2014 Purdue University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The 2014 Combined Report of Annual Accomplishments and Results includes many examples of how formula funds impacted Indiana, the nation and the world.
Formula funding is awarded to three distinct colleges at Purdue University--the College of Agriculture, the College of Veterinary Medicine and the College of Health and Human Sciences. These colleges were among the first in the land-grant system to integrate research, education and extension in the classroom, the field and in research projects. Our strong integrated research and extension programs allow us to effectively and efficiently translate research to the field for the full benefit of our Indiana, regional, national and international stakeholders.
Our team-oriented discovery efforts pull from expertise across many disciplines and engage like-minded partners, whether from industry, other academic institutions, non-governmental organizations, or government.
The three colleges combined have over 300 faculty to conduct state-of-the-art research and teach more than 7,000 undergraduate and 1,200 graduate students. Scientists conducted more than 400 research projects on more than 40 different crops across more than 3,000 acres at our eight regional farms known as the Purdue Agricultural Centers (PACs).
There are about 260 Extension Educators across the state located in each of the 92 counties of Indiana. Educators' roles are in four program areas: 4-H Youth Development, Agriculture and Natural Resources, Community Development, and Health and Human Sciences.
Extension Educators with agricultural and natural resource specialties offer programs and information on agricultural production and financial management for farmers, food and fiber processors, manufacturers and consumers. They also provide expertise in environmental issues, natural resource conservation and land use.
Health and Human Sciences Extension Specialists and Educators provide education to help communities analyze, identify and meet the needs of families; train volunteers and paraprofessionals to assist in areas of critical concern to families; motivate people to become leaders in addressing community issues; and collaborate with agencies, community organizations, and educational groups to address the needs of families.
Extension Educators in community development, provide Indiana citizens with educational programs and information they can use to increase community vitality, build leadership capacity, enhance public decision-making, and resolve public issues.
A dedicated network of Extension Educators, parents, local leaders and volunteer staff, makes Indiana 4-H one of the most valued youth programs in the state. Purdue Extension youth educators develop individual talents, life skills and leadership abilities among Indiana's young people through the traditional venue of 4-H clubs and county fairs, but also through field-tested school enrichment materials and local-led community programs.

Childhood obesity
Extension approaches to address childhood obesity included educational summer programs linking gardening and nutrition, staff training programs for child care providers, and education for parents and children in limited-resource families.

Bringing gardening and nutrition education together for children and youth, Camp RAVE, a 9-week summer program, introduces skills in gardening to children and helps them explore growing vegetables and fruit, and tasting "new" (healthier) foods, along with nutrition education and daily physical activity. Campers reported that they: 1) tried new fruits and vegetables while attending camp; 2) will look for more opportunities to garden; 3) will wash their hands more often before eating food, 4) will wash fresh fruits and vegetables before eating them, and 5) plan to eat more fruits and vegetables each day.
I am Moving, I am Learning is a staff development program for child care providers in locations across Indiana where the greatest number of military families reside. This training provided child care staff with information and practices to incorporate more daily physical activity and nutritious snacks and meals for the children in child care settings, and to work with families to bring those practices home, too.
Purdue Extension's Nutrition Education Programs provides education to parents and children in limited-resource families to address obesity by focusing on healthy eating and physical activity. Children in grades 3-5 increased their intake of vegetables, fruits, and healthy snacks, and increased their physical activity.

Climate Change
Weather and climate patterns are a driving force behind the success or failure of cropping systems. The ability to successfully produce crops under more variable climate conditions is critical for food security and rural livelihoods. Farmers can benefit from incorporating climate information into their farm management planning, but the actual use of such information remains limited. The Useful 2 Useable (U2U) project is focused on enhancing the usability and adoption of climate information for farmers and their advisors, and expand Extension's capacity to address agro-climate issues across the Corn Belt. The team has conducted studies examining the ability of three crop models of varying complexity to represent changes in climate and agronomic practices, and simulate the impacts of climate variability and change on agricultural production. Several approaches have been tested for migrating site-level models to operating on a continuous grid, and addressed numerous data gap issues that arose when scaling up modeling to a regional scale. An economic modeling framework based on the Purdue Crop/Livestock Linear Program (PC-LP) has been developed that demonstrates how climate and crop simulations will be integrated with farm-level economic modeling to evaluate adaptation strategies under future climate scenarios. The team's unprecedented surveys of Corn Belt farmers and agricultural advisor groups has improved scientific understanding about the climate information needs, climate change beliefs, trusted information sources, and risk management strategies of the agricultural community. The role of agricultural advisors in guiding on-farm management decisions and their role as climate information brokers has been clearly documented. Building from these activities and results, the team has built a total of four web-based decision support tools (two built in 2014), to help farmers and agricultural advisors examine outcomes on production, finances, environment based on different climate scenarios and decisions. The team members participated in 43 outreach events to train farmers and public/private advisors on using the various U2U tools.
Food Safety
Aspergillus Flavus and Fusarium are important parts of the nutrient cycling process and are found growing on dead plants and animals in agricultural fields. Both produce a toxin that when eaten by humans or animals can make them very sick or even be fatal. This toxin takes the form of "ear rot"--the ear of corn literally rots when these toxins are growing on it. Since the ear rot is a problem for human and animal health, the corn can't be sold when it reaches a certain concentration. This project target includes identifying the critical knowledge gaps in farm management practices that could reduce the amount of toxin in corn. Another goal is to develop genetically engineer corn to express a gene that would stop the toxin from being able to hurt the ear of corn. Field experiments were conducted in Indiana, North Carolina, and Texas. They tested fungicides and biocontrol applications in addition to creating transgenic corn designed to protect itself from the toxin. All of this research found that fungicide applications did not reduce fumonisin levels in Indiana nor did they reduce toxin levels in Texas or North Carolina. Additionally, there was no interaction of fungicide and atoxigenic strains on the reduction of toxins in the Indiana and North Carolina experiments.

Global Food Security and Hunger

The phrase "Do You Know Where Your Food Comes From?" has been gaining significant traction as the agricultural community struggles to educate the public about how food ends up in grocery stores and restaurants. Purdue researchers and Extension staff are on the front lines of the burgeoning Eat Local; Farm to Fork; and Small Farm efforts. A great example is the work being done by Jodee Ellett, Purdue's first Local Foods Coordinator. Ellett focuses on making connections along the value chain from consumer to producer and all related agencies involved in sales of local foods. A robust local food system with year-round markets is paramount for agricultural producers working to meet the high demand for locally grown and produced food. Hoosiers spend $17 billion on food annually, but few resources exist for large volume buyers to purchase locally grown food. Ellett, along with Extension Specialists, Educators and a state-wide advisory board, developed intentional local food systems that have the potential to grow the state's economy and agricultural production systems. One program will enable communities to better understand their local food system, engage multiple groups in a dialogue about rebuilding their local food system, and assist with a strategic plan for implementing their rebuilding strategy. As a result of pilot programs in two locations, both communities have a better understanding of a local food system, the factors that are essential and where they can improve and rebuild their local food system.

Sustainable Energy

Purdue research studies on tomatoes and on flowering plants were conducted to determine which environmental factors can overcome the growth-limiting conditions and minimize the energy required to grow plants and crops productively and affordably in controlled environments. Light-emitting diodes (LEDs) were used as the source of plant-growth lighting. For propagation of tomato seedlings in the greenhouse, supplemental lighting enhanced seedling production and with the addition of solar UVB radiation which stimulated ascorbic acid content produced better flavor. For bedding plants - impatiens, marigold, petunia, vinca and geranium - red and blue LEDs were used to supplement sunlight, but also as sole-source lighting to grow seedlings in multilayer production, stacked on top of each other on shelves with no sunlight. Resulting seedling quality was similar to, and in some cases better than, those grown in greenhouses with high-pressure sodium lamps. Seedlings produced indoors with no sunlight but with LEDs as the sole source of light were high-quality and uniform, compact and sturdy.

For renewable resource materials as alternatives to fossil sources for fuel production, grasses can be grown on marginal lands and won't compete with row crops for field space. Shawnee and Liberty switch grass plots grew successfully in dry and wet land areas. These plants established well and in the second year with Nitrogen application at 60 pounds per acre rate treatments saw improved yield. These demonstration sites were used for field training engaging Extension Educators in field day planning, and stand assessment and data gathering for campus-based staff.

Poplar trees are gaining importance as a source of biomass for many uses including biofuels due to their consistent quality and growth patterns. To complete an economic and financial feasibility analysis of the entire value Wood-to-Wheels pathway, all costs and benefits associated with producing a biofuel from woody biomass were incorporated into an economic model. More than 60 genotypes of poplar were evaluated at three locations in Indiana. From the collected growth data, the team was able to develop yield equations that accurately predict whole-tree, dry-weight biomass using diameter at breast height (DBH) as the sole input variable. This allows growers to make more effective harvesting decisions based on market price.

Natural Resources and the Environment

The largest salamander in North America, Cryptobranchus alleganiensis, or more commonly known as the Hellbender, is considered to be an endangered species in Indiana. Purdue has partnered with the three zoos in the state of Indiana to raise hellbenders in captivity and then release them in an effort to improve their numbers. Research shows that if they are raised in captivity for 3-4 years, they have a much higher survival rate in the wild.

Over the past year, one research group has made a number of discoveries in the field of disease ecology. In one project, drivers of infection heterogeneity in host populations were assessed. Using field surveys, it

was found that parasitic infections were strongly aggregated among individual amphibian hosts within populations. Using laboratory experiments, the team assessed how factors such as host behavior and immunity influenced these patterns of parasite infection heterogeneity. They discovered that a reduction in immune function or behavior of hosts significantly amplified infection heterogeneity within a population. These results emphasize how, alongside extrinsic variation in parasite exposure risk, individual host attributes have the potential to influence infection success and parasite aggregation. For managers seeking to control disease, these results suggest that targeting hosts with specific traits may be a valuable approach for reducing disease risk.

Human, Family and Community, Health and Well-being

Indiana is home to nearly 20,000 youth with a loved one serving in the military. Being the fourth largest National Guard state in the nation, Indiana military youth have a unique situation in that they do not see their parent consistently for one weekend a month and two weeks out of the summer, plus any federal deployments for which they are activated. Purdue Extension created Indiana Operation: Military Kids (OMK) which provided high-quality, hands-on programming to over 500 military youth to coincide with drill weekends for National Guard units. One event was "Robotics Encounter" hosted by the 4-H Youth Educators of Southeastern Indiana. OMK covered the cost for military youth who participated. As a result of participating, nearly 95% of the youth indicated they met a new military kid who they plan to stay in touch with after the event. As feedback, one father, an Indiana National Guardsman unable to attend with his children because he had to be at drill, thanked us "Again, thank you both so much! My wife just sent me pictures and videos of the boys running their robots. All with smiles on their faces. Wish I could have been there. Take care and thank you for all you do enriching our children and making the communities a better place."

Extension efforts are impacting immigrants by empowering them for civic engagement and by strengthening human capital via education. In Marion County, Purdue Extension trains natural helpers (those recognized by their peers in diverse ethnic communities as caring, honest and worthy leaders) who are now active members of the Immigrant Welcome Center and assist fellow immigrants by providing valuable information about services and the processes to access them. In Clinton County, when the Indiana Department of Workforce Development chose a new high school equivalency test, interest in the General Educational Development (GED) tests heightened so Purdue's Learning Network opened additional testing sessions for residents to take and pass the test before a new exam was rolled out and provided tutoring programs and English as a Second Language and High School Equivalency preparation programs in Spanish to support local in-school and out-of-school youth and adults taking the test.

Purdue Extension enhanced community engagement and built capacity of local coalitions which focused on improving health of individuals, families and communities. Community Health Engagement Program (CHEP) links experience and skills of community leaders, health professionals, and university researchers to improve the health of Indiana residents. Purdue University and Extension, Indiana University, and University of Notre Dame collaborated to engage Indiana communities and residents to achieve the goal of a healthier state. As a result: 1) 135 agencies or partners made connections to improve the health in local communities and over 56,000 individuals benefitted from these connections; 2) 39 partnerships have been developed or created; 3) 11 coalitions have grown in their capacity to improve the health of the community; 4) two new health policies were generated; 5) nine programs were developed or enhanced. Purdue Extension's Health Coalition Capacity Building Team provided training and coaching for Extension Educators to gain skills and have support for working with their local coalitions. Extension Educators were leading or involved with coalitions in over 60 counties across the state which focus on health, tobacco, mental health, substance use, aging, domestic violence or child abuse, childcare, and breastfeeding, food pantries, and parenting. As a result of increased capacity in leadership and activities, there were: 1) more new partners for programs; 2) broader networks of community partners; 3) enhanced access opportunities for new audience groups; 4) increased efforts and awareness of health issues; and 5) increased collaborations for grants and donations received with over $630,000 from various funders.

Public space management decisions made by public policymakers, private business owners and residents impact the well-being and livelihood of the community as a whole. Purdue Extension's Enhancing the Value of Public Spaces was crafted to address quality of place to help regions, communities, and

neighborhoods plan and prepare for a sustainable future. Purdue Extension provided sustainability expertise to develop a curriculum and create, implement, and evaluate the education program. About 60 community leaders from five counties were provided a decision support framework that helps assess the value of their community public spaces using social, economic, and environmental indicators to support the development and management of sustainable and resilient Indiana communities. Participants demonstrated understanding of the value of public spaces and the impact public spaces have on overall quality of life and economic development in their community planning and decision-making processes. Participants indicated the program was useful in providing new knowledge to assist with making decisions and taking actions to help develop new or enhance existing public spaces. Participants in one community used the data, tools and worksheets to assist one local town with the decision-making process for a new master plan.

Role of Technology and Data
The role of technology and data has become increasingly important as we shift from Precision Agriculture to Decision Agriculture. The past 40 years has seen a tremendous growth in our ability to apply precision ag decisions on a row-by-row and even to a specific GPS identified point to manage a specific place in the field. We are exploring how to use sensors, fiber optics and robotics to improve data collection and analysis. The past year has seen more apps for smart phones and tablets being developed that tie multiple systems together, expanding the knowledge and accuracy going into each decision being made in the field. As a result, productivity has significantly improved for farmers that are able to take advantage of this technology. And we will continue to explore and build new technology that gets us reliable results that are workable for farmers.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	78.2	0.0	273.2	0.0
Actual	70.6	0.0	221.9	0.0

II. Merit Review Process

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

- Internal University Panel
- External Non-University Panel
- Combined External and Internal University External Non-University Panel

2. Brief Explanation

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

Brief explanation.

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
- Use Internal Focus Groups
- Open Listening Sessions
- Needs Assessments

Brief explanation.

{NO DATA ENTERED}

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

{NO DATA ENTERED}

3. A statement of how the input will be considered

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

Brief explanation.

{NO DATA ENTERED}

Brief Explanation of what you learned from your Stakeholders

As a result of the Lt. Governor visits to the 92 counties of Indiana, eight regional conferences were held in communities across the state to present a new initiative, the Hometown Collaboration Initiative (HCI). This effort is for communities under 25,000 people to expand their pipeline of local leaders, strengthen and expand jobs by build on existing economic assets, and embrace place making strategies focusing on natural and built resources and improving attractiveness and quality of life for the hometowns. A core principle of HCI is broad-based input and buy-in vital to long-term success and sustainability. In 2014 communities across Indiana applied for the new initiative. As a result, five were selected to become the HCI community finalists. Each of these five communities have selected their focus - leadership, economics, or quality of life, and will begin working with Purdue Extension in collaboration with the Lt. Governor's office and the Indiana Office of Community and Rural Affairs in 2015. Another round will begin in the fall of 2015 to select five more communities for 2016 activities.

The College of Agriculture is developing a new 5-year strategy to be rolled out in 2015. As part of that effort, the College conducted several important types of stakeholder sessions to understand where we should focus our energy for both research and extension. The Dean of the College of Agriculture conducted listening sessions with 6 communities, the Dean's Advisory Council and the Industry Stakeholder Group. Purdue's extension facilitated 21 community forums across the state for stakeholder concerns, priorities, actions and strategies regarding child, youth and family issues and for community, economy (farms & businesses), and natural/environmental resources. At this writing, the data are still be analyzed for use in the strategic plan to be released later in 2015.

In 2012 we interviewed individuals at the Indiana State Fair who entered the Purdue sponsored exhibit. This qualitative survey indicated that directionally we are focused on the right things: food security/scarcity, crop production and environmental impact, food handling, obesity, alternative fuels, companion animal health and livestock health.

