

2019 Annual Report of Accomplishments and Results

Illinois
University of Illinois Cooperative Extension Service
University of Illinois Agricultural Experiment Station

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your Plan of Work. Use this space to provide updates to your state or institutions as needed.

<p>1. Executive Summary (Optional)</p> <p><u>The College of Agricultural, Consumer and Environmental Sciences</u></p> <p>ACES is an interdisciplinary community of scholars and learners, spanning life sciences, social sciences, and engineering, committed to addressing societal challenges related to food, agriculture, environmental sustainability, and human wellbeing. ACES is a complex enterprise, with a total budget exceeding \$190M, including centrally budgeted University of Illinois Extension. The ACES workforce of about 1,500 people includes 180 tenure-system and 65 specialized faculty FTE and nearly 700 Extension employees. Our growing student body consists of 2,800 undergraduate and 745 graduate students. As such, ACES is a unique component of the University of Illinois at Urbana-Champaign.</p> <ul style="list-style-type: none">• Extension is a centrally budgeted unit, residing in ACES and reporting to the Dean. Extension’s mandate is supported by federal, state, and county resources to serve Illinois residents in every county.• The Illinois Agricultural Experiment Station (IAES) is a subsidiary unit of ACES with a statutory federal mission. The IAES is a federal-state research partnership, funded by formula through the National Institute of Food and Agriculture (USDA/NIFA) and matched by state investment. <p>Over the past year, we have worked diligently to reduce our dependence on state funding, as we improved our net revenue position by nearly \$1.4M. Despite enduring multiple years of budget cuts and reductions, the financial position of the college is improving. To meet the new challenges presented by budget reform, ACES is implementing measures consistent with Operational Excellence at Illinois, strategically investing cash and recurring resources to support growth opportunities in our discovery, education, and engagement missions. At the same time, we are emphasizing improved performance across units and in our budget management processes.</p>
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The Planned Programs

Agricultural and Biological Engineering – Research projects included a study to test the effectiveness of biochar addition to swine bin composters to reduce the spread of disease, work to optimize the design of vegetative filter strips to prevent the transport of infective microbial pathogens to receiving waters, research to establish the feasibility of using unmanned aircraft systems as agricultural monitoring tools in cost and resource constrained environments, and the evaluation of best management practices for water quality improvement at various scales – from laboratory to watershed. Extension activities continued to demonstrate the pivotal role we play as a partner to state regulatory agencies. The **Certified Livestock Manager (CLM) Program** provided training to certify more than 204 livestock managers to meet the requirements of the Illinois Livestock Management Facilities Act. In addition, livestock producers were again offered workshops focusing on new technologies available for **Animal Mortality Composting**.

Agricultural and Consumer Economics – Research activities included an analysis of the local, state, federal, and selected international laws that constitute the formal legal environment for agriculture, work to expand the knowledge base for those working in the agricultural sector in assessing crucial information provided in bankers' forecasts of farmland values and USDA farm income forecasts, an exploration of the mechanisms through which climate change affects agriculture and civil conflict, and an effort to develop a comprehensive and weighted measure of global financial inclusion. Extension activities targeted individuals of all ages to build literacy in personal finance and promote positive consumer behavior. **Welcome to the Real World** taught students in middle and high school settings strategies for balancing income and expenses. **Financial Wellness for College Students** programs resulted in positive steps toward saving for the future. Through workshops and online resources adults of all ages learned to protect their credit, stretch their income, prepare for retirement, and plan for their estate. Agricultural producers and stakeholders attended the **Illinois Farm Economics Summit** offered in three regional sites and **Annie's Project**, offered in four multi-county Extension units. Multi-session, hands on training provided participants the opportunity to learn about all aspects of small and urban farm operations through the **Master Urban Farmer Training Program** and through online options such as the **Small Farms Winter Webinar Series**. WILLAG.org, a partnership of Extension and Illinois Public Media, broadcast three daily market reports and a weekly **Commodity Week** to more than three million listeners or viewers each week. In 2019, the **farmdoc** project celebrated twenty years of providing U.S. Corn Belt crop and livestock producers with constant access to integrated information and expertise to manage their farm businesses. The celebration included seminars on lessons learned and future directions in addition to a nine-part series of articles looking back and thinking ahead in the next twenty years.

Animal Health and Production - Research activities included an effort to elucidate the causes of pregnancy loss in dairy cows in order to develop protocols to increase fertility, and hence profitability, of dairy operations, an exploration of the viability of alternative options such as drylot housing for beef cows during the summer, work to identify novel diagnostic markers and therapeutic targets that could lead to a reduction in both individual animal morbidity and the economic impact of osteoarthritis in agricultural species, a study to determine the pharmacokinetic and pharmacodynamic properties of apixaban in healthy horses, and work that seeks to better understand what fetal microglia do when activated during critical periods of fetal brain development (aberrant behavior reduces health, productivity, and overall wellbeing). Extension activities focused on providing leadership for several statewide conferences and seminars including the **Annual Sire Selection and Reproduction Management Seminar**, **Northwest Grazing Conference**, and **Illinois Forage Institute**. Efforts to promote quality assurance in livestock management included **Beef Quality Assurance Training** and **4-H Quality Assurance and Ethics Certification**. Extension continued educational programs, testing, and consultation on the incidence of anaplasmosis and recommended practices to farmers for limiting transmission in beef cattle.

Community Resource Planning and Development – Research activities included a study to determine if there is a relationship between participation in a family-based nature activities and individual and family outcomes, work focusing on intimate partner violence, an exploration of the socialization practices, autonomy issues, and cultural issues with respect to youth's participation in mainstream institutions, and research that seeks to deepen our understanding of the contribution of remote enculturation to the well-being of immigrant youth. Extension activities included technical support to promote planning for community development, disaster mitigation, and economic vitality. Extension educators and specialists trained professionals to improve their capacity to interact, serve, and lead within their organizations through programs such as **Real Colors**, **Poverty Simulation**, and **On the Front Line Customer Service Training**. Government officials and community leaders from over 240 different jurisdictions attended the **Local Government Education Webinar Series** and 27 elected or appointed officials completed more than 40 hours of training offered through the **UCCI Leadership Academy**. Targeting the leaders of tomorrow, over 1,130 elementary and high school audiences participated in **A Lesson in Rural Economics**, a curriculum to improve awareness of shopping local and the importance of an entrepreneurial approach to strengthen the economic future of rural communities.

Food Safety and Food Security – Research activities included the development of strategies to reduce the risk of microbial contamination in microgreens, efforts to make Hispanic-style fresh cheeses safer to help meet market demand and prevent Listeria outbreaks, work undertaken to evaluate the effects of power ultrasound on the nutritional properties of germinated oats, the development of a novel technique for microencapsulation that can be applied to a wide range of applications, efforts to extract hydroxycinnamic acids from maize for use as a food-additive in processed food products to make the health benefits of hydroxycinnamic acids more easily available, and the development of an iron sensor that provides an accurate, reliable, and sensitive alternative to measure iron in fortified corn in low-resource settings. Extension activities focused on promoting food safety from source to service through training food producers to meet the standards of the **Food Safety Modernization Act Produce Rule**, building capacity of retail food managers to pass the **Certified Food Protection Manager Certification**, and educating non-retail food servers through **Serve it Safely** and **Yes, You Can - Preserve it Safely**. Extension continued the partnership between Master Gardener volunteers and SNAP-Ed educators, **Growing Illinois Food Access Allocation**, to increase fresh produce at local pantries and promote selection and use of the produce among pantry patrons. The **Illinois 4-H Feeding and Growing Our Committees** program held meal packaging events throughout the state and supported mobile markets to address food access in their local communities.

Human Health and Human Development – Research activities included a project that seeks to evaluate the efficacy of non-pharmacological approaches for reducing cardiovascular disease risk and improving quality of life in hemodialysis patients, the evaluation of environmental toxins associated with liver cancer incidence, an examination of the health, well-being, and economic opportunities available to LGBT persons in rural Illinois, research focusing on the influence of school-based nutrition policies on childhood obesity among American children with special health care needs, a study of the mechanisms through which thermally abused frying oils increase breast cancer metastasis, and work to identify successful programs that promote positive parenting with regard to healthy nutrition. Extension activities focused on physical, mental, emotional, and social aspects of health and human development across ages and issues. Programs in the **Brain Health Series** were expanded to include more ways to help adults explore ways to nurture their brains and exercise their memory. Other social and emotional wellness programs targeted **Being Mindful in a Busy World**, **Someday is Today - Live Your Bucket List**, and **Looking for the Funny Side**. Nutrition programs spanned a diverse array of issues including weight management, mindful eating, healthy shopping on a budget, food and drug interactions, practical strategies to integrate organic foods, food label literacy, ways to use new and unusual foods, and seasonal favorites targeting healthy holiday meals. Two signature youth nutrition and healthy eating programs, **4-H Food Challenge** and **4-H Health Jam**, promoted knowledge and skill building around healthy food preparation and choices. Additional programming related to youth health and wellness focused on bullying, drug use

prevention, sexuality education, and coping with anxiety. Extension programs targeted individuals, families, teachers, school food service personnel, and community environments like food pantries.

Natural Resources and the Environment – Research activities included a project to generate tools, datasets, and guidelines for use by managers to detect, predict, and mitigate the individual and interactive ecological effects of climate change, land use practices, stakeholder use, and invasive species on fish communities and aquatic ecosystems, the development of practical and easy-to-implement strategies that help address nitrogen leaching and N₂O emission concerns in Illinois, work to refine vegetation-based indicators of ecological integrity that can be used to monitor natural areas and evaluate the progress of ecological restoration projects, and a study measuring the socio-economic impact of climate change and natural hazards. Extension activities focused on training and support of 913 active **Illinois Master Naturalists** in 2019, who devoted more than 75,000 hours (valued at more than \$2 million of economic value to local communities) to promote awareness and action for citizens of all ages to be better stewards of the environment. Young people participated in **Youth Conservation Days** and school-based programs like **I Think Green**, **Monarchs on the Move**, and **Honeybee Challenge** to learn about ways they be environmental stewards. Overall, environmentally-related projects in 4-H had more than 105,000 enrollments statewide. Northern Illinois residents and schools in Cook County learned how to adopt practices to qualify for certification in the **Conservation@Home** and **Conservation@School** programs. To strategically address nitrogen runoff mitigation in support of Illinois' **Nitrogen Loss Reduction Strategy**, Extension water quality specialists provided workshops and podcasts to educate producers and residents about practices to reduce nitrogen loss.

