rootworm [WCR]. Soybean producers also face pests besides WCR that use soybean and corn, like Japanese beetles [JB], as well as specific soybean pests [and beneficial insects] that will be affected by foliar insecticide applications that are intended to target WCR or JB [such as bean leaf beetle [BLB], stink bugs, and ladybird beetles [LBB]]. For both WCR and JB, movement influences the severity of pest impact. Their frequent movement in response to factors like crop phenology and local weather also means that their abundance can vary significantly over the course of the growing season and amongst years. Soybean pest abundance monitoring has been ongoing since 1998.

#### **What has been done**

The 2013 WCR abundance per sweep net sweep is down slightly compared to the drought year of 2012; though overall WCR abundance in soybean is very low [peak was 0.27 adults per sweep in 2013]. Compared to 2005-2006 collection rates in Champaign County [0.73 beetles per sweep] and the over 1.5 WCR per sweep in 2004, the current abundance is very low; arguably so low that adult WCR monitoring in soybean would likely indicate that use of corn rootworm Bt hybrids in rotated corn may be unneeded in some fields. The extreme drought of 2012 appears to have been hard on other pests like JB and BLB; both were collected at rates which were less than one tenth of their 2012 collection rates. I anticipated the reduced JB abundance based on poor conditions of grass and turf. Outside of Champaign County, 2013 contacts from growers and monitoring revealed an alarming development in rotated cornfields and adjacent soybean fields. Extreme adult WCR abundance [over 0.9 WCR adults per sweep] was measured in soybean fields adjacent to rotated Bt cornfields expressing the Cry3Bb1 trait that had been in long-term rotation with soybean where extreme root injury and high adult populations were present.

#### **Results**

These observations suggest that WCR resistance to Bt corn has been selected for among rotation-resistant WCR populations. This is a serious development that suggests resistance can be selected for in the absence of continuous corn cultivation; this apparent failure of Bt toxin Cry3Bb1 in rotated fields will lead to increased use of soil insecticides in 2014. Several thousand WCR adults were collected from each of three locations in August 2013. Nearly 1 million WCR eggs were collected for use in single plant Bt resistance bioassays planned to assess Bt resistance in Livingston and Kankakee County WCR populations. If confirmed, Bt resistance in rotation resistant WCR may result in a call to develop methods [such as foliar insecticide application] to manage WCR egg-laying in soybean fields. Such treatment will expose many other pests and non-pest species to insecticide. Documenting insect population dynamics in soybean fields will contribute to an informed appreciation for the broader consequences of an all-in approach to managing one important pest.

#### 4. Associated Knowledge Areas

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

#### Outcome #14

##### 1. Outcome Measures

Discovery Of New Viruses In Plant Parasitic Nematodes

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

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.

### **What has been done**

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.

### **Results**

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 recently been discovered, thus this approach has the potential to rapidly identify new viral species. The study of nematode viruses could be very important for understanding their impact on soil ecology, but also for controlling damaging plant nematode species. Viruses have never been used to kill parasitic nematodes, thus it is well worth the effort to identify new virus species and then test them for their ability to kill plant nematodes. If successful this approach may generate a sustainable method to manage plant parasitic nematodes in Illinois and thought the world.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
205	Plant Management Systems
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

## **Outcome #15**

### **1. Outcome Measures**

Quantification And Documentation Of The Occurrence And Distribution Of Herbicide-Resistant Weed Populations In Illinois

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

### **Issue (Who cares and Why)**

The evolution of weed biotypes and populations demonstrating resistance to herbicides from one or site-of-action category continued to increase across many areas of Illinois during 2013. Currently in Illinois, biotypes of 12 weed species have been confirmed resistant to one or more herbicide mechanisms of action. Resistance to herbicides that inhibit the ALS enzyme is the most common type of resistance in Illinois. Waterhemp has evolved resistance to more herbicide mechanisms of action than any other Illinois weed species, including resistance to inhibitors of acetolactate synthase [ALS], photosystem II [PSII], protoporphyrinogen oxidase [PPO], enolpyruvyl shikimate-3-phosphate synthase [EPSPS] and hydroxyphenyl pyruvate dioxygenase [HPPD]. Perhaps even more daunting is the occurrence of multiple herbicide resistances within individual plants and/or fields.

### **What has been done**

Research began in 2013 to characterize a waterhemp population from east-central Illinois that was not effectively controlled in the field with foliar-applied herbicides from two different site-of-action categories. Seeds of the putative resistant population were collected and plants generated under greenhouse growing conditions. Uniformly-sized plants were treated with various doses of foliar-applied herbicides from six different site-of-action categories. Results of this experiment revealed that waterhemp mortality was very low and that the majority of treated plants survived four of the five herbicides evaluated. Survivorship was high and plant injury was low following application of herbicides from the following site-of-action categories: ALS, PPO, PSII, and HPPD. Plant mortality was high following application of glyphosate and intermediate mortality was observed following application of dicamba. Additional research is underway to determine the initial frequency of each type of resistance within the overall population, and to determine the frequency of individual plants resistant to herbicides from all four site-of-action categories. If confirmed, this would represent a unique second occurrence of fourway multiple resistant waterhemp plants in Illinois. Two other waterhemp populations from central Illinois were screened for resistance to HPPD-inhibiting herbicides.

### **Results**

Greenhouse results demonstrated each population contained plants that survived following foliar applications of tembotrione, atrazine, or imazethapyr applied at rates twice the labeled application rate. However, the frequency and magnitude of resistance to the HPPD-inhibiting herbicide tembotrione were not as high as observed in a previously-characterized HPPD-resistant waterhemp population from McLean county. These results suggest the farmers should integrate management tactics that do not rely on herbicides from the HPPD, ALS, and PSII site-of-action categories to slow the continued evolution of these resistance traits in these populations. One population of Palmer amaranth was collected in east-central Illinois and screened for resistance to herbicides from three site-of-action categories. Results indicate treated plants were sensitive to all herbicides. Additional populations of Palmer amaranth are being located across a broad region of Illinois.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
206	Basic Plant Biology
213	Weeds Affecting Plants

## **Outcome #16**

### **1. Outcome Measures**

Number Of Individuals Increasing Knowledge Related To Detecting And Managing Invasive Pests

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	1408

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Emerging pathogens and insects can cause serious damage and loss to Illinois trees if not detected early, resulting in economic and environmental consequences related to treatment or replacement.