In 2012, 4-H expanded use of the Expansion Review Committees(ERC). ERCs are a group of adults and youth which are representative of the county demographics and review the county 4-H program to ensure that it is relevant, current, and provides impact based on local county needs. Since 2012, these committees continue to meet at least annually and document efforts, activities and findings.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
9136924	0	6442314	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	8883877	0	5616572	0
Actual Matching	20329267	0	27030661	0
Actual All Other	2267875	0	10970308	0
Total Actual Expended	31481019	0	43617541	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

☑ 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	4%		4%	
201	Plant Genome, Genetics, and Genetic Mechanisms	4%		4%	
205	Plant Management Systems	10%		10%	
206	Basic Plant Biology	4%		4%	
302	Nutrient Utilization in Animals	4%		4%	
304	Animal Genome	4%		4%	
305	Animal Physiological Processes	4%		4%	
307	Animal Management Systems	10%		10%	
315	Animal Welfare/Well-Being and Protection	4%		4%	
402	Engineering Systems and Equipment	10%		10%	
501	New and Improved Food Processing Technologies	2%		2%	
502	New and Improved Food Products	2%		2%	
512	Quality Maintenance in Storing and Marketing Non-Food Products	2%		2%	
601	Economics of Agricultural Production and Farm Management	10%		10%	
604	Marketing and Distribution Practices	3%		3%	
606	International Trade and Development Economics	4%		4%	
608	Community Resource Planning and Development	10%		10%	
801	Individual and Family Resource Management	3%		3%	
802	Human Development and Family Well-Being	3%		3%	
805	Community Institutions and Social Services	3%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	37.2	0.0	171.4	0.0
Actual Paid	35.8	0.0	118.5	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**
2750611	0	3204794	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
4425725	0	11582783	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
582949	0	2803436	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Develop publications, workshops, consultations, seminars, certification programs, distance education modules, field days, and other opportunities.
• Conduct research
• Collaborate with other agencies
• Coordinate meetings with important stakeholders (researchers, industry, organizations, farmers, regulatory, etc.)
• Increase number of participants in life-long learning programs.
• Foster leadership and economic development and facilitate strong partnerships and participation in state, regional, national, and international agencies, organizations, and groups.
• Encourage participation by extension specialists in: Taskforces, Review Committees, Advisory Boards, Editorial Boards, Commodity committees/boards, Invited presentations, Honors and Awards, Common Interest Groups, Professional Societies

2. Brief description of the target audience

National and International:

• Livestock and crop producers
• Livestock and crop industry (entire value chain)

- Elected officials and decision makers
- Agencies
- Extension specialists
- Potential 3rd party partners (NGO's, educational institutions, etc.)
- Consumers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	99468	1208647	23201	76894

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

Patent Applications Submitted

Year: 2014

Actual: 7

Patents listed

South Korea 10-1377336; 10-1358524; 10-353831; 10-1350110; Canada 2,776,152; US 4547464 - Trademark; US 8,761,898

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	37	236	309

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops conducted

Year	Actual
2014	8374

Output #2

Output Measure

- Number of Extension products (publications, web resources, apps, etc)

Year	Actual
2014	370

Output #3

Output Measure

- Number of research publications

Year	Actual
2014	236

Output #4

Output Measure

- Number of volunteers

Year	Actual
2014	3154

Output #5

Output Measure

- Number of workshop participants

Year	Actual
2014	2106

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	An impact on livestock resulting from new knowledge related to the environment, productivity, and/or health & welfare.
2	An impact on crops resulting from new knowledge related to the environment, productivity, and/or biotic/abiotic stress.
3	An economic and/or community impact resulting from new knowledge about food production systems, marketing & retail management, logistics & systems, and/or business development.
4	An impact on hunger and/or malnutrition resulting from new knowledge about food products, food quality, and/or food quantity.
5	An impact on non-food products resulting from new knowledge related to non-food products, and/or non-food systems.
6	An impact on disaster preparation, education, and/or recovery.
7	Number of people who have new knowledge related to small and community farms.
8	Number of people with new knowledge related to crops regarding the environment, productivity, and/or biotic/abiotic stress.
9	NIFA National Outcomes and Indicators - Global Food Security and Hunger (Outcome 2, Indicator 1) Number of new or improved innovations developed for food enterprises.
10	An impact on poultry resulting from new knowledge related to the environment, productivity, and/or health & welfare.
11	An impact on crops resulting from new knowledge related to technology
12	Number of people with new knowledge related to regulatory permits management on farms.
13	Number of people with new knowledge regarding crop management through workshops.
14	Number of people with new knowledge related to expanding local food capacities.
15	An impact on aquaculture resulting from new knowledge related to the environment, productivity, and /or abiotic stress

Outcome #1

1. Outcome Measures

An impact on livestock resulting from new knowledge related to the environment, productivity, and/or health & welfare.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	468483

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nuisance flies are a major problem on and around agricultural buildings, especially animal housing facilities. Flies spread disease, antibiotic resistant bacteria, and annoy humans and animals. Controlling flies is a major difficulty due to insecticide resistance to older products and active ingredients. The project is developing a novel, highly attractive bait for fly control, based on a novel insecticide, cyantraniliprole.

What has been done
The bait has been tested in various lab and field studies and have optimized it for attractiveness and efficacy. The bait was tested on a commercial swine farm with a large housefly infestation and was compared to other commercial baits.

Results
A new bait has been developed for managing nuisance flies in residential and commercial situations. Because the active ingredient is new to the market, the bait is a powerful new tool to fight the growing problem of resistance. The bait offers a new active ingredient that can provide Pest Management Professionals (PMPs) control of a common pest problem, while serving as an effective resistance management tool in urban, rural and commercial markets.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
304	Animal Genome
305	Animal Physiological Processes

307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection
402	Engineering Systems and Equipment
501	New and Improved Food Processing Technologies

Outcome #2

1. Outcome Measures

An impact on crops resulting from new knowledge related to the environment, productivity, and/or biotic/abiotic stress.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	549865

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One of the challenges to producing vegetables is managing diseases. Growers require up-to-date information on symptoms of diseases, biology of the pathogen and management options. Management options might include cultural methods such as crop rotation or new fungicide options.

What has been done
In November of 2013, a new blog was started, veggiediseaseblog.org. This blog features high quality photographs of diseases that the author/expert has seen recently and what management options are recommended. As appropriate, links to on-line publications and other resources are given. In season, offerings are mostly what the author has seen in commercial vegetable fields in Indiana. Off-season blogs feature new products, meeting dates or research updates.

Results
In total, the number of unique page views has been 7,722. Average page views have been 74 per day with a high of 120 views in July 2014, in the middle of the growing season. Total number of posts has been 22.

4. Associated Knowledge Areas

KA Code	Knowledge Area

102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
206	Basic Plant Biology

Outcome #3

1. Outcome Measures

An economic and/or community impact resulting from new knowledge about food production systems, marketing & retail management, logistics & systems, and/or business development.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	485352

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Indiana ranks fifth in corn and soybean production in the US, and an increasing volume of grain produced is stored on-farm. In recent times, maintaining grain quality in storage has been an issue on indiana farms. This has been due to wet harvest, inadequate drying capacity, higher than normal mycotoxin pressures at harvest and inadequate storage from a bumper crop like we experienced in the fall of 2014. Additionally, there has been a lapse in recurrent training for farmers on stored grain management for some time and the need to increase Extension outreach in this area. With the high rates of bin entrapment incidences on Midwest farms directly correlated to grain going "out of condition" in storage, there is a need to increase education on stored grain management both on-farms and off-farm grain operations.

What has been done
In 2014, we participated in workshops primarily focused on stored grain management as invited speakers or organizers. More than 450 persons attended 6 workshops on stored grain management; 5 of the workshops were organized by Purdue Extension and 3 were organized by the grain Post-Harvest team with one of these through the Diagnostic Training Center (DTC). Additionally, the team engaged in drafting or contributing to timely articles on grain storage issues and advisories that were published on Purdue's AgAnswers, Purdue Agriculture News on the web, and other media outlets. Other outreach mechanisms included consultation on the phone or conducting farm visits.

Results
Grain post-harvest team has been providing training and timely information on grain quality issues and proactive stored grain management that is helping farmers better manage stored grain on-farm. About 450 farmers and stored-grain managers were impacted by participating in workshops on stored grain management, with most likely more were reached through timely news releases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
606	International Trade and Development Economics
608	Community Resource Planning and Development
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
805	Community Institutions and Social Services

Outcome #4

1. Outcome Measures

An impact on hunger and/or malnutrition resulting from new knowledge about food products, food quality, and/or food quantity.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
To produce milk, cows must synthesize glucose in the liver and then convert glucose into lactose. An average cow produces approximately 10 lbs of glucose to meet this need and this glucose production process occurs in the liver. Studies have shown that when cows eat more feed, the capacity of the liver expands to make more glucose, resulting in more lactose and ultimately more milk. What is it about an increase in feed that results in more milk and how can we use this this knowledge to improve diets in cows?

What has been done

Experiments were conducted to (1) quantify supply, availability, and interaction of nutrients and bioactive compounds utilized for efficient milk production while reducing environmental impact, (2) identify and quantify molecular, cellular, and organismal signals that regulate partitioning and efficient conversion of nutrients to milk and (3) to use this knowledge of feed properties and metabolic and molecular quantitative relationships to challenge and refine nutrient requirement models leading to more precise feeding systems for dairy cattle.

Results

The research showed that cows have very unusual metabolic control systems that change the activity of the genes responsible for expanding the liver's capacity to produce glucose and this is triggered by greater feed intake. The bacteria in the rumen of cows ferment dietary sugars to propionate which in turn is absorbed by the cow and used to synthesize glucose in liver . What is unusual is that propionate, a precursor of glucose formation, regulates its own metabolism by sending molecular signals within the liver. This in turn sets off a chain of metabolic reactions such that the liver is able to expand its capacity to receive and convert propionate to glucose and consequently provide more lactose for milk production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
302	Nutrient Utilization in Animals
304	Animal Genome
305	Animal Physiological Processes
307	Animal Management Systems
402	Engineering Systems and Equipment
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
512	Quality Maintenance in Storing and Marketing Non-Food Products
604	Marketing and Distribution Practices
606	International Trade and Development Economics
608	Community Resource Planning and Development
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
805	Community Institutions and Social Services

Outcome #5

1. Outcome Measures

An impact on non-food products resulting from new knowledge related to non-food products, and/or non-food systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	2584

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
501	New and Improved Food Processing Technologies
512	Quality Maintenance in Storing and Marketing Non-Food Products
604	Marketing and Distribution Practices

Outcome #6

1. Outcome Measures

An impact on disaster preparation, education, and/or recovery.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of people who have new knowledge related to small and community farms.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	22080

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dearborn County Indiana continues to become more suburban in its make up, and with that more students have become farther removed from agriculture production. There is a need to fill the gap and educate students about the importance of agriculture in society as well as in their own community.

What has been done
To meet this need, the Extension Office coordinated and planned a two day agriculture awareness program for all of the 3rd graders in the county. The Extension Office partnered with the local Farm Bureau, Soil and Water Conservation District, Solid Waste District, and numerous producers to staff the program for the 3rd graders. Each student visited 16 agriculture education stations during the day learning about beef, sheep, goats, plants, recycling, poultry, grains, rabbits, farm equipment, soil and water conservation, orchards, nutrition, agricultural products and farm safety. There were 39 volunteer presenters that assisted with the learning stations over the two day period.

Results
718 third grade students and 96 adults attended the program over the two days. Teachers were surveyed following the program and 18 of the 18 responding reported that ag day was worth class time spent to attend. All 18 responding either strongly agreed or agreed that their students left ag day with a better understanding of agriculture and natural resources and increased their knowledge of Dearborn County Agriculture. One teacher stated that their students wanted to further discuss Ag day topics when they returned to the classroom and were very excited to attend.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
206	Basic Plant Biology
302	Nutrient Utilization in Animals
307	Animal Management Systems
604	Marketing and Distribution Practices

Outcome #8

1. Outcome Measures

Number of people with new knowledge related to crops regarding the environment, productivity, and/or biotic/abiotic stress.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soybean is usually thought of as the second crop to corn, an afterthought, in the crop production world. Many people feel that soybean yields have flat-lined while corn continues to increase. This program is focused on changing the mindset of producers and crop professionals to increase soybean yields through Intentional Soybean Management. The idea is to be purposeful in decisions to increase yields from variety selection and planting dates to pesticide management.

What has been done
The efforts were directed toward publications, presentations, training workshops, applied research, and statewide field survey of soybean limitations. The field survey of soybean across Indiana has continued, which represented 34 counties and 95 fields. Extension educators volunteered to scout 3 to 5 fields per county during early, mid-, and late season stages. Presentations at production conferences and training workshops discussed the foundation of soybean yields genetics and management (planting date and fertility). Soybean Extension publications, newsletters (Soybean Success) and field guides continue to be developed and revised. Evaluated various cultural practices, new and upcoming inputs, and integrated

management in 33 different studies located in 9 different sites. Several studies are also comparing practices of soybean, corn, and cover crops.

Results
Field surveys exposed the soil fertility limitations that growers thought they were managing well, which has become a new focus area for Purdue ANR Extension education. A statewide meeting was hosted in February to summarize the findings. Extension Soybean Agronomist counterpart, Laura Lindsey, started a similar statewide survey in Ohio. Purdue and Ohio teamed up to promote the importance of soil fertility for soybean with a communications campaign (Know Your Numbers magnet and flyer) supported through the United Soybean Board and the respective soybean associations. Growers and crop professionals were receptive to the message of "Soybean Supply and Demand of Nitrogen" and "Breaking Bean Barriers" through the team's interactions at diagnostic training workshops, field days, and crop production clinics. Purdue Diagnostic Training Workshops (500 people) and IN CCA conference (366 people) are two examples. This Extension program has been recognized nationally and internationally with various invitations to train growers and crop professionals as well as present findings in Ohio, Kentucky, and Michigan. Its monthly newsletter (Soybean Success) has been maintained in the Indiana Prairie Farmer that is circulated to 28,000 subscribers. The companion periodicals, Illinois Prairie Farmer and Ohio Farmer, published most of these articles.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
206	Basic Plant Biology
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #9

1. Outcome Measures

NIFA National Outcomes and Indicators - Global Food Security and Hunger (Outcome 2, Indicator 1) Number of new or improved innovations developed for food enterprises.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	24

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
At present there are no current methods to analyze the formation, composition, and subcellular location of protein complexes in a high throughput manner. This knowledge is needed in order to engineer cellular pathways and phenotypes.

What has been done
In 2014 novel computational tools were developed for a multidimensional statistical analysis of leaf epidermal development. The new tools included important live cell imaging methods and tagged proteins that allow us to measure the importance of specific proteins during growth in living cells. Novel computational tools to cross correlate cell growth patterns and cell wall biophysics have also been successfully implemented, and this work will be published in 2015. At the same time the team has developed novel mass spectrometry based tools to gain systems level information on protein complex assembly as a function of cellular location and environmental condition. This technology will play a critical new role in determining how systems respond to environmental changes and how these systems might be genetically improved.

Results
The team is rapidly generating new knowledge about the molecular and cellular mechanisms of plant cell growth. This basic knowledge can be directly applied to practical applications like cotton fiber improvement, and in the longer term, the genetic engineering of leaf size and shape. The mass spectrometry based technology development will create a new type of phenotyping tool that will allow scientists to take accurate and important measurements of protein complex systems that are modulated during plant growth and in response to environmental stress. These data are expected to rapidly accelerate the cycle of hypothesis testing, refinement, and practical application. The work on cell shape control is expected to have direct applications to the engineering of cotton fibers with increased economic value.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

An impact on poultry resulting from new knowledge related to the environment, productivity, and/or health & welfare.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Heat stress is a major problem experienced by the poultry industry in the United States. In the Midwest, for example, the exceptionally hot summers of 1995, 2011, and 2012 were devastating to the egg industry as hen mortalities climbed to 10% due to heat. Heat stress associated annual economic loss in poultry in the United States is estimated at $240 million. Evaporative cooling, commonly used to alleviate heat stress in hens, increases in-house humidity, manure moisture, and aerial ammonia. An obvious solution is to develop alternative methods to safeguard hen welfare during heat stress. The egg industry is converting conventional to enriched cages to meet hen behavioral needs. Perches in enriched cages could be modified to improve hen thermal comfort. Conductive cooling through enclosed cooled perches could avoid the disadvantages of evaporative cooling.

What has been done
Through a summer pilot study, we demonstrated that thermally cooling perches were effective in reducing hen core body temperature and delaying the onset of panting and wing spreading during an acute heating episode of 4 hours. Furthermore, once these stress related behaviors did become evident later in the hens with access to thermally cooled perches, they remained lower during and after the heating episode as compared to hens with access to perches that were not cooled and controls without perches (all $P < 0.05$). Results have been disseminated through presentations at local, regional, national, and international meetings (Poultry Day at Purdue University in Sept. 2014, the Poultry Science Association meeting, 12th International Society for Applied Ethology North-American Regional Meeting, 48th Congress of the International Society for Applied Ethology held in Spain, and the American Society of Agricultural and Biological Engineers International Meeting held in Montreal, Canada)

Results
This pilot study provides preliminary evidence that the cooled perch system may assist laying hens in coping with heat stress. We demonstrated proof of concept that our engineering design for thermally cooling perches was effective in reducing hen core body temperature and delaying the onset of panting and wing spreading during an acute heating episode. A full scale experiment is currently in progress to evaluate the effectiveness of thermally cooled perches in improving hen welfare and thermal comfort using higher ambient temperatures than what was employed in the pilot study. This project has facilitated graduate student training and offered opportunities for undergraduate students to gain research experience.

4. Associated Knowledge Areas

KA Code	Knowledge Area
305	Animal Physiological Processes
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection
402	Engineering Systems and Equipment

Outcome #11

1. Outcome Measures

An impact on crops resulting from new knowledge related to technology

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Existing online descriptions of pathogens and diseases reside in a diverse array of platforms; which vary widely in quality, scope and cost. Few accurate descriptions of plant pathogens are available freely online which results in lengthy literature searches and time consuming visits to libraries by plant disease diagnosticians to find the relevant materials. There has long been a need for an online, curated image repository specifically designed to house high quality images of fungal structures to facilitate plant disease diagnostics.