Plant Health, Systems and Production – Research activities include an effort to illustrate the increasing occurrence of multiple-resistant weed populations in order to foster changes in weed control practices that speed the evolution of resistance, the development of effective management of *X. cucurbitae* in pumpkins, work to reveal and identify new and important genes and proteins that confer safener-induced tolerance in grain sorghum, the development of a new satellite-based algorithm for measuring crop productivity, the identification of pathogenesis proteins from major diseases of corn, soybean, and wheat that will allow us to make informed recommendations for the deployment of disease-resistant varieties and chemical controls, research focusing on strategies to overcome limitations to photosynthetic productivity caused by developmental and environmental factors, and the development of a new satellite-based algorithm for measuring crop productivity. Extension activities resulted both classroom based and online core training options for **Master Gardeners** to gain the knowledge and skills they need to provide education and consult with local gardeners. Core training and continuing education was provided to support 2,719 active Master Gardeners in 2019. The **Four Seasons Gardening Webinar**, **Ask Extension - Hort Corner**, and **Gardener's Corner** online resources were popular ways for people to access reliable and trusted information around horticulture. Activities also included support for crop producers and specialty crop growers to learn best management practices to improve production through conferences such as the annual **Crop Management Conference** and the **Soil Fertility Webinar**. In 2019, the **University of Illinois Plant Clinic** provided 3,329 diagnoses for 1,701 plant samples submitted for disease diagnosis, phytosanitary certification, plant identification, or insect identification.

Sustainable Energy – Research activities included an examination of the behavioral factors that influence the adoption of low carbon, renewable energy technologies and the design of policy incentives to accelerate adoption, and efforts to develop sustainable switchgrass bioenergy feedstock production systems on marginally productive croplands in Illinois. Extension expanded the **Smart Grid/Smart Meter** outreach activities to provide 51 educational workshops with 1,132 participants to promote use of smart meters and energy efficiency within largely rural areas and with limited-resource populations.

4-H Youth Development – In 2019, 4-H Club enrollment in Illinois totaled 27,975 youth who participated in over 1,900 clubs across the state. Recruitment efforts resulted in 343 new club volunteers in 2019. Over 250,000 youth participants were involved in some type of 4-H program including clubs or programs offered at the community level to address a special interest, during school, at a partner site, or at a military installation. Efforts continued to focus on expanding these 4-H opportunities to underserved youth including those in metro areas of 100,000 or more to meet the needs of urban youth. Modest gains have been made to engage minority youth, and specifically youth of Hispanic ethnicity. High school youth represent nearly one-fourth of all 4-H club members, providing positive youth development experiences during a pivotal time when career and skill development can make the difference in future paths. This past year over 4,600 adult volunteers contributed time and talents to the 4-H Youth Development program, translating to an equivalent in FTEs valued at over \$15 million of economic value serving their communities. Youth career exploration and workforce preparation activities included the **Illinois Summer Academies** conference held on the University of Illinois campus, and **Welcome to the Real World**, a multi-disciplinary curriculum and simulation to explore careers and money management. **STEM-related projects** included more than 51,000 enrollments (up from 37,000 enrollments in 2018) and 299 educational programs reached nearly 13,000 youth, including both club members and youth not currently affiliated with 4-H clubs. Volunteerism and community service to address food insecurity remained important features of the 4-H program, focused on maintaining community gardens, organizing food drives, holding meal packaging events, and creating mobile pantries for those living in food deserts. Leadership development opportunities included **Teen Teachers**, advocates empowered to tell their 4-H story to legislative officials through **Speaking for Illinois 4-H**, and two statewide **4-H Leadership Conferences** (one targeting middle school age youth and one targeting high school age youth).

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA’s attention.

Process	Updates
<p>1. <u>The Merit Review Process</u></p>	<p>Extension state program leaders, working with staff on their respective teams, have been charged with the responsibility for ensuring that Extension programs are research-based. In most cases, local programs and curriculum will be developed by more than one educator and reviewed by several of their peers who have the same assigned specialized areas of delivery. Curriculum materials are often sent for review directly to peers in other states and 4-H curriculum materials are often sent through a national jury process. In addition, annual staff performance reviews include criteria to assess demonstration of programming quality through evaluation findings. Finally, the merit of all new program efforts and a selected number of ongoing programs are evaluated by participants regarding content and delivery.</p>
<p>2. <u>The Scientific Peer Review Process</u></p>	<p>Department heads reported in late 2019 that their peer review process for Hatch proposals was primarily as it had been the previous year and they did not have significant updates or alterations to report. In addition, there have been no updates to the scientific peer review process for Extension as outlined in the 2017 Plan of Work.</p>

III. Stakeholder Input

The NIFA reviewer will refer to your Plan of Work. Use this space to provide updates as needed or activities that you would like to bring to NIFA’s attention.

Stakeholder Input Aspects	Updates
<p>1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation</p>	<p>Ongoing actions to seek stakeholder input included hosting workshops, meetings with internal and external advisory committees, and the use of social media. Targeted stakeholders continued to include industry partners (and potential future partners), local, state, and federal agencies, other researchers, and the local agriculture community.</p> <p>The Department of Food Science and Human Nutrition has an annual meeting with a group of stakeholders from industry, government, and academia (FSHN External Advisory Committee) to seek input on all of their scholarly activities, including research. They reported in 2019 that they are modifying this committee structure slightly to be more responsive to undergraduate focal areas (which also include research areas of dietetics, hospitality management, and food science and human nutrition).</p> <p>At the state level, members of the Extension State Advisory Council (ESAC) are recruited to reflect the geographic and programmatic diversity of the Extension organization. In addition, state program leaders, specialists, and faculty seek opportunities to connect to state and regional stakeholders in their specialty areas. Locally, unit directors and staff devote time and attention to recruit and support local Extension Council members who provide advice on educational programming and priorities. Unit leaders submit annual reports that monitor the race, ethnicity, and gender of their volunteer leadership to regularly assess need for more targeted actions to engage underrepresented stakeholders.</p> <p>Additionally, Extension field staff have a deep and broad network of partners who are consulted in efforts to expand offerings, reach new audiences, and maximize impact. The statewide Program Planning and Assessment Committee members reflect a diverse array of internal stakeholders representing a wide variety of roles and all regions. Each member serves a two-year term to assure that insights and input are continually refreshed.</p>
<p>2. Methods to identify individuals and groups and brief explanation.</p>	<p>The Department of Animal Sciences underwent an extensive evaluation by an external review team in late 2018 that included five members from different peer institutions. Key future opportunities identified by the team are included in the “What Was Learned From Stakeholders” section below. The Department of Agricultural and Consumer Economics identified farmdoc (https://farmdoc.illinois.edu/) and the associated social media platforms as especially valuable in FFY 2019 in identifying and interacting with stakeholders in areas such as commercial agriculture. Traditional methods such as advisory committees, faculty meetings,</p>

	<p>efforts to seek input from students, faculty, and alumni, attendance at regional, national, and international conferences, and coordination with development, corporate relations, and public engagement offices continue to be very important.</p> <p>As part of the University of Illinois Extension Affirmative Action plan, county Extension directors and Extension educators identify individuals to serve on formal local multi-county, regional, and state advisory groups for Extension. These groups play a key role in identifying research and Extension priority activities, as well as suggesting others who should be contacted. In addition, Extension staff members network and establish relationships with individuals and groups in assigned areas to assess priority needs. Extension administrators at the regional and state level also network with internal and external individuals and groups and regularly use these contacts to seek suggestions for expanding stakeholder engagement.</p>
<p>3. Methods for collecting stakeholder input and brief explanation.</p>	<p>The dean, associate deans, department heads, Extension directors, educators, and faculty members of the College of ACES interact frequently and significantly with a number of stakeholders, both individual and organizational, external to the College of ACES. Key stakeholders include groups both within Illinois and across the nation. In general, stakeholders include individual producers, commodity organizations, state and federal legislators, academic and corporate partners, international partners, and other individuals and organizations within the University of Illinois. Provided below are interactions the Associate Dean of Research (Dr. Germán Bollero) had with specific stakeholders in FFY 2019 to serve as a representative sample.</p> <p>In FFY 2019 Dr. Bollero served on the board of the Illinois Nutrient Research and Education Council, met with or video conferenced with leadership and members of the Illinois Farm Bureau, Corn Marketing Board, Corn Growers Association, Soybean Association, Illinois Pork Producers, and the Illinois Beef Association, worked to develop collaborative activities with corporate partners including Bayer, Syngenta, Wyffels, GDM, Burrus, ADM, Tate and Lyle, Growmark, Agrible, and Kraft Heinz, served as a member of the joint steering committee of the University of Illinois/Corteva partnership to coordinate collaborative efforts in research, education, and outreach, participated in the meeting of the Illinois Agricultural Legislative Roundtable (this meeting included representation from the Illinois Farm Bureau, multiple commodity organizations, and other educational institutions in Illinois that have agricultural programs), worked with representatives from the Illinois Corn Growers Association on the development of an internal seed grant program associated with an award from the Regional Conservation Partnership Program, participated in meetings of the Illinois-Indiana Sea Grant advisory committee, met with members or their staff of the Illinois House Delegation in Washington, D.C. on issues of importance in agricultural research, participated in meetings of the North Central Region Agricultural Experiment Station directors, met with the College of ACES external advisory</p>