#### **What has been done**

One-day First Detector programs were offered at six [6] locations in Illinois focusing on training tree care professionals, Master Gardeners, Master Naturalists, forestry and natural resource professionals, and conservationists to: [1] Increase their awareness of the Emerald Ash Borer, Thousand Cankers Disease and other Invasive plants of importance to the host location area where the program was conducted; [2] Reduce potential risks from these pathogens and pests; and [3] Increase knowledge of plant diagnostic support. Extension specialists delivered course elements for each pest that included: [1] Identification and detection; [2] Life cycle/biology; [3] Hosts; [4] Sampling; [5] Management; [6] Commonly confused look-alikes; and [7] Regulation. Following the training 228 of the 324 participants completed an evaluation that asked them to compare their degree of understanding of these topics before and after the training sessions using a 1 to 5 scale [with 1 being very little and 5 being a lot].

In addition, several online IPM modules have been developed to increase Master Gardeners' knowledge about plant pathogens or pests and provided 1,304 of them with continuing education opportunities. When finished with a module, participants take a short quiz and complete an evaluation before being able to print a certificate of completion.

#### **Results**

With respect to knowledge related to the Emerald Ash Borer, 207 of 228 [90%] First Detector program participants increased their degree of understanding in at least one of the seven topics.

Based on an average group rating score on each topic before and after the training, a comparison of the scores revealed that the topic that generated the greatest change in knowledge [54.4%] was 'commonly confused look-alikes' closely followed by 'sampling' [52.1%], 'regulation' [47.9%], 'management' [46.8%], and 'life cycle/biology' [44.2%].

When reviewing the knowledge areas for Thousand Cankers Disease, the before training average group scores for topics related to this pest ranged from 1.51 to 1.84 and after training scores ranged from 3.84 to 4.16. Percentage changes in knowledge of the topics were therefore higher for this pest, ranging from 132.8% [commonly confused look-alikes] to 158.3% [regulation]. These findings are not surprising based on the more recent discovery of this pest. Ninety-seven percent [222 of 228] increased their degree of understanding in at least one of the Thousand Canker Disease topics. When asked to indicate the number of people they encounter in regards to tree care, as many as 51,900 people could be reached by these trained First Detectors.

Ninety-seven percent [97%] of the 1,304 online module participants increased their knowledge of the pest or pathogen when asked to rate their knowledge before and then after completing the module yielding an average knowledge increase of 58%. For example, using a rating scale of 1 = Low to 5 = High, evaluation results for the Bacterial Leaf Scorch module indicated that 242 respondents reported a 64% average increase in knowledge of the pathogen after completing the module and a confidence level of 3.43 in being able to identify the pathogen and institute management methods. They also indicated a comfort level of 3.55 regarding teaching others about the pathogen discussed in the module.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

#### V(H). Planned Program (External Factors)

##### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

##### Brief Explanation

#### V(I). Planned Program (Evaluation Studies)

##### Evaluation Results

See State Defined Outcomes for the First Detector Program evaluation results.

**Key Items of Evaluation**

**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	5%		15%	
136	Conservation of Biological Diversity	0%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		20%	
206	Basic Plant Biology	35%		20%	
402	Engineering Systems and Equipment	15%		20%	
601	Economics of Agricultural Production and Farm Management	10%		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%	
	<b>Total</b>	100%		100%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	6.0	0.0
Actual Paid Professional	0.0	0.0	3.6	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
128158	0	753705	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
128158	0	753705	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
672284	0	3411431	0

## V(D). Planned Program (Activity)

### 1. Brief description of the Activity

Activities included work to improve our understanding of enzyme and yeast behavior with the goal of improving ethanol plant productivity and reducing energy inputs during ethanol production, an experiment focusing on determining sustainable practices for the establishment and nitrogen management of switchgrass for biomass feedstock production, an examination of seed germplasm of black locust as a potential bioenergy feedstock crop from Afghanistan, Iran and Uzbekistan [seedlings were produced from these seeds and are being grown in the field for evaluation of resistance to common problems found in U.S. seed populations], the use of replicated, experimental micro-landscapes to assess how animal movements are affected by biofuel crops [our focal species is the meadow vole, a grassland species that is absent from current row-crop agriculture in the Midwest region], a project with the objective of quantifying the contribution of nitrogen-fixing bacteria to *Miscanthus* plant nitrogen and identifying plant and microbial traits and environmental factors that influence diazotroph colonization and activity [understanding factors that influence plant-microbe mutualisms will allow for the optimization of associative N fixation in perennial grasses and thereby enhance sustainability of these bioenergy crops], an examination of biofuel production strategies from cereal grains and various processing byproducts, the development of baseline data on the implications of using different feedstocks for biofuel production, research to improve our understanding of components that accelerate fouling in maize processing evaporators, work to quantify the roles of genetic and transgenic maize improvement on plant mineral nutrient use, the breeding of *Miscanthus* cultivars with improved winterhardiness and high yield-potential in the central and northern Midwest, and the development of near-infrared [NIR] spectroscopy as an inexpensive and high-throughput method for evaluating quality characteristics of *Miscanthus* genotypes.

Conference presentations included the Energy Bioscience Institute Retreat and Energy Farm Tour, EBI Feedstocks Symposium, American Chemical Society, World Congress on Industrial Technology, Cluster of Excellence in Plant Sciences, 2nd Workshop on Genetics of Maize-Microbe Interactions, Ecological Society of America, American Seed Trade Association's Corn and Sorghum Seed Research Conference, XV National Congress of Plant Biochemistry and Molecular Biology, International Heat Exchanger Fouling and Cleaning, American Institute of Chemical Engineers, American Society of Agronomy, Crop Science Society of America, and the Soil Science Society of America.

The **Dudley Smith Initiative** continued to provide financial support to create a positive loop and feedback relationship between researchers on campus and agriculturalists and leaders in the community regarding biomass energy generation. The site and related Extension programs have helped build the foundation of biomass [such a tropical maize] utilization using a farm-scale model to improve biomass harvesting methods and develop utilization strategies and services to provide inventories of harvestable

biomass for national efforts to reduce nutrient run-off and match crop nutrient requirements with crop production goals with fragile or impaired waters and watershed areas. Field days and tours have reached over 400 adults in the past two years. In addition, an energy crop display was created for the Illinois State Fair. A multi-state project is underway involving biomass bale transfer to a biomass research and development site in North Carolina to provide heat and power to large commercial poultry production facilities. That effort will have a direct relationship on improving practices that reduce phosphorus nutrient loads due to land application of manure and fertilizer run-off.