What has been done
The team worked in collaboration with diagnosticians from Missouri, South Dakota and the Southern IPM region to create a curated online diagnostic resource repository. The key output from the North Central Region is a set of 17 pathogen and disease profiles; with a total of 90 reviewed online resource pages produced. Each resource consists of detailed morphological descriptions of important plant pathogens and key diseases they cause, combined with high quality images to create concise identification tools for diagnosticians, extension specialists and others. The Plant Pathogen Profiles and Plant Disease Profiles are housed on the Bugwood platform and served through the IPM Images site (http://wiki.bugwood.org/Category:Diagnostic_Resources) The focus is on pathogens of important crops; including major agronomic, vegetable, fruit and horticultural crops as well as specialty

Results
Of the newly uploaded images from this team, 76 have been requested for inclusion in 25 different publications. Those requests include: 1)Public outreach information for the U.S. Customs and Border Protection 2)Training materials for the USDA and DHS agriculture officers enforcing quarantines and port of entry condition for various plant diseases. 3) Illustrations for online reference materials being developed for Home Depot by Scotts Miracle Gro. 4) Extension

presentations at The Ohio State University, Washington State University, University of Florida, University of Maryland, University of Delaware, Kansas State University, and University of Bucharest in Romainia 5)Popular press articles in Organic Gardening Magazine, Lien horticole, and Garden Gate Magazine 6)Florida Department of Agriculture and Consumer Services Circulars and Plant Inspector Training materials.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
206	Basic Plant Biology

Outcome #12

1. Outcome Measures

Number of people with new knowledge related to regulatory permits management on farms.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dubois County, Indiana ranks first for total cash livestock receipts with $164,084,000 in sales (2010, Indiana NASS). As environmental and regulatory requirements for these producers continue to change, however, assistance is sometimes needed to insure that the producer is able to remain in business, especially as production numbers change or facilities are upgraded.

What has been done
To address needed Indiana Department of Environmental Management (IDEM) regulatory requirements, Purdue provided on-farm consultations at the producer's request as needed for the 5-year permit reporting cycle. Permits are required for facilities exceeding designated animal numbers. Purdue Extension consultations were provided during 2014 on IDEM Confined Feeding Operation (CFO) Animal Waste permits for livestock producers to assist with animal regulatory issues. The sessions, which were about three hours for IDEM re-applications or six hours for new construction applications, were done on the producer's farm to insure all paperwork and facilities information are available and to better observe operations being permitted. Follow-up meetings were conducted on-farm or in the Purdue Extension office, depending on the needs. Farmers

were provided with guidance and recommendations for the permit completion. In addition, these onsite consultations established a more personal, on-farm presence for Purdue Extension for future farming concerns, with most consultations resulting in same day informational queries not related to the consultation during the visit.

Results
Impact of provided consultations to market value of livestock for this year were: 1) one consultation affecting 26,000 turkeys worth $780,000, 2) four consultations affecting 9,400 market hogs and 436 sows worth $2,754,080; and 3) one consultation affecting 150 cattle worth $225,000. Total value of livestock impacted based on market value was $3,759,080.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

Outcome #13

1. Outcome Measures

Number of people with new knowledge regarding crop management through workshops.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agribusiness personnel, which include fertilizer and chemical dealers, crop consultants, seed company agronomists, producers, and county Extension Educators, need pertinent and timely information on current and future issues tied to crop production systems and crop and pest management strategies. These individuals rely heavily on this information in order to make environmentally and economically sound crop production and crop and pest management input decisions and/or recommendations. Failure to utilize this information could result in a loss of thousands of dollars per year for an agribusiness or farm operation.

What has been done

In 2014, the Center developed and conducted 33 state-of-the-art training workshops. Extension specialists, primarily representing the Departments of Aricultural & Biological Engineering, Agricultural Economics, Agronomy, Animal Sciences, Botany & Plant Pathology, and Entomology, presented in-depth information on a number of issues tied to crop production systems and crop and pest management strategies. The Center also developed/revised five heavily utilized training publications; the Corn & Soybean Field Guide, the Corn & Soybean Field Guide App, the Forage Field Guide, the Wheat Field Guide, & the Midwest Cover Crops Field Guide. These publications are references covering topics related to corn, soybean, cover crops, wheat and forages in production and management.

Results
In 2014, a total of 990 participants attended the Crop Diagnostic Training and Research Center Workshops. These participants have an impact on nearly 18,000,000 acres of farmland in the Midwest. Participants highly rated the educational value of the workshops as indicated by our survey results: 98% of the participants indicated that the workshops clearly helped them improve their overall crop production knowledge; 95% of the participants (when considering their costs) indicated that attending these workshops was well worth their time and expense; 99% of the participants determined that the information gained will likely be shared with colleagues/customers; and finally, when the participants were asked to rate the overall value of the workshops, 92% of the participants were satisfied to highly satisfied with the program they attended. These values clearly indicate that the workshops conducted at the DTC are highly valuable to the participants and are very successful in training individuals in the area of production agriculture.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
205	Plant Management Systems
502	New and Improved Food Products
512	Quality Maintenance in Storing and Marketing Non-Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #14

1. Outcome Measures

Number of people with new knowledge related to expanding local food capacities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A robust local food system with year-round markets is paramount for agricultural producers working to meet the high demand for locally grown and produced food. The popularity of local food is evidenced as direct sales to consumers doubled for Indiana growers in the past 20 years, and the number of farmers' markets doubled in the past three years (Indiana Agricultural Statistics 2011-2012). However, sustained growth for local food cannot be maintained with seasonal farmers' markets alone. Hoosiers spend over $17 billion on food annually, but few resources exist for large volume buyers to purchase locally grown food. Developing intentional local food systems has the potential to grow the state's economy and agricultural production systems. This program will enable communities to better understand their local food system, engage multiple groups in a dialogue about rebuilding their local food system, and assist with a strategic plan for implementing their rebuilding strategy.

What has been done
Our program was developed with Extension Specialists, Educators and a state-wide advisory board. As a team, we created the year-long program that has been piloted in two Indiana communities. Program leaders met with the Core Group from each community every month for 12 months to provide technical assistance and education: 1) Created an asset map for local food 2) Enabled group to lead the redevelopment of a local food system 3) Led educational tours to Chicago and Indiana local food initiatives 4)Provided guest speakers for meetings 5)Conducted workshops 6)Created a network for pilot communities in the state 7)Presented at professional conferences: National Association of Community Development Extension Professionals, Purdue Extension Professional Development Conference and Institute for Sustainable Development.

Results
As a result of the pilot program, both groups have a better understanding of a local food system, the factors that are essential and where they can improve and rebuild their local food system. The Elkhart group formed a new organization called the 'Elkhart County Foodshed Initiative' as a result of participating in the program and have regular monthly events and meetings and a robust website that better integrates the groups working in local food in their foodshed. The Batesville group applied for and received a $30,000 planning grant from the Interact for Health Foundation in Cincinnati, Ohio for SIFTI, the Southern Indiana Farmer Training Initiative; compiled information on locally available commercial kitchens and are now working with a group to process locally grown fruits and vegetables for institutional use; and worked with the Mayor's office to create visible signage in town for local growers and food.

4. Associated Knowledge Areas

KA Code	Knowledge Area

205	Plant Management Systems
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management
608	Community Resource Planning and Development
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
805	Community Institutions and Social Services

Outcome #15

1. Outcome Measures

An impact on aquaculture resulting from new knowledge related to the environment, productivity, and /or abiotic stress

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since 2006, Purdue's Aquaculture Research Lab has been collaborating with the Indiana Aquaculture Association, the Indiana Soybean Alliance and Illinois-Indiana Sea Grant to establish strategic plans that support Indiana producers of fin fish.

What has been done
A series of aquaculture workshops on developing fin fish operations to help interested producers get started was offered. Website tools for decision-making to assist new or potential fin fish producers regarding planning, budgets, cash flow, etc. were created.

Results
In 2006, there were 18 fin fish producers in Indiana. By 2013, that number had grown to 50. More impressively, the value of output generated in Indiana's aquaculture grew from USDA aquaculture farm sales in 2006 of $2.5 million to nearly $38 million in 2013. Recent activities have shifted focus from beginning production to helping established producers with processing, marketing, and

aquaculture facilities via webinars and YouTube videos. Two future directions for Purdue's aquaculture efforts in Indiana are to build the market for fish and to expand into development of shrimp operations.

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
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm 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

Outcome 1 - Testing of bait for flies in lab and field studies.
Outcome 2 - Page views of vegetable disease blog.
Outcome 3 - Training provided on grain management.
Outcome 4 - Lab studies of cow milk
Outcome 5 - Field study of Unmanned Aircraft System images of soy bean fields.
Outcome 7 - Post-survey of teachers of third grade students attending Ag day.
Outcome 8 - Scouting studies in 95 fields by Extension Educators, training of farmers about findings.
Outcome 9 - Lab studies of live cell imaging and tagged proteins to measure growth.
Outcome 10 - Field study of hen core body temperature.
Outcome 11 - Use of online resources.
Outcome 12 - Economic value of livestock covered by permit for CFO.
Outcome 13 - Post survey of workshop benefit to participants

Outcome 14 - Two pilot sites given technical assistance and education, asset mapping for local food.
Outcome 15 - Trend of economic growth of aquaculture operations across Indiana.

Key Items of Evaluation

Outcome 1 - New active ingredient in bait powerful tool to fight growing problem of resistance.
Outcome 2 - Average page views 74 per day with high of 120 in middle of growing season.
Outcome 3 - Over 450 farmers and stored grain managers trained in grain management.
Outcome 4 - Identified precursor gene which triggers liver when increased feed is coming.
Outcome 5 - Identified spatial accuracy of pixels in mosaic image, and accuracy with which small plots (2-5 meters) of genetically similar plants could be extracted.
Outcome 7 - Teachers reported that their students had a better understanding of agriculture after attending the event.
Outcome 8 - Found soil fertility limitations growers thought were being managed well.
Outcome 9 - New type of phenotyping tool for accurate and important measures of protein complex systems modulated during plant growth and in response to environmental stress.
Outcome 10 - Cooled perch system may assist laying hens in coping with heat stress.
Outcome 11 - Uploaded images requested for inclusion in 25 different publications.
Outcome 12 - Total of $3,759,080 livestock value impacted.
Outcome 13 - 98% indicate workshops clearly helped them improve their overall crop production knowledge.
Outcome 14 - Both sites participating groups have better knowledge of local food systems. One site formed a new organization. One group received $30,000 planning grant.
Outcome 15 - Since 2006, aquaculture went from $2.5 million to $38 million in aquaculture farm sales.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

☑ 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	10%		10%	
112	Watershed Protection and Management	5%		5%	
123	Management and Sustainability of Forest Resources	10%		10%	
132	Weather and Climate	10%		10%	
135	Aquatic and Terrestrial Wildlife	10%		10%	
201	Plant Genome, Genetics, and Genetic Mechanisms	10%		10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%		10%	
212	Diseases and Nematodes Affecting Plants	5%		5%	
213	Weeds Affecting Plants	5%		5%	
306	Environmental Stress in Animals	5%		5%	
605	Natural Resource and Environmental Economics	15%		15%	
610	Domestic Policy Analysis	5%		5%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	5.9	0.0	12.3	0.0
Actual Paid	2.1	0.0	7.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
815874	0	335319	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2437688	0	1592791	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
242586	0	1284257	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct meetings, conferences, workshops
- Publish research and extension publications
- Establish web sites
- Organize field days
- Consultations
- Work with mass media

2. Brief description of the target audience

- Producers
- Consumers
- Youth
- Elected officials and policy makers
- Professionals involved in weather and climate

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	630	332	18	0

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

Patent Applications Submitted

Year:	2014
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	6	24	30

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Extension publications, written, new or revised

Year	Actual
2014	2

Output #2

Output Measure

- Number of research publications

Year	Actual
2014	24

Output #3

Output Measure

- Number of research projects

Year	Actual
2014	9

Output #4

Output Measure

- Number of consultations

Year	Actual
2014	24

Output #5

Output Measure

- Number of educational workshops or seminars conducted

Year	Actual
2014	36

Output #6

Output Measure

- Number of volunteers

Year	Actual
2014	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of observers monitoring weather and climate
2	Number of research-based studies, publications, and reports for policy organization members and legislators on climate change
3	Number of participants who increase their knowledge about climate change
4	Number of participants who reduce pesticide, nutrient and water inputs while maintaining high quality turf
5	Number of participants who increase knowledge of pesticides, nutrients and water inputs for maintaining high quality turf
6	Number of participants who increase knowledge of management practices that maximize environmental stewardship
7	Number of participants who adopt management practices that maximize environmental stewardship
8	Number of participants who increase their knowledge of opportunities and challenges for agriculture under carbon dioxide emissions policies to address climate change
9	An impact of new knowledge about crop management related to climate change and decision making.
10	An impact of new knowledge of plant molecular and physiological functions relating to climate change.
11	An impact of plant genetic and/or epigenetic functions relating to climate change.

Outcome #1

1. Outcome Measures

Number of observers monitoring weather and climate

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

Outcome #2

1. Outcome Measures

Number of research-based studies, publications, and reports for policy organization members and legislators on climate change

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of participants who increase their knowledge about climate change

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	654

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Purdue Extension Educators are uncertain as to their role in communicating climate science, as evidenced by multiple recent surveys of educators in other states. In many cases, uncertainty stems from a lack of knowledge of climate and the tools available for use with their clientele.

What has been done
A team of Purdue Extension educators, researchers and specialists organized workshops across Indiana on communicating climate science, including content information and learning activities, discussion of web-based tools (including Purdue's Useful 2 Usable decision support tools) and new 4-H curricula. The workshops were designed to increase confidence of Extension educators in discussing climate with clients, increase knowledge of resources and where to refer clients, and enhance their ability to teach climate subject matter. Team members and climate professionals from U2U and the Midwest Regional Climate Center in Illinois provided climate content, resources and information.

Results
Educators completed an evaluation at the end of the workshop. They found the climate data presentation to be the most effective, and felt the activities helped them better understand changes in the climate system. Most would participate in an advanced workshop on climate and climate change. Educators in the workshop will use what they learned in discussions or consultations with clients, for referrals to key resources and information, and in implementing workshops to teach climate to youth and adults in their communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

610 Domestic Policy Analysis

Outcome #4

1. **Outcome Measures**

Number of participants who reduce pesticide, nutrient and water inputs while maintaining high quality turf

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

Number of participants who increase knowledge of pesticides, nutrients and water inputs for maintaining high quality turf

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

Number of participants who increase knowledge of management practices that maximize environmental stewardship

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Number of participants who adopt management practices that maximize environmental stewardship

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Number of participants who increase their knowledge of opportunities and challenges for agriculture under carbon dioxide emissions policies to address climate change

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

An impact of new knowledge about crop management related to climate change and decision making.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Weather and climate patterns are a driving force behind the success or failure of cropping systems. With U.S. corn and soybean production accounting for nearly one-third of global supplies and contributing over $50 billion annually to the national economy, the ability to successfully produce crops under more variable climate conditions is critical for food security and rural livelihoods. There have been resources available on historic and future climate, but these are underutilized. Current efforts of the Useful 2 Usable (U2U) project are to determine how to increase use of climate resources for crop decision-making.

What has been done
Since reporting last year, the Useful 2 Usable (U2U) project has made significant progress on modeling production, environmental and financial outcomes of various climate scenarios and farm management strategies on Midwestern corn production systems. An economic modeling framework was developed to demonstrate how climate and crop simulations will be integrated with farm-level economics to evaluate adaptation strategies under future climate scenarios.

The U2U Social Science Working Group completed three climate needs assessment surveys: 1) Producers (4,778 corn farmers in 11 Corn Belt states) to understand concerns about climate impacts, climate information needs, climate change beliefs and adaptation attitudes, and trust in various information sources; 2) Advisors (2,100 public and private farm advisors in four Corn Belt states) to understand concerns about climate impacts, climate information needs, climate change beliefs and adaptation attitudes, and trust in various information sources; and 3) Advisors follow up (860 advisors completed both surveys) to see if/how advisors concerns, beliefs, and attitudes were affected by the severe 2012 Midwestern drought. In addition, focus groups and interviews were conducted with: 1) farmers, public advisors, and private advisors in Nebraska and Indiana where they provided feedback about current and future U2U decision support tools; 2) corn

farmers and advisors were in the Maple River watershed in Michigan to help understand climate information diffusion within the agricultural community; and 3) selected advisors from that group in Michigan to understand how they adjust delivery of climate information to clients with differing levels of concerns about climate change.