	<p>committee, participated as a member of the advisory committee for the Institute for Sustainability, Energy, and Environment, participated with research and Extension staff at the Dixon Springs Agricultural Center to discuss the future of research and education programs at DSAC, attended the Illinois State Fair Agriculture Day and the Farm Progress Show, and was extensively involved in activities of the Dudley Smith Research Program (an endowed program in sustainable agricultural production centered on the Dudley Smith Farm in Christian County, Illinois).</p>
<p>4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.</p>	<p>The team from the Department of Animal Sciences review (first mentioned above) identified three areas of opportunity for the department in the years ahead: 1. The joint undergraduate major with Computer Science designed to integrate the disciplines of biology of animals and computer and big data systems is commendable and fits the rapidly emerging area of precision animal agriculture. The review team believes that this program will have a tremendous upside if it is properly implemented. 2. Building a new feed mill complex offers another opportunity for the department to develop a world-class feed technology program. The review team suggests that collaboration with faculty in Agricultural Engineering to include feed processing technologies can be very useful in developing this minor in the teaching program. 3. The review team also believes that an opportunity exists to develop a large program project grant under the umbrella of One Health or similar themes that would include collaboration with faculty across campus, especially in the Colleges of Veterinary Medicine and Human Medicine. The department faculty is well positioned to be a strong player and campus leader in this program.</p> <p>The Department of Agricultural and Consumer Economics external advisory committee offered strong support for initiatives such as the new Center for the Economics of Sustainability. This center seeks to engage in cutting-edge research and vigorous engagement with external audiences to find solutions to global threats and challenges such as climate change, fostering sustainable food production, energy use, and urban development.</p> <p>Current and emerging issues identified by stakeholders of the Department of Agricultural and Biological Engineering included agricultural and industrial safety and health (agricultural injury causation and effective injury and illness risk reduction measures, stress, and mental health), bioenvironmental engineering (controlled environment systems, precision livestock farming applications, energy efficiency and sustainability, air quality improvement, handling and treating biowaste, diesel engine emissions, building energy efficiency, and animal welfare), biological engineering (renewable energy, biological nanotechnology, sustainability, and synthetic biology), food and bioprocess engineering (production of fuels and chemicals from cereal grains/biomass, novel biomass fractionation processes for recovery of food, and nutraceutical and industrial products), off-road equipment engineering (machine learning, autonomous decision making</p>

	<p>and control, machine vision systems, unmanned aerial systems, precision agriculture, and appropriate and scale mechanization), and soil and water resources engineering (water drainage, erosion and sediment control, watershed ecosystem dynamics, pathogen, and nutrient and chemical transport).</p> <p>Stakeholder input played a significant role in Natural Resources and Environmental Sciences investigators identification of opportunities to make justified integrated pest management-based recommendations to growers, crop protection/pest management professionals, Extension personnel, agricultural biotechnology company representatives, and college students in agricultural sciences and receive input in return, the review of over 1,000 pages along with stakeholder interviews at the county level to analyze permitting of the Dakota Access Pipeline in Illinois, the improvement of conservation strategies in relation to habitat use by birds, and research studying the socio-economic impacts of forest and on-farm tree conservation and management that resulted in the principal investigator being selected to lead the IUFRO (International Union of Forest Research Organizations) global assessments on forests and poverty.</p> <p>Stakeholder input continues to play an important role in decision making at all levels in the College of ACES, including the allocation of resources, the development of Extension programs, the hiring of faculty members and Extension educators, and the development of media communication and other outreach materials.</p>
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IV. Planned Program Table of Contents

No.	Program Name in order of appearance	Activity Descriptions
1.	Agricultural and Biological Engineering	<u>Reducing the Spread of Animal Disease Due To Improper Composting</u> (Research)
2.	Agricultural and Consumer Economics	<u>Supporting Producers to Start or Enhance Small and Urban Farms</u> (Extension)
2.	Animal Health and Production	<u>Improving Pork Production Sustainability Through a Better Understanding of Maternal Immune Activation</u> (Research)
3.	Community Resource Planning and Development	<u>Exploring the Health Benefits of Nature-Based Activities</u> (Research) <u>Elected Officials and Community Leaders Build Capacity to Serve Their Constituents</u> (Extension) <u>Extension Volunteers Contribute Over \$23.8 Million in Value of Service Delivery to Illinois Communities</u> (Extension)
4.	Food Safety and Food Security	<u>The Development of Strategies to Reduce the Risk of Microbial Contamination in Microgreens</u> (Research) <u>Promoting Food Access From Garden to Fork</u> (Extension) <u>Maximizing Food Safety Systems in Illinois</u> (Extension)
5.	Human Health and Human Development	<u>Promoting Positive Parenting and Child Care Provider Behavior Around Healthy Nutrition</u> (Research) <u>Adults Demonstrate High Rates of Behavior Change to Reduce Risks of Chronic Disease</u> (Extension) <u>Illinois Nutrition Programs Motivate Youth to Make Healthy Choices</u> (Extension)
6.	Natural Resources and the Environment	<u>Mitigating the Ecological Effects of Climate Change, Land Use Practices, and Invasive Species on Fish Communities and Aquatic Ecosystems</u> (Research) <u>Development of Better Water-Saving Strategies</u> (Research) <u>Youth Learn the Importance of Protecting Pollinators</u> (Extension)
7.	Plant Health, Systems and Production	<u>Valued-Added Extension Outreach Impacts Illinois Crop Producers and Agri-Business Professionals</u> (Extension) <u>Developing Strategies to Overcome Limitations to Photosynthetic Productivity</u> (Research) <u>Identifying New and Important Genes and Proteins That Confer Safener-Induced Tolerance in Grain Sorghum</u> (Research)
9.	Sustainable Energy	<u>Factors Impacting Farmer Adoption of Alternative Energy Crops</u> (Research)
10.	4-H Youth Development	<u>4-H Leadership Development Builds Confidence and Motivation to Positively Impact the Lives of Others</u> (Extension) <u>4-H Programs Enhance STEM Skills and So Much More</u> (Extension)

V. Planned Program Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). See Section V of the Guidance for information on what to include in the qualitative outcomes or impact statements. Add additional rows to convey additional accomplishments. You may expand each row as needed.

No.	Title or Activity Description	Outcome/Impact Statement	Planned Program Name/No.
1.	Reducing the Spread of Animal Disease Due To Improper Composting	<p>Composting is a way of recycling nutrients. One of the critical factors in composting animal mortalities is achieving pathogen-eliminating temperatures so compost piles do not cause the spread of animal diseases. It is also important to prevent leachate formation to protect water and soil quality and to minimize ammonia emissions to maintain fertilizer value of the finished product. Regular composting often fails to meet these requirements and needs to be improved according to stakeholders.</p> <p>From October 2018 to September 2019, a lab/pilot-scale composting experiment was designed. Whole chicken carcasses were composted using wood chips enriched with biochar. Five biochar ratios (0, 1, 5, 10, and 15% by dry weight) were tested over three heating cycles (eleven weeks). Ammonia emissions, oxygen levels, temperature, leachate quantity and quality, and finished compost characteristics including macro- and micro-nutrients and color were measured. Adding biochar at the rates of 5, 10, and 15% helped reduce leachate formation and chemical oxygen demand of the leachate was significantly lower compared to that of 0 and 1% biochar.</p> <p>The results of this study will directly benefit animal producers who are under huge pressure due to foreign animal diseases such as avian influenza. In this study, we composted poultry mortalities, but there is no reason the results of this study cannot be applied towards other species (e.g., swine). Considering African swine fever is rapidly becoming one of the most devastating disease outbreaks in the world, affecting global trade, driving pork prices up, and resulting in the depopulation of tens of millions of pigs and hogs, it is important to have mortality disposal methods that would help to contain the disease. It is anticipated that once the results of the study are promoted, animal producers will better understand how important it is to achieve high temperatures during composting and start trying biochar amended composting. This will have a big impact on</p>	Agricultural and Biological Engineering

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		<p>animal health, food security, and the environment. Members of the target audience include other researchers, scientists, engineers, and livestock stakeholders. The lead investigator of this project has also hosted Extension workshops in 2019 based on this research titled “Livestock Facilities and Manure Management – Animal Mortality Composting Workshops.” For more information on these workshops please see: https://extension.illinois.edu/lfmm/animal-mortality-composting-workshop.</p>	
<p>2.</p>	<p>Supporting Producers to Start or Enhance Small and Urban Farms</p>	<p>While Illinois contains some large and complex farming operations (with 228 farms having sales in 2017 greater than \$5 million), the majority (67.4%) of the 72,651 farms in Illinois recorded in the 2017 Census of Agriculture had sales below \$100,000. Often operated by part-time farmers, first-time farmers or “hobby farmers”, small farm operations can place high demands on the expertise, support, and hands-on assistance that Illinois Extension provides. Cook County (encompassing the city of Chicago) is the most densely urban Illinois county where farms average 65 acres – far below the Illinois average of 375 acres per farm. It is in the State of Illinois’ best interest to see these small business and entrepreneurial urban food ventures succeed, and Illinois Extension has stepped forward to develop specific programs to support small farm operators and new urban farmers.</p> <p>In 2019, the Small Farms Winter Webinar Series reached 527 attendees via 11 live webinars, which were subsequently recorded and posted to the Extension website along with all prior series since 2015. The series provided online presentations, filled with practical strategies relevant to small farm enterprises. Several Extension field offices hosted a webinar site if potential audiences did not have access to broadband internet access for streaming and to promote a more “high touch” approach for discussion in these hosted settings. A diverse array of topics were covered in 2019, including financial considerations, legal requirements, digital marketing techniques, and food safety in addition to a variety of best practices for maximizing production on small scale farms. Post-webinar evaluations confirmed that 100% of respondents reported a knowledge increase for the following webinar topics: <i>2018 Updates on the Illinois Cottage Food Law, Intro to Digital Marketing in the Local Food System, Maximizing Your Production: Succession and Companion Planting, Reducing Damage to Livestock</i></p>	<p>Agricultural and Consumer Economics</p>