Extension campus specialists and Extension field educators continued in coordination with other campus institutions to support applied research and outreach education with respect to biomass heat and power. This past year Extension staff have become involved with Illinois Department of Transportation [IDOT] staff in a program to determine the feasibility of using roadside harvestable biomass as a fuel feedstock for regional and district IDOT maintenance facilities across the state. Extension has provided support to develop site identification and assessment, industry networks and contacts and appropriate renewable energy furnace systems availability, and capacity matching. Most recently this collaboration has brought support from the Governor's office and is a potential model for harvestable biomass combustion systems being considered for regional Illinois Department of Corrections facilities.

Other sustainable energy programming involved displays and demonstrations at the Illinois State Fair, Farm Progress Show and Southern Illinois Sustainability Expo reaching an estimated 1,000 attendees, as well as at the first regional Green Energy Business Summit that attracted 300 participants. Workshops were also conducted that addressed small wind, biomass, and solar power for homeowners. Interest in solar power re-emerged due to a drop in the cost of solar panels. 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 suppliers, continued to promote their website as a source of information to increase energy efficiency through presentations, videos, games, and links. In addition, 507 youth were enrolled in the 4-H Wind Energy project.

## **2. Brief description of the target audience**

Members of the target audience included the dry grind and cellulosic ethanol industries and allied companies such as seed, enzymes/biotech and equipment companies, basic scientists and production agriculturists interested in plant utilization for animal growth or production of value added products such as biofuels, energy grass producers, government officials, biomass conversion specialists, undergraduate and graduate students, producers of energy crops and local conservation groups, crop consultants, farm input suppliers, regional and national agriculture industries, state and national governmental agencies, green industries of the Midwest [including members of the nursery and landscape industries, botanical gardens and arboreta], conservation biologists, agronomists, sorghum breeders and producers, commodity groups, industry segments that support cereal grain processors, and farmers who wish to grow crops to meet U.S. renewable energy needs. Extension also targeted individuals and families who wish to reduce energy consumption and expenses, as well as youth.

## **3. How was eXtension used?**

Two Extension staff are members of the Wood Energy and Home Energy Communities of Practice.

### **V(E). Planned Program (Outputs)**

#### **1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6637	4193	2428	0

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

**Patent Applications Submitted**

Year: 2013

Actual: 4

**Patents listed**

TF 07188-CON [Method of Producing Solvent in the Presence of Furfural and Hydroxymethyl Furfural]; TF 09115-DIV [Methods and Compositions for Improving Sugar Transport, Mixed Sugar Fermentation, and Production of Biofuels]; TF 10181-US [Xylose-Fermenting Microorganism]; and TF 12043-US [Prairie Cordgrass Cultivar 'Savoy' for Biofeedstock Production].

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	35	35

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

Year	Actual
2013	4

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number Of Program Participants Increasing Knowledge Of Bio-Energy Production/Harvesting/Storage Systems
2	Determination Of Sustainable Practices For The Establishment And Nitrogen Management Of Switchgrass For Biomass Feedstock Production
3	Quantification Of The Contribution Of Nitrogen-Fixing Bacteria To Miscanthus Plant Nitrogen
4	The Development Of Baseline Data On The Environmental Impacts Of Using Different Feedstocks For Biofuel Production
5	Understanding The Causes Of Evaporator Fouling In Maize And Ethanol Production Systems
6	Improving Yield Per Unit Of Nitrogen And Per Acre
7	An Examination Of The Land Use, Economic, And Environmental Implications Of Cellulosic Biofuel Production

## **Outcome #1**

### **1. Outcome Measures**

Number Of Program Participants Increasing Knowledge Of Bio-Energy Production/Harvesting/Storage Systems

### **2. Associated Institution Types**

- 1862 Extension

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	26

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Society is facing many choices related to renewable energy and University of Illinois Extension seeks to provide information that will assist in making informed decisions.

#### **What has been done**

Extension programming related to biomass energy production has focused on how renewables are produced on the land and how renewable energy crops are developed, introduced, utilized and often reinvented to provide immediate value to consumers and early adopters. This has been translated into working with farmer networks and other stakeholders to support their adoption of renewable energy research findings and to apply that new knowledge to their respective environments. Over 100 individuals have been involved as collaborators and stakeholders engaged in University of Illinois Extension biomass energy activities. In addition, 11 Illinois biomass industry collaborators have been engaged in biomass energy projects. Eleven programs were delivered with a biomass energy theme and they addressed biomass and nutrient management strategies, biomass energy feedstock safety net, biomass heat and power with small farm application, food, fuel, and fiber, woody biomass systems, and biomass and cover crop strategies reaching approximately 400 participants.

#### **Results**

An incomplete inventory of results of Extension demonstrations, exhibits, field days, workshops, tours, presentations and networking follows: [1] Biomass Energy Crops Production: Collaborator sites number 13 and include three sites for evaluating sugar extraction, three sites for collaborator field day demonstrations, five sites regionally distributed for end-use as combustion materials, and two sites for end-use of biomass crops as animal feed options. These activities are field-based and augment biomass energy crops produced on campus research sites; [2] Biomass Markets Partially Established: Illinois local and regional markets include six combustion trial sites, two sites for industrial trialed materials for adsorbent and bedding material, and a ChipEnergy

market site for densified biomass for heat and power and designer biochar feedstock. Contacts have also been made with three states that have markets for displacement of propane and furnace oil, production of feedstock-based combustion pellets, and power for a poultry facility using litter adsorbent and convertible through gasification; [3] Energy crops integrated with cover crops [maize and tropical maize with warm-season and cool-season perennials grasses] were demonstrated on two field sites; and [4] Renewable feedstock heat systems installed and associated with ongoing Extension supported programs [two have been installed and two more are in the planning stage].

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
601	Economics of Agricultural Production and Farm Management

#### Outcome #2

##### 1. Outcome Measures

Determination Of Sustainable Practices For The Establishment And Nitrogen Management Of Switchgrass For Biomass Feedstock Production

##### 2. Associated Institution Types

- 1862 Research

##### 3a. Outcome Type:

Change in Knowledge Outcome Measure

##### 3b. Quantitative Outcome

Year	Actual
2013	0

##### 3c. Qualitative Outcome or Impact Statement

###### Issue (Who cares and Why)

The goal of this experiment is to determine sustainable practices for the establishment and nitrogen management of switchgrass for biomass feedstock production. The specific objectives to achieve the goal will be: Study 1. Companion Cropping Corn in Switchgrass During Switchgrass Establishment Year: [1] To evaluate the productivity of corn and switchgrass during the year of establishment; and [2] To determine the effects of corn plant populations and N fertilization on switchgrass establishment and corn yield. Study 2. Nitrogen Fertility Management of Switchgrass for Sustainable Bioenergy Feedstock Production: [1] To determine nitrogen fertilizer application rate and source to maximize biomass production in different regions of Illinois; [2] To determine the effects of N application rates on feedstock quality; and [3] To determine the effects of harvest timing on switchgrass N response and stand longevity.