Results
As a result of modeling development and in conjunction with feedback from survey participants, there are now four decision support tools available online. One tool, the U2U Corn Split N tool has been approved as a training resource for the Indiana Pesticide Application Recertification Program (PARP) and can be used to fulfill the educational requirements. The unprecedented surveys and interviews of Corn Belt farmers and agricultural advisor groups have improved scientific understanding about climate information needs, climate change beliefs, trusted information sources, and risk management strategies of the agricultural community. Clearly documented in these results is the role of agricultural advisors in guiding on-farm management decisions and as climate information brokers. Based on survey results about effective ways to reach key stakeholders, the approach to sharing information will not be regional expansion workshops as initially planned. Instead, emphasizing the role of the local agriculture advisor, U2U team members and Extension partners throughout the region have been recruited to conduct decision support tool trainings onsite at popular, existing farmer and advisor events, where the role of the local agriculture advisor is central to the event.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

Outcome #10

1. Outcome Measures

An impact of new knowledge of plant molecular and physiological functions relating to climate change.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Perennial ryegrass is an important cool-season grass widely used for pasture and turf in cool climate regions. Perennial ryegrass is highly digestible for all classes of ruminant animals and has high feeding quality for forage. For turf, it is mainly used in sod production, golf courses, athletic fields, parks and lawns. Environmental factors such as drought, salinity and flooding negatively affect growth and persistence of turf grass. The frequency and intensity of these stresses are expected to increase due to climate change, which can be more detrimental to grasses. A better understanding of physiological, genetic and molecular mechanisms of stress tolerance is beneficial to grass improvement and efficient management programs for enhancing stress tolerance.

What has been done
A global collection of 500 diverse perennial ryegrass accessions were planted for investigation of growth responses to variable environments as well as genetic mechanisms underlying the whole-plant response. Salinity stress affects plant growth. As salt accumulates in tissues it kills the leaves and eventually kills whole plants. Salinity reduces water uptake of the plants. Physiological responses to salinity were studied in tolerant and sensitive accessions.

Results
Results showed turf and forage cultivars vary in salinity tolerance. Genes were identified which controlled sodium transport and water movement in grasses influencing salinity tolerance. Research on identified genes will impact grass breeders by providing molecular and genetic markers for marker-assisted breeding and germ plasm enhancement of stress tolerance of perennial grass species. This research will impact grass turf managers by providing basic knowledge of whole-plant responses to stress conditions and can helping them select adequate cultivars for use in turf sites, particularly in salt-affected sites.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

Outcome #11

1. Outcome Measures

An impact of plant genetic and/or epigenetic functions relating to climate change.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
How plants cope genetically with environmental challenges is not fully known. To better understand how plants survive and are productive when there is not enough water, when there is too much salt in the soil, or when temperatures are too cold would be helpful for plant resilience to changes in climate.

What has been done
Trying to improve how crops resist environmental challenges, research was conducted on chemical reactions in plant cells that switch parts of the genetic information off and on at strategic times and locations. Research was conducted on Arabidopsis thaliana (mustard plants) to isolate genetic structures of the plant cells.

Results
Research on genetic and epigenetic mechanisms of plant responses to adverse environments led to identification of genes for modifying the responses of crops to environmental stressors. A signaling pathway was discovered for intracellular sodium and potassium homeostasis in mustard plants in response to high salt conditions, and a core pathway was found for the sensing and signaling of the chemicals that regulate plant growth. A single small molecule can activate multiple receptors and protect plants from drought stress, and amino acids also have important functions in drought stress responses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms

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

Outcome 3 - post-survey of climate knowledge gained
Outcome 9 - Needs assessment surveys, followups, interviews and followups of farmers and agriculture advisors
Outcome 10 - Plot studies of grass cultivars
Outcome 11 - Lab study - isolate genetric structure of cells of mustard plants

Key Items of Evaluation

Outcome 3 - In building the capacity to provide climate science education, Educators felt they learned about climate and available resources and would use information for consultations and for education programs for adults and youth.
Outcome 9 - Farmers trust agriculture advisors for information about climate and crops. Extension approaches need to focus on educating agriculture advisors and getting research findings and information to them.
Outcome 10 - Genes identified that enhance stress tolerance in perennial grasses to help breeders with enhancement and turf managers in selection of cultivars.
Outcome 11 - Identified signaling pathway for sensing, signaling and regulating plant growth in response to salt conditions.

V(A). Planned Program (Summary)

Program # 3

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
102	Soil, Plant, Water, Nutrient Relationships	10%		10%	
131	Alternative Uses of Land	5%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	10%		10%	
204	Plant Product Quality and Utility (Preharvest)	15%		15%	
213	Weeds Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	5%		5%	
402	Engineering Systems and Equipment	10%		10%	
511	New and Improved Non-Food Products and Processes	10%		10%	
605	Natural Resource and Environmental Economics	20%		20%	
610	Domestic Policy Analysis	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	11.1	0.0	35.2	0.0
Actual Paid	6.7	0.0	16.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1155830	0	366784	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2613480	0	2765314	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
318780	0	1272464	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct meetings, conferences, workshops, seminars
- Conduct research projects
- Publish research and extension publications
- Publish newsletters
- Establish web sites
- Organize field days and demonstrations
- Consultations
- Work with mass media

2. Brief description of the target audience

- Producers
- Consumers
- Youth
- Professionals related to energy
- Agribusiness
- Elected officials and public policy decision makers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1098	0	29	0

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

Patent Applications Submitted

Year:	2014
Actual:	2

Patents listed
US 8,921,648; US 8,790,904

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	36	75	111

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Extension publications written, new or revised

Year	Actual
2014	0

Output #2

Output Measure

- Number of research publications

Year	Actual
2014	75

Output #3

Output Measure

- Number of research projects

Year	Actual
2014	20

Output #4

Output Measure

- Number of consultations

Year	Actual
2014	57

Output #5

Output Measure

- Number of educational workshops or seminars conducted

Year	Actual
2014	26

Output #6

Output Measure

- Number of volunteers

Year	Actual
2014	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of energy producers, farmers, and consumers who increase their knowledge of the technical and economic implications of various Indiana crops being used for biofuels
2	Number of technologies developed and disseminated that will increase the efficiency of bio-fuel production
3	Number of participants who increased their knowledge of policy issues related to sustainable energy
4	Number of research-based studies, publications, and reports for policy organization members and legislators on sustainable energy
5	An impact of new knowledge on plant productivity from alternative energy sources in closed environments.
6	An impact on agricultural machines related to new knowledge about green technology.

Outcome #1

1. Outcome Measures

Number of energy producers, farmers, and consumers who increase their knowledge of the technical and economic implications of various Indiana crops being used for biofuels

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	75

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is need to evaluate renewable resource materials as alternatives to fossil sources for fuel production. Corn grain has been effectively used as a renewable bioenergy feedstock for ethanol. Other bioenergy sources high in fiber and low in starch, unlike corn grain, able to be grown on soils not conducive to corn production need to be evaluated for yield and composition content. Tall perennial warm-season grasses, switch grass, big bluestem and Indian grass, dominated the landscape of much of the US' current Corn Belt 150 years ago. These grasses protect the soil from being eroded, improve water quality, and may be an important renewable bioenergy resource.

What has been done
Field demonstration plots of two switch grass varieties, Shawnee and Liberty, and a mixture of big bluestem, Indian grass and side oats grama have been established on private landowner farms at two sites less than optimum for corn and soybean production in Indiana. Shawnee is a forage-type variety of switch grass, whereas Liberty was developed for the purpose of bioenergy production. Plots were randomized and replicated twice. Three rates of nitrogen, 0, 60 and 120 pounds per acre, were applied in the spring to the grasses. Each plot was measured for plant density in the spring and fall, and monthly assessments were made during summer and early fall for plant height, canopy closure, and yield. Sample collected for yield determination was processed to measure compositional content. Demonstration sites were used for field training.

Results
Shawnee had better plant stands than Liberty switch grass the year of establishment. Liberty switch grass tiller density improved to acceptable stands. Within the big bluestem, Indian grass and side oats grama mixture, big bluestem was the dominant plant type at the sandy locations, but Indian grass was most prolific on the droughty ones. Weed control with herbicide use was

helpful in establishment. Nitrogen application beginning the second year of production improved yield, although the 120 pound per acre rate produces similar yield as the 60 pound per acre rate. Higher nitrogen rate at the sandy soil sites caused grasses to fall over (lodging) mid-summer. Grasses were well established on the droughty soil and the poorly drained sections of the sites. Engaging local Extension Educators in field day planning, stand assessment and data gathering has been helpful to the project and a positive experience to campus-based personnel. At one site which is the location of the Indiana FFA Leadership Center, an eight-station walking tour exhibit was developed and available for individual or group education.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of technologies developed and disseminated that will increase the efficiency of bio-fuel production

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Cost and feasibility are important considerations for the production of biomass for biofuels. Poplar trees are gaining importance as a source of biomass for many uses including biofuels due to their consistent quality and growth patterns. They are harvestable every 6 years, so regardless of how the biomass is used, accurate growth estimates are needed to make realistic projections for buyers and growers. To complete an economic and financial feasibility analysis of the entire value Wood-to-Wheels pathway, all costs and benefits associated with producing a biofuel from woody biomass need to be incorporated into an economic model. For this model to be of use to potential growers in Indiana, relevant growth data are needed to assemble a yield component.

What has been done

The overarching goal of this research was to assess the silvicultural and economic viability of dedicated poplar (species within the genus Populus) energy plantations in Indiana. More than 60 genotypes of poplar were evaluated at three locations. The output from this project was relevant growth data needed to assemble a yield component for an economic model that estimates all of the costs and benefits associated with producing a biofuel from poplar bioenergy plantations.

Results
From the collected growth data, the team was able to develop yield equations that accurately predict whole-tree, dry-weight biomass using diameter at breast height (DBH) as the sole input variable. This allows growers to make more effective harvesting decisions based on market price.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Number of participants who increased their knowledge of policy issues related to sustainable energy

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of research-based studies, publications, and reports for policy organization members and legislators on sustainable energy

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

An impact of new knowledge on plant productivity from alternative energy sources in closed environments.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Lack of sunlight severely limits crop and plant production in protected cultivation in northern climates. Energy for heating and lighting to grow vegetables and ornamentals in greenhouses during the off-season is costly. Traditional lamps used for supplemental lighting in horticulture are electrically inefficient, blisteringly hot, spectrally challenged, have limited lifetimes, are fragile, and have disposal restrictions due to mercury content.

What has been done
Research studies on tomatoes and on flowering plants were conducted to determine which environmental factors can overcome the growth-limiting conditions and minimize the energy required to grow plants and crops productively and affordably in controlled and semi-controlled environments. Light-emitting diodes (LEDs) were used as the source of plant-growth lighting. LEDs have extremely long lifetimes, are robust due to their solid-state nature, have color emissions that can be custom selected for specific crop requirements, are cool in temperature and can be placed close to leaf surfaces, and do not require high electrical power.

Results
For propagation of tomato seedlings in the greenhouse, supplemental lighting enhanced seedling production during months of the year having low ambient solar light levels. Effects of different red to blue ratios of supplemental lighting from LEDs were season specific, but stimulation of seedling growth from LEDs generally responded linearly to total daily light interval. Adding blue light to supplemental lighting stimulated seedling growth. For tomatoes, overall, 5% blue to 95% red light gave the best growth responses across seasons. The greatest growth benefits of supplemental light occurred during periods of low ambient lighting. Energy for lighting definitely was saved. Also, because greenhouse tomatoes have a stigma of poor quality and flavor relative to garden-grown tomatoes, and because greenhouse glass does not allow solar UVB radiation to transmit into the greenhouse, a greenhouse was equipped with UV-emitting lamps with and without a transparent Mylar barrier. Analysis of fruits indicated that broad-band UV treatment reduced fruit mass 20% but stimulated ascorbic acid content 31%.

For bedding plant species, impatiens, marigold, petunia, vinca and geranium, red and blue LEDs were used as supplement to sunlight. Also, studied was sole-source LED lighting to grow plant seedlings in multilayer production when plants are stacked on top of each other on shelves where this is no sunlight. Resulting quality of seedlings grown with LEDs as supplement to sunlight was similar to, and in some cases better than, those grown in greenhouses with high-pressure sodium lamps to supplement sunlight. Seedlings produced indoors with no sunlight but with LEDs as the

sole source of light were high-quality and uniform, compact and sturdy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
204	Plant Product Quality and Utility (Preharvest)
511	New and Improved Non-Food Products and Processes

Outcome #6

1. Outcome Measures

An impact on agricultural machines related to new knowledge about green technology.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Power transmission using hydraulics and hydrostatic pump and motor systems are used for most machines from robots to construction, agricultural and marine machines. But they are not without issues. Hydraulics include undesired dynamic behaviors from resonances, limiting productivity of many applications, and can cause safety hazards. Current methods to reduce oscillations may introduce system slow-downs. Noise emission levels of fluid power system limits application of this technology to many fields, especially for machines working closely to humans. Current fluid power machines are energy inefficient, their fuel consumption is excessive. Current power transmission systems and agricultural machines are most often based on old-fashioned technology for the hydraulic system using petroleum-based fluid with energy inefficient system configurations. These is a need for new and environmentally friendly agricultural machines with low fuel consumption and zero-leakage risk.

What has been done
A series of research studies were conducted to develop new approaches and designs for hydraulic systems: 1) A pressure feedback method was developed forming an auto-tuning strategy to control applications of the machine itself (mechanical arms) but also of the payload in real time. 2) A thermal-fluid structure interaction model was created on external gear pumps with

direct film thickness measurements to analyze main sources of energy dissipation inside hydrostatic units in internal lubricating gaps. 3) A new design was created for variable delivery flow on external gear machines, preserving advantages of cost, reliability and flexibility. 4) Novel experimental approaches were designed to address noise emission sources in pumps. 5) New designs were created for green, high efficient agricultural machines powered by high-pressure water hydraulic technology.

Results

These new approaches developed for hydraulic systems are being put to use by industry partners in consideration for future commercialization and in their research and development departments. Industry partners are using the numerical models to study for more efficient solutions and using the four new designs formulated for pumps. Current testing also is occurring on the feasibility of the new technology created for using water in hydraulic systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment

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

Outcome 1 - field plots of switch grass on diverse soil conditions for biomass
Outcome 2 - field test of plots of poplars
Outcome 5 - greenhouse studies of LED lighting for enhancing plant growth
Outcome 6 - mechanical testing of engine designs for improved efficiency and fuel use

Key Items of Evaluation

Outcome 1 - Switch grasses were well established in droughty soil and in poorly drained sites making them great candidates for growing in marginal land areas for biomass; use of nitrogen application at 60 pound per acre rate improved yield.
Outcome 2 - Able to determine that there is only measure (diameter breast height) needed to calculate volume of poplar biomass for use in biofuel production.

Outcome 5 - Tomatoes thrived with red and blue LED combination as supplemental lighting with inclusion of UVB light to enhance taste. Ornamentals thrived with red and blue LED combination either as supplemental or sole-source of lighting.
Outcome 6 - New hydraulic designs improved efficiency without increasing cost or losing power

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

☑ 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
201	Plant Genome, Genetics, and Genetic Mechanisms	5%		5%	
204	Plant Product Quality and Utility (Preharvest)	5%		5%	
212	Diseases and Nematodes Affecting Plants	5%		5%	
216	Integrated Pest Management Systems	5%		5%	
308	Improved Animal Products (Before Harvest)	10%		10%	
501	New and Improved Food Processing Technologies	20%		20%	
503	Quality Maintenance in Storing and Marketing Food Products	10%		10%	
504	Home and Commercial Food Service	10%		10%	
607	Consumer Economics	5%		5%	
702	Requirements and Function of Nutrients and Other Food Components	5%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	5%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	15%		15%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	4.5	0.0	7.0	0.0
Actual Paid	4.0	0.0	16.6	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**
974052	0	407815	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2559900	0	3033583	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
323032	0	1297460	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research-based programs will focus on conducting research experiments and programs emphasizing our key interest areas including detection and control of foodborne pathogens.

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A wide variety of programs will be delivered to our targeted audiences. Some programs will include a complete development of curriculum, while others will involve the use of readily available programs used in other states and/or available for purchase through different organizations. Our output effort will include:

• partnering with important stakeholders •development of workshop materials and curricula •conducting workshops •development of web-based and distance education materials •working with the media

We expect to increase our offerings through distance education and/or web-based materials. Most programs involve some type of collaboration or partnerships with our stakeholders, with industry, with consumers, or with regulatory agencies. Evaluation tools vary greatly depending on the intended audience and program type ranging from surveys, to pre-and post test, to national certification exams, and intensive follow up surveys to better assess knowledge gain.

2. Brief description of the target audience

- Animal production personnel
- Plant production personnel
- Food manufacturing and processing plant personnel
- Food service and food retail workers
- Consumers
- Youth
- State and county health departments
- Federal regulatory officials
- State industry associations
- First Responders

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5782	339082	793	1719

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	1	42	43

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of food safety programs offered to consumers

Year	Actual
2014	0

Output #2

Output Measure

- Number of programs offered to the food industry

Year	Actual
2014	0

Output #3

Output Measure

- Number of research projects on food safety

Year	Actual
2014	37

Output #4

Output Measure

- Number of research publications related to control of foodborne hazards

Year	Actual
2014	0

Output #5

Output Measure

- Number of research publications related to detection of foodborne pathogens

Year	Actual
2014	0

Output #6

Output Measure

- Number of research publications related to food defense and protection

Year	Actual
2014	0

Output #7

Output Measure

- Number of Extension publications related to food safety

Year	Actual
2014	37

Output #8

Output Measure

- Number of volunteers

Year	Actual
2014	161

Output #9

Output Measure

- Number of consultations

Year	Actual
2014	600

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of incidents (reduction is goal) of foodborne illness associated with unsafe food handling practices
2	Number of persons who increased their knowledge of cooking foods adequately
3	Number of persons who increased their knowledge of avoiding cross-contamination
4	Number of persons who increased their knowledge of keeping food at a safe temperature
5	Number of persons who increased their knowledge of storing foods properly
6	Number of persons who increased their knowledge of proper hand washing
7	Number of participants passing food handler certificate
8	Number of participants adopting best management practices related to food safety
9	An impact from new knowledge related to food quality and nutrient uptake.
10	Number of people with new knowledge related to hunting and meat processing.
11	An impact from new knowledge related to economics regarding food safety.
12	An impact on food safety from new knowledge related to technology
13	An impact on family and community capacity to grow local foods.