		<p><i>and Specialty Crops from Wildlife, and ABC's of Tomato Production.</i> The Master Urban Farmer Training Program (MUFTP) trained 24 participants through 11 onsite educational sessions during 2019. The MUFTP, operating out of Cook County, is designed to provide new urban farmers with the introductory knowledge and skills to start and manage an urban farm. With a focus on research-based information and practical application opportunities, the 2019 cohort of MUFTP participants experienced a multi-faceted array of sessions including business planning, weed and pest management, production planning and practices unique to urban farming, food safety, and marketing strategies. Since 2016, the MUFTP has trained five cohorts of beginning farmers comprising a total of 136 participants. In addition to educational programming, Illinois Extension's support for urban farming has been significantly enhanced with the opening of the South Suburban Cook County Urban Ag Demo Farm. Deliberately small, to mimic the type of operations occurring in urban farming, the 0.2 acre site demonstrates season extension structures, raised bed systems, in ground bed systems, and storage. It has been located at the Matteson Area Center as a part of Prairie State College and is designed to serve as a training asset for the MUFTP and site for other urban farm training and education sessions. Produce grown on the Urban Ag Demo Farm will be used within the Prairie State College culinary arts program with excess donated to food pantries.</p> <p>Periodically throughout the MUFTP, participants were asked to rate their knowledge gain in the 50 topical areas covered over the course of the program. Participation in the post-session educational effectiveness evaluation of the individual modules varied from 8 to 19 respondents. Comparison of average knowledge ratings (i.e. mean scores) from before and after participation revealed a positive knowledge gain in ALL of the 50 topical areas and the magnitude of knowledge changes in all but one topical area reached statistical significance (through the application of t-tests). On average, evaluation respondents reported the greatest knowledge gain in <i>"where to access grants and programming available to farmers and ranchers"</i>. In addition, a strong majority (89%) reported a <i>"high"</i> or <i>"very high"</i> knowledge increase in application of microgreens to urban settings. While consistency and extent of measured knowledge gain as a result of the program was impressive, these gains were also accompanied by adoption of new or changed practices. Among the respondents completing the final end of program evaluation (N=9), the majority (56%-89%) indicated they had already</p>	
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		<p>adopted new recommended practices related to production operations and business operations. When asked their plans for the coming year, four of the end of program evaluation respondents plan to start some type of new urban farm site and two plan to apply their new knowledge to start or participate in a community food project in an underserved community. New businesses and efforts to promote food access for those in greatest need will benefit the local economies and communities, above and beyond the personal benefits to the Master Urban Farmers impacted by Extension.</p>	
<p>3.</p>	<p>Improving Pork Production Sustainability Through a Better Understanding of Maternal Immune Activation</p>	<p>Maternal immune activation during pregnancy (MIA) increases the risk for neurobehavioral problems in offspring. In a previous study, we hypothesized that MIA in pregnant gilts affects stress resilience in offspring by altering the developmental trajectory of the brain and particularly the microglial cell environment. We established new tools for assessing brain development and function in piglets and investigated the impact of perinatal insults including MIA. An exciting finding was that offspring of gilts experimentally infected with porcine reproductive and respiratory syndrome virus (PRRSV) at the beginning of the third trimester (gestational day (GD) 76) exhibited anti-social behavior compared to offspring of non-infected gilts. Contrary to our hypothesis that behavioral disorders would be associated with persistent aberrant microglial cell activity, the change in social behavior was evident independent of altered postnatal microglial cell activation and neuroinflammation. Therefore, if microglia played a role in altering brain development and behavior, it likely was in the acute phase of MIA.</p> <p>This is plausible because microglia respond to insults by becoming inflammatory, and in the fetal brain are fully mature and required for proper neurodevelopment. Our newest data support this notion as fetal microglia displayed a pro-inflammatory phenotype during MIA caused by PRRSV infection but not after MIA when the acute phase response was resolved. Furthermore, in other studies we found that MIA reduced fetal brain weight without affecting fetal body weight, reduced the number of hippocampal neurons, and increased astrogliosis. Clearly this issue is relevant to pig production as aberrant behavior reduces health, productivity, and overall wellbeing - issues key to sustainable production of high quality pork. Members of the target audience for this research include research scientists in academia, government, and industrial</p>	<p>Animal Health and Production</p>

		<p>enterprises, veterinarians and others involved in the animal health and well-being field, and undergraduate students in animal biology. Work under this Hatch Project (and the lead investigator’s previous Hatch Project) helped to generate research that led to a successful proposal for a \$1.6 million award from the National Institutes of Health– USDA “Dual Purpose for Dual Benefit” program. More information about the award can be found at: https://aces.illinois.edu/news/illinois-researchers-receive-16-million-study-effects-maternal-infection-offspring-brain.</p>	
<p>4.</p>	<p>Exploring the Health Benefits of Nature-Based Activities</p>	<p>Although studies reveal that family leisure time can contribute to improved family functioning, family resilience, and increased satisfaction with family life, little is known about the health benefits of family leisure in nature. Past research on family outdoor recreation primarily focused on therapy and adventure challenge programs, and is not well represented in peer-reviewed journals. Family-based nature activities (FBNA) refers to "outdoor recreation (e.g., camping, fishing, hiking), utilization of natural environments (e.g., parks, gardens, backyard), and family vacations in natural areas (e.g., visiting a forest preserve, national park, beach) with two or more family members". Further examination of the relationship between FBNA and health is needed as FBNA may have the potential to contribute to increased family cohesiveness more so than other types of leisure contexts. Furthermore, the majority of research in the last few decades has focused on the health benefits of nature-based activities for individuals in urban populations, which has contributed to the current national push for increased access to nature in urban communities through efforts such as the "Cities Promoting Access to Nature" initiative and "Nature in the City" programs. There has been little research or practice focused on the health benefits of nature exposure for rural populations. Rural populations are more likely than urban residents to experience health disparities, especially in regards to chronic health conditions. Because access to green spaces can play a vital role in reducing health inequalities, it is increasingly important to study rural families' use of natural environments.</p> <p>We found that exposure to nature was more cognitively restorative than exposure to indoor settings for mothers, which replicated previous results of studies of individual exposure. The effect of settings for daughters was not</p>	<p>Community Resource Planning and Development</p>

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		<p>significant; walking in any setting with mothers restored cognitive functioning equally. Interactions between mothers and daughters were more cohesive and positive following exposure to nature compared to interactions after exposure to indoor settings. Additional analyses have highlighted the reasons that mothers and daughters spend time outdoors, the benefits they obtain from being outside, and the challenges that prevent them from spending more time outside.</p>	
<p>5.</p>	<p>Elected Officials and Community Leaders Build Capacity to Serve Their Constituents</p>	<p>Building leadership capacity among community leaders and elected officials is critical to community viability and sustainability. Newly elected officials can benefit from learning how to perform government work and how to collaborate with agencies and individuals that can assist with economic development, problem-solving, accountability, and policy implementation. Increasing the capacity of local decision-makers in the areas of communication, decision-making, teamwork, and learning-management will enhance community vitality and improve the quality of life in rural and urban areas alike. When leaders improve their own competencies and effectiveness, they have the potential to positively influence the lives of entire communities and regions.</p> <p>Two central and popular Extension programs target elected or appointed officials and community leaders to provide decision support tools and training for effectively carrying out the roles they play to influence the organizations and populations they serve.</p> <p>Illinois Extension Local Government Education (LGE) webinars help elected and appointed officials across Illinois stay informed on policy issues and emerging trends, as well as learn about ways to effectively serve their communities. LGE webinars offer tools, approaches, and information to support better decision-making, which in turn affect communities, organizations, and citizens. The topics covered help to improve the efficiency and effectiveness of public management across Illinois. The LGE webinars are offered at no cost, are accessible across the state, are each a feasible one hour time commitment, and can also be view on-demand (after the live webinars are recorded) via easy to access online archives now totaling 80. In 2019, 13 LGE live webinars were attended by 891 participants and subsequent recordings registered 401 views. While personal contact information is not collected from participants during each webinar, registration</p>	<p>Community Resource Planning and Development</p>

		<p>rosters indicate that registrants come from over 240 cities across 21 states (with the majority from Illinois). The most popular sessions (drawing over 100 combined live participants and online views) included: 1. <i>Ready to Diversify: Lessons learned for Coal Communities Across the Country</i> (n=133); 2. <i>Counting for Dollars: Census 2020</i> (n=131); 3. <i>Developing a Creative Economy</i> (n=129); 4. <i>Minimum Wage in Illinois</i> (n=122); 5. <i>State Legislative Update</i> (n=117); and 6. <i>Economic Impact of Plant and Mine Closures and Making the Case for Renewables</i> (n=111).</p> <p>Attendees were polled during the live webinar broadcasts to efficiently capture extent of perceived knowledge gains as a result of the webinar. The most highly reported knowledge gains (% who reported their knowledge was increased “considerably” or “a lot”) were associated with: 1. <i>Local Efficiency Assessment Program (LEAP) and dashboard</i> (87%); 2. <i>Changing demographics and economic development implications</i> (80%); 3. <i>Economic impact of the declining coal industry and what actions leaders and policymakers can take to help communities and regions respond</i> (75%); and 4. <i>Opportunities and case examples of economic diversification in coal-dependent communities</i> (66%).</p> <p>A common thread throughout LGE webinars with the highest reported knowledge gains is a focus on fiscal planning needs and responses to potential threats to local economic stability.</p> <p>The UCCI Leadership Academy was developed by University of Illinois Extension in partnership with the United Counties Council of Illinois (UCCI) to provide leadership training on issues important to elected and appointed county officials. The curriculum is designed for county officials who want to explore new ideas and learn practical responses to current issues, challenges, and opportunities. The five instructional modules, each lasting a full day, allow participants to learn, share, and apply skills on a variety of practical and pertinent topics. Topics addressed in the academy include leadership fundamentals, improving your management skills, change management, managing conflict, fiscal management, developing strategies for economic development, data-driven decision making, parliamentary procedure, leadership in crisis situations, and crisis</p>	
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		<p>communications. Twenty seven (27) participants graduated from the UCCI Leadership Academy in 2019.</p> <p>Participants were invited to complete an end-of-program evaluation to solicit feedback about their experience. Twenty three participants completed the program evaluation in 2019. When asked if their participation in the Academy changed the way they approach their role, all but one commenter provided at least one example of positive impact as a result of their experience. The most frequently reported impacts related to increased confidence to make informed decisions, improved communication skills, and the benefits of collaboration with peers to learn from other leaders. A significant majority (21 out of 23) indicated that they would be "Very Likely" to recommend the UCCI Leadership Academy to others. When asked how they will use the information learned in the Academy in their role as a leader, examples of responses included:</p> <p><i>"I have already been able to take some of this information back to my community and help look at asset development for our growing community. It is information of value today and tomorrow that I will always be able to look back and apply."</i></p> <p><i>"I plan to use the communication tools to improve inter-governmental relations as well as with the community. Also, I plan to use the economic data available through U of I Extension to aid in economic development in our county."</i></p> <p><i>"The ideas regarding involving others (community capitals) provided numerous possibilities going forward that I hadn't previously considered."</i></p> <p><i>"I plan to use the communication tools to improve inter-governmental relations as well as with the community. Also, I plan to use the economic data available through U of I Extension to aid in economic development in our county."</i></p> <p>Clearly, the time commitment made by leaders in the LGE webinars and UCCI Leadership Academy was a good return on their investment. Application of their new knowledge and peer connections as they carry out their leadership roles can benefit organizations and community systems throughout Illinois and beyond.</p>	
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6.	<p>Extension Volunteers Contribute Over \$23.8 Million in Value of Service Delivery to Illinois Communities</p>	<p>Extension volunteers play a vital role in expanding the reach of research-based decision-support and public engagement in programs within the communities they serve throughout Illinois. Extension volunteers are highly valued and passionate partners who respond to requests for technical assistance, deliver educational programs, and create positive youth development environments. Investments made in volunteer training, support, and management can result in significant economic value. In addition, Extension volunteers represent an audience receiving the most sustained, intensive outreach and education across the organization and serve as key stakeholders who are connected to their communities. Their input provides Extension with integral information to guide and refine outreach relevant to residents throughout Illinois.</p> <p>Extension staff dedicate targeted and strategic effort every year to assure volunteers have the capacity, resources, and support to carry out their work on behalf of Extension. Core training and continuing education requirements are important to the infrastructure and integrity of the Master Gardener and Master Naturalist volunteer programs. In 2019, Master Gardener and Master Naturalist volunteers collectively participated in over 51,000 hours of continuing education. Adult volunteers in the 4-H program have on-demand access to online training resources and regular individualized support from local Extension Program Coordinators to prepare them for their pivotal roles in leading clubs and programs.</p> <p>Efforts devoted to support the Illinois Extension volunteer workforce through volunteer recruitment, training, support, and management across the established Master Gardener, Master Naturalist, and 4-H Adult volunteer programs resulted in 8,300 trained volunteers, who devoted more than 888,000 hours of service on behalf of Extension, which <i>translates into an economic value of \$23.8 million of service delivery to Illinois residents</i>. The total number of volunteer FTEs donated in 2019 is nearly double the number of total paid professional FTEs across Illinois Extension. These volunteer contributions benefit youth and communities in every county throughout Illinois. For example, 4-H club volunteers supported positive youth development experiences for over 27,000 4-H club members. Master</p>	<p>Community Resource Planning and Development</p>