### **What has been done**

Corn yields responded to nitrogen fertilization with the highest yields being achieved at the 224 kg N ha<sup>-1</sup> for all seeding rates [48,000, 59,000, 69,000 [control] seeds ha<sup>-1</sup>]. There was no significant difference of corn yields among seeding rates except for the 48,000 seeding rate at 224 kg N ha<sup>-1</sup> which was significantly lower than other treatments. Switchgrass was successfully established under companion cropping with corn and biomass yields increased from the second to third year. There was no significant difference of switchgrass biomass yields observed among different corn seeding rates. However, switchgrass biomass yields were lower in switchgrass and corn companion plots than in switchgrass control plots in which no corn was planted. The results of these two studies show that companion cropping switchgrass with corn can result in a successful switchgrass establishment. When doing a cost analysis on the amount of income generated from companion cropping and no companion crop, companion cropping yields a higher gross income than the control. Depending on the end use of the field, companion cropping switchgrass with corn may be a desirable method for switchgrass establishment.

### **Results**

Switchgrass biomass yield responses to N-application rates were highly variable for all soil types and climatic conditions based on this study. In general, however, lower N fertilizer application rates achieved maximum biomass yields as harvest timings were successively delayed. There were no significant differences in biomass yield between urea and slow-release Environmentally-Smart Nitrogen [ESN], except under conditions where N loss from the soil is likely. Applying ESN also increased the nitrogen content in the harvested biomass, which is an undesirable characteristic of a bioenergy feedstock. The results of this experiment showed that although yield reductions occurred with delayed harvest timing, the quality of the biomass improved the most when harvest was delayed until late winter or early spring. If fermentation to biofuels is the goal, a late-fall harvest is recommended to take advantage of higher biomass yield, relatively higher cellulose and hemicellulose concentrations, and relatively lower protein and ash concentrations. Conversely, early spring harvest may be the best option if thermochemical processing is the goal, or if storage and transportation issues with moisture content are most important.

## **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
133	Pollution Prevention and Mitigation
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management

## **Outcome #3**

### **1. Outcome Measures**

Quantification Of The Contribution Of Nitrogen-Fixing Bacteria To Miscanthus Plant Nitrogen

### **2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Our objective in this research is to quantify the contribution of nitrogen-fixing bacteria to Miscanthus plant N, and to identify plant and microbial traits and environmental factors that influence diazotroph colonization and activity. Understanding the factors that influence plant-microbe mutualisms will allow for the optimization of associative N fixation in perennial grasses, and thereby enhance sustainability of these bioenergy crops. We hypothesize that the efficiency of plant-microbe mutualisms will vary as a function of microbial community structure and environmental conditions. We further hypothesize that the efficiency of such mutualisms varies among plant species or genotypes. Nitrogen efficiency is important for the sustainability of crops, and especially critical for biofuel feedstocks. Improving our understanding of the biological mechanisms governing beneficial associations between gramineous bioenergy crops and nitrogen-fixing bacteria has the potential to enhance the sustainability of biofuel feedstocks. We are currently in the early stages of breeding perennial grasses for use as bioenergy feedstocks, making this a key time to evaluate the sustainability and N efficiency of these crops. There is relatively little information on how plant genetic variation affects diazotroph associations and natural N fixation. However, our preliminary data indicates that plant genetics play an important role. Thus, the results of this study are expected to facilitate efforts to breed Miscanthus for improved efficiency of plant-microbe interactions.

**What has been done**

To fulfill our objective of quantifying the contribution of nitrogen-fixing bacteria to Miscanthus plant N, we conducted a field experiment on mature Miscanthus plant during its growing season using an N-15 isotope dilution approach. A total of ten sample collecting time points were made for five replicated fields during the experimental period. Total plant available nitrogen, N-15 labeled plant available nitrogen in bulk soil, and the accumulation of N-15 labeled nitrogen in plant tissue were monitored during the experiment. Nitrogen-fixing bacteria community from rhizosphere and endosphere of Miscanthus plant were also collected at each sampling time. So far, we finished measuring the total and N-15 labeled plant available nitrogen in bulk soil. The rest of the samples are still under processing. For work focusing on identifying important ecological drivers and environmental factors, identical M. x giganteus rhizomes cultivated in four field sites in NE, KY, IL, and NJ were collected for microbial analysis after three years of cultivation. Our data indicated that local soil edaphic factors had great influence on the diazotroph assemblage in rhizosphere, and less influence on the endosphere community. Despite differences in regional microbial species pools, the same Miscanthus genotype selects for specific assemblages of endophytic diazotrophs. Surprisingly, although the total soil nitrogen affected the richness and diversity of the diazotrophs in endosphere to some extent, the microbial assemblage seemed to receive little

influence from the artificial nitrogen fertilization.

**Results**

Our 20-week greenhouse experiment using four different Miscanthus genotypes indicated that different Miscanthus genotypes tend to recruit different diazotroph species from the bulk soil. Using 454-generated nifH sequences, we are able to identify the main diazotroph species that reside inside the plant tissue and rhizosphere soil, and also we identified OTUs that respond to different Miscanthus genotypes. We will continue to analyze the results from a large sequencing project and evaluate the Miscanthus associated microbiome as a function of plant genotype. As samples from our large N-15 isotope dilution experiment are processed, we will be able to quantify N fixation in mature Miscanthus.

**4. Associated Knowledge Areas**

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

**Outcome #4**

**1. Outcome Measures**

The Development Of Baseline Data On The Environmental Impacts Of Using Different Feedstocks For Biofuel Production

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

The primary accomplishment of this project was to provide baseline data on the implications of using different feedstocks for biofuel production. Miscanthus in particular is a new candidate feedstock in the Midwest.

**What has been done**

For birds, the primary factors to consider are what is attracted to a given cover type and, during the breeding season, how successful the species are that attempt to nest. Simply counting 'species seen' is rarely sufficient since viability of constituent populations depends on breeding

success. For miscanthus, the results are clear that it offers poor habitat for wildlife and birds in particular. On the other hand, switchgrass appears to offer suitable habitat for breeding of selected grassland birds.