Outcome #1

1. **Outcome Measures**

   Number of incidents (reduction is goal) of foodborne illness associated with unsafe food handling practices

   Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

   Number of persons who increased their knowledge of cooking foods adequately

   Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

   Number of persons who increased their knowledge of avoiding cross-contamination

   Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

   Number of persons who increased their knowledge of keeping food at a safe temperature

   Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

   Number of persons who increased their knowledge of storing foods properly

2. **Associated Institution Types**

   - 1862 Extension
   - 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	2157

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Egg products are a growing market opportunity for U.S. egg producers. Over one-third of eggs are converted into pasteurized egg products such as dry whole egg, sugared white, salted yolk, and many others. Many of these products are used as natural food ingredients in cakes, cookies, pies, mayonnaise, and ice cream, for example.

What has been done
A consortium of egg industry, the American Egg Board and a number of egg product experts from multiple universities developed a four day hands-on workshop to train persons in egg product manufacturing. These courses are offered bi-annually in even years. The participants receive laboratory training in evaluating egg product functionality, quality, and safety along with a tour of egg product manufacturing, and chef demonstration of various egg products.

Results
Over forty persons were trained in egg product technology. These forty persons were from 20 U.S. egg product manufacturers and contribute over 50% of the egg product volume produced in the United States.

4. Associated Knowledge Areas

KA Code	Knowledge Area
504	Home and Commercial Food Service
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #6

1. Outcome Measures

Number of persons who increased their knowledge of proper hand washing

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of participants passing food handler certificate

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	2512

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Indiana fresh fruit and vegetable producers play an important role in the state's agriculture, food systems and local economies. Growers must satisfy consumer, buyer, and government expectations for produce safety in order to remain competitive. Many will soon be required by law to follow specific on-farm food safety regulations. Recent foodborne illness outbreaks have heightened awareness of these issues in Indiana among a variety of audiences. New state guidelines require operations that sell fresh fruits and vegetables to wholesale accounts to document that they have received basic training in food safety practices. These facts combine to create a need for basic and continuing education for fruit and vegetable farmers about food safety.

What has been done
Since 2011, Purdue Extension offered Good Agricultural Practices from A to Z, and in 2014 that included 19 locations around the state (in person or via webinar), teaching people how to identify and reduce food safety risks on the farm. Topics in the program include worker health and hygiene, water quality, animals and manure, sanitation during production, harvest and postharvest, and documentation including food safety plans and traceability systems. We offered food safety update workshops at the Indiana Horticultural Congress and in Odon, Indiana. We created an online version of the GAPs A to Z course. Team members delivered shorter presentations about good agricultural practices at other programs, including the Illiana Vegetable Growers School. We launched the Food Safety for Fruit and Vegetable Farms web site. We published an Extension bulletin introducing GAPs.

Results
Educational programs in 2014 informed more than 340 fruit and vegetable producers about Good Agricultural Practices and on-farm food safety. Over 80% of the participants in the webinar version of the GAPs A to Z program reported they would change practices in a least one area of

food safety, and at least 50% reported they would make a change in all areas discussed. Over 300 individuals were eligible to receive a certificate of attendance at a GAPs A to Z program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #8

1. Outcome Measures

Number of participants adopting best management practices related to food safety

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2012, an outbreak of Salmonella was traced to a cantaloupe grower's farm in Indiana. This followed a larger outbreak of foodborne illness linked to cantaloupe in Colorado during the 2011 growing season. During the 2013 season, the Indiana melon industry faced a decrease in cantaloupe acreage, FDA inspections of cantaloupe packinghouses, and the need to rebuild the industry's reputation. In 2014, growers faced the uncertainty of potential federal regulations, as well as the challenges of continuing to rebuild the Indiana cantaloupe industry. Growers also faced the challenges of making sure that the entire industry produced and packed cantaloupe in a manner that reduced the risk of a foodborne illness outbreak.

What has been done
Efforts were undertaken to support melon and produce industry in Southwestern Indiana. In 2014, a 60% time commitment was focused on this issue by Daviess County ANR. Mock audits were offered for those seeking a third-party food safety certification. Workshops were conducted for Indiana melon growers to prepare them for the 2014 harvest season and potential FDA inspections. Workshops updated growers on issues such as sanitizer use, inspection activity in the previous year, and general packinghouse sanitation. Audit services were provided for Indiana

members of the Eastern Cantaloupe Growers Association. This group represents over 75% of the cantaloupe acres grown in Indiana.

Results

Of the 13 farms on which audits were offered in 2014, 12 of them obtained their third-party food safety certification. Workshops, held collaboratively with Food Science personnel and the Indiana Department of Health, helped to prepare growers for the upcoming harvest season. No farm had the opportunity to test their protocols with a formal FDA audit. After the workshops, one grower thanked us and commented that they were very impressed with the support and assistance that Purdue was willing to provide in the event of a federal inspection. Unannounced audits were performed on farms and packinghouse of Indiana Eastern Cantaloupe Growers Association (ECGA) members. Per ECGA protocol, all members submit to one unannounced audit during the growing season. All Indiana members passed the unannounced audit. This translates into no excess or unnecessary contamination risk being detected on a majority of the cantaloupe acres in the state.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

An impact from new knowledge related to food quality and nutrient uptake.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Consumption of phytochemical-rich foods has been associated with prevention of chronic disease. This project explored the effects of food formulation and processing on absorption, metabolism and potential physiological activity of dietary phytochemicals from common fruits, vegetables and beverages.

What has been done
This past year, researchers studied factors influencing polyphenol stability and bioavailability from foods including an assessment of polyphenol-protein interactions and their relationship to stability and bioaccessibility. Results indicate that milk proteins can stabilize tea and cocoa flavonoids to thermal processing and oxidation. Further, non-covalent binding does not appear to limit bioaccessibility of tea phenolics suggesting that protein-based formulation strategies may be employed to enhance stability and delivery in novel foods. In this last year, studies were expanded related to bioavailability of carotenoids from human milk. Lutein was found equally bioaccessible but more readily absorbed by Caco-2 human intestinal cells in culture when derived from human milk compared to infant formula. This may suggest that yet-to-be-determined factors in human milk can be leveraged to enhance absorption of select bioactive compounds such as carotenoids.

Results
These efforts have provided key insights on how interactions in the food matrix (protein, lipid and carbohydrates) may influence stability and bioavailability/metabolism of polyphenols, carotenoids and other micronutrients. Specific knowledge of how macronutrient interactions can modulate absorption and metabolism of phenolics in vivo with additional results to be published in 2015. Combined, these results are helping to define biologically relevant phytochemical forms and factors impacting their absorption form food and distribution to target tissues. Overall, this will facilitate design and development of product formulations and dosing strategies favoring absorption of bioactive phytochemicals from foods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components

Outcome #10

1. Outcome Measures

Number of people with new knowledge related to hunting and meat processing.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Hunting is a way of life for many citizens of Indiana. In 2012, a record 136,248 deer were harvested across the state. While some of these deer end up at commercial meat processing facilities, many are butchered by hunters at home. Of those who choose to process their harvested animals themselves, very few have formal training about how to properly process a wild game animal and must rely on practices that have simply been passed down from relatives or learned from friends. In addition, commercial processors are often concerned by the dirty, spoiled deer carcasses that end up at their facilities.

What has been done

Purdue Extension Educators in Ripley and Fayette Counties conducted a series of venison workshops in 3 Indiana counties: Wayne, Clark, and Marion. During each workshop, the educators discussed the proper techniques for field dressing and aging of deer; skinned and quartered the deer; discussed proper storage and preservation methods; cut up the meat and prepared it in a variety of ways for participants to taste. Educators also presented information about proper meat handling and safety, and provided an update about chronic wasting disease in Indiana. At the conclusion, participants had the opportunity to sample venison products prepared that evening as well as some donated from local deer processors.

Results

Over 350 participants from 17 Indiana counties attended the programs. Ninety-nine percent of respondents indicated they learned field-dressing tips that would help them keep the carcass clean and free of contamination. One hundred percent indicated they had learned something about food safety, and 99% responded they had learned how to make better use of the meat. Also, 97% of respondents indicated they planned to change how they handle their deer meat after attending this workshop, one hundred percent of the respondents indicated they would like to see similar workshops in the future that focused on additional upland game and fish, and 73% indicated this was the first extension program they had ever attended. Nine returning participants were surveyed, and 85% indicated that they hunt and fish more as a result of attending the workshops, while 93% reported they also tend to keep and bring home more fish and game. When asked about the program, one participant said, "I have never processed a deer before and would have been intimidated to try. Now I feel comfortable enough to try it". Another added "the meat tasted much better than the meat I had processed last year at a high cost!" Finally, one individual who indicated he had never attended a Purdue Extension program before wrote "if this is how Purdue does outreach, then I am very impressed."

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

Outcome #11

1. Outcome Measures

An impact from new knowledge related to economics regarding food safety.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Creating value added products from underutilized by-products can not only enhance their commercial end-value, but also create a more sustainable industry. Over the years, animal and plant by-products have mainly been used as fertilizers and livestock feeds with little commercial value and/or few food applications. In an attempt to create a more sustainable food industry, byproducts can be exposed to proteolytic enzymes, leading to the hydrolysis of the proteins in the material. This process converts otherwise underutilized material into more marketable and functional products known as protein hydrolysates (PH). Protein hydrolysates can be used by the food industry as emulsifying, foaming and water-binding agents. In addition, recent interest in PH has shifted toward their potential bioactive properties not only to human health (anti-hypertensive), but also in stabilizing food products, such as preventing lipid oxidation and freeze-induced damage in frozen foods. In food products, cryopreservatives (cryoprotectants) prevent protein denaturation during frozen storage. Commercial cryoprotectants currently used in fish products, such as surimi seafoods, require the use of high concentrations to impart satisfactory cryoprotection. These concentrations have a tendency to impart a sweet taste to the final product, which is not always the preferred case and would not be suitable for consumers suffering from diabetes. Therefore, alternative ingredients are desirable in the context of sensory attributes and issues related to health. Tilapia (Oreochromis niloticus) is a commercially important aquatic species. The volume of farmed tilapia produced in the Americas is believed to have doubled in the last 10 years, with the U.S. being the second biggest consumer (Fitzsimmons, 2000). When fish such as tilapia is processed, the yield recovery ranges only from 30 to 40% fillets with the remaining percentage accounting as by-products (Torres et al., 2007). Another example of underutilized resources is the case of Asian bighead carp (Hypophthalmichthys nobilis) and silver carp (Hypophthalmichthys molitrix). These fish, native to Asia, pose a significant risk to the U.S. Midwest rivers' and Great Lakes' ecosystems due to the competition with the native species for food resources. Currently, there is no established commercial fishing in the U.S. for these two invasive species (Schrank et al., 2003; Rogowski et al., 2009). In summary, this project will assist

in creating value added products from Indiana's Agriculture derived by-products, to enhance their commercial value and create a more sustainable industry.

What has been done
The main objective of this project is to explore the potential of using protein hydrolysates, derived from animal and plant byproducts, as functional, bioactive and cryopreservative ingredients in food systems. The specific objectives include: 1)To establish processing conditions for production of protein hydrolysates (PH) 2)To characterize the functional, physicochemical and cryopreservative properties of the protein hydrolysates Will the protein hydrolysates have optimal functionality in terms of solubility, emulsifying and foaming capacity Are the protein hydrolysates able to act as cryopreservatives in a model system 3)To assess the potential antioxidant and antimicrobial activities from protein hydrolysates. The research will assist in the long-term objective, which is to increase the commercial value and use of by-products derived from agriculture production in Indiana.

Results
The research project has successfully developed a mechanism for creating several types of value-added products derived from under-utilized, invasive silver carp. As mentioned previously, silver carp species are now considered "Injurious wildlife" by the United States Fish and Wildlife Service. Recommendations by the Asian Carp Regional Control Committee (ACRCC) for control of Silver carp populations primarily relate to the harvest and use of these fish rather than piscicidal options such as chemical and electrochemical barriers. The research has caught the attention of John Goss (Asian carp Director for the White House Council on Environmental Quality), leading to conversations and networking ideas. The project has successfully developed a mechanism for creating several types of value-added products derived from under-utilized, invasive silver carp

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
702	Requirements and Function of Nutrients and Other Food Components

Outcome #12

1. Outcome Measures

An impact on food safety from new knowledge related to technology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rapid and accurate detection of foodborne pathogen are crucial for improving food safety. We investigated whether laser light scattering sensors can detect Salmonella, Shigatoxin producing E. coli (STEC), and Bacillus spp. at low levels from naturally contaminated food and environmental samples in less than 24 hours.

What has been done
Test samples, after a period of enrichment in appropriate pathogen enrichment broths, were surface plated on selective agar plates and the millimeter sized colonies were screened using the laser light scattering sensor. The incident laser beam sequentially runs through each preselected colony and generated scatter signature which were matched to the image library for detection and identification.

Results
The sensor detected all test pathogens; Salmonella enterica, STEC and Bacillus spp. from varieties of inoculated or naturally contaminated samples within 16-24 hours, validating the sensor's potential application with real-world samples to benefit the food processing industry and regulatory agencies.

4. Associated Knowledge Areas

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

Outcome #13

1. Outcome Measures

An impact on family and community capacity to grow local foods.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Across Indiana, Purdue Extension provides training for volunteers to become Master Gardeners in a 35-hour program that covers such topics as plants, soils, gardening tools and techniques, fertilizers, plant problems, diseases, pests, weeds, and insecticides and fungicides. Those who complete the training, pass an exam with a score of 70% or more, and contribute at least 35 hours of volunteer service related to home gardening education become Certified Purdue Master Gardeners.

What has been done

In 2013, Indiana Master Gardeners provided over 160,000 volunteer hours of educational activities, provided food from Master Gardner educational demonstration gardens to Indiana food banks, and provided horticulture scholarships for local college students.

Results

Using the Independent Sector's Value of Volunteer Time of $21.56/hour in Indiana, the value of these volunteer efforts was over $3.5 million. Also, Indiana food banks received over 27 tons of produce created and maintained by Master Gardeners for educational demonstration gardens. And Local Master Gardener associations awarded over $40,000 in scholarships for local college students studying horticulture or related fields.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
212	Diseases and Nematodes Affecting Plants
216	Integrated Pest Management Systems
503	Quality Maintenance in Storing and Marketing Food Products
607	Consumer Economics
702	Requirements and Function of Nutrients and Other Food Components
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.)
- Other (state and national priorities)

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Outcome 5 - Training of staff working in egg processing
Outcome 7 - Post survey of intentions for making changes in practices by participants
Outcome 8 - FDA certification of farms producing fruit.
Outcome 9 - Lab study
Outcome 10 - Post survey and followup of knowledge gained and changes in activities
Outcome 11 - Lab study
Outcome 12 - Lab study
Outcome 13 - Tracking of volunteer hours with Independent Sector Values for Indiana.

Key Items of Evaluation

Outcome 5 - 50% of egg product volume impacted by staff who were trained
Outcome 7 - Over 80% would change practices in at least one are of food safety.
Outcome 8 - 12 of 13 fruit farms obtained third-party food safety certification.
Outcome 9 - Development of product formulations for absorption of phytochemicals from foods.
Outcome 10 - 100% learned something new about food safety. On followup, many indicated they hunted and fished more, and brought home more fish and game as a result of the workshop.
Outcome 11 - Developed value-added food products from silver carp.
Outcome 12 - Sensor can now detect all pathogens - Salmonella, STEC, and Bacillus.
Outcome 13 - Over $3.5 million Master Gardener volunteer hours for Indiana.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Childhood Obesity

☑ 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
201	Plant Genome, Genetics, and Genetic Mechanisms	10%		10%	
502	New and Improved Food Products	10%		10%	
607	Consumer Economics	10%		10%	
610	Domestic Policy Analysis	5%		5%	
701	Nutrient Composition of Food	5%		5%	
702	Requirements and Function of Nutrients and Other Food Components	10%		10%	
703	Nutrition Education and Behavior	20%		20%	
806	Youth Development	30%		30%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	1.2	0.0	11.0	0.0
Actual Paid	0.8	0.0	6.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
701081	0	270328	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2358054	0	1268299	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
274117	0	1191143	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct research
- Conduct educational workshops, seminars, short courses, conferences
- Partner with other agencies interested in childhood obesity
- Work with the media
- Develop curricula, publications, web sites, distance education materials

- Publish research and Extension articles

2. Brief description of the target audience

- Parents
- Youth
- Children
- Consumers
- Day Care Providers
- Healthcare Providers
- State and county health departments
- Professional organizations

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2095	9680	6762	2088

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

Patent Applications Submitted

Year:	2014
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	2	89	9

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Extension publications written, new or revised

Year	Actual
2014	3

Output #2

Output Measure

- Number of research publications

Year	Actual
2014	89

Output #3

Output Measure

- Number of research projects

Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of consultations

Year	Actual
2014	184

Output #5

Output Measure

- Number of educational workshops or seminars conducted

Year	Actual
2014	281

Output #6

Output Measure

- Number of volunteers

Year	Actual
2014	400

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of persons who adopt one or more practices to improve food choices
2	Number of participants who have increased their knowledge of how to raise healthy eaters
3	Number of persons who increased their knowledge of selection and preparation of foods with reduced fat and/or calories
4	Number of persons who increased knowledge of USDA serving sizes
5	Number of participants consuming appropriate serving sizes
6	Number of participants demonstrating ability to choose or prepare foods with reduced fat and/or calories
7	Number of youth who increased knowledge of the importance of physical activity
8	Number of participants who adopt increased physical activity levels
9	Number of participants who increased their knowledge of the connection between food choices and risk of chronic disease
10	Number of participants who increased their knowledge of the relationship between nutrition and health
11	Number of participants who adopt one or more practices to improve food choices and activity levels
12	NIFA National Outcomes and Indicators, Childhood Obesity (Outcome 1, Indicator 1.c) - Number of children and youth who reported eating more of healthy foods.