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		<p>Gardeners provided over 3,700 hours of helpline services to their communities and supported 274 community gardens that served as an outdoor classroom for education, demonstration, environmental stewardship, and food donation. Master Naturalists served 72 counties across the state, leading citizen scientist efforts, conducting environmental education, and promoting natural resource stewardship with both adult and youth populations. This competent and committed cadre of Extension volunteers are able to magnify efforts and outcomes in countless ways.</p>	
<p>7.</p>	<p>The Development of Strategies to Reduce the Risk of Microbial Contamination in Microgreens</p>	<p>Microgreens are high-profit-margin produce that are gaining in popularity. However, the microbial food safety aspects of this new produce type are not well understood. It is urgent to develop strategies to reduce the risk of microbial contamination in microgreens. To enhance the microbial safety of microgreens, we developed an ultrasound and warm water combined (USww) treatment for seeds to inactivate microorganisms. Members of the target audience included the fresh produce industry, produce growers, and the public.</p> <p>Kale seeds were inoculated with around 6 log CFU/g of nonpathogenic E. coli O157: H7 87-23. The inoculated seeds were treated for twenty minutes using tap water and 20,000 ppm Ca(OCl)₂ solution (at room temperature), or 55 degrees C water with ultrasound at 25% power for five or ten minutes, and rinsed with distilled water for another twenty minutes. The treated seeds were sprouted on filter paper without soil for 24 hours in the dark at room temperature, and for another 72 hours in light, then stored at room temperature for 96 hours. The germination rate and yield were recorded at the end of the sprouting. The E. coli survival count was enumerated after pre-washing, sprouting, and storage on TSA plates.²⁰</p> <p>The treatments with 20,000 ppm Ca(OCl)₂, and the five and ten minute US-ww significantly reduced the E. coli counts in the seeds, by 1.6, 2.1, and 3.1 log CFU/g, respectively. The ten minute US-ww treatment had a significantly higher E. coli cell reduction than the five minute US-ww or 20,000 ppm Ca(OCl)₂ (p < 0.01). Only the ten minute US-ww treated seeds maintained a lowered E. coli cell concentration after 96 hours sprouting, but the cell amount increased significantly, to 3.8 log CFU/g during storage. The germination rates for all</p>	<p>Food Safety and Food Security</p>

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		<p>samples were above the federal standard. The new US-ww treatment may be used as an effective and environment-friendly seed sanitation method for enhancing the microbial food safety of microgreens.</p>	
<p>8.</p>	<p>Promoting Food Access From Garden to Fork</p>	<p>According to Feeding America, as of 2017 nearly 1.4 million Illinois residents are food insecure (10.9%), which means they do not have regular access to nutritious food. The rate of food insecurity in Illinois is even higher among children (15.7%). Children experiencing food insecurity are more likely to have trouble concentrating, suffer from headaches and infections, be hospitalized, and are less likely to perform well on athletic fields and in classrooms. In Illinois, total excess health care cost associated with adult food insecurity is estimated at over \$1.9 billion according to data published by Feeding America Research.</p> <p>Illinois 4-H combats hunger with the 4-H Feeding & Growing Our Communities initiative through holding meal-packaging events (assembling raw ingredients into casserole meals which are provided to food pantries), filling weekend backpacks for children and seniors, assisting in Mobile Food Markets which deliver fresh produce to food deserts, and planting community gardens that generate produce donated to families.</p> <p>In 2019, the Illinois SNAP-Ed program partnered with 2,019 sites to provide nutrition education and support food pantry managers in making pantry-level changes to promote health. Partnerships with agencies in every Illinois county included a total of 295 food pantries and emergency food partners. Through outreach and consultation provided by the Illinois SNAP-Ed program, 65% of food pantries and emergency food partners have implemented 843 food access and health promotion strategies to positively impact food insecure individuals and families they serve by meaningfully addressing food insecurity through direct service and changed environments. Through the Growing Together program, Illinois SNAP-Ed has partnered with Master Gardeners to create an explicit link in the local food supply system from garden to fork. In 2019, this partnership resulted in 4,022 pounds of produce donated to 14 pantries reaching 21,241 individuals.</p>	<p>Food Safety and Food Security</p>

		<p>In the spirit of getting the food to the people who need it, where they need it, over 10,000 4-H volunteers have devoted more than 43,000 hours to distribute over 1 million healthy packaged meals benefitting more than 7,500 families since 2014. In addition, Master Gardner volunteers enabled 284 Extension-supported community gardens to donate more than 80,000 pounds of produce with an estimated value of \$116,000 annually.</p> <p>Through these combined efforts, Extension has the potential to contribute to a reduction in the negative consequences and excess health care costs associated with food insecurity in Illinois.</p>	
<p>9.</p>	<p>Maximizing Food Safety Systems in Illinois</p>	<p>A 2015 study estimated that foodborne illness represents an annual burden to society of approximately \$36 billion, with an average cost burden of <u>\$3,630 per illness</u>. In a 2013 study where a single cause was identified for restaurant-associated foodborne disease outbreaks, 34% of outbreaks were associated with practices within the establishment and 22% were associated with contamination introduced before reaching the restaurant. Illinois regulations require food establishments to have at least one Certified Food Protection Manager (CFPM) on staff. Federal regulations outlined in the Food Safety Modernization Act articulate standards of practice and training requirements for producers to improve both animal and human food safety and prevent food-borne illness at the supply source.</p> <p>Extension fills a vital role as a provider of the Produce Safety Alliances Grower Training Course to help mitigate foodborne illness at the source of production. The Grower Training Course is designed to provide fundamental, science-based, on-farm food safety knowledge to fresh fruit and vegetable farmers, packers, regulatory personnel, and others interested in the safety of fresh produce. In 2019, Extension educators on the local foods/small farms team trained 105 participants on the requirements of the FSMA. To avert foodborne illness where food is prepared and served, Extension educators on the nutrition and wellness team conducted 26 Certified Food Protection Manager (CFPM) training programs with 331 participants. The eight-hour course is designed to prepare food managers with the knowledge needed to pass the state-mandated certification.</p> <p>In 2019, 105 participants completed the Produce Safety Alliances Grower Training Course, demonstrating competence in knowledge of food safety best practices</p>	<p>Food Safety and Food Security</p>

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		<p>that adhere to the FSMA regulations. Their competency in food safety techniques will contribute to a safer food supply, emerging from their fruit and vegetable farms that serve the public. On the service side of food safety, 95% of Certified Food Protection Manager (CFPM) participants successfully passed National Registry of Food Safety Professionals certification exam in 2019, with an average passing score of 87 out of 100. Based on Bureau of Labor Statistics 2019 data for Illinois, food service managers have an average annual pay in Illinois of \$49,690 per year. Extrapolating this average pay to 290 CFPM training participants who passed the exam following CFPM training, Extension is helping to support Illinoisans earning over \$14 million in combined annual pay supplying the training that enabled food managers to meet this job-essential certification requirement.</p> <p>The impact of Extension’s food safety training programs reaches far beyond the individuals who demonstrate knowledge of food safety given the many thousands of individuals who will benefit from a safer food supply from farm to service settings.</p>	
<p>10.</p>	<p>Promoting Positive Parenting and Child Care Provider Behavior Around Healthy Nutrition</p>	<p>Parent-child relationships and child care-relationships can play a pivotal role in the health and wellbeing of young children. Specifically, these adults serve as role models and guide behaviors surrounding good nutrition and physical activity. Poor diet and physical activity at an early age can increase risk for health problems later in life. This workgroup reviewed the literature and identified successful programs that promote positive parenting and child care provider behavior around healthy nutrition and physical activity during childhood. The results of this workgroup will be distributed nationwide across Extension communities to provide accessible programming for parents and child care providers to promote positive nutrition and physical activity habits from an early age. Members of the target audience include scientists and Extension educators in the fields of human development and family studies, human nutrition, and physical activity.</p> <p>The work we have published thus far has indicated that how families respond to strong emotions during mealtimes and the level of distractions during mealtimes is associated with food consumption and risk for obesity. For example, when mothers respond to their child's negative emotions with controlling and non-</p>	<p>Human Health and Human Development</p>

