FY 2020 Annual Report of Accomplishments and Results

ILLINOIS
University of Illinois Extension
University of Illinois Agricultural Experiment Station

I. Report Overview

The NIFA reviewer will refer to the executive summary submitted in your FY 2020 Plan of Work located in the Institutional Profile. Use this space to provide updates if needed.

1. Executive Summary (Optional)

The College of Agricultural, Consumer and Environmental Sciences

The College of Agricultural, Consumer and Environmental Sciences (ACES) is committed to ensuring a vibrant future for our community of discoverers, learners, stakeholders, and beneficiaries. As a vital part of the University of Illinois, ACES produced a strategic plan last year aligned with **The Next 150** campus strategic plan (**2020-2025 ACES Strategic Plan** located at https://aces.illinois.edu/strategic-plan). In the Fall of 2020, each unit within ACES completed action plans designed, as a collective, to fulfill the goals of the college strategic plan. 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 well-being. ACES is a complex enterprise, with a total budget of over $115 million. The ACES workforce of about 1,525 people includes 188 tenure-system and 59 specialized faculty FTE and 699 Extension employees. Our student body consists of 2,778 undergraduate and 743 graduate students.

University of Illinois Extension

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. As part of its more than $60 million annual budget, Extension received over $10 million in federal Smith-Lever funds to conduct agricultural extension work in 2020. This federal investment requires one-to-one state or local matching contributions. Extension is the university's most visible, purposeful means of public education and engagement and embodies the land grant mission of the University of Illinois, providing applied research and education to address societal grand challenges and local issues. Through its extensive network of campus resources, professionals, and field operations, educators across 102 counties partner with faculty and campus staff to develop, deliver, and assess locally adapted, research-based outreach.

The University of Illinois Agricultural Experiment Station

The Illinois Agricultural Experiment Station (IAES) is a subsidiary unit of ACES managed in the Office of Research with a statutory federal mission. The IAES is a federal-state research partnership, funded by formula funds through the Hatch Act of 1887, which requires a one-to-one matching state investment. ACES received $5,697,236 in Hatch funds, $1,476,924 in Hatch Multistate funds and $274,000 in McIntire-Stennis funds in FFY 2020. Both Hatch and Hatch Multistate are intended to support agricultural research programs at the State Agricultural Experiment Stations in the 50 states, the District of Columbia and U.S. insular areas. Hatch encompasses research on all aspects of agriculture, including soil and water conservation and use; plant and animal production, protection, and health; processing, distribution, safety, marketing, and utilization of food and agricultural products; forestry, including range management and range products; multiple use of forest rangelands; urban forestry; aquaculture; family and consumer sciences; human nutrition; rural and community development; sustainable agriculture; molecular biology; and biotechnology. Hatch funding also contributes to research technology support and activities led by the Office of International Programs. Research is conducted on problems of local, state, regional, and national concern. Hatch Multistate funding is also used for cooperative research employing multidisciplinary approaches in which a state agricultural experiment station, working with another state agricultural experiment station, the Agricultural Research Service, or a college or university, cooperates to solve problems that concern more than one state. McIntire-Stennis funds are directed towards forestry research.

College of ACES Fiscal Management Strategies

Over the past few years, we have worked diligently to reduce our dependence on state funding with demonstrated success as exemplified by our improved net revenue position over the first two years of the **Integrated and Value-Centered Budgeting Model**. With several units in ACES having enrollment challenges, an assertive recruitment and marketing campaign could amplify the positive financial trajectory of the college.

Two major financial setbacks significantly impacted ACES in 2020: 1. An $8.839 million reallocation/reduction from campus over five years (FY21-FY25); and 2. COVID-19. ACES (~$4.5 million) and Extension ($1.5 million) suffered nearly $6 million in revenue losses, workshop/camp cancellations, etc. in the first six months of the pandemic. Losses were either absorbed or counterbalanced with reductions in operating costs or shifting to online delivery venues. These unanticipated financial losses disrupted our fiscal management strategy. We are now retooling to adjust to higher than anticipated budget reductions over the next four fiscal years.

In 2017, ACES began to implement adaptive budget management strategies to generate more sustainable funding platforms for research, teaching, and extension activities by improving the return on state funded investments and expanding non-state funding streams. We have invested and will continue to invest as possible in strategic curricular, marketing, and advancement activities designed to grow enrollment, expand giving, increase our endowment and enhance competitive grant acquisition, as well as engagement with non-profit organizations and industry partners. Our long-term goal is to develop a diverse array of revenue streams that collectively will provide consistent support for critical positions, operating expenses, scholarships, and infrastructure thereby reducing our reliance on state funding.

The Critical Issues

Community Involvement, Inclusion and Leadership – Research activities included efforts to better understand the influence of interpersonal relationships on the mental health outcomes of African-American adolescents who have experienced racial discrimination, research into the roles environmental exposures might play in rural cancer disparities, a study into how young children experienced the effects of the recession within their families, schools, and communities and how these experiences shaped their development and impacted educational inequality during elementary school, an examination into the health, well-being, and economic opportunities of LGBT persons in rural Illinois, research that seeks to inform the field of youth and emerging adult leadership education, and ongoing work under the **Community Participation and Genomic Integration for Health** (CPgI4H) program that provides a unique research opportunity as studies addressing gene-environment interactions in the pathogenesis of obesity or weight gain trajectories are lacking.

Overall, Extension provided 402 educational sessions, including 71 online learning opportunities, with more than 15,000 attendees to support thriving youth, community connectedness, and leadership. In addition, more than 26,000 4-H club memberships provided the benefits of positive youth development, thanks to the support of 3,400 adult club volunteers across the state. Extension educators and program coordinators provided training and support to more than 7,200 volunteers through the signature Master Gardener, Master Naturalist, Money Mentor, and 4-H programs. Collectively, volunteers devoted nearly 575,000 hours in service to their communities, valued at more than $16 million. Despite pandemic related restrictions that cancelled county fairs and the state fair during the summer of 2020, Illinois 4-H quickly pivoted and embraced a virtual format for summer exhibitions in every county, showcasing the work of 2,200 members.