Outcome #1

1. Outcome Measures

Number of persons who adopt one or more practices to improve food choices

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1606

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In Indiana, 57.3 percent of children between the ages of 10-17 are obese, 68.4 percent of men and 56.8 percent of women are overweight or obese. These significant statistics create a critical need for improved nutrition and increased physical activity for youth.

What has been done
Camp RAVE Garden project, through partnership with Chances and Services for Youth, United Way and the City Parks Department, was a 9-week series of demonstrations and workshops for youth held at the Booker T. Washington community garden. Instruction was of gardening skills and plant science, nutrition, healthy living, food safety, and physical fitness. Over half of the youth had never worked in a garden prior to Camp RAVE.

Results
As a result of the program, campers had an increased desire for healthier food choices and overall improved lifestyle. Campers reported that they: 1) tried new fruits and vegetables while attending camp; 2) will look for more opportunities to garden; 3) will wash their hands more often before eating food, 4) will wash fresh fruits and vegetables before eating them, and 5) plan to eat more fruits and vegetables each day.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
806	Youth Development

Outcome #2

1. Outcome Measures

Number of participants who have increased their knowledge of how to raise healthy eaters

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	223

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Military families face unique challenges and have a growing need to access quality community-based child care. Indiana was one of 13 states chosen to participate in the Childcare and Youth Training and Technical Assistance Project (CYTTAP) conducted by the University of Nebraska-Lincoln Extension with Penn State Extension and in partnership with the US Department of Defense. This three-year grant-funded project was to provide training and technical assistance to early childhood professionals who care for young children of off-installation military families to increase quality child care.

What has been done
Five target counties were identified in Indiana to participate in this national initiative based on the number of military families in those counties who need quality child care services. I Am Moving, I Am Learning (IMIL) is a hands-on, interactive workshop on increasing physical activity and promoting healthy nutrition choices for children birth to 5. IMIL seeks to increase daily moderate to vigorous physical activity, improve the quality of movement activities intentionally planned and facilitated by adults, and promote healthy food choices every day. Train-the-trainer sessions were given to Extension Educators so they could provide the face-to-face workshops for child care providers in their communities using the various curricula and resources provided by the grant.

Results
Based on post evaluations, the child care staff had improved knowledge regarding: 1) developmentally appropriate strategies to promote physical activity in children; 2) how motor development influences one's overall health; 3) how to use appropriate verbal cues and music to encourage various movement activities; 4) health benefits associated with and strategies to apply moderate to vigorous physical activity practices; 5) how moderate to vigorous physical activity supports pre-school readiness: 6) impact of good nutrition on children's overall health and

development and strategies to promote healthy food choices for children, 7) benefits of outdoor play and time in nature to children?s motor skill development; and 8) how culture and unique experiences of children and families influence children's healthy development. In addition, those child care staff showed improvement in these practices: 1) using movement vocabulary to support children's development; 2) discussing strategies with parents to support moderate to vigorous physical activity with children at home; 3) building in movement activities with children that achieve 60 minutes of moderate to vigorous physical activity per day; 4) encouraging families to use developmentally appropriate activities with children at home; and 5) implementing strategies for improving nutritional choices among parents and children.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #3

1. Outcome Measures

Number of persons who increased their knowledge of selection and preparation of foods with reduced fat and/or calories

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1559

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The impact and prevalence of overweight and obesity continues to be high. In Indiana 29% of adolescents and 65% of adults are overweight/obese. Poor nutrition and sedentary behaviors are contributing to this epidemic.

What has been done
Eat Healthy-Be Active was a program developed by the Centers for Disease Control and Prevention was implemented in counties across Indiana. The six-session curriculum focused on nutrition and exercise with each session providing nutrition education, food demonstration, and exercise.

Results

Adult participants learned a lot of great information about preparing healthier meals. They planned to: change their recipes to reduce salt and sugar, refer to the written material when planning healthy meals, and use the recipes that were provided. The best part of the program was getting to taste examples of healthy foods which made them more confident to try it at home. Participants planned to become more active and to improve their eating habits.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
806	Youth Development

Outcome #4

1. Outcome Measures

Number of persons who increased knowledge of USDA serving sizes

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Number of participants consuming appropriate serving sizes

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of participants demonstrating ability to choose or prepare foods with reduced fat and/or calories

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Number of youth who increased knowledge of the importance of physical activity

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

   Number of participants who adopt increased physical activity levels

   Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

   Number of participants who increased their knowledge of the connection between food choices and risk of chronic disease

   Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

   Number of participants who increased their knowledge of the relationship between nutrition and health

   Not Reporting on this Outcome Measure

Outcome #11

1. **Outcome Measures**

   Number of participants who adopt one or more practices to improve food choices and activity levels

   Not Reporting on this Outcome Measure

Outcome #12

1. **Outcome Measures**

   NIFA National Outcomes and Indicators, Childhood Obesity (Outcome 1, Indicator 1.c) - Number of children and youth who reported eating more of healthy foods.

2. **Associated Institution Types**

   - 1862 Extension
   - 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1868

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2014, Indiana, like the rest of the nation, had an increase in poverty and joblessness. According to US Bureau of Labor Statistics, 5.7% of Hoosiers were unemployed in September 2014, with individual counties as high as 6.7% unemployment. In 2012, STATS Indiana reported Indiana ranked 20th in the US with 15.5% of Hoosiers living in poverty. According to the Indiana Family and Social Service Administration (October 2013), 926,653 individuals in Indiana received food assistance (SNAP).

What has been done
The Purdue Extension Nutrition Education Programs (NEP), in partnership with Purdue University Cooperative Extension Service, Indiana Family Social Service Administration, and the U.S. Department of Agriculture (FNS and NIFA), continued to provide education to low-income participants on food safety, diet quality, and economizing food dollars to help bring about nutrition-related lifestyle changes and reduce food security. In 2014, NEP provided this program in 91 Indiana counties. From the mission to empower limited-resource audiences are two that address prevention of obesity: making healthy food choices, and engaging in regular physical activity to enhance the quality of life. Of the clients reached through NEP in Indiana, over 37,908 were youth ages 5-17.

Results
Of the 6,000 children in grades 3-5 who completed the Nutritional Educational Survey before and after the nutrition education program: 1) 29.10% increased their intake of vegetables; 2) 24.80% increased their intake of fruits; 3) 31.13% increased their intake of healthy snacks; and 4) 26.02% increased their physical activity levels.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
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

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Outcome 1 - Post survey of knowledge gained and intentions for actions
Outcome 2 - Post survey of knowledge gained and practices impacted
Outcome 3 - Post survey of knowledge gained and intentions for eating habits
Outcome 12 - NIFA - Pre- and post-surveys of self-reported eating behaviors. Paired t-tests to compare the pre- and post-test answers with statistical significance level $p<0.05$.

Key Items of Evaluation

Outcome 1 - Youth introduced to gardening and tasting a variety of fresh foods plan to eat more fruits and vegetables.
Outcome 2 - Staff caring for children of military families were more prepared to increase daily physical activity and to make healthier food choices available for those children in the child care setting in an effort to prevent overweight and obesity.
Outcome 3 - Participants planned to become more active and improve their eating habits.
Outcome 12 - NIFA - Children in grades 3-5 increased their intake of vegetables, fruits, and healthy snacks, and increased their physical activity.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Human, Family, and Community, Health and Well-being

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
608	Community Resource Planning and Development	12%		12%	
610	Domestic Policy Analysis	3%		3%	
611	Foreign Policy and Programs	3%		3%	
701	Nutrient Composition of Food	3%		3%	
702	Requirements and Function of Nutrients and Other Food Components	10%		10%	
703	Nutrition Education and Behavior	10%		10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	3%		3%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	10%		10%	
721	Insects and Other Pests Affecting Humans	3%		3%	
723	Hazards to Human Health and Safety	3%		3%	
801	Individual and Family Resource Management	12%		12%	
802	Human Development and Family Well-Being	12%		12%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	10%		10%	
805	Community Institutions and Social Services	3%		3%	
806	Youth Development	3%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	16.9	0.0	29.6	0.0
Actual Paid	16.2	0.0	31.7	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**
1510979	0	506286	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
3328626	0	3979027	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
289751	0	1612562	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Develop, workshops, consultations, seminars, certification programs, distance education modules, field days, and other opportunities
• Develop and implement curriculum
• Conduct evaluation/research
• Provide youth and volunteer training and development
• Develop web sites
• Provide staff development
• Collaborate with other agencies/stakeholders
• Publish research and extension articles
• Increase number of participants in life-long learning programs.
• Foster leadership and economic development and facilitate strong partnerships n state, regional, national, and international agencies, organizations, and groups.
• Encourage participation by extension specialists in: Taskforces, Review Committees, Advisory Boards, Editorial Boards, Commodity committees/boards, Invited presentations, Honors and Awards, Common Interest Groups, Professional Societies

2. Brief description of the target audience

Families, parents, youth, 4H youth/volunteers/administration/parents, children, appointed and elected public officials, Commodity boards and committees,

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	85036	44724503	266392	1459690

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	8	178	29

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of programs offered to parents, childcare providers, youth, adults, low-wealth households and consumers

Year	Actual
2014	0

Output #2

Output Measure

- Number of research publications

Year	Actual
2014	178

Output #3

Output Measure

- Number of Extension publications written, new or revised

Year	Actual
2014	4324

Output #4

Output Measure

- Number of new partnerships, coalitions, advisory boards created

Year	Actual
2014	0

Output #5

Output Measure

- Number of new/revised curriculum topics (youth)

Year	Actual
2014	0

Output #6

Output Measure

- Number involved in community collaborations (youth)

Year	Actual
2014	0

Output #7

Output Measure

- Number of volunteer development opportunities

Year	Actual
2014	0

Output #8

Output Measure

- Number of quality, educational workshops for youth

Year	Actual
2014	0

Output #9

Output Measure

- Number of youth participating in Career Events

Year	Actual
2014	0

Output #10

Output Measure

- Number of youth participating in educational workshops

Year	Actual
2014	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	An impact on human health resulting from new knowledge about nutrition & wellness, chronic diseases, and/or environmental factors
2	An impact on family well-being resulting from new knowledge about family resources management, parenting & relationships, and/or child development.
3	An impact on youth development resulting from new knowledge about youth leadership, life skills, volunteers, and/or career development.
4	An impact on economic and/or community development resulting from new knowledge about leadership, economic development, government operations and/or community development
5	An impact on policy and/or regulation related to human, family and community, health and well-being.
6	An impact on social, economic and environmental sustainability of communities.
7	An impact on comprehensive community health coalition capacity for quality of life in communities.
8	An impact on economic and financial literacy of youth.
9	An impact on new knowledge about school readiness in under-served and under-represented populations.
10	An impact on economic and/or community development resulting from new actions related to leadership, economic development, government operations and/or community development.
11	An impact on STEAM (Science, Technology, Engineering, Agriculture, and Math) education for youth.
12	Number of community collaborations, coalitions, and partnerships
13	Number of consultations
14	Number of workshops conducted

Outcome #1

1. Outcome Measures

An impact on human health resulting from new knowledge about nutrition & wellness, chronic diseases, and/or environmental factors

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	191336

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Over 1.5 million cancer cases are diagnosed every year. Many studies focusing on cell regulation have linked Adenosine triphosphate (ATP)-dependent helicases (or enzymes), to cancer, however, precise molecular basis for cellular transformation is not understood.

What has been done
Focusing on a single class of enzymes called DEAD-box RNA helicases which regulate Ribonucleic acid (RNA) structures in cells, research is being conducted on the function and biochemical mechanisms of these enzymes with specific emphasis on members shown to promote cancer development. The approach is to use simple, single cell model organisms and a combination of biochemistry and genetics to conduct experiments otherwise too complex to perform in human cells.

Results
This research uncovers previously unrecognized connections between enzymes and gene regulation. DEAD-box RNA helicases reorganize RNA structures into long non-coding RNAs (lncRNAs) to promote proper gene expression, and this activity is required for normal cell growth and cell cycle progression. Failure to resolve these RNA structures results in genomic instability consistent with cancer development in humans. This study revealed the unique and previously unexplored targets indicated for chemotherapeutics in the treatment of cancer.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

610	Domestic Policy Analysis
611	Foreign Policy and Programs
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
721	Insects and Other Pests Affecting Humans
723	Hazards to Human Health and Safety
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions and Social Services
806	Youth Development

Outcome #2

1. Outcome Measures

An impact on family well-being resulting from new knowledge about family resources management, parenting & relationships, and/or child development.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	69252

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Parenting education is critical for children to survive and thrive. Abused and neglected children and children in poverty are especially needful of positive parenting. The child abuse/neglect rate in 2012 in Indiana was 12.5 per 1,000 children, or one case every 26 minutes. There were 1,992 child physical abuse cases, 14,802 child neglect cases, and 27 deaths. Children who experience maltreatment often are at risk of cognitive delays, emotional difficulties, and at higher risk for health problems. Long-term consequences of abuse and neglect affect the child, family, school and community. Abused and neglected children are 11 times more likely to engage in criminal

behavior as an adult. If parents understand a child's development and what can be expected at different ages and stages, there is less likely to be abuse. Children under age 18 comprise 24.6% of Indiana's population, those under age 6 are about one-third of the children, one of every three children lives in single parent families, 22.4% live in poverty and are most likely to be under age 6. Parents and families have significant impacts on a child's outcomes from health and development, to school readiness and school attendance. Children fare better physically, cognitively, emotionally, and socially when parents are consistently responsive and involved in their children's lives.

What has been done
Two parenting education programs were provided. Parenting Piece by Piece was a multi-session program designed for parents identified as at-risk through social service agencies or by court mandated parenting education, due to abuse or potential abuse with their children. Program topics were of child development, praise, stress, and discipline. Four counties offered a series of trainings for parents/grandparents of over 250 children and grandchildren. Parenting Counts, designed to support parents and caregivers of young children in raising socially and emotionally healthy children, included lessons on basic child development principles, stress management, communication, literacy, and school readiness.

Results
Parents indicated that when they felt stressed they blew off steam by yelling less frequently after the program. There were significant positive changes among participants on praise and for relationships parents had with their children's caregiver. Participants became more available to talk to their children whenever they needed them or when they wanted to talk. Parent participants felt they could do things as well as other parents, that they were happy with their parenting, that they could list 10 things that they do well as a parent, and gave themselves a higher grade on parenting for the last week of training.

Statistically significant positive changes were shown in adult participants for understanding appropriate responses to newborn communication cues, for knowledge of how to recognize and show value to children's emotions, for understanding how quick responses to given cues help babies feel secure and attached. As a result of these programs, there will be more parents and their children and grandchildren with positive and stronger family relationships.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
721	Insects and Other Pests Affecting Humans
723	Hazards to Human Health and Safety
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

805	Community Institutions and Social Services
806	Youth Development

Outcome #3

1. Outcome Measures

An impact on youth development resulting from new knowledge about youth leadership, life skills, volunteers, and/or career development.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	265305

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Indiana is home to nearly 20,000 youth with a loved one serving in the military. Since there are active installations in Indiana where military families live, these "geographically dispersed" youth and families can struggle to find resources and programs commonly available to military youth living on a base. Military youth often state that civilian youth don't understand the military lifestyle and that they like to connect with other military youth. As the fourth largest National Guard state, Indiana military youth have a unique situation in that they do not see their parent consistently for one weekend a month and two weeks out of the summer, plus any federal deployments for which their loved ones are activated.

What has been done
Indiana Operation: Military Kids (OMK) serves as the "base away from the base." As part of Purdue Extension and Indiana 4-H, OMK provides high-quality, hands-on programming across Indiana to over 500 military youth. Indiana OMK intentionally planned programming to coincide with drill weekends for National Guard units. One such event was Robotics Encounter. OMK advertised the program and covered the cost for any military youth participating in the event.

Results
Nearly 95% of participating youth indicated they met a new military kid with whom they plan to stay in touch after the event. One father and Indiana National Guardsman, was unable to attend with his children because he had to be at drill. After the event he was thankful, "Again, thank you both so much! My wife just sent me pictures and videos of the boys running their robots. All with smiles on their faces. Wish I could have been there. Take care and thank you for all you do

enriching our children and making the communities a better place."