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		<p>responsive feeding practices then their children are more likely to consume less vegetables and eat more energy dense foods. Further, when there are more distractions during meals (such as television on, cell phones at the table, use of media during meals) then parents tend to use more controlling feeding practices and children in turn consume less healthy foods.</p> <p>We have also found that when families involve their children in mealtime planning (grocery shopping, meal planning, food preparation) as young as three years of age then these behaviors predict fruit and vegetable consumption one year later. These findings were shared with multistate collaborators and are used to inform the multistate meta-analysis of a larger literature base.</p>	
<p>11.</p>	<p>Adults Demonstrate High Rates of Behavior Change to Reduce Risks of Chronic Disease</p>	<p>Illinois has the 27th highest adult obesity rate in the nation, and the 17th highest obesity rate for youth ages 10 to 17. As of 2017, Illinois's adult obesity rate was 31.1%, up from 20.4% in 2000 and 12.1% in 1990. Parents, guardians and adult family members can play a key role in promoting healthy nutrition choices. Research has demonstrated that healthy food selection, preparation, and consumption can contribute to a lower prevalence of chronic diseases that disproportionately affect limited-resource populations. According to a national cost-benefit study of the Expanded Food & Nutrition Education Program conducted in 2008, for every \$1 spent on EFNEP, there is a potential long-term healthcare cost reduction of between \$3.63 and \$10.75 as a result of reduction in chronic disease.</p> <p>The Expanded Food & Nutrition Education Program (EFNEP) is designed to assist limited-resource audiences in gaining knowledge and skills needed to eat a nutritious diet and to live a healthy lifestyle. Programs are research based, hands on, and taught by trained peer educators. EFNEP is located in six counties in Illinois - Cook, Peoria, Champaign, Vermilion, Madison, and St. Clair. In 2019, EFNEP made over 80,000 educational contacts through 574 programs implemented with 3,289 adults and 4,972 youth. Overall, 11,888 family members were reached with skill building opportunities to improve their nutrition and physical activity behavioral practices.</p>	<p>Human Health and Human Development</p>

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		<p>In 2019, EFNEP in Illinois has reported high levels of impact with limited resource families. Self-report data based on entry and exit measures of behavior documented that 91% of adult participants (n=3,059) improved their nutrition practices as a result of their participation in EFNEP educational programs. This impact is particularly powerful in that nearly half (43%) of program participants identified as minority and over one-fourth (26%) identify as Hispanic or Latino, reaching the underserved audiences in Illinois counties at highest risk for food insecurity with ways to maximize their choices. Impact highlights in 2019 include:</p> <ul style="list-style-type: none"> --91% of adults improved nutrition behaviors --70% of adults improved physical activity behaviors --74% of adults improved food safety behaviors --76% of adults improved food budgeting behaviors <p>Because adults have a significant influence over the food options available to their families, the potential impact for healthier choices could be estimated to 91% of 11,888 family members (n=10,818) served by Illinois EFNEP in 2019. Given the high rates of behavior change evidenced, the long-term societal benefits could be significant.</p>	
<p>12.</p>	<p>Illinois Nutrition Programs Motivate Youth to Make Healthy Choices</p>	<p>As of 2017, the obesity rate among 10-17 year olds in Illinois is 16.2%, which ranks 17th highest among 51 states reporting. This rate is affected by health behaviors associated with obesity. According to the 2018 Illinois Youth Survey, one out of every ten 8th-12th graders reported they did not eat <u>any vegetables in the prior week</u>. In addition, more than one out of every four 12th graders reported that they were <u>not physically active on the majority of days</u> during the prior week. Because at least 80% of premature heart disease, stroke and type 2 diabetes diagnoses could be prevented through healthy lifestyle choices, it is imperative for young people to develop positive dietary choices early in life.</p> <p>Extension offers programs to build the capacity of youth to engage in healthy nutrition behaviors and to learn the benefits of healthy choices. The 4-H Food Challenge encourages youth to experiment by creating meals that are healthy and inexpensive, while using mystery ingredients and all without a recipe! 4-H Health Jam brings health careers alive with elementary-aged youth in a nine-</p>	

		<p>week program that introduces youth to a variety of health profession careers, engages young people in creative exercise, and teaches them how to keep their bodies healthy. In 2019, over 1,500 Illinois youth experienced one of these signature 4-H programs designed to make healthy choices fun. Targeting limited resource audiences with evidence-based curricula over the course of multiple program sessions, over 4,900 youth were served in Illinois Extension’s Expanded Food and Nutrition Education Program (EFNEP).</p> <p>Program evaluations were conducted with a subset of participants (n=1183) in the 4-H Food Challenge and 4-H Health Jam programs. Overall, 87% said that they learned about healthy food choices through their 4-H experience. In addition to knowledge of healthy food choices overall, 83% said they intend to <i>eat more fruits</i>, 83% intend to <i>drink more water</i>, 70% intend to <i>exercise more</i>, and 68% intend to <i>eat more vegetables</i>. While intentions do not automatically translate to changes in behavior, the majority seemed to have a firm focus on behaviors they felt a need to change.</p> <p>Among youth who participated in programs offered through Illinois EFNEP in 2019:</p> <ul style="list-style-type: none"> --82% of youth improved knowledge and ability to choose healthier foods --56% of youth improved food safety knowledge or behaviors --52% of youth improved physical activity knowledge or behaviors --57% of youth improved knowledge or ability to prepare simple, nutritious, affordable foods <p>Through Illinois Extension’s nutrition programs, thousands of youth across the state are motivated to make healthy choices that can help avert childhood obesity and promote healthy lifestyles.</p>	
<p>13.</p>	<p>Mitigating the Ecological Effects of Climate Change, Land Use Practices, and Invasive Species on Fish Communities and Aquatic Ecosystems</p>	<p>Fish are a critical component of aquatic ecosystems, and serve a number of important roles for both humans as well as for aquatic environments. Owing to a number of threats such as climate change, land use changes through agriculture, stakeholder use patterns, and invasive species, many freshwater fish populations have experienced declines, resulting in potential negative consequences for both aquatic ecosystems and human users. More importantly, many of the impacts of climate change on fish and aquatic ecosystems operate indirectly through land</p>	<p>Natural Resources and the Environment</p>

		<p>use factors such as soil conservation and agricultural process, leading to important linkages between climate, agricultural land use, and fisheries. Thus, there is a strong connection between climate change, land use practices such as agriculture, the quality and integrity of aquatic ecosystems, and the ecosystem services provided to humans through fisheries. Results from this project are potentially of interest to a wide range of individuals that include conservation practitioners, aquatic biologists, fisheries managers, and individuals involved in aquatic restoration/rehabilitation.</p> <p>We seek to define the impacts of climate-related stressors, stressors related to agricultural land use, stakeholder use patterns, and invasive species on individual fish, as well as fish populations. In addition, the interaction of these challenges can be quantified, as many of these challenges do not occur in isolation. To accomplish this goal, a series of laboratory- and mesocosm-scale studies were performed. These studies typically involve simulating challenging conditions and then quantifying both individual- and population-level responses that range from gene expression patterns to swimming performance to indices related to reproduction. This project is generating tools, datasets, and guidelines for use by managers to detect, predict, and mitigate the individual and interactive ecological effects of climate change, land use practices, stakeholder use, and invasive species on fish communities and aquatic ecosystems.</p> <p>When taken together, results from this study have generated a number of new, fundamental findings related to how environmental stressors impact the behavior of fishes, and how those changes in behavior can translate to interactions with fisheries resources by anglers that can aid in management activities. For example, data have shown that an absence of food will result in increased capture rate for largemouth bass, presumably because fish are more willing to ingest lures. Interestingly, a lack of food does not influence “curiosity” of largemouth bass, and so the mechanism is likely that fish simply strike/ingest lures more readily when they are hungry. In addition, there was no behavioral aspect of fish (bold/shy, active/passive) in influencing capture, despite the various environmental scenarios tested, indicating that anglers likely will not select for specific behavioral types through harvest. These findings not only can inform managers on how to manage fish in an altered (agricultural) landscape, but</p>	
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		<p>also highlights the fact that fish in these landscapes are resilient to selection for specific behavioral characteristics, ensuring their long-term sustainability.</p>	
<p>14.</p>	<p>Development of Better Water-Saving Strategies</p>	<p>Recent studies on the impact of climate change anticipate a significant decrease in both the availability and quality of water resources in the next half-century, which will directly impact domestic and international food supply chain linkages. In the U.S., agricultural production requires less irrigated water than in the past but it is still responsible for more than a third of total water withdrawals. The target audience for this project is first the academic community, and second people who work in the agribusiness industry (ranchers, farmers, distributors) as well as policy makers and the public at large. Indeed, the results of our virtual water flows calculation concern the final consumers as well.</p> <p>To better understand the evolution of water use in this sector, we performed a structural decomposition analysis over the 1995-2010 period using the Exiobase 3 database. More precisely, we emphasize: 1. The evolution of water withdrawals for eight different crops and six livestock categories; 2. The difference in results based on the U.S. Geological Survey's water consumption data vs. Hoekstra's water footprint data; and 3. The trends in the pre-crisis (1995-2005) and post-crisis (2005-2010) periods. Our results show that the pre-crisis period experienced an overall decline in water withdrawals in the production of all crops except oil seeds (which includes soybeans). For such crops, the increase in water use comes primarily from a greater water intensity and changes in international inter-industrial trade patterns. This increase persisted in the post-2005 period but was driven primarily by direct exports to industries and changes in the average global expenditure structure.</p> <p>We also found that changes in the production structure of the U.S. food manufacturing sector contributed to an increase in water use in agriculture pre-2005 but to a decrease post-2005. Livestock has also shown a decline in water use during the entire period, mainly driven by domestic final demand and a change in the mix of livestock. Overall, these results will help develop future</p>	<p>Natural Resources and the Environment</p>