Multistate Extension activities in 2020: University of Illinois Extension (UIE) collaborated with 4-H staff from around the country in the **National Association of Extension 4-H Youth Development DEI Working Group** to advance diversity, equity and inclusion in 4-H, collaborated with Extension colleagues from nine states to conduct interviews and qualitative data coding to support the **4-H Youth Thrive Model**, and worked with colleagues from Purdue Extension and the Ohio State University to develop and pilot test a model for ROSC (**Recovery Oriented Systems of Care**) that uses a complex adaptive system to solicit, organize, manage, and evaluate community responses to substance use disorder.

Economic and Workforce Development – Research activities included a project that revisits the value of USDA reports in the electronic era by identifying the efficient price return variance of corn and soybean futures prices during the hour following the report release, an examination of educational attainment and aspirations for career and geographic residency for rural students at four-year, public institutions in the state of Illinois, and a project that seeks to construct a theoretical framework to explain how, as a result of political imperatives, governments may take actions that increase commodity price volatility and to test the validity of the model empirically using a new, bespoke dataset.

The global economy suffered a tremendous hit as a result of the COVID-19 pandemic. Extension quickly responded to needs gathered from local government officials, business owners, and community organizations to provide resources and programs specific to their main concerns. With internet connectivity essential for remote work and for schools to reach learners in K-12 and beyond, Extension offered a four-part webinar series **Local Government Education: Broadband Leadership** and other online learning opportunities for grant programs available to rural communities for broadband expansion. Other timely topics covered in Local Government Education webinars addressed economic recovery and relief resources available to communities. Collectively more than

2,800 participants attended the live webinars and all were recorded for 24/7 access. Stakeholders in the agricultural economy were eager to learn how to navigate the impact of COVID-19. For more than 20 years, they have turned to **farmdoc** (https://farmdoc.illinois.edu/), a comprehensive compendium of online resources, webinars, and analysis tools that provide U.S. Corn Belt crop and livestock producers with constant access to integrated information and expertise to better manage their farm businesses. From March through September of 2020, the farmdoc team delivered 24 coronavirus and agriculture webinars reaching more than 8,000 attendees. In 2020, 45 farmdoc webinars served 14,508 attendees. To put this impressive response in perspective, the farmdoc team offered 13 webinars with a total attendance of 2,400 in 2019. Collectively, more than 2,000 educational sessions (nearly 25% online) were offered by Extension, serving 96,000 participants in 2020 to address economic vitality, promote workforce development, and support financial wellbeing.

Multistate Extension activities in 2020: UIE coordinates the **Midwestern Hemp Database Program**, a collaborative effort between multiple land-grant institutions to provide hemp production research and outreach. Hosted by four regional land grant institutions (including UIE) the **Quad State Hemp Production Webinar** was held to discuss and share novel production strategies. UIE collaborated with Illinois-Indiana Sea Grant and partners from other land-grant institutions on a multistate needs assessment and planning process to build an **Equitable and Just Green Infrastructure Strategy in the North Central Region**. An educator with UIE served as Chair Elect of the **Extension Disaster Education Network** (appointed National Chair in September 2020) and provided training and technical support to other states around disaster programs related to community development, and chaired the 2020 Annual Meeting Committee. UIE community and economic development specialists participated in the **CREATE BRIDGES** initiative, a partnership among the Southern Rural Development Center, University of Kentucky's Community and Economic Development Initiative of Kentucky (CEDIK), University of Arkansas Cooperative Extension Service's Community, Professional and Economic Development (UACES-CED), Oklahoma State University Extension, North Carolina State Extension, New Mexico State Cooperative Extension Service, and Illinois Extension. UIE served in a critical role providing Zoom technology assistance and hosting of the **National Association of Community Development Education Professionals Virtual Conference**, May 29-June 3, 2020 (the first time the national conference was held virtually). UIE collaborated with Purdue Extension and Iowa State Extension colleagues on development of a **CED Extension Library** to create a repository of shared resources for community and economic development across the North Central Region.

Hatch projects integrated with Extension included a survey of farm owners and operators in Illinois to identify sources of stress, prevalence of anxiety and depression, describe current coping strategies, and identify opportunities for mental health improvement interventions (Extension programming will be created to promote mental wellbeing and teach health coping strategies and stress management to reduce the burden of mental health disorders among the farming population), the development of a model to evaluate credit cycles in the agricultural sector, an analysis of local, state, federal and international laws that significantly impact agriculture and natural resources, and development of an algorithm that can map out areas with high risk of a grain entrapment using weather conditions (tied directly with a preemptive training program that can focus on these high-risk zones to reduce the number of grain entrapments incidents).

Thriving Natural Resources – Research activities included a study that seeks to understand the role of nitrogen fertilizers in phosphorus biogeochemical processes in agricultural soils to optimize the use of the soil organic phosphorus pool for agricultural production, research to develop capacity for applied uses of eDNA in freshwater ecology and management while advancing statistical modeling frameworks for the better interpretation of this new type of biodiversity data, work to advance knowledge of the varying factors that influence how anglers are contributing to biological invasions in the Great Lakes region, an

evaluation of the effects of tillage on the fate and transport of sediment and the impacts of land management on the fate and transport of different forms of nitrogen, and work to establish the feasibility of using unmanned aerial systems as agricultural monitoring tools in cost and resource constrained environments.

Research activities also included 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, the development of effective conservation strategies and management techniques (by understanding how the use of habitats change over time and why species use different habitats we can develop more effective conservation strategies), research testing the effectiveness of biochar addition to swine bin composters (this will achieve quicker temperature increase and higher temperatures, which will reduce the risk of spreading diseases and address livestock producers' concerns and reduce ammonia emissions, which will increase fertilizer value of finished compost and decrease odor/indirect greenhouse gas emissions), efforts to better understand the ecology of sites involved in restoration and "set aside" programs that are crucial to the conservation of wildlife in landscapes with significant commitment to agricultural production, and the utilization of new methods of chemical analysis to measure the mercury content of environmental samples and characterize its chemical forms (building our knowledge of the factors that govern the formation of methylmercury - the most toxic form of Hg - in agricultural watersheds so that efforts aimed at mitigating other water quality problems, such as excess nutrients, will not inadvertently worsen the problem of Hg pollution).

Historically, Extension has devoted significant effort toward the goal of supporting engagement with natural resources in both home and public spaces; 2020 was no exception. Through strategically-pooled expertise and high levels of statewide coordination across talented members of Extension's agriculture and natural resources (ANR) teams, programs were quickly converted to virtual formats. On average, ANR programs available to local unit residents more than tripled in 2020, including 182 new ANR webinar recordings, videos, and podcasts posted to Extension's website over the year. A total of 1,800 educational sessions, with an audience of 80,000 participants, were offered by Extension to promote engagement with home and community landscapes and stewardship of natural resources. ANR staff responded to more than 5,000 requests for expert assistance and Master Gardeners provided on-demand informational services in response to more than 51,000 inquiries related to plant cultivation. In addition, Extension staff and volunteers supported more than 300 community gardens (about one-third with operations affected by COVID-19 restrictions) that serve a variety of purposes such as education, demonstration, therapeutic uses, environmental stewardship, and youth engagement. Extension's most popular online resources reached more than one million viewers in 2020 included regular updates to blogs that provided timely, seasonal information around gardening, landscaping, and sustainable practices.

Multistate Extension activities in 2020: UIE participates in the **North Central ANR Program Leaders** group, meeting monthly and sharing programming resources, on the **Illinois-Indiana Bi-State Ag Group**, a team of Illinois and Indiana Extension educators that plans three to five joint programs annually, on a multistate team working toward development of the **Dashboard for Agricultural Water Use and Nutrient management** (DAWN) project, on the **Midwest Agriculture and Climate Team** (MAC-T), hosted by the USDA Midwest Climate Hub, as a forum to share climate impacts and agricultural concerns across the Midwest, and on the **Bi-State Conservation Action Network** (BICAN), an Illinois/Iowa committee of conservation minded groups and individuals. UIE educators collaborate regularly with **Illinois-Indiana Sea Grant** staff to develop resources and programming. An educator with UIE serves as the Vice-Chair for the North Central Region in the **National Association for County Ag Agents**. Another educator served as presenter and discussion facilitator at **Managing Manure in the 2020s: Opportunities vs Risks**, a workshop held in Wisconsin on dairy manure management issues.

Hatch projects integrated with Extension included efforts to refine and improve the practice of denitrifying bioreactors to mitigate agricultural drainage nitrogen losses for societally-desired clean water outcomes, work to develop sustainable switchgrass bioenergy feedstock production systems on marginally productive croplands in Illinois, and research to evaluate the performance of conventional drainage, drainage water management, and combination drainage/sub irrigation systems under projected climate scenarios and to use this information to make recommendations on the most effective drainage designs for a specified soil in a given county in Illinois.

Safe, Plentiful, and Accessible Food Supply - Research activities included a study to elucidate the causes of pregnancy loss in dairy cows in order to develop protocols to increase fertility, and hence profitability, of dairy operations, work focusing 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, the development of recommendations for integrated pest management practices that can be adopted by corn producers to improve the economic returns of their operations and minimize negative impacts on the environment, the utilization of ultrasound as a new biofortification strategy to enhance the nutritional value of fresh produce and sprouted grains, and work focusing on examining food microstructure and evaluating its changes due to food processing (new products expected to stem from this research are foods with increased nutrient bioavailability, foods with increased stability, dried foods with increased rehydration ability, and edible films with increased thermal and mechanical stability).

Research activities also included the development of strategies to make Hispanic-style fresh cheeses safer to help meet market demand and prevent Listeria outbreaks, the development and breeding of anthocyanin rich corn germplasm as an affordable and natural source of colors for foods and beverages, the identification and comparison of the genes whose expression is altered in reservoirs of cattle, pigs, bats, chickens and bees (this work serves a critical need in that the knowledge from this research would make a significant environmental and economic contribution to the success of multiple species, including larger calf crops for beef cattle, shorter calving intervals for dairy cattle, larger litters for pigs, less frequent insemination required for chickens, improved species preservation for bats, and sustaining the population of bees), 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 control, and research that seeks to preserve the utility of Bt traits as corn rootworm management tools, slowing the evolution and spread of resistance, developing effective integrated pest management (IPM) and insect resistance management (IRM) strategies, as well as improving our understanding of corn rootworm genetics, biology, ecology, and behavior.

Research activities also included a soybean breeding program focused on developing knowledge, technology, germplasm, and varieties that will increase the productivity, profitability, and sustainability of soybean production in Illinois and throughout the U.S., ongoing research focused on selective breeding of livestock (breeds of livestock species have been continuously selected for economically-important traits using trait-based selection and the growth and availability of short read sequencing technologies open new opportunities for breed improvement through marker-assisted selection), research characterizing the chemical composition and nutritional adequacy of alternative and sustainable protein sources to create viable solutions to feed livestock and to create nutritionally-adequate and complete diets for companion animals while maintaining a sustainable food chain without direct competition with human food systems, and continuation of the **Illinois Long-Term Selection Experiment** (ILTSE was initiated in 1896 and has completed more than 900 cycles of directed selection for protein and oil concentration in maize grain).

The pandemic has negatively impacted this critical issue in many ways, interrupting food supply chains and increasing food insecurity for our most vulnerable residents. Overall, 80,000 participants attended more than 1,800 educational sessions delivered to crop producers, livestock producers, and other agri-business professionals, residents aiming to grow and preserve fresh produce, young people learning where their food comes from, professional food managers and servers, and Extension volunteers supporting food donation gardens throughout Illinois. In 2020, Master Gardeners supported 81 active food donation gardens, which generated more than 73,000 pounds of produce donated to overwhelmed emergency food sites and mobile markets. Extension educators responded to more than 6,000 food production and access related inquiries, providing responsive assistance via many communication channels. A new webinar series, **Farmers Markets During COVID-19**, provided evolving guidance for navigating the protocols and practices to maximizing safety. Extension's multi-session **Master Urban Farmer Training Program** pivoted to a virtual format that included both synchronous and asynchronous components, resulting in twice the usual number of applicants. For the first time in the history of the program, two separate cohorts of training were offered in 2020 to accommodate the 60 applicants. The virtual format seemed to improve access for historically under-represented audiences in terms of age (76% were under age 60), race (24% identified as African-American), and gender (72% identified as female). Feedback from participants suggests that the virtual format should continue, with opportunities for in-person demonstrations and networking when COVID-19 social distancing restrictions are lifted.

Multistate Extension activities in 2020: UIE educators jointly planned a six session **Advanced Soil Health Training Series** with the University of Kentucky and Purdue University, with sessions hosted in the three different states. The **Northwest Illinois Agronomy Summit** and **Iowa State University Crop Advantage Series** involves a collaborative effort with colleagues across Midwestern states to organize an annual regional event providing updates in agricultural production research and strategies. The **Driftless Region Beef Conference** is a joint project between Extension staff in Iowa, Illinois, and Wisconsin. UIE is a member of the planning committee for the **Small Grains Conference**, sponsored by Practical Farmers of Iowa, and a member of the **North Central Food Safety Extension Network** (NCFSEN), which developed and implemented a standardized evaluation for home food preservation training across various states of the region.

Hatch projects integrated with Extension included work to reduce the yield loss caused by plant-parasitic nematodes on economically important crops in the U.S., an exploration of fruit and vegetable selection, preparation, intake, safety, and waste by cross-sections of consumers with implications for fruit and vegetable farmers, nutritionists, dietitians, and legislators, ongoing development of effective management strategies for X. cucurbitae in pumpkins, and development of a new satellite-based algorithm for measuring crop productivity, including Gross Primary Production (GPP), plant autotrophic respiration (Ra), Net Primary Production (NPP), and crop yield using sun-induced fluorescence from the NASA OCO-2 satellite.

Safe, Healthy Environments and Behaviors - Research activities included a study that found that the federal recognition of same-sex marriage was related to improved well-being in individuals in same-sex relationships (this was particularly true for those individuals who experienced the highest levels of minority stress (that is the federal recognition of same-sex marriage appeared to benefit most those individuals who were at the highest risk), the design, evaluation, and implementation of strategies and technologies that will assess nutrition status of and maximize nutrition delivery to individuals and populations at different stages in the nutrient/energy adequacy continuum, a study of the impact of dietary or environmental estrogen exposure on metabolic, cardiovascular, or reproductive health of women living in Illinois, and an investigation into how parental involvement in young adolescents' social and

academic lives and youths' psychological and physiological receptivity to parenting may provide further insight about how to promote youths' adjustment within these domains.

Research activities also included the development of targeted dietary interventions for disease prevention and treatment by identifying key foods and/or nutrients that can be utilized for manipulation of the gastrointestinal microbiome for health benefit, a study of when and how mothers' self-reported intimate partner violence (IPV) is documented in divorce cases and how IPV documentation relates to decisions regarding custody and visitation of minor children, work to determine the impact of obesity on nutritional status during and following pregnancy among rural populations of women participating in the Women, Infants, and Children program, an examination into policy, systems, and environmental factors that influence the consumption and waste behaviors of children and their families, particularly in the school setting, an investigation into the anti-cancer effects from various dietary bioactive compounds and the regulatory mechanisms by which dietary factors impact colon cancer development and colon cancer prevention, and research that seeks to compare the effect of an anthocyanin-rich extract from purple maize pericarp, and pure anthocyanins, on adipogenesis, inflammation, and insulin resistance in adipocytes on basal and inflammatory conditions.

In terms of audience reach, Extension serves more residents to address this critical issue than all other issues combined. More than 343,000 participants attended 17,247 educational sessions to promote healthy behaviors and make changes to the environments people live, learn, play, and grow. Extension's collective **Illinois Nutrition Education Programs** (INEP), comprised of the **SNAP-Ed** and **EFNEP** programs, are located in geographical areas throughout Illinois where audiences with limited resources are highest. Direct education targets populations most vulnerable to chronic diseases that are highly correlated with behavioral choices around nutrition and physical activity. In 2020, more than 1,700 community partnerships were developed or nurtured with K-12 schools, early childhood centers, community-based agencies/centers, and emergency food sites to extend resources and maximize opportunities to support healthy behavioral choices and environments. Target audiences of Extension's core programs to support physical health and mental health include youth (e.g., **4-H Health Jam**, **4-H Food Challenge**, **4-H Cooking 101**), teachers and others working with youth to employ practices that create safe environments (e.g., **Trauma Informed Classrooms**, **Youth Mental Health First Aid**), farmers (e.g., **Farm Stress**, **AgrAbility**), caregivers of young children and older adults, veterans, individuals at risk for diabetes, and the general public looking for reliable and unbiased sources to inform decisions about their health.

Multistate Extension activities in 2020: UIE educators served as members of the **National Extension Association of Family and Consumer Sciences** (NEAFCS) **Professional Development Webinars Committee and Nominating Committee**, and the **North Central Region Aging Network** (NCRAN). UIE developed and presented a professional development program on dementia and ageism in collaboration with South Dakota State University Extension and contributed to a needs assessment and program development for farm families with a loved one with dementia in collaboration with Iowa State University Extension and Outreach. Led by Michigan State University Extension, UIE worked with a team of Extension educators, specialists and professors from more than eight different land-grant universities that provided farm stress training at the **National Farm Bureau Conference** and **National Farmers Union Conference**.

Hatch projects integrated with Extension included a study of app technology adoption by dietitians, diabetes educators, medical center administrators, and physicians, an exploration of the short-term and long-term individual and family health benefits of nature-based activities, research into how consumption of thermally abused frying oil can significantly alter breast cancer metastasis, and work under the **Stronger Together Project** to develop and pilot test a new

couple-focused program that will support treatment and long-term recovery for individuals with substance use problems, particularly for rural residents in Illinois.

In addition to the integrated and multi-state activities associated with each critical issue described above, travel expenses were supported for faculty and staff to attend conferences and professional association meetings at the regional and national level to showcase current research and Extension initiatives. These activities contributed to informing, addressing, and refining ongoing work across all critical issues.

II. Merit and Scientific Peer Review Processes

The NIFA reviewer will refer to your 2020 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 ONLY
1. The Merit Review Process	There were no updates to the merit review process in 2020.
2. The Scientific Peer Review Process	The scientific peer review process and review criteria were largely unchanged from previous years. Examples include review by faculty peers, Department heads, and Department Research Committees. The most significant modification is that the Office of Research is working to develop an online review form for reviewers to provide their evaluations. We expect that this will be the method used to collect reviewer evaluations and share them with Project Directors and Department Heads in 2021.

III. Stakeholder Input

The NIFA reviewer will refer to your 2020 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 ONLY
1. Actions taken to seek stakeholder input that encouraged their participation with a brief explanation	The Department of Crop Sciences held their **External Stakeholder Advisory Committee** meeting on March 10th of 2020. The ESAC members were chosen by polling faculty and departmental stakeholders about who would be good representatives for the committee. The ESAC group recommended that maintaining a balanced research portfolio, including research projects that span the basic through applied portions of the research continuum. So, for example, work done on basic biology of nematodes gets translated into research on new integrated pest management tactics. 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 get input on all scholarly activities, including research. In 2020 this committee structure was modified slightly to be more responsive to FSHN's undergraduate focal areas (which also include research areas – of Dietetics, Hospitality Management, Food Science and Human Nutrition) as well as graduate programs and research.
2. Methods to identify individuals and groups and brief explanation.	The Dean of the College of ACES (Dr. Kim Kidwell) and the Associate Deans for Research (Dr. Germán Bollero) and Extension (Dr. Shelly Nickols-Richardson) 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. The Dean and Associate Deans provide reports to the **College of ACES External Advisory**; this diverse group includes participants from the agricultural production community, natural resources management groups, human sciences, and agribusiness. The group meets annually and creates an excellent opportunity for presentation and review of the activities of the AES to an external audience of broad cross-section. Specific interactions in FFY 2020 of the Associate Dean for Research/Director of AES with stakeholders included: 1. Served on the Board of the Illinois Nutrient Research and Education Council (NREC https://illinoisnrec.org/); 2. Met or video-conferenced on multiple occasions with leadership and members of the Illinois Farm Bureau, Corn Marketing Board, Corn Growers, Soybean Association, Pork Producers, Illinois Beef, and other organizations throughout FFY 2020; 3. Invested much time in development of collaborative activities with corporate partners. Major contacts included Bayer, Syngenta, Wyffels, GDM, Burrus, ADM, Tate and Lyle, Growmark, Agrible, and Kraft Heinz; 4. 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 between the two organizations; 5. Participated in the meeting of the Illinois Agricultural Legislative Roundtable in January 2020 (virtual meeting). This meeting included representation from the IFB, multiple commodity organizations, and other educational institutions in Illinois that have agricultural programs; 6. Virtually met and worked with representation of the Illinois Corn Growers Association on development of an internal seed grant program associated with an award from the Regional Conservation Partnership Program; 7. Participated in virtual meetings of the Illinois-Indiana Sea Grant advisory committee; 8. Met with members or their staff of the Illinois House Delegation in Washington, DC on issues of importance in agricultural research in March 2020; 9. Participated virtually in meetings of the NC regional AES directors in March 2020; 10. Met virtually with External Advisory Committee of the Division of Nutritional Sciences in the College of ACES; 11. Participated as a member of the advisory committee for the **Institute for Sustainability, Energy, and Environment** UIUC throughout 2020; and 12. Extensive involvement in activities of the **Dudley Smith Research Program**. This is an endowed program in sustainable agricultural production centered on the Dudley Smith Farm in Christian County, Illinois. Met virtually with the Dudley Smith External Advisory Committee in December 2020. The Department of Food Science and Human Nutrition continues to have brainstorming sessions through various faculty meetings and also the Department Faculty Advisory Committee to select stakeholders of most value to provide feedback. One example would be the External Advisory Committee, composed of industry, academia, hospitality managers, and government representatives. FSHN tries to maintain balance in the committee by seeking input from faculty. Also, FSHN identifies influential stakeholders through attending the Council for Food Science and Human Nutrition administrators. Research groups (such as the **Center for Advanced Research in Drying**) also identify external stakeholders that provide valuable insight.
3. Methods for collecting stakeholder input and brief explanation.	The most significant updates to our methods used for collecting stakeholder input revolve around the COVID-19 pandemic that began in early 2020 (and is ongoing as of this writing). Many of the methods traditionally used for collecting input were either not viable or were extremely limited. In-person meetings were almost entirely canceled and were primarily limited to Zoom meetings. These types of meetings significantly limit interactions compared to those that can take place in person (although as a potential positive they do allow those who might not have been able to attend in person to attend remotely). Those who are not regular Zoom users became very difficult to contact as a result. Interactions with students were extremely limited as classes were mostly online and laboratory or field research were significantly slowed. Extension specialists and educators quickly adjusted surveys of stakeholders to an online format as well. For example, a needs assessment conducted in May 2020 with constituents of the community and economic

	development team to determine pressing issues they were facing as the pandemic unfolded. Constituents included local government officials, small business owners, community organization representatives, all with responsibilities for economic development and leadership. Another example was weekly contacts (phone and email) of local partners, conducted from April-August 2020 by SNAP-Ed educators to determine how Extension could best support them during the crisis. Partners included school and district stakeholders, emergency food sites, public health departments, and other community-based organizations. SNAP-Ed staff made more than 700 partner contacts to gather input.
4. A Statement of how the input will be considered and brief explanation of what you learned from your stakeholders.	As mentioned above the COVID-19 pandemic severely limited our ability to collect input in 2020 (and by extension our ability to consider input). To the extent that we were able to gather input, our ability to utilize it in guiding our research activities was significantly impacted by the slow-down of field and laboratory research as a result of COVID-19. This will continue potentially for the next several years as the impact on budgets from the pandemic will be felt for several years beyond 2020. For example, stakeholder input is considered in the hiring of new researchers, but our expectation is that hiring will be significantly limited for at least the next few years. The Department of Agricultural and Consumer Economics has been encouraged to proceed with initiatives such as a new **Center for the Economics of Sustainability** and a certificate program in **Agriculture Focused Financial Planning**. ACE researchers regularly interact with and present findings to a diverse range of stakeholder groups ranging from state commodity groups to Federal Reserve bank officials to policymakers and practitioners in developing country governments as well as donor organizations such as USAID, World Bank and, through such interactions, are able to adjust and refine the objectives of their research inquiries. The Department of Human Development and Family Studies addresses the well-being of diverse individuals and families. The main issues are COVID-19, racism, violence, and other forms of societal inequality (e.g., unequal access to child care). The pandemic and societal inequities create stress, which leads to poorer outcomes regarding physical, mental, and social health. We need culturally-relevant prevention/intervention programs and policies. The Department of Food Science and Human Nutrition reports that the Council for Food Science Administrators was successful in making progress on a white paper on the lack of funding for food science and there was a letter of support sent by several members of congress. FSHN hopes to further discuss this issue at a 2021 CFSA meeting.

	Stakeholders of the Department of Animal Sciences expressed strong support for diversity of applied and basic research, growth in digital animal agriculture, the quality of students in the department, and the breadth of the curriculum. Feedback and input, gathered through the Extension community and economic develop stakeholders survey, grounded a response to provide programming and support for access to COVID-19 relief funds for small businesses and a new partnership with the Illinois Restaurant Association to provide programming and technical assistance to restaurant owners to follow COVID-19 safety protocols and minimize losses. The SNAP-Ed local agency needs assessment informed a response strategy to distribute relevant resource materials for partners to provide to clients, virtual programming, facilitating collaboration between community resources/partners, professional development opportunities, and design of signage to improve emergency food site visibility.

IV. Critical Issues Table of Contents

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V. Activities and Accomplishments

Please provide information for activities that represent the best work of your institution(s). In your outcome or impact statement, please include the following elements (in any order): 1) the issue and its significance (e.g. who cares and why); 2) a brief description of key activities undertaken to achieve the goals and objectives; 3) changes in knowledge, behavior, or condition resulting from the project or program's activities; 4) who benefited and how. Please weave supporting data into the narrative.

No.	Project or Program Title	Outcome/Impact Statement	Critical Issue Name or No.
1.	**Illinois 4-H Leans into Their Theme: "Stronger Together... Act/Lead/Inspire"**	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. Leadership skills are reinforced through many 4-H projects and programs; sometimes through learning new skills while carrying out project work and sometimes through more formalized leadership development opportunities. When the pandemic abruptly created the need to stay apart in order to stay safer, Illinois 4-H adopted a theme of "Stronger Together.. Act/Lead/Inspire." Throughout the state, 4-H youth, volunteers, and staff leaned into that theme by demonstrating resilience and innovation to benefit their communities in locally relevant ways. Examples of their stories include: • 4-H clubs in several counties quickly mobilized to make thousands of masks to protect the safety of first responders, health care providers, and community members. • 4-H members addressed local food insecurity by building "pop-up" food stands and pantries, organized contact-free meal delivery to schools, food pantries, and churches, and put their gardening skills to work donating produce from their club garden to emergency food sites. • STEM-focused 4-H clubs with access to 3D printers and materials printed and assembled more than 6,800 face shields as additional personal protective equipment for healthcare workers. Their response was a perfect way to couple mastery of technical skills with serving others.	Community Involvement, Inclusion and Leadership

		• 4-H members found creative ways to connect with nursing home residents facing loneliness and isolation through sending letters and cards, creating inspiring and uplifting videos, scheduling window visits (sometimes with their horses!), and installing bird feeders outside residents' windows. The Illinois 4-H Youth Leadership Team, comprised of 21 high school aged 4-H members in 2020, annually plans and leads statewide events support leadership development among their peers and younger 4-H members. **Speaking for Illinois 4-H** provided an opportunity for 30 Illinois 4-H members across 18 different counties to meet with legislative officials at the Illinois State Capitol in early March 2020 (prior to COVID-19 restrictions). These delegates shared their collective, compelling 4-H stories as the face of Illinois Extension 4-H. Another pre-pandemic statewide event held in February 2020, the **Illinois 4-H Junior Leadership Conference**, was hosted by the state leadership team. This overnight conference offered 110 junior high aged youth opportunities 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. In 2020, conference participants learned about food insecurity and packaged more than 9,000 meals to be distributed at their local pantries. After COVID-19 restrictions required a shift to virtual activities, the state leadership team continued to offer additional activities and events throughout the year. Through both structured and organically-grown 4-H leadership opportunities, youth are motivated to influence others and are comfortable with working in partnership with other teens and adults to complete important tasks. These experiences are consistent with findings from the North Central Region 4-H Volunteer Study, in which 93% of respondents agreed that volunteering with 4-H makes communities stronger and 78% agreed that volunteering with 4-H increases civic engagement.	
2.	**The Continuing Impacts of the Great Recession on Communities**	The Great Recession which began with the collapse of the housing market in December 2007 resulted in the largest contraction of the U.S. labor market since the Great Depression, with devastating consequences for American families and communities. While the recession officially ended in 2009, the impact of the reduced economic activity, job loss, falling wages, foreclosure and diminished wealth had lasting effects for many American workers and their families. The Great Recession and subsequent slow recovery provide a unique opportunity to examine how exposure to adverse social and economic circumstances affects children's	Community Involvement, Inclusion and Leadership

		development and learning. Further, the recession occurred on the heels of rising income inequality and persistent disparities in educational achievement and attainment between racial and socioeconomic groups. Therefore, the overall goal of this research project is to understand how young children experienced the effects of the recession within their families, schools, and communities and how these experiences shaped their development and impacted educational inequality during elementary school. The impact of the recession and the later recovery was not experienced equally by individuals or across regions, states, and communities. For example, less educated workers and workers employed in manufacturing, construction, and low-end service were more likely to experience job loss and prolonged unemployment. Neighborhoods with higher concentrations of poverty and African-Americans also fared much worse during the recession and have been slower to recover. Rural areas, in general, were less impacted by job loss during the recession compared to urban and suburban areas, though rural counties with high concentrations of African-Americans were the exception. States also experienced the recession differently. High unemployment and persistent financial uncertainty resulted in the tightening of state budgets which directly impacted many school budgets leading to reduced teaching staff and larger class sizes. Given the geographic and individual variation in both the employment effects of the recession and the speed with which workers and their communities have recovered, it is essential to examine how the recession has impacted children at multiple levels and across different contexts. Utilizing longitudinal data collected from a national, longitudinal sample of kindergarten children beginning in 2010-2011, we examined how the recession affected children's cognitive, socioemotional, behavioral, and physical health over time within the context of their families, schools, and communities. We developed new measures to capture the dynamic nature of economic uncertainty and the depth, duration and cyclical nature of poverty over time. Further, we have completed a paper which examined how neighborhood crime and school composition influenced children's formation of healthy peer relationships in elementary school. The results from this study suggest that students who attended schools where a small percentage of students were from the neighborhood had, on average, poorer quality peer relationships compared to students who attend schools with a moderate or high percent of students from the neighborhood, controlling for race, family socioeconomic status, and neighborhood violence. These analyses suggested attending elementary schools where a low percentage of students are from the neighborhood coupled with living in a neighborhood with higher levels of violence may significantly lower the quality of peer relationships overall and may be important in	

		explaining the lower quality of peer relationships among Black students compared to White students. The findings from this paper were presented at the annual meeting of the National Council on Family Relations in November of 2020.	
3.	**Illinois 4-H Pivots to Create a Virtually Spectacular Experience in 2020**	Illinois 4-H has a long history of providing culminating events to showcase 4-H projects, many of which represent a significant time, emotional, and financial investment for members. From a statewide perspective, county fairs and the Illinois State Fair have served as an important venue for 4-H members to exhibit their projects, receive feedback from volunteer judges, and get recognition for their excellent work. When Illinois' Governor Pritzker implemented a statewide "safer at home" order in March 2020 to mitigate coronavirus transmission, there was a high degree of uncertainty about the fate of summer fairs, traditionally home of 4-H exhibits. No one could predict when or where restrictions for public gatherings would be lifted. Illinois 4-H was committed to preserving this culminating experience for members, many of whom were already facing so much loss associated with cancelled events and celebrations, while maintaining a firm focus on health, safety, and principles of equity and inclusion. Within a few weeks of shifting to working from home, Illinois 4-H was hosting virtual trainings and listening sessions with staff focused on how to continue to engage 4-H members and provide them with virtual opportunities. Behind the scenes, staff were working to identify ways for 4-H members to showcase their culminating project work, as they would typically do at in-person fairs and shows. A team of state staff worked with our fair registration system vendor, as well as field staff, to develop a virtual solution. Early in the process, Illinois 4-H hosted listening sessions to address concerns about access and equity relating to the virtual format. To make sure limited or poor internet access did not create a barrier to participation, they developed a low bandwidth exhibit option, and put accommodations in place to assist families who had access issues (such as extending Extension office public internet access into adjacent parking areas, and providing statewide maps of free Wi-Fi hotspots to families). Animal shows and public presentation contests required short video submissions, while all other types of projects required a few photos or a digital slideshow, and a project report responding to common questions about what was learned through the process of developing their 4-H exhibit. Training was provided for staff on how to use the registration and judging system, and training documents were produced for families to use when signing up and uploading their work. A statewide judges' training was also hosted and recorded for later viewing to train judges on how to judge virtually. The 4-H Alumni Engagement Manager	Community Involvement, Inclusion and Leadership

		enlisted the Illinois 4-H alumni network to get additional judges to support both county and statewide shows. The integrated entry and judging system meant that 4-H families only needed to upload their project documentation once, at their county level. Overall, 444 county contests and shows were hosted using this virtual method with more than 17,500 participants. If a project was one of the top local exhibits, it could be sent up to the state level to be judged in the same system. More than 70 people helped serve as the cadre of state level judges in this new and responsive format. Ultimately, 2,300 youth submitted projects that were judged at the state level. One veteran livestock judge commented, "From my perspective, I like that an exhibitor can replay their video and read the judge's comments. It is a little bit like watching a game film." A variety of families shared stories with 4-H staff about new things they learned and experienced. Some shared how they had fun taking pictures of their animals, something they would not have normally done. While many expressed disappointment, one 4-H member added perspective in a social media post: "One day, you're going to age out and close your show box for the last time. I promise you, it's not the banners or shows you'll miss. It's doing chores with your dad." On a lighter note, one family shared that their favorite thing about the 4-H Virtual Show was "when the chicken attacked Dad as he was filming!" When 2020 proved to be a year like no other, Illinois 4-H envisioned and activated a monumental pivot to maximize involvement, inclusion, and leadership across Illinois communities, families, volunteers, and youth.	
4.	**Community-Engaged Planning Process Nets More than $7M in Grant Funds to Illinois Communities**	Fulton County, a small rural county in west central Illinois, has experienced challenges like many other rural communities across the U.S. University of Illinois Extension's local community and economic development educator has partnered with Fulton County organizations and leaders for the past 30 years on a variety of efforts including leadership academies, workforce development, and multiple studies and assessments to support community planning. When the USDA Rural Economic Development Innovation (REDI) Initiative opened applications to provide regionalized planning support and capacity building in targeted communities, the local Extension educator alerted Fulton County partners about the opportunity. Spoon River Partnership for Economic Development submitted a successful application and Fulton County was selected as a targeted community.	Economic and Workforce Development

		The REDI planning process began with a two-day, countywide, community-building event in January of 2020 which served as a platform for community members to gather, exchange ideas, discuss common challenges and opportunities, and share ideas to make Fulton County a better place to live, work and play. Working with Spoon River Partnership for Economic Development and the Fulton County Board Chairman, University of Illinois Extension developed a diverse and representative listing of key leaders who have a stake in community and economic development throughout the county. More than 20 different businesses and organizations from throughout the county participated in the event. The REDI Initiative provided intensive technical assistance, data support, and facilitators through a cadre of REDI cooperators. Representatives from Purdue University and the University of Kentucky served as Fulton County's REDI cooperators, providing invaluable support during the two-day event and throughout the planning process. In small breakout groups, participants explored topics from a county perspective to generate ideas for how to create a healthy and thriving rural economic development climate. Their discussions focused on four major areas: 1. Workforce development; 2. Diversity and inclusion; 3. Innovation and entrepreneurship; and 4. Quality of life and place. With strong participation and a great deal of interest expressed during the retreat, University of Illinois Extension continued to engage leaders in remote facilitated planning discussions that were essential to building a robust planning document that will be supported by many in the county. The process has helped engage a range of partners, including local economic development organizations, community leaders and residents, the private sector, educational institutions, and other stakeholders in planning for the future of Fulton County. As a result, the process has helped identify locally-grown strategies that will guide county economic development, encourage partnerships and collaboration, and improve economic outcomes and overall quality of life in Fulton County. Thanks to the USDA Rural Economic Development Innovation (REDI) Initiative, the Fulton County REDI team has created the capacity-building foundation needed to ensure that public sector entities, working in conjunction with other economic actors (individuals, firms, industries), can create the environment that is essential for achieving county and regional economic prosperity. As the plan evolved, community organizations on the local REDI team were actively pursuing grants to support their collective goals. To date the following grant awards, totaling more	

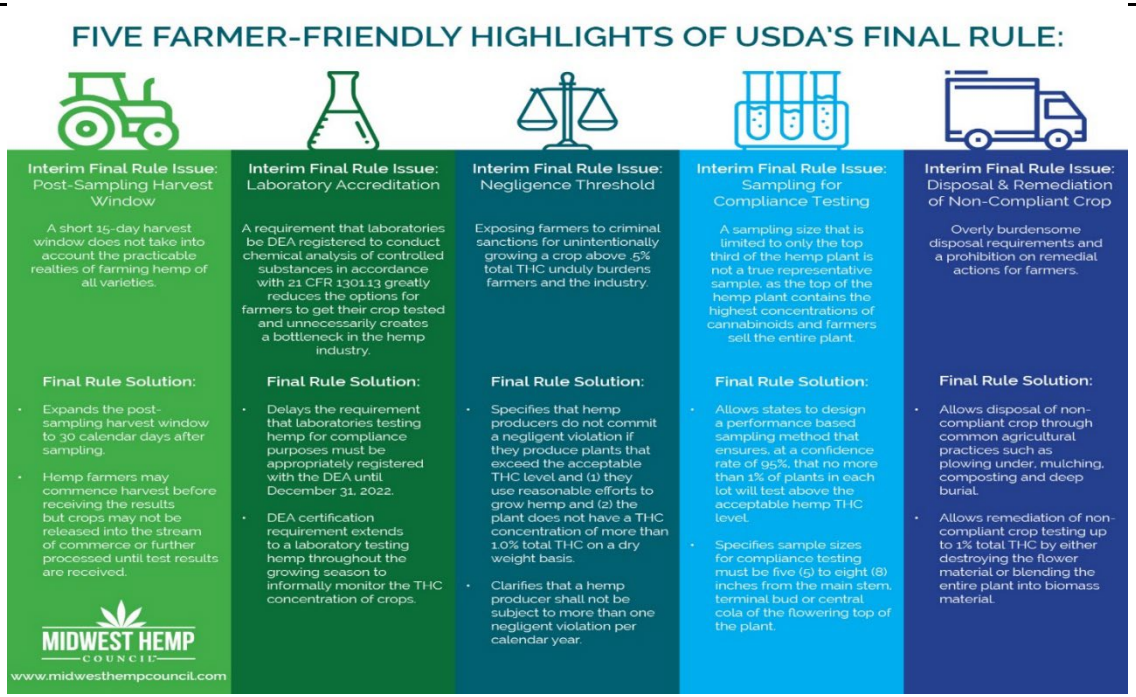
		than $7 million, have been secured to benefit economic development in Fulton County. Each award represents a focal goal of the plan and grant applications were supported by the rich data and partnerships strengthened through the REDI planning process: • A Connect Illinois grant ($3,123,122) was awarded to Century Enterprises, Inc. to build a **Fiber to the Premises** (FTTP) program that will provide broadband to 581 households, businesses, farms, and anchor institutions in Fulton, Peoria, and Knox Counties. • The Spoon River Partnership for Economic Development adopted this plan as their guiding framework for future development goals, and pursued funding to support small business development. The organization was awarded a $90,000 USDA Rural Business Development Grant to establish a revolving loan fund to support Canton area businesses, located in Fulton County. • Spoon River College (located in Fulton County) was awarded a $4 million U.S. Economic Development Administration Public Works Economic Adjustment grant to enhance career and technical programs for workforce development.	
5.	**Evaluating the Impact of USDA Reports on Agricultural Futures Markets**	The objective of this project is to revisit the value of USDA reports in the electronic era by identifying the efficient price return variance of corn and soybean futures prices during the hour following the report release. A common method to separate efficient price variance from noise is by pre-processing data, for example, by subsampling prices every five minutes or lower frequency, since the latter are commonly accepted as noise-free prices. While resampling methods are easy to implement, they cannot be used to measure efficient price return variance over a very short time window (e.g., one minute), which is required to understand USDA report market impacts. Another alternative is to rely on variance measures that are robust to microstructure noise and do not require filtration of data. We adopted a newly developed method based on the Markov property of discrete price changes. By assuming endogenous and serially correlated noise, Hansen (2015) and Hansen et al. (2015) have recently proposed a Markov chain (MC) framework that decomposes intraday observed price return variance into efficient price return variance and microstructure noise. This method can be used to identify variance in very short time intervals, such as the ones required by the grains markets to absorb USDA reports. Our empirical application is based on nearby futures transaction prices for corn and soybeans, tick data, time-stamped to the nearest second. The sample period included different specific sub-	Economic and Workforce Development

		periods with different trading hours and announcement times. For simplicity and for comparison with previous research results, we divide our data into two main periods. The trading halt era (up to May 2012) and the real time era from June 2012. We expect our main findings to differ substantially from previous literature findings, with previous research overestimating both the magnitude and duration of the USDA effects. This is due to previous research ignoring the observed price variance coming from microstructure noise and the persistence of this noise. Public news announcements carry informational value for market participants if they trigger a response in price return variance. Recently published articles fail to disentangle efficient market price adjustments from microstructure noise in the context of public announcements. Our contribution to the literature lies in the use of a Markov Chain framework that solves the shortcomings of previously used approaches, the use of agricultural commodity markets with larger tick sizes than financial futures likely causing high microstructure frictions, and the analysis of the impacts of recent public information release policy changes affecting agricultural markets. We demonstrate that, by ignoring noise, previous literature has underestimated the informational content of the United States Department of Agriculture (USDA) reports, while overestimating the time required for the market to absorb the information. Overall, our findings are highly relevant to public policy, in particular the USDA, and have implications for market design. In 2012 the USDA began releasing their reports during trading hours. This changed how USDA information was impounded into the market. Prior reports were released during a trading halt, where traders competed on price in a Pre-Opening Batch Auction (POBA) for two hours. Compared to the current real-time release policy, the POBA mitigated speed advantage, reduced rents from arbitrage, lowered adverse selection, and improved market quality around report releases, but at the cost of lengthening price discovery. Our findings support that development of a shorter POBA could improve on the lengthy price discovery process while maintaining the auction's other advantages.	
6.	**Extension's Annual Impact on the State of Illinois Valued at $603 Million**	University of Illinois Extension, within the College of Agricultural, Consumer and Environmental Sciences, operates on