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
805	Community Institutions and Social Services
806	Youth Development

Outcome #4

1. Outcome Measures

An impact on economic and/or community development resulting from new knowledge about leadership, economic development, government operations and/or community development

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	11961

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Immigrant populations are increasing in Indiana. In Marion County, where Indianapolis is located, the foreign-born population is up 69% since 2000 to about 100,000 people. The immigrant population includes Latino, Asian, African, Indiana, Pakistani, Nigerian, Burmese and Chinese. In one school system alone, children speak 74 languages. With these number of foreign born residents in the city of Indianapolis, there is a great need to help these new residents become acquainted with the receiving community. In addition, in Clinton County where 43.6% of students who attend the Community Schools of Frankfort are the children of Spanish-speakers, many local residents can communicate on a basic interpersonal level in English, but struggle with academic proficiency in their second language. The need to prepare adult learners whose first language is Spanish to pass the state High School Equivalency exam is growing. Offering preparation and testing in Spanish allows local adults to complete their education and gain valuable workforce skills.

What has been done

In Marion County, in collaboration with the Indianapolis Immigrant Welcome Center, a nonprofit organization, Purdue Extension developed a curriculum to train natural helpers (those recognized by their peers in diverse ethnic communities as caring, honest and worthy leaders). The curriculum provided training for: All about culture, Leadership, Helping without Hurting, Helping Tools, Systems of Care in Indianapolis, Immigrant Welcome Center, Ethics and Recommendations when working with diverse populations and Basic Financial Management Skills. In Clinton County, when the Indiana Department of Workforce Development chose a new high school equivalency test, interest in the General Educational Development (GED) tests heightened. Purdue?s Learning Network opened 10 additional testing sessions for residents to take and pass the test before an new exam was rolled out; provided tutoring programs and English as a Second Language and High School Equivalency preparation programs in Spanish four afternoons or evenings per week, 40 weeks a year to support local in-school and out-of-school youth and adults attempting to pass the test.

Results

New Natural Helpers volunteers from 11 different countries were trained and are now active members of the Immigrant Welcome Center and assist fellow immigrants by providing valuable information about services and the processes to access them. The training provided them with skills and knowledge to help others in their community. Most useful things they learned were: 1) how to interact with people from very different cultures in nonjudgmental and positive manners; 2) the process to help others in a lawful, respectful and positive way by empowering them rather than creating dependency; 3) developing personal relationships with service providers who assisted them in helping others; 4) forming a network of peers going through similar experiences and supportive of each other. For the GED testing, one adult who passed the test indicated that growing up, they were always living from paycheck to paycheck. He remembered how difficult that was, and wanted a better situation for his son, who is six. One month after passing his test he started attending classes full time at Ivy Tech Frankfort majoring in computer information systems. Since earning his credential, he has had more calls, more opportunities than ever had before.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
610	Domestic Policy Analysis
611	Foreign Policy and Programs
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
721	Insects and Other Pests Affecting Humans
723	Hazards to Human Health and Safety
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions and Social Services
806	Youth Development

Outcome #5

1. Outcome Measures

An impact on policy and/or regulation related to human, family and community, health and well-being.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	5742

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Community Health Engagement Program (CHEP) of the Indiana Clinical and Translational Sciences Institute (CTSI) aim to link experience and skills of community leaders, health professionals, and university researchers to improve the health of Indiana residents. Purdue University and Extension, Indiana University, and University of Notre Dame collaborated to engage Indiana communities and residents to achieve the goal of a healthier state. With the advice and participation of community leaders, CHEP seeks to provide better ways to conduct and disseminate research about health to Indiana's communities and citizens. Purdue Extension expands the reach of the CHEP to be statewide.

What has been done
About 20 Extension Educator positions are cost-shared with this initiative and connect with health partnerships and/or health coalitions in their communities. Through interactions and community-identified needs, CHEP can be engaged to link the community to clinicians or academics who can further progress toward improved health.

Results
Due to Purdue Extension efforts with CHEP: 1) 135 agencies or partners made connections to improve the health in local communities and over 56,000 individuals benefitted from these connections; 2) 39 partnerships have been developed or created; 3) 11 coalitions have grown in their capacity to improve the health of the community; 4) two new health policies were generated; 5) nine programs were developed or enhanced.

4. Associated Knowledge Areas

KA Code	Knowledge Area

608	Community Resource Planning and Development
610	Domestic Policy Analysis
611	Foreign Policy and Programs
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
721	Insects and Other Pests Affecting Humans
723	Hazards to Human Health and Safety
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions and Social Services
806	Youth Development

Outcome #6

1. Outcome Measures

An impact on social, economic and environmental sustainability of communities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Public spaces, like parks, greenways, and town centers, are essential to social, economic, and environmental sustainability of communities and define a sense of place where residents experience social interactions, explore nature, and purchase goods and services. Public space management decisions made by public policymakers, private business owners and residents impact the well-being and livelihood of the community as a whole.

What has been done
Enhancing the Value of Public Spaces has been crafted to address quality of place to help regions, communities, and neighborhoods plan and prepare for a sustainable future. Purdue Extension provided sustainability expertise to develop a curriculum and create, implement, and evaluate the education program. The program provided about 60 community leaders from five counties with a decision support framework that assesses the value of their community public spaces using social, economic, and environmental indicators to support the development and management of sustainable and resilient Indiana communities.

Results
Participants demonstrated understanding of the value of public spaces and the impact public spaces have on overall quality of life and economic development in their community planning and decision-making processes. 95% of participants indicated the program was useful in providing new knowledge to assist with making decisions and taking actions to help develop new or enhance existing public spaces. Participants in one community used the data, tools and worksheets from the training to assist one local town with the decision-making process for a new master plan. Participants recognized benefits of engaging diverse stakeholders in the public spaces decision-making processes. One participant described their most important take away as "learning who to invite into the discussion. Sometimes there are fantastic ideas and people are talking about them, but not talking to the right people."

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

An impact on comprehensive community health coalition capacity for quality of life in communities.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A variety of health concerns impact communities across Indiana. Most require a multi-disciplinary comprehensive community approach using a collaborative model. Purdue Extension has a major role in connecting the community through partnerships and coalitions to impact health throughout the state of Indiana.

What has been done
Purdue Extension's Health Coalition Capacity Building Team provided training and coaching for Extension Educators to gain skills and have support for working with their local coalitions. Training efforts were to build awareness, develop coalition coaches, and connect coaches as mentors to Educators to help them engage with local coalitions.

Results
Purdue Extension Educators are leading or involved with coalitions in over 60 counties. Coalitions across the state focus on health, tobacco, mental health, substance use, aging, domestic violence or child abuse, childcare, and breastfeeding, food pantries, and parenting. Health coalitions across Indiana were: 1) building new and improved networks or relationships; 2) increasing awareness of community needs; 3) increasing coalition member knowledge and skills; 4) facilitating work toward a common goal; 5) increasing community awareness of an issue; and 6) bringing new and diverse faces to the table. As a result of increased capacity of Purdue Extension Educators in leadership and activities in local health coalitions, there were: 1) more new partners for programs; 2) broader networks of community partners; 3) enhanced access opportunities for new audience groups; 4) increased efforts and awareness of health issues; and 5) increased collaborations for grants and donations received with over $630,000 in total from the various funders including Indiana Prevention Resource Center, Indiana Housing and Community Development Authority, Indiana Department of Transportation, Community Foundations, AFRI grant, CVS, and Robert Wood Johnson Foundation.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

An impact on economic and financial literacy of youth.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Americans in general, and Indiana Hoosiers in particular, struggle with economic and financial literacy. Many Indiana residents still lack basic levels of financial literacy and do not apply fundamental decision-making skills to real life situations. Early intervention and engaging students with motivating and relevant instruction can mitigate these deficiencies and increase the likelihood of adopting habits that lead to wiser decision making in their lives. About 80% of states have guidelines/standards for financial education (including Indiana), and 89% of teachers agree that financial education should be included in K-12. However, very few teachers reported feeling competent to teach financial education based on their pre-service education; additional pre-service and in-service programs for teachers are sorely needed. Students taught by teachers who are better trained in both subject matter and curricular materials, and who are using good curricular materials, will have significantly stronger achievement levels in economics and personal finance.

What has been done
Several approaches were implemented for economics education for students and professional development for teachers. High school programs included Economics Challenge Competitions and Personal Finance Challenges, focusing on knowledge about: 1) earning, protecting, and insuring income; 2) using credit; 3) buying goods and services; 4) saving and financial investing. For grades 4-12, the Stock Market Program was implemented across 135 school with over 8,000 students participating. Students managed hypothetical $100,000 portfolios of stocks, bonds, and mutual funds. They learned about financial markets and what causes them to fluctuate. These programs integrated and complemented existing instruction in social studies, math, language arts, business, family and consumer science, and computer applications. Meeting the professional development needs of K-12 teachers and youth educators across Indiana is a primary focus of this project. As a coordinated effort, eleven university centers were organized to provide resources and facilitate professional development programs for teachers on content, teaching strategies, exemplary materials, and assessments to implement into their existing instruction. Topics aligned with academic standards and instructional mandates. In-service programs were offered as one-day workshops, multi-day institutes, or sessions presented at teacher conferences.

Results
Research from data collected from the National Assessment of Educational Progress (NAEP) revealed that the pedagogical practice that had significant impact on knowledge was participation in the Stock Market Game. Participation in Stock Market increases both students achievement in

mathematics and financial literacy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #9

1. Outcome Measures

An impact on new knowledge about school readiness in under-served and under-represented populations.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Through Purdue Extension's strategic planning process, Indiana stakeholders have identified school readiness as a top issue of concern in our state. One Purdue Extension effort focuses on improving children's language development and literacy skills to better prepare children to succeed in kindergarten and beyond.

What has been done
Purdue Extension and Purdue University formed an interdisciplinary team of staff who work with Spanish-speaking audiences and interviewed families across Indiana about expectations for education and their efforts and needs for educating their children and preparing them for school.

Results
Spanish-speaking parents interviewed had strong aspirations for their children to obtain an education and pursue a professional career. Parents' aspirations were embedded in their home practices, including interacting with their children on activities related to early school preparation like reading, writing, and counting. Mothers were not the sole agent in fostering their children's learning experiences, spouses, older children, and other relatives were contributors in helping parents to achieve goals and dreams for their children. Challenges parents face that may prevent them from moving forward with their dreams and goals were: 1) limited accessibility of learning

and recreational centers in their communities, and 2) personal barriers, including financial challenges and low levels of English language proficiency (e.g., not having English literacy competence to help their children with homework assignments). Learning about parents' attitudes and practices offers guidance for Purdue Extension to provide these families with effective family-oriented programs to enhance their efforts in preparing their children for success in school.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

An impact on economic and/or community development resulting from new actions related to leadership, economic development, government operations and/or community development.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are over 3,000 Certified Master Gardener volunteers across Indiana. In their role in the community, there is opportunity to build confidence, skills and knowledge of these volunteers to be leaders in their organizations and to serve in leadership roles in the community. Leadership development is critical to organizational and community viability and sustainability.

What has been done
Purdue Extension created and implemented a five-week leadership development training. Participants gained knowledge about their leadership capacity, nature of leadership, interpersonal communication skills, working with others, serving on boards and committees and running effective meetings, conflict management.

Results
As a result of training, participants reported increased desire to get involved or increase involvement in Master Gardener organizations and felt increased confidence to take on leadership roles. Many participants planned to use leadership skills within three months after

training. In follow-up, participants were in leadership roles promoting sound gardening education across the community including non-profit organizations and local garden clubs in addition to Purdue Extension boards and committees.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

An impact on STEAM (Science, Technology, Engineering, Agriculture, and Math) education for youth.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1984

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With only 18% of 12th graders in the US proficient in science, there is a need for more youth to go into science-related careers to meet the demand. Only 5% of college graduates earn degrees in science, engineering, or technology. Thus, youth need more opportunities to increase their competence in science and to learn about science related career possibilities.

What has been done
At Science Sensation, a fun, hands-on, interactive, three-day event, 397 seventh graders, and their teachers, learned about water quality, food science, cow digestion, robotics, engineering, forestry, insects, aquatic science, and plant science. National Science Day curriculum for Maps and Apps was presented. Most students even had the opportunity to put their hand inside a live cow's stomach.

Results
Students were excited about science: 98% reported they learned something about science, 95% enjoyed lessons about science. Teachers, too, liked the program: 94% said lessons were

applicable to their classrooms, 100% reported students were more excited about science. Students commented: "The advice and lessons today will help me in school because I will remember them for years to come." "It will help me pay attention and enjoy science class more." With students being more interested in science, teachers can expand on these lessons to keep them engaged and encourage students to pursue a career in science or a related field.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #12

1. Outcome Measures

Number of community collaborations, coalitions, and partnerships

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	3741

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
610	Domestic Policy Analysis
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and

	Communities
805	Community Institutions and Social Services
806	Youth Development

Outcome #13

1. Outcome Measures

Number of consultations

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	9533

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
610	Domestic Policy Analysis
703	Nutrition Education and Behavior
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions and Social Services
806	Youth Development

Outcome #14

1. Outcome Measures

Number of workshops conducted

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
610	Domestic Policy Analysis
723	Hazards to Human Health and Safety
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions 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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Outcome 1 - Lab study of RNA structure of cells
Outcome 2 - Pre - post survey of knowledge paired t-test for comparison
Outcome 3 - Post survey of youth for knowledge gained and intentions for action
Outcome 4 - Tracking of completion of program requirements to serve in community and for the test for earning GED
Outcome 5 - Post survey of Community Health Engagement Program (CHEP) participants on activities completed and networks formed in the community.
Outcome 6 - Post survey of knowledge gained and activities completed in community.
Outcome 7 - Annual survey of members of health coalitions across Indiana for activities completed during the year.
Outcome 8 - National assessment of educational progress of pedagogical practice.
Outcome 9 - Interviews of Spanish-speaker parents about their education aspirations for their children.
Outcome 10 - Post and follow-up surveys on knowledge gained and actions taken after leadership training.
Outcome 11 - Post survey of student knowledge gained about STEAM.

Key Items of Evaluation

Outcome 1 - Identified connection between RNA structure and enzymes for normal cell growth, resulting in targets for chemotherapeutics for cancer treatment.
Outcome 2 - Statistically significant positive changes in parenting skills for reduction of abuse and neglect and more responsive behaviors to newborn cues for stronger family relationships.
Outcome 3 - Connections were made between military youth during program, and intentions were to continue to be in touch afterward.
Outcome 4 - Immigrant individuals were serving their community as resources and connections; Spanish-speaking adults were taking and passing the GED to keep active in the workforce.

Outcome 5 - Increased connections, partnerships, coalitions in local communities, new health policies generated, and programs developed or enhanced.
Outcome 6 - Knowledge gained helped communities make decisions in developing new or enhancing existing public spaces, and creating new master plans
Outcome 7 - Development of new networks and programs, and grants received over $630,000 total for communities.
Outcome 8 - Stock Market Game had significant impact on financial literacy of children grades 4-12
Outcome 9 - Parents aspirations for education for their children where embedded in their home practices, including reading, writing, and counting, and all family members helped with education, not just mothers.
Outcome 10 - Many participants went into leadership roles in their organization, non-profit organizations, and community within three months of their training.
Outcome 11 - Students learned about science and enjoyed the activities. They felt participation in this program would help them in school when they are in science class.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Natural Resources and 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
101	Appraisal of Soil Resources	1%		1%	
102	Soil, Plant, Water, Nutrient Relationships	18%		18%	
104	Protect Soil from Harmful Effects of Natural Elements	5%		5%	
111	Conservation and Efficient Use of Water	2%		2%	
112	Watershed Protection and Management	6%		6%	
121	Management of Range Resources	1%		1%	
123	Management and Sustainability of Forest Resources	18%		18%	
125	Agroforestry	1%		1%	
131	Alternative Uses of Land	10%		10%	
132	Weather and Climate	4%		4%	
133	Pollution Prevention and Mitigation	24%		24%	
135	Aquatic and Terrestrial Wildlife	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	1.4	0.0	6.7	0.0
Actual Paid	4.9	0.0	23.7	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**
975450	0	525246	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2605794	0	2808864	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
236660	0	1508986	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Workshops •Extension publications •Public service announcements •Research projects •Web site development •Home and farm visits •Displays •IP video programs •Demonstrations and field days •One-on-one consultations •Collaboration with other agencies

2. Brief description of the target audience

• Agricultural producers • Rural and urban residents •Elected officials and other decision-makers •Owners of private and public forestlands and wildlands •Natural resource professionals •Technical service providers •Tree care providers •Right of way managers •Urban planners •Youth

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	51707	163855	24118	8804

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

Patent Applications Submitted

Year:	2014
Actual:	1

Patents listed
4509451 Trademark

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	29	552	109

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of programs offered to producers, land owners, and land managers.
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Number of research projects

Year	Actual
2014	19

Output #3

Output Measure

- Number of demonstrations and field days
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of Extension publications written, new & revised

Year	Actual
2014	6928

Output #5

Output Measure

- Number of K-12 Classroom visits
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of one-on-one consultations

Year	Actual
2014	3155

Output #7

Output Measure

- Number of newsletter or magazine articles written
  Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of volunteers trained
  Not reporting on this Output for this Annual Report

Output #9

Output Measure

- Number of Extension publications distributed

Year	Actual
2014	6928

Output #10

Output Measure

- Number of research publications

Year	Actual
2014	552

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of participants who increase knowledge of practices to protect water resources
2	Number of participants who improve decision making for use of water resources
3	Number of participants who increase knowledge of proper application of fertilizer, manure and waste products to soil and potential for environmental consequences of misapplication
4	Number of participants who increased adoption of proper application of fertilizer, manure and waste products to soil
5	Number of participants who increase knowledge of best management practices for optimal manure nutrient utilization with on- and off-site agricultural lands
6	Number of participants who adopt best management practices for optimal manure nutrient utilization with on- and off-site agricultural lands
7	Number of participants who increase knowledge of the value of ponds in landscapes and methods for installing and managing ponds
8	Number of participants who increase value of landscapes through better installation and management of ponds
9	Number of participants who increase knowledge of on-site wastewater treatment siting and maintenance needs
10	Number of participants who make more informed decisions for on-site wastewater treatment siting and maintenance
11	Number of water quality violations related to animal production and land application in the state of Indiana
12	Number of tree care providers in Indiana who become certified arborists.
13	Number of professional natural resource advisors who have the skills necessary to assess the health of the wildlands
14	Number of wildlands owners who have a relationship with knowledgeable professional natural resource advisors and have developed and implemented a management plan
15	Number of natural resource professionals and wildland owners who have worked with landowners to develop and implement management plans
16	Number of owners of wildlands who will have assessed the health of their lands and developed and implemented management plans
17	Number of landowners with knowledge of proper tree planting and management techniques

18	Number of participants who increased their knowledge of natural resource management
19	Number of participants who increased their knowledge of proper application of pesticides
20	Number of participants who increased their knowledge of topsoil importance
21	Number of participants who increased their knowledge of Indiana's diverse wildlife
22	Number of woodlot owners who improved their management skills
23	Impact on biodiversity resulting from new knowledge related to insects.
24	An impact on urban pests resulting from new knowledge related to new technology.
25	Number of people taking new management actions related to various species impacted by renewable energy development
26	Number of people with new knowledge related to alternative land use management.