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		<p>water-saving strategies in the U.S. as the country, like its trade partners, will meet increasing challenges to secure food availability in the face of climate change.</p>	
<p>15.</p>	<p>Youth Learn the Importance of Protecting Pollinators</p>	<p>According to the Pollinator Partnership: “pollinators provide pollination services to over 180,000 different plant species and more than 1,200 crops. That means that one out of every three bites of food we eat is there because of pollinators. Pollinators add \$217 billion to the global economy and honey bees alone are responsible for between \$1.2 and \$5.4 billion in agricultural productivity in the United States. In addition to the food that we eat, pollinators support healthy ecosystems that clean the air, stabilize soils, protect from severe weather, and support other wildlife”. Environmental stewardship is essential for protecting and enhancing pollinator habitats. In addition to the clear benefits to the environment, Fisher et al (2015) have argued that environmental stewardship is also linked to civic engagement. Introducing environmental stewardship at an early age can help set the foundation for the future pollinator protectors of the world.</p> <p>In 2019, Illinois 4-H nurtured youth engagement in environmental stewardship through more than 105,000 4-H projects and educational programs serving more than 23,000 youth. Three popular 4-H curricula focused on increased awareness of the importance of pollinators among elementary age youth: I Think Green: Butterfly Track, Monarchs on the Move, and Honeybee Challenge. These programs help youth investigate, using hands-on methods, how pollinators interact with their environment and how to protect their habitats. Collectively, these programs reached 6,400 youth across Illinois in 2019.</p> <p>While program evaluation tools vary across the three curricula, there are some common outcomes assessed across these programs. At the conclusion of their participation in one of the three programs, 95% of youth agreed that they understand why protecting natural resources, like pollinators, is important. Additionally, the majority (71%) indicated they would like to work on projects that better their community (including those that focus on environmental stewardship). The programs fostered more than awareness in pollinator protection. About 75% also agreed that “<i>it was important to work in a group to accomplish the tasks</i>”. Cooperation is an important ingredient for working</p>	

		<p>together to address challenges and make a difference. Through building appreciation for collaboration and stewardship, youth are better prepared to make a difference in their world.</p>	
<p>16.</p>	<p>Value-Added Extension Outreach Impacts Illinois Crop Producers and Agri-Business Professionals</p>	<p>Illinois is a major production state for major commercial row crops. The production of corn and soybeans is particularly extensive. In 2018 corn was planted on 11 million acres of Illinois agricultural land and producing output with a market value of over \$8.2 billion. Soybeans were planted on a similar acreage (10.8 million acres), producing a direct economic output of \$6.25 billion. Additional row crops grown in Illinois in 2018 included wheat, sweet corn, oats, and sorghum. There is also a significant crop of hay grown in the state in support of the livestock industry. Illinois crop producers and advisers seek ways to improve the efficiency and sustainability associated with production enterprises. Extension must be ready to provide production recommendations and help producers solve challenges across many major crop types.</p> <p>The annual Crop Management Conferences held at four Illinois locations provided information to support field crop producers and related agri-business professionals in making research-based decisions for the crops they produce or advise on. Specific topics among the four 2019 conference locations addressed weed, pathogen, and pest management as well as nitrogen management and factors affecting tile nitrate loads. A total of 224 conference participants represented those primarily employed in agri-business (69%), as certified crop advisers (61%), and as crop producers (36%).</p> <p>The vast majority (93%) of the 88 Crop Management Conference evaluation respondents reported that attending the conference increased their knowledge of one or more crop management practices addressed at the conference. Increased knowledge of “identifying Dectes stem borer damage” was noted in 79% of respondents and increased knowledge of “factors affecting tile nitrate loads” was reported by 58% of respondents. A clear majority (78%) indicated that in the coming year they intend to implement a new crop management technique or practice as a result of what they learned. Evaluation respondents who identified as farmers (and reported the number of acres they farm) estimated an economic value of conference information and techniques at over \$82,900 to their operations. If that estimate is extrapolated to all farmers who participated</p>	<p>Plant Health, Systems and Production</p>

		<p>in the conference, the estimated value to individual producers would be nearly \$230,000. Even this estimate is based on just a subset of conference participants. In fact, 55% of participants who identified as crop advisors (with the potential to influence far more acreage given the multiple farmers with whom they consult), estimated the conference information would be valued at \$5 to \$20 per acre they advise on. Among those who attended the conference in a prior year, 88% reporting making a change in one or more management practices as a result of attending the conference. Given reported changes in management practices and the estimated value of the conference by participants, the Crop Management Conference has the potential for significant impact on crop production in Illinois.</p> <p>Another example of crop production decision-support outreach was offered through the 2019 Soil Fertility Webinar. To increase access, the webinar is broadcast digitally while some Extension offices throughout the state host locations for participants to view the webinars in small group settings. In 2019, 85 participants attended the webinar either online or via hosted locations. Their roles included agri-business (32%), crop producers (17%), Certified Crop Advisors (38%), and other stakeholders in agriculture (13%) such as educators and agency representatives. The central focus in 2019 was on organic nutrient management techniques, including cover crops, tillage, and crop rotation. In addition, presenters shared an overview of the Illinois farmer-led S.T.A.R. program designed to award farmers for the adoption of farming practices that promote conservation of natural resources.</p> <p>The majority of participants of the Soil Fertility Webinar reported increased knowledge of the S.T.A.R program (92%), organic nutrient management strategies (73%), and the impact of crop rotation and tillage on greenhouse gas emissions and crop production (70%). Participants reported the highest level of interest in the webinar segment on cover crops and soil N availability in corn and soybean systems. Application of the knowledge gained has the potential to influence over 191,000 acres of farmland that participants reported they plant or consult upon.</p>	
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<p>17.</p>	<p>Developing Strategies to Overcome Limitations to Photosynthetic Productivity</p>	<p>Row-crop farmers need to make many decisions annually to efficiently maximize photosynthetic productivity. While producers can't control the weather, soil type, or crop prices, they do make decisions about what variety they plant, at what density, and application levels of multiple inputs, such as fertilization, insecticides, and fungicides. Farmers choosing to have a more conservative approach with less extra inputs but stable yields, or for times of nutrient loss would prefer a "defensive" (soy) or "workhorse" (corn) variety. On the other hand, those selecting a more input-intensive approach to promote an even greater photosynthetic yield would need a variety that is adaptable and can use those extra inputs, called an "offensive" (soybean) or "racehorse" (corn) variety. To support their decisions, a better understanding and classification of plant varieties according to their responses in such situations is warranted. Members of the target audience for this work include agricultural scientists, corn and soybean farmers, and the agricultural industry.</p> <p>The focus of this research is on the determination of photosynthetic productivity of different commercial corn and soybean varieties on a whole-plant basis in response to differing levels of management inputs. Multiple genotypes of both corn and soybean were grown in several environments with various populations, nutritional availabilities, and plant health additives to allow characterization into "offensive-racehorse" or "defensive-workhorse" classifications depending upon their efficiency of capturing sunlight, interacting with agronomic management, and powering yield. The information gained on the crop responses to these management factors will enable breeders and farmers to select the right variety for the planned management situation.</p> <p>147 commercial hybrids were grown at three sites (Yorkville, Champaign, and Harrisburg) in Illinois under three N rates (0, 60, and 280 lbs N/acre), three plant densities (32,000, 38,000 and 44,000 plants/acre), and two row arrangements (20 and 30 inches). Hybrids exhibited wide ranges in their yield responses to the different agronomic parameters tested. Narrower row spacing (20") tended to be a better arrangement of 44,000 plants/acre, and was conducive to the highest yields in the trial. Similar yield responses to narrow row spacing were observed at all locations. Understanding the agronomic factors that most influence grain yield for different corn genotypes will allow growers to most efficiently produce the greatest yields.</p>	<p>Plant Health, Systems and Production</p>
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<p>18.</p>	<p>Identifying New and Important Genes and Proteins That Confer Safener-Induced Tolerance in Grain Sorghum</p>	<p>Herbicide safeners are non-phytotoxic compounds that confer protection to cereal crops by inducing detoxification and defense systems, including massive increases in the expression and activity of glutathione S-transferases (GSTs) and cytochrome P450 enzymes, although the precise mechanisms for crop protection via induction of defense gene expression remain largely unknown. Safeners are frequently used with herbicides that normally cause injury in unsafened cultivated grain sorghum (<i>Sorghum bicolor</i> L. Moench), and are typically applied as seed treatments to avoid safening weedy sorghum relatives such as Johnsongrass (<i>Sorghum halepense</i>). The overall goal of our project is to reveal and identify new and important genes and proteins that confer safener-induced tolerance in grain sorghum using a diverse array of methods, as described below. Members of the target audience include growers, students, and scientists in the seed, agrochemical, and crop protection industries, as well as academics throughout Illinois and the Midwestern U.S.</p> <p>A genome-wide association study (GWAS) evaluated 800 diverse sorghum lines for phenotypic differences in natural and safener-induced herbicide tolerance, and the expression of two candidate SbGST genes identified via GWAS was investigated further via gene-specific RT-pPCR. Transcript profiling (via RNAseq) studies identified numerous safener-induced GSTs, P450s, glucosyl transferases, and vacuolar transporters that are likely involved with cellular herbicide detoxification pathways, but interestingly several new and novel defense-signaling related genes were also induced such as 12-oxo-phytodienoic acid reductases (SbOPRs) and genes related to synthesis and catabolism of the sorghum chemical defense compound dhurrin. The possible connection between safener-regulated detoxification responses and dhurrin synthesis/catabolism in sorghum seedlings is a new and intriguing link that warrants further investigation, and metabolite profiling experiments are underway to comprehensively understand how safeners coordinately regulate and reprogram the transcriptome and metabolome towards enhanced chemical-defense mechanisms in addition to identifying specific SbGSTs potentially involved in the safener-mediated detoxification pathway.</p>	<p>Plant Health, Systems and Production</p>