**Results**

Given that grassland-dependent species in the Midwest have declined more than any other habitat group, these data are important if acreage devoted to feedstocks increases. Of particular interest is land that is marginal for rowcrop production but beneficial to wildlife when grass is present [for example, under a CRP contract]. If marginal land is converted to feedstock production the type of feedstock and tillage practice will have important implications. Large-scale conversion to Miscanthus will likely have adverse effects, but other options such as switchgrass will help to maintain wildlife populations in the region. Data for these types of decisions are a primary accomplishment of this project.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
136	Conservation of Biological Diversity
206	Basic Plant Biology

**Outcome #5**

**1. Outcome Measures**

Understanding The Causes Of Evaporator Fouling In Maize And Ethanol Production Systems

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Evaporator fouling is a common, chronic problem during maize starch and ethanol production. To compensate for the consequences of fouling, capital costs are increased, operating costs are incurred, productivity is reduced and environmental impact is increased. Despite these issues, fundamental causes of increased fouling in maize processes are not understood. Process streams are biological in origin and have variable compositions. The objective was to develop an improved understanding of components that accelerate fouling in maize processing evaporators.

**What has been done**

Two experiments were performed with commercial and model processing streams. In the first experiment, we used model materials [starch and sucrose] to study fouling characteristics of streams having well defined compositions. In a second experiment, commercial thin stillage samples were treated by adding carbohydrate materials [starch and sucrose] and tested in a fouling rig to simulate variation in composition.

**Results**

In the first experiment, sucrose had smaller effects than granular starch on heat transfer fouling. In the second experiment, inclusion of granular starch in thin stillage increased the rates of fouling. These introductory results have broad implications on process strategies. In model thin stillage, the fouling resistance increased with increased starch concentration. Higher levels of starch in model thin stillage shortened time needed to reach 170°C. Model thin stillage containing only sucrose did not foul during ten hours of testing. In model thin stillage, there was a larger effect on fouling tendencies from starch content than sucrose content. With increased starch levels in thin stillage, the rates of fouling were increased.

**4. Associated Knowledge Areas**

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management

**Outcome #6**

**1. Outcome Measures**

Improving Yield Per Unit Of Nitrogen And Per Acre

**2. Associated Institution Types**

- 1862 Research

**3a. Outcome Type:**

Change in Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2013	0

**3c. Qualitative Outcome or Impact Statement**

**Issue (Who cares and Why)**

Improving the amount of yield produced per unit of N and per acre [NUE] is a complex problem requiring an understanding of the genes and metabolic pathways involved. The impact of

sustainable modern maize crop production practices, including fertilizers, fungicides, populations, tillage, and stover management, will be evaluated for maize plants grown for grain yield or high-biomass varieties for renewable bioenergy and biofuels. The major goals of this project are to determine the mechanisms regulating photosynthate partitioning and carbon partitioning engineering and to analyze the limitations to photosynthetic productivity caused by environmental factors.

#### **What has been done**

Understanding the interaction of environmental, genetic, and management factors in altering light interception, photosynthesis, and corn productivity is needed to feed a growing world population. Work in 2013 helped to quantify the roles of genetic and transgenic maize improvement on plant mineral nutrient use, the need for higher plant populations to optimize biomass production and corn yield, and the ability to use tropical maize hybrids as a biomass and sugar source for bioethanol production. Specific results included determining that when corn is grown continuously in the same field, year-after-year, the productivity is especially hindered by hot, dry weather, limiting nitrogen availability, and further hindered by accumulated corn residue. Additionally, we learned that some modern, transgenic corn-rootworm protected [Bt] maize hybrids have increased biomass and grain accumulation that is accompanied by increases in N,P, K, S, and Zn in the grain. The yield-responsive Bt hybrids had double the phosphorous and biomass accumulation during mid-grain fill than their traditional counterparts. The results of these experiments may lead to a re-evaluation of fertilizer levels and production environments necessary for maximum grain yields.

#### **Results**

We have obtained much needed data on the nutrient uptake and partitioning of current hybrids, which will provide an opportunity to further refine fertilizer method and timing recommendations for maize biomass and grain production. We also learned that in favorable environments, transgenic corn-rootworm protected hybrids not only produce more total biomass and yield, but also maintain greater nutrient and photosynthate acquisition during grain filling. We have also learned that the response of grain yield to fertilizer nitrogen in current hybrids is more dependent on uptake of fertilizer nitrogen than the efficiency of fertilizer nitrogen utilization, and approximately two-thirds of genetic gain [over the decades] for grain yield at high nitrogen fertilizer can be explained by improvements in grain yield at low nitrogen. We also learned that the primary causative agents of the continuous corn yield penalty are nitrogen availability, corn residue accumulation, and weather.

#### **4. Associated Knowledge Areas**

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

## **Outcome #7**

### **1. Outcome Measures**

An Examination Of The Land Use, Economic, And Environmental Implications Of Cellulosic Biofuel Production

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Actual</b>
2013	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

This project will examine the land use, economic, and environmental implications of cellulosic biofuel production in the U.S., including the effects of biofuel production on food and fuel production and prices and on greenhouse gas emission mitigation under various policy scenarios.

#### **What has been done**

We developed a numerical simulation model to analyze the economic and environmental potential of using various types of cellulosic feedstocks for bioenergy production. We developed a framework to investigate the economic incentives for landowners to switch from growing an annual crop to growing energy crops.

#### **Results**

We found: [1] Carbon taxes would cause a significant increase in nitrogen use in association with a shift from petroleum to biofuels, and that a second-best carbon pricing policy would stop short of a first-best price in order to moderate the impacts on carbon; [2] The Renewable Fuel Standard [RFS] could raise the present value of cumulative payments needed to maintain the CRP at its current level by 19% over 2007-2020; [3] The increase in crop prices under the RFS is likely to be about 20%; [4] The tax credit for corn ethanol and import tariff that accompany the RFS can delay the transition to advanced biofuels and exacerbate the negative impact of the RFS on food crop prices; [5] Both the RFS and LCFS have the potential to lead to economic benefits for the U.S. by improving the international terms of trade; [6] The RFS could reduce greenhouse gas emissions by the U.S. by 5%, but this would be 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%]; and [7] The tax credit for corn ethanol and import tariff that accompany the RFS can delay the transition to advanced biofuels and worsen the negative impact of the RFS on food prices.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
133	Pollution Prevention and Mitigation
601	Economics of Agricultural Production and Farm Management

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Economy
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges

**Brief Explanation**

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

No formal evaluation study was carried out by Extension.

**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%	
	<b>Total</b>	100%		0%	

**V(C). Planned Program (Inputs)**

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	38.0	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
2233585	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2233585	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
11716951	0	0	0

**V(D). Planned Program (Activity)**

1. Brief description of the Activity

**4-H Club** enrollment in Illinois totaled 22,700. More than 150,000 young people 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 and now include 13 educators who are creating opportunities for younger youth to become involved in sustained science and/or gardening opportunities while helping older youth 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 37 groups reaching 1,400 youth who participated in the **4-H National Youth Science Day**. They completed the **Maps and Apps Challenge** to create a design and map of their ideal park and solve a community problem using GIS mapping with the help of **Youth Science Ambassadors** and adults. The 4-H robotics project involvement nearly doubled in enrollment again this year with 3,467 youth enrolled in one of three project levels. Forty-two teams participated in the fifth annual Illinois 4-H **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 at three sites this past year. 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 4 through 6, 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 **I Think Green** curriculum was developed by 4-H and horticulture Extension specialists to engage 3<sup>rd</sup> through 5<sup>th</sup> grade youth in investigating how living things interact with each other and with their environment [also see Natural Resources and the Environment planned program]. New this year, the **4-H Citizen Scientist** program provided junior and senior high youth opportunities to extend learning into the world of hands-on research to observe and record information from a stream site close to their home community and then contributed to the Illinois River Watch data collection site.

Several activities and programs focused on youth career exploration and workforce preparation. **Illinois Summer Academies** three-day conferences were held on the University of Illinois campus and provided 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 to 18 to explore careers and money management [balancing income and expenses] in adult life, was on-going [also see Agricultural and Consumer Economics planned program]. A grant-funded national applied research project, **Health Jam**, involved more than 650 youth in two-day camps that allowed them to explore health careers and to learn about pursuing a healthy lifestyle in keeping their bodies fit [also see Human Development and Family Wellbeing planned program].

Building youth leadership skills is both a national and Illinois 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. More than 100 **Youth Science Ambassadors** were involved in conducting the **Maps and Apps Challenge** and some 160 are involved in other teaching opportunities that contributed greatly to the success of reaching new and diverse audiences.

Volunteers are key to the delivery of 4-H Youth Development programs and are instrumental as caring adults who create an environment that is a critical element of positive youth development. This past year 20,067 volunteers gave time and talent to the 4-H Youth Development program in Illinois with more

than 4,200 serving as club leaders. Leaders had instant access to seven online courses to help them carry out their role. In addition to a basic course orienting new volunteers, other course topics include an overnight chaperone orientation, child protection, parliamentary procedure, working with committees, club program planning, and public presentations. Illinois volunteers also participated in the **North Central 4-H Leaders Volunteer Forum** held via distance technology and hosted by local Extension offices. Leaders were able to interact with experts from various states to gather information and ideas on working with parents, engaging older youth, using technology, and exploring science.

**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?**

One Extension staff member is a member of the Military Families eXtension Community of Practice.

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Actual</b>	181819	0	333462	435580

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

**Patent Applications Submitted**

Year: 2013  
 Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
<b>Actual</b>	0	0	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- {No Data Entered}



**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Increased Knowledge About Science And Health Careers
2	Increased Knowledge Of Positive Youth Development
3	Pursuit Of Higher Education Including Science, Engineering, And Technology Careers
4	Number Of 4-H Youth Applying Leadership Skills
5	Presence Of 4-H Club Experiences That Foster Positive Youth Development
6	Increased Knowledge Of The Costs Of Independent Living
7	Number Of Youth Who Indicate Increased Knowledge Of Science, Engineering And Technology

## **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**

<b>Year</b>	<b>Actual</b>
2013	385

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Reports of college degrees awarded, media reports, and business and industry leaders' expressed concerns about the declining interest of youth in science, engineering, and technology and have identified this decline as a situation 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 650 youth in seven counties using a two-day camp format and an eight-week Walk Across Illinois activity that involved tracking daily and weekly steps as a team. During the camps, the youth learned how to keep their bodies healthy and fit and explored health professions. Science Siesta, designed for girls in grades 4 through 6 also introduced them to fun hands-on science activities and career opportunities.

#### **Results**

Using a pre- and post-test evaluation format, 359 youth [55% of the 654 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 all but two of the nine locations. Students also demonstrated knowledge gained in responding to multiple-choice questions. For example, at one location 52% of the participants learned that emergency nurses' work involves scientific inquiry, detective work, high technology, and compassion and caring. Pre-tests compared to post-test completed by girls who participated in the Science Siesta program indicated that 26 [60%] learned about what a genetic counselor does.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
724	Healthy Lifestyle
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**

Pursuit Of Higher Education Including Science, Engineering, And Technology Careers

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number Of 4-H Youth Applying Leadership Skills

Not Reporting on this Outcome Measure

**Outcome #5**

**1. Outcome Measures**

Presence Of 4-H Club Experiences That Foster Positive Youth Development

Not Reporting on this Outcome Measure

**Outcome #6**

**1. Outcome Measures**

Increased Knowledge Of The Costs Of Independent Living

Not Reporting on this Outcome Measure

## **Outcome #7**

### **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**

<b>Year</b>	<b>Actual</b>
2013	9255

### **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. Students need more exposure to challenging and engaging content. For more information see:  
[http://vitalsigns.changetheequation.org/images/vs\\_newsletter/illinois.pdf](http://vitalsigns.changetheequation.org/images/vs_newsletter/illinois.pdf).

#### **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-2 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 and local Extension Educators. Evaluations were collected from 311 teachers in nine counties in Northeastern Illinois to determine their perceptions of impact related to their 11,368 students' science ability gains.

Now in its eleventh year, Science Siesta provides girls in grades 4-6 with the opportunity to meet and interact with female scientists, conduct fun hands-on science activities in a laboratory setting, and participate in activities in stimulating science-centered environments. This past year 97 girls participated in one of the following three tracks: Space Geologist, Genetic Counselor, or Rain Forest Ecologist.

In addition, a questionnaire was distributed and collected from 292 youth participants in robotics clubs this past year that included fourteen questions related to interest in science now and in the future and in designing robots. Youth were asked to respond to the questions using a 1-4 scale with 1 = Strongly disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly agree.

## Results

Using a scale of 1-4 [1 = Not at all, 2 = Sometimes, 3 = Usually, and 4 = Always], grades K-2 teachers were asked to rate their students' level [as a group] with respect to five [5] science abilities, and grades 3-12 teachers were to rate their students' level on ten [10] 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 80% of the 238 teachers who answered these questions [see Evaluation section of this planned program for more information].

Of the 87 participants who completed both the pre-test and post-test evaluation at the end of Science Siesta, 26 [31%] learned the steps of the scientific method and eighteen [21%] learned why it is important to use the scientific method. Of the 24 girls who participated in the Space Geologist track, 22 [92%] learned about meteorites and/or tools a geologist uses. Of the 23 girls who participated in the Genetic Counselor track, 19 [83%] learned about genes and/or what a genetic counselor does as part of their job. Of the 43 girls who participated in the Rain Forest Ecologist track, 34 [79%] learned about rain forest nuts and/or learned how certain frogs improve their survival in the rain forest. In summary, 75 of the 85 girls who completed the evaluation were able to answer at least one question correctly at the end of the program that they had answered incorrectly on the pre-test.

Ninety percent [280] of the 292 youth who responded to the questionnaire distributed and collected at robotics club events indicated that they agree or strongly agree that they: [1] Learned to test and improve robot designs; [2] Learned to think about different options to identify the best robot solutions; and [3] Came up with ideas used in robot designs. In addition, with respect to other findings related to science, 95% affirmed that they like science and want to learn more about science and 92% think science, engineering, or technology will be important in their future job.

## 4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

## V(H). Planned Program (External Factors)

### External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

### Brief Explanation

## **V(I). Planned Program (Evaluation Studies)**

### **Evaluation Results**

#### **Incubation and Embryology**

Using materials developed by the University of Illinois poultry specialist in conjunction with state and local 4-H staff, 311 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 10,262 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 [5 science skills for K-2 and 10 for 3-12].

With respect to the science abilities of students in grades K-2, 142 [84%] of the 169 teachers who answered this question indicated a perceived increase in at least one of five [5] science abilities. More than one-half of the teachers reported perceived increases in their students' observation ability [67% of the teachers], hypothesizing ability [66%], predicting ability [60%], organizing/ordering/classifying [57%], and comparing/contrasting [51%].

With respect to students in grades 3-12, 46 [71%] of the 65 teachers who answered this question indicated a perceived increase in at least one of the ten [10] science abilities. More than one-half of the teachers reported perceived increases in their students' observation ability [57%] and communication/demonstration ability [51% of the teachers]. Between 40% and 50% of the teachers reported perceived increases in students' ability to evaluate [48%], interpret/analyze/reason [48%], collect data [43%], hypothesize [43%], predict [43%], problem solve [42%], summarize [42%], and question [42%].

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

#### **Science Program Study**

In 2012, 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 members and volunteers 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 agree'. Those coding data for analysis assigned values ranging from 1 = 'Strongly disagree' to 4 = 'Strongly agree'.

This past year, three evaluations containing ten of the same eleven questions and four additional ones were added specific to three 4-H programs of interest -- robotics, animal science, and 4-H camp. The data collection protocol involved 4-H leaders with a 4-H staff person assisting distributing paper copies of the questionnaire at club meetings or science-related 4-H events and collecting completed questionnaires between April and

October of 2013. A total of 446 were collected from the animal science activities, 115 from a 4-H camp location, and 292 from robotics clubs/groups. Results of an analysis of the responses from each group follows and is compared to the findings from the 2012 baseline study of a cross-program stratum of 405 youth participants.

### **Animal Science Events [n=446]**

#### Attitude/Interest in Science

[1] I like science [78.6% agreed or strongly agreed as compared to 82.2% for the baseline study]; [2] I am good at science [79.6% agreed or strongly agreed as compared to 82.9% for the baseline study]; and [3] I do science-related activities that are not for schoolwork [66.0% agreed or strongly agreed as compared to 70.7% for the baseline study].

#### Relevance/Value/Utility

[1] Science is boring [76.0% disagreed or strongly disagreed as compared to 87.2% for the baseline study]; [2] I think science, engineering, or technology will be important in my future job [88.2% agreed or strongly agreed as compared to 80.6% for the baseline study]; and [3] I can explain to others how I use science, engineering, or technology in my 4-H program/project [75.5% agreed or strongly agreed as compared to 76.6% for the baseline study].

#### Encouragement

[1] I often get to do hands-on activities in my 4-H program/project [94.1% agreed or strongly agreed as compared to 87.6% for the baseline study]; [2] I am encouraged to ask questions about science, engineering, or technology [72.9% agreed or strongly agreed as compared to 79.5% for the baseline study]; and [3] When I graduate from high school, I would like to have a job related to science [63.9% agreed or strongly agreed as compared to 61.2% for the baseline study].

#### Aspiration

[1] Science is useful for solving everyday problems [82.9% agreed or strongly agreed as compared to 70.5% for the baseline study]; and [2] I want to learn more about science [81.0% agreed or strongly agreed as compared to 85.3% for the baseline study].

### **4-H Camp [n=115]**

#### Attitude/Interest in Science

[1] I like science [80.7% agreed or strongly agreed as compared to 82.2% for the baseline study]; [2] I am good at science [80.8% agreed or strongly agreed as compared to 82.9% for the baseline study]; and [3] I do science-related activities that are not for schoolwork [64.8% agreed or strongly agreed as compared to 70.7% for the baseline study].

#### Relevance/Value/Utility

[1] Science is boring [76.5% disagreed or strongly disagreed as compared to the 87.2% for the baseline study]; [2] I think science, engineering, or technology will be

important in my future job [83.2% agreed or strongly agreed as compared to 80.6% for the baseline study]; and [3] I can explain to others how I use science, engineering, or technology in my 4-H program/project [75.2% agreed or strongly agreed as compared to 76.6% for the baseline study].

#### Encouragement

[1] I often get to do hands-on activities in my 4-H program/project [98.3% agreed or strongly agreed as compared to 87.6% for the baseline study]; I am encouraged to ask questions about science, engineering, or technology [80.5% agreed or strongly agreed as compared to 79.5% for baseline study]; and [3] When I graduate from high school, I would like to have a job related to science [53.1% agreed or strongly agreed as compared to 61.2% for the baseline study].

#### Aspiration

[1] Science is useful for solving everyday problems [81.7% agreed or strongly agreed as compared to 70.5% for the baseline study]; and [2] I want to learn more about science [78.1% agreed or strongly agreed as compared to 85.3% for the baseline study].

#### **Robotics Groups [n=292]**

##### Attitude/Interest in Science

[1] I like science [95.5% agreed or strongly agreed as compared to 82.2% for the baseline study]; [2] I am good at science [90.2% agreed or strongly agreed as compared to 82.9% for the baseline study]; and [3] I do science-related activities that are not for schoolwork [79.6% agreed or strongly agreed as compared to 70.7% for the baseline study].

##### Relevance/Value/Utility

[1] Science is boring [94.8% disagreed or strongly disagreed as compared to 87.2% for the baseline study]; [2] I think science, engineering, or technology will be important in my future job [92.0% agreed or strongly agreed as compared to 80.6% for the baseline study]; and [3] I can explain to others how I use science, engineering, or technology in my 4-H program/project [81.1% agreed or strongly agreed as compared to 76.6% for the baseline study].

#### Encouragement

[1] I often get to do hands-on activities in my 4-H program/project [87.8% agreed or strongly agreed as compared to 87.6% for the baseline study]; [2] I am encouraged to ask questions about science, engineering, or technology [85.1% agreed or strongly agreed as compared to 79.5% for the baseline study]; and [3] When I graduate from high school, I would like to have a job related to science [74.4% agreed or strongly agreed as compared to 61.2% for the baseline study].

#### Aspiration

[1] Science is useful for solving everyday problems [91.3% agreed or strongly agreed as compared to 70.5% for the baseline study]; and [2] I want to learn more about science

[94.8% agreed or strongly agreed as compared to 85.3% for the baseline study].

#### Robotics Related Questions

[1] In robotics club, I learned to test and improve robot designs [92.86% agreed or strongly agreed]; [2] In robotics club, I learned to think about different options to identify the best robot solutions [92.5% agreed or strongly agreed]; and [3] In robotics club, I came up with ideas used in robot design [90.97% agreed or strongly agreed].

### **Key Items of Evaluation**

#### Incubation and Embryology

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 students' observation skills. More than half of the K-2 teachers also reported observed increases in their students' hypothesizing, predicting organizing/ordering/classifying, and comparing/contrasting skills. In addition, nearly half or more of the grades 3-12 teachers reported observed increases in their student's ability to communicate/demonstrate, evaluate, and interpret/analyze/reason.

#### Science Program Study

More than half of the 446 animal science event participants responded favorably to the science related statements. In addition, all percentages were near or slightly below the 2012 baseline with the exception of a larger percentage indicating that science, engineering, and technology [SET] is: [1] Important to a future job; [2] Having opportunities to do hands-on activities; [3] Being encouraged to ask SET related questions; and [4] Wanting to have a science-related job [also see Animal Health and Production planned program for additional results regarding youth and animal science findings].

More than half of the 115 4-H camp participants responded favorably to the science related statements. In addition, all percentages were near or slightly below the 2012 baseline with the exception of a larger percentage indicating that SET is: [1] Important to a future job; [2] Having opportunities to do hands-on activities; and [3] Believing science is useful for solving everyday problems [as see Natural Resources and the Environment planned program for additional results regarding youth camping science findings].

More than three-fourths and as many as 95% of the 292 robotics club participants responded favorably to the science related statements and agreed at the highest rates and had higher mean scores than all other groups who had completed the questionnaire. In addition, all favorable percentages were above the 2012 baseline. With respect to questions related to specific robotics activities, 90% or more of the respondents: [1] Learned to test and improve robot designs; [2] Learned to think about different options to identify the best robot solutions; and [3] Came up with ideas used in robot designs.

Complete findings are still being reviewed but will be made 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

Results related to childhood obesity are located in 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: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	4.5	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**

2013	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: 2013

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	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
2013	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Number Of Children/Youth That Gained Knowledge About Eating More Healthy Foods [Those Low In Fat And High In Fiber]
2	Number Of Children/Youth That Increased Physical Activity
3	Number Of Active Research Projects On The Development Or Adoption Of Healthy Eating Guidelines And Childhood Obesity

**Outcome #1**

**1. Outcome Measures**

Number Of Children/Youth That Gained Knowledge About Eating More Healthy Foods [Those Low In Fat And High In Fiber]

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number Of Children/Youth That Increased Physical Activity

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number Of Active Research Projects On The Development Or Adoption Of Healthy Eating Guidelines And Childhood Obesity

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
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

**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

Results related to climate change are located in 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: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	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**

2013	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: 2013

Actual: {No Data Entered}

**Patents listed**

{No Data Entered}

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	0	9	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

Year	Actual
2013	0

**Output #2**

**Output Measure**

- Number Of New Climate Relevant Databases, Monitoring Systems, And Inventories Managed Or Under Development

<b>Year</b>	<b>Actual</b>
2013	0

**Output #3**

**Output Measure**

- Number Of New Assessment And Management Tools Developed, Including Models And Measurements Of Greenhouse Gas Emissions

<b>Year</b>	<b>Actual</b>
2013	0

**Output #4**

**Output Measure**

- Number Of Current Year Climate-Relevant Research Programs

<b>Year</b>	<b>Actual</b>
2013	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Dissemination Of Air Quality And Atmospheric Data Through Web Hits On The National Atmospheric Deposition Program Website

**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

**V(H). Planned Program (External Factors)**

**External factors which affected outcomes**

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

**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

Results related to food safety are located in 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: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	5.0	0.0	6.0	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**

2013	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: 2013

Actual: {No Data Entered}

**Patents listed**

{No Data Entered}

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2013	Extension	Research	Total
Actual	1	20	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Number Of Completed Hatch Projects

Year	Actual
2013	0

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Practices Adopted That Prevent Foodborne Illness Contamination During The Production And Distribution Of Fresh Produce
2	Number Of Projects Focused On Increased Safety Of All Inputs In The Food Chain
3	Number Of Food Preparers Reporting Using Proper Time And Temperature Controls
4	Number Of Food Preparers Reporting Taking Steps To Reduce Cross-Contamination

**Outcome #1**

**1. Outcome Measures**

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

Not Reporting on this Outcome Measure

**Outcome #2**

**1. Outcome Measures**

Number Of Projects Focused On Increased Safety Of All Inputs In The Food Chain

Not Reporting on this Outcome Measure

**Outcome #3**

**1. Outcome Measures**

Number Of Food Preparers Reporting Using Proper Time And Temperature Controls

Not Reporting on this Outcome Measure

**Outcome #4**

**1. Outcome Measures**

Number Of Food Preparers Reporting Taking Steps To Reduce Cross-Contamination

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
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

**Brief Explanation**

{No Data Entered}

**V(I). Planned Program (Evaluation Studies)**

**Evaluation Results**

{No Data Entered}

**Key Items of Evaluation**

{No Data Entered}