Outcome #1

1. Outcome Measures

Number of participants who increase knowledge of practices to protect water resources

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In 2014, we reported on a workshop and ongoing effort by several agronomy faculty to

brainstorm, identify and foster beneficial linkages toward a broad goal of standardizing function data in agriculture. Ag data can be collected 24x7, 365 days a year and there exist few standards for aggregating, comparing and analyzing this data. Genetic data, long considered a benchmark for data standards, has been standardized for a long time but it doesn't change in time and space, whereas agricultural data does. How do we get a handle on the various types, quantity and quality of ag data for decision making?

What has been done
The team continues to work inside of a $25 million USDA CAP grant to address data standards for its own program while translating their learnings to as many audiences as possible.

Results
As a result, the team was "on the road" in 2014 and will be in 2015, promoting the need for data standardization and exploring mechanisms for actually getting the data standardized. Working with the National Ag library on data standards, provenance and archiving, met with all of Ag Research Experiment Station directors to inform them, and in 2015 will bring the discussion to the joint meeting of American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

Number of participants who improve decision making for use of water resources

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Intensive agricultural practices are critical for providing resources needed to support growing national and global human populations. While agriculture has undeniably altered stream ecosystems, management practices (e.g., crop rotation, 2-stage ditches, no-till agriculture, etc.) have demonstrated some success in moderating these impacts. However, growing demands for biofuel feedstock production may be intensifying agricultural land use effects in some cases. There is thus great need to better understand the potential roles of changing land management practices for compromising or even protecting stream biodiversity and ecosystem services in agricultural landscapes.

What has been done

The project studies the roles of various agricultural land management practices on stream biological community structure and elements of ecosystem function. In addition to in situ fish and invertebrate sampling, laboratory studies reveal fish and salamander responses to elevated sediment levels. Studies were conducted in the field and in laboratories to evaluate how changes in terrestrial energy subsidies affect in stream communities and function.

Results

The studies were able to demonstrate that a much more explicit relationship occurs between many freshwater fishes that occupy these streams and the total suspended solids in stream. Using SWAT modeling, we can make consistent predictions about the distribution of stream fish based on the outputs on the models regarding suspended solids. If there is a land use change causes a change in total suspended solids, the model suggests that we might lose certain fishes over the long term. Conversely, the model shows that a change in the land-use that reduces total suspended solids, could lead to an improvement in biodiversity as the fish negatively impacted by increase in solids return to begin breeding. The utility of this is that the modeling can be done remotely allowing us to run various scenarios to optimize how we manage landscapes to promote stream biodiversity. More data in this model allow us to design landscapes that favor biodiversity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #3

1. Outcome Measures

Number of participants who increase knowledge of proper application of fertilizer, manure and waste products to soil and potential for environmental consequences of misapplication

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Number of participants who increased adoption of proper application of fertilizer, manure and waste products to soil

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

Number of participants who increase knowledge of best management practices for optimal manure nutrient utilization with on- and off-site agricultural lands

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

Number of participants who adopt best management practices for optimal manure nutrient utilization with on- and off-site agricultural lands

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

Number of participants who increase knowledge of the value of ponds in landscapes and methods for installing and managing ponds

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Number of participants who increase value of landscapes through better installation and management of ponds

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

Number of participants who increase knowledge of on-site wastewater treatment siting and maintenance needs

Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

Number of participants who make more informed decisions for on-site wastewater treatment siting and maintenance

Not Reporting on this Outcome Measure

Outcome #11

1. **Outcome Measures**

Number of water quality violations related to animal production and land application in the state of Indiana

Not Reporting on this Outcome Measure

Outcome #12

1. **Outcome Measures**

Number of tree care providers in Indiana who become certified arborists.

Not Reporting on this Outcome Measure

Outcome #13

1. **Outcome Measures**

Number of professional natural resource advisors who have the skills necessary to assess the health of the wildlands

Not Reporting on this Outcome Measure

Outcome #14

1. **Outcome Measures**

Number of wildlands owners who have a relationship with knowledgeable professional natural resource advisors and have developed and implemented a management plan

Not Reporting on this Outcome Measure

Outcome #15

1. **Outcome Measures**

Number of natural resource professionals and wildland owners who have worked with landowners to develop and implement management plans

Not Reporting on this Outcome Measure

Outcome #16

1. **Outcome Measures**

Number of owners of wildlands who will have assessed the health of their lands and developed and implemented management plans

Not Reporting on this Outcome Measure

Outcome #17

1. **Outcome Measures**

Number of landowners with knowledge of proper tree planting and management techniques

Not Reporting on this Outcome Measure

Outcome #18

1. **Outcome Measures**

Number of participants who increased their knowledge of natural resource management

Not Reporting on this Outcome Measure

Outcome #19

1. Outcome Measures

Number of participants who increased their knowledge of proper application of pesticides

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Small fruit and grape growers across the Midwest depend on up-to-date information about pests, pest management strategies, pesticide registrations, and pest control recommendations. There are dozens of pesticides registered for use on small fruit and grape crops. Trade magazines are full of adds for products that claim to be the best on the market. Growers need unbiased, research-based information to make sound pest management decisions. There are a number of new pest threats facing growers in the Midwest. Spotted Wing Drosophila and Brown marmorated stink bug are two new serious insect pest threats. Glyphosate resistant weeds, especially mare's tail, is common in fruit plantings. Indiana has a vibrant and growing wine industry that contributes significantly to the economic wealth of our State and enhances the lives and livelihoods of its residents and visitors. Between 1991, when the program started, and 2014, 70 new wineries opened statewide, bringing the total to 80. As wine grape production has increased in Indiana, growers and vintners demand up-to-date information on new grape cultivars, sustainability and pest management, winemaking techniques and marketing strategies.

What has been done
A team of specialists and Purdue researchers from across the region through the Midwest Fruit Workers Group was created. It met in Indianapolis to discuss the current pest situation, share research results, and come to a consensus on recommendations for growers. These new recommendations are incorporated into the annual spray guide updates. The spray guide is revised annually with more than 3000 copies printed and distributed to 13 states. The spray guide is available in electronic form so that growers can access the information from computer, tablet, or smart phone. Over 12,000 downloads were made in 2014. Updated pest management recommendations are presented at conferences and workshops. Growers can get advice for their specific problems by attending these sessions. In addition, growers can get Private Application Recertification Program credits for attending these sessions.

Results
Thousands of small fruit and grape growers across the Midwest make informed pest management decisions because of our educational programs and resources. They are able to manage pests with less expense and reduced negative impact on the environment. By better managing pest problems, fruit quality is improved and losses are reduced. This has a positive economic impact on their operation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation

Outcome #20

1. Outcome Measures

Number of participants who increased their knowledge of topsoil importance

Not Reporting on this Outcome Measure

Outcome #21

1. Outcome Measures

Number of participants who increased their knowledge of Indiana's diverse wildlife

Not Reporting on this Outcome Measure

Outcome #22

1. Outcome Measures

Number of woodlot owners who improved their management skills

Not Reporting on this Outcome Measure

Outcome #23

1. Outcome Measures

Impact on biodiversity resulting from new knowledge related to insects.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Preservation of native insect biodiversity is vital to the well-being of humans. These species perform many ecosystem services upon which we depend for pollination, biocontrol of pests, nutrient cycling, and supporting food webs. Insects are an important minority pest species and are influenced by the mosaic pattern of land-use with landscapes. This research determines how to best configure landscapes and plan land-use decisions to preserve biodiversity and ecosystem services while limiting losses from pests.

What has been done
The project examined the effects of humans on land-use patterns on arthropod biodiversity in the Midwestern United States to understand how to balance the needs of native biodiversity with human land-use needs. It's objectives were to: 1)quantify the impacts of various land cover mosaics on the movement and occurrence of both pest and beneficial insect species using GIS and field surveys; 2)use multi-scale techniques to uncover the spatial scales at which different landscape features and processes affect the study species; 3)determine threshold values in the landscape that lead to large changes in the pest or beneficial guilds of insects; and 4) use the information to determine how to structure landscape mosaic patterns to achieve an optimal balance between preserving beneficial insects and the ecosystem services they provide against the economic losses they cause.

Results
Researchers found that there are "levers" for affecting the pest populations that are critical for balancing insect biodiversity against human needs. Habitat connectivity "studying gene flow through habitats connected across fragmented landscapes" predicted genetic similarity of a species of native longhorned beetle that is an important pollinator. Habitat connectivity was found to predict movement across large regions, not just habitat selection. Circuit theory- like the flows of electrons through a circuit- was used to model the flow of families of beneficial predator insects that feed on invasive soybean aphid. A map of the Midwest was created based on this research that allows farmers to estimate potential benefits to controlling soybean aphids. Recent studies focused on landscape biodiversity relative to function groups (similar roles in environment), which allows better resolution of landscape and management influences than biologically artificial pest-beneficial classifications.

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
135	Aquatic and Terrestrial Wildlife

Outcome #24

1. Outcome Measures

An impact on urban pests resulting from new knowledge related to new technology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The German cockroach is a common indoor pest of residential housing as well as commercial establishments. It is one of the most important urban pests in terms of frequency of occurrence and dollars spent on control. Human health, property, food supplies and the environment in which we live, work and play are affected by the presence of this cockroach; thus, our quality of life is impacted. Its cosmopolitan distribution, universally unacceptable aesthetic appeal, and association with filth while cohabitating with man have resulted in the German cockroach being one of the most socially, economically and medically important pests with which man has to deal. Management of the German cockroach still relies extensively on insecticides. The advent of highly effective bait products in the late 1990s significantly reduced the number and size of German cockroach infestations in the U.S., and reduced liquid and dust insecticide use as well. Through many years of pesticide use, the German cockroach developed resistance to virtually every class of insecticide used in its management. Recently, cockroach resistance to gel baits has been reported, with some cockroaches being highly resistant to a variety of current gel baits in the market. Given this history of insecticide resistance, including the recent gel bait aversion, in the German cockroach, it is imperative that more non-chemical control technologies be developed for use in management programs.

What has been done

The project developed green (non-chemical and low-impact insecticide) technologies for use in German cockroach control which evaluates new insecticide chemistries and formulations. Insect

growth regulating (IGRs) compounds, pheromones, attractants, and repellents that are used in insect pest management (IPM) programs were identified as well as new exclusion, removal, trapping, and other non-chemical technologies. The project is evaluating and developing biopesticides (such as essential oils, fungi, and other pesticides derived from animals, plants, and bacteria) for cockroach IPM. Of critical importance to an IPM strategy is management and project is developing management strategies through a better understanding of behavioral and toxicological factors that influence insecticide resistance. Technologies and intervention techniques for use in cockroach allergen reduction are also under development.

Results

German cockroach population reductions are usually accomplished using cockroach gel baits (a "targeted" formulation to keep the insectcide away from humans, pets, food, etc.) New bait active ingredients and formulations are constantly entering the marketplace as older baits become ineffective due to cockroach resistance. Proprietary baits were evaluated in field tests conducted in infested apartments, with cockroach populations being evaluated at 0, 2, 4, 6, and 8 weeks after treatment. Cockroach numbers were significantly reduced at all periods following treatment. Integrated pest management (IPM) continues to be a focus of this project. Trapping, exclusion, and biopesticides cannot be relied upon for effective German cockroach population reduction as "stand alone" technologies. Training and education are key to the long-term success of IPM programs. IPM will continue to be stressed in all extension programs to pest management professionals, housing managers, and consumers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
104	Protect Soil from Harmful Effects of Natural Elements
135	Aquatic and Terrestrial Wildlife

Outcome #25

1. Outcome Measures

Number of people taking new management actions related to various species impacted by renewable energy development

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 2013-2014, several continuing projects were investigating the impacts of land management on Indiana's natural and agricultural landscapes. These projects explored the impacts of bioenergy harvests from natural forests in southern Indiana and wind-energy development in the west-central part of the state.

What has been done
A study was finished that was looking at the response of salamanders to the harvest and removal of downed woody debris from forest ecosystems. Woody debris is critical habitat for organisms found in the forest soil such as salamanders. The debris has been targeted as a possible source of domestic energy as an alternative to fossil fuels. From the broader research, the project contributed to an interdisciplinary study on how timber harvest affects forest ecosystems by examining how breeding birds respond to timber harvest. A study of wind-energy development and its effect on the American Golden-Plover, a migrant bird using agricultural fields where the wind turbines are being built, is ongoing.

Results
The research is designed to educate private forest landowners, state agency professionals and ecologists on the impacts of different land management activities. The impacts can be measured on a wide variety of native species. Current research is primarily on birds and amphibians but associated Purdue research is focused on reptiles, mammals and native plants. The broader project supported field days and other extension events. The shorebird and salamander studies will help determine if there is a conflict between renewable energy development and the needs of native wildlife.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
132	Weather and Climate
135	Aquatic and Terrestrial Wildlife

Outcome #26

1. Outcome Measures

Number of people with new knowledge related to alternative land use management.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Landowners across Indiana including farmers are looking for ways to manage their resources responsibly and where appropriate, produce income from these resources. Many landowners do not understand the impacts of their actions on the landscape over the long-term when managing and monetizing their resource. The Natural Resource Enterprises Program was created in part to encourage informed decision-making regarding land management and enterprises.

What has been done
Natural Resources Enterprises Program in Indiana Purdue Extension, in partnership with Mississippi State University, Indiana Farm Bureau, and Indiana Agricultural Law Foundation, hosted workshops to showcase outdoor recreational businesses and other income-producing enterprises. Natural resources enterprises include agritourism, lumber production, trail riding, bird watching, hunting, fishing, bed-and-breakfast inns, and more. These can be viable sources of supplemental income for rural landowners that are compatible with existing land uses while enhancing natural resources.

Results
Prospective entrepreneurs learned about revenue potential, liability, business planning and successful business ventures, and took part in field tours of featured properties, natural resources, and enterprises. They learned the most important aspects of natural resource enterprises, talked with successful business owners, and interacted with local land and wildlife management professionals. Since 2009, 275 prospective entrepreneurs who owned or managed over 33,000 acres, attended Indiana workshops. Expected annual earnings were estimated at $752,000 to $1.4 million, or $22.59 to $42.05 per acre.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land

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

Outcome 2 - Soil and Water Assessment Tool (SWAT) modeling predictions on sediment levels and fish distribution in streams.
Outcome 19 - Distribution of new, updated recommendations - paper and online.
Outcome 23 - Field study
Outcome 24 - Field testing of several levels of new bio-pesticide treatment of cockroach infected apartments.
Outcome 25 - Field studies
Outcome 26 - Post program survey on plans for natural resources operations.

Key Items of Evaluation

Outcome 2 - Modeling can be done remotely to run various scenarios to optimize how landscapes managed to promote stream biodiversity.
Outcome 19 - Over 3000 printed/distributed over 13 states; over 12,000 online downloads.
Outcome 23 - Mapping helps understanding of habitat connectivity (gene flow through habitats connect across fragmented landscapes) predicting: 1) similarity of species, 2) movement across large regions not just habitat selection.
Outcome 24 - All levels of treatment resulted in reduced cockroach numbers. New bait helped in overall IPM strategies.
Outcome 25 - Identified impact on species from renewable energy development.
Outcome 26 - Tools for effective business and preservation of natural resources along with connection to network of natural resources experts in community beneficial to the implementation of new businesses.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

Childhood Obesity (Outcome 1, Indicator 1.c)	
1868	Number of children and youth who reported eating more of healthy foods.
Climate Change (Outcome 1, Indicator 4)	
0	Number of new crop varieties, animal breeds, and genotypes whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
24	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
0	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
0	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.