		<p>Identifying effective herbicide x safener combinations is an ongoing challenge that limits grain sorghum production in the U.S., but understanding the biochemical and molecular basis of safener-induced detoxification responses via this research will facilitate the discovery of new crop protection chemicals for enhancing herbicide tolerance in cereal crops, as well as assist in developing rapid and high-throughput marker-based screening assays to identify sorghum lines with an increased safener response or abiotic stress tolerance. In the long term, these results with grain sorghum can also be used to identify homologous genes and proteins to improve plant abiotic stress tolerance in other important high-value cereal crops such as wheat, maize, barley and rice.</p>	
<p>19.</p>	<p>Factors Impacting Farmer Adoption of Alternative Energy Crops</p>	<p>The purpose of this study is twofold. First, we examine the impact of loss aversion on the extent to which farmers will allocate land to two alternative energy crops (miscanthus and switchgrass in this study) under alternative biomass prices, discount rate, and credit constraint scenarios. Second, we examine the effectiveness of two policy instruments, namely an establishment cost subsidy and subsidized energy crop insurance, which reduce the likelihood of losses from adopting energy crops through different mechanisms. An establishment cost subsidy reduces the upfront costs of establishing an energy crop and potential losses due to establishment failure. Subsidized crop insurance, however, reduces losses in post-establishment years due to inter-annual variability in yields and consequently in annual incomes. We choose these two instruments because (a) an establishment cost subsidy is currently provided by the Biomass Crop Assistance Program that was established in the 2008 Farm Bill and reauthorized in the 2014 and 2018 Farm Bills; and (b) subsidized crop insurance is commonly provided for conventional crops and has been proposed for energy crops to offset the disincentives for switching from conventional crops.</p> <p>Our results show that ignoring farmer's loss aversion tends to overestimate miscanthus production and underestimate switchgrass production. We also find that bioenergy crop production on marginal land is relatively less sensitive to farmers' loss preferences. Therefore, the results lend support to possible policy interventions that encourage biomass production on marginal land, for example, interventions allowing biomass harvesting on land in the Conservation Reserve Program (CRP) without imposing a program payment reduction. We also find</p>	<p>Sustainable Energy</p>

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		<p>that biomass production from bioenergy crops is more sensitive to farmers' loss aversion when farmers are credit constrained than when they are not, indicating that the availability of credit to farmers may mitigate the effect of loss aversion for bioenergy crop production. Results also show that the impact of loss aversion under high discount rate is larger than that under low discount rate. Moreover, the geographical configurations of miscanthus and switchgrass adoption are significantly affected by farmers' loss aversion preferences, credit constraint status, and discount rates. Policy simulations show that an establishment cost subsidy favors miscanthus production whereas a subsidized energy crop insurance program favors switchgrass production. The efficacy of these two policy instruments (measured by biomass increased by per dollar of government outlay via a policy) depends on farmers' loss aversion parameters and discount rates.</p>	
<p>20.</p>	<p>4-H Leadership Development Builds Confidence and Motivation to Positively Impact the Lives of Others</p>	<p>Longitudinal research shows the youth involved in 4-H are more than four times as likely to contribute to their communities as other youth and about two times as likely to be civically active. Crooks et al. (2010) concluded that youth community engagement is connected to a wide range of positive outcomes such as higher academic performance, lower rates of pregnancy, and lower rates of marijuana use. Nurturing adolescent leadership skills reaps immediate and long term benefits for the adolescent and the communities they serve.</p> <p>Leadership skills are nurtured through many 4-H projects and programs; sometimes through learning new skills when carrying out a project and sometimes through more formalized leadership development opportunities. In 2019 over 49,000 4-H projects focused on communication, leadership, and creative expression. One statewide leadership opportunity is to become a trained Teen Teacher. The Teen Teacher training was offered to high-school age youth to develop leadership and other life skills by facilitating 4-H youth programs in a variety of content areas. The model provides the Teen Teachers a way to build skills important for leadership while providing their younger peers a role model who can be a powerful positive social influence.</p> <p>A subset of Teen Teachers (n=41) completed an evaluation in 2019 to better understand how the experience of being a Teen Teacher impacted them. All</p>	<p>4-H Youth Development</p>

		<p>respondents <i>agreed</i> or <i>strongly agreed</i> that they <i>feel motivated to influence and impact others</i> because of their experience as a 4-H Teen Teacher. When asked how they will apply what they have learned or gained from their experience in this role, many referenced a specific skill like public speaking but the majority referenced how they would use the skills they developed to support a career goal as evidenced in comments such as: <i>“I can communicate effectively and am confident with my speaking and reasoning which will be beneficial in any career.”</i></p> <p>A statewide leadership effort offered to middle grade level youth is helping to develop a foundation for current and future leadership opportunities. The Illinois State 4-H Youth Leadership Team plans and leads the annual Illinois 4-H Junior Leadership Conference for 7th and 8th grade 4-H members, attended by 100 youth in 2019. All activities and workshops are developed by the 4-H Youth Leadership Team teens in partnership with adult volunteers. This overnight conference offers a chance to explore new 4-H project areas, learn activities and games they can take home to their 4-H clubs, learn and practice new leadership skills, and interact with other 4-H members from around the state. Participants leave with a better understanding of the opportunities available in the Illinois 4-H program and learn how to make a difference in their own communities.</p> <p>Nearly all (n=97) Illinois 4-H Junior Leadership Conference participants completed the conference evaluation survey in 2019. Collectively, they represented about one-third of the counties in Illinois. The majority (82%) reported that they <i>feel motivated to influence and impact others</i> and 78% indicated they feel confident in their <i>ability to influence others</i> as a result of their experience. When asked to share how the conference impacted them and their view of their future, examples of comments include:</p> <p><i>“The Junior Leadership Conference helped teach me more about problem solving, teamwork, and adaptability skills. I now feel confident to be a leader in school and my everyday life.”</i></p> <p><i>“I feel that the Jr. Leadership Conference has helped me with my teamwork and delegation skills. I will definitely bring everything I learned back to my 4-H club and community.”</i></p>	
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		<p><i>“This conference makes 4-H more than just state fair projects and group meetings, it is a way of teaching, learning, and leading.”</i></p> <p>Because of these structured and targeted 4-H leadership opportunities, youth are motivated to influence others and are comfortable working in partnership with other teens and adults to complete important tasks. Through application of what they learned, these youth leaders have the potential to influence hundreds of 4-H youth across 37 counties in Illinois.</p>	
<p>21.</p>	<p>4-H Programs Enhance STEM Skills and So Much More</p>	<p>According to the Department of Labor's Bureau of Labor Statistics, STEM fields have the greatest potential for job growth in the 21st century. However, a 2018 Pew Foundation report observed both a gender and racial gap in the STEM workforce where <i>“Women account for the majority of healthcare practitioners and technicians but are underrepresented in several other STEM occupational clusters, particularly in computer jobs and engineering. Black and Hispanic workers continue to be underrepresented in the STEM workforce”</i>. STEM education has been a cornerstone of the Illinois 4-H program for many years. In addition to a focus on mastery of STEM skills, these programs provide opportunities to develop complementary life and social skills through integration of team building and other “soft skills” development. Engaging youth early in scientific discovery is an important way to nurture skills and interests in preparation for making career choices. In 2019, over 51,000 4-H projects focused on STEM, such as robotics, computers, small engines, and welding. Across the state, 299 STEM educational programs were attended by 12,983 participants.</p> <p>The 4-H Incubation and Embryology project has been implemented in elementary school classrooms for over two decades using hands-on science concepts in caring for and observing the growth process of chicken embryos from the inception of the eggs through hatching of chicks. Curriculum development and training was provided to teachers by the Extension poultry faculty member and local educators. Teachers were trained to conduct classroom incubation and embryonic development projects with methods for how to use classroom incubation and embryonic development projects to enhance programs in science, language arts, mathematics, social studies, and art.</p>	<p>4-H Youth Development</p>

		<p>In 2019, 205 Extension-trained teachers implemented the curriculum with 12,653 students, delivering more than 2,900 hours of STEM education. Evaluations were completed by the teachers who implemented the program across 17 counties in 2019. Collectively, respondents reported reaching a student population of over 5,492 students with the program. The majority (78%) were teachers of Kindergarten through 4th grade. Teacher were asked to rate their students' competencies in a specific set of science skills and life skills targeted by the program, comparing pre-program competencies with post-program competencies. For <u>every science skill</u> rated and for <u>every life skill</u> rated, a higher proportion of teachers reported that their students demonstrated the competency after the program compared with competency ratings prior to the program. When asked why they would use the curriculum again, responses included references to science education impacts such as <i>"Students are engaged and excited to see that science is really important in the real world."</i> Other comments focused on the life skills social competencies also supported by the program with comments such as, <i>"students learned more about responsibility and became more nurturing"</i> and <i>"It teaches many skills such as caring for another, cooperation, predicting"</i>.</p> <p>The Illinois State 4-H Robotics Competition provided an opportunity for 303 youth to showcase their robotics skills. The competition participants ranged from 3rd to 11th grade in 2019. With guidelines announced in January, 4-H clubs had four months to solve each robotics challenge. The goal was to design and build a robot that can complete most tasks from the challenge list and subsequently demonstrate the robot during the state competition event. The majority (63%) of participants reported they would like to study science after high school and (64%) said they would like a job that uses science. With an 11% increase in female registration, a 9% increase in African American registration, and a 9% increase in Hispanic/Latino registration (compared to the 2018 competition), this opportunity has increasingly attracted the populations who can help bridge the STEM workforce gender and racial gap over time.</p> <p>A popular STEM program, DIY Build and Code, reached 2,357 youth in 2019 through 40 educational programs offered throughout the state. Youth ranging from 3rd through 11th grade use a programmable device called a Makey Makey®. Makey Makey kits provide an opportunity for youth to learn about electricity and</p>	
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		<p>computer programming while being innovative and imaginative. Using the Makey Makey® with MIT Scratch allows youth to join the Maker movement and create almost anything, using almost anything, including bananas, cardboard, and aluminum foil. Participants from eight counties completed an evaluation of their experience (n=107). A higher proportion of respondents were female (46%) than male (40%). Most (82%) shared that they have a <i>better understanding of computer science</i> and 74% said they <i>would be interested to learn more</i>. This experience was particularly important to attendees as 64% reported that they do <u>not</u> have in-school or extra-curricular opportunities to learn about computer science where they live. Given the reaction to this STEM focused skill building experience, the DIY Build and Code program is making a difference by providing an important and meaningful building block for youth who have limited options to explore computer science in their traditional educational settings.</p>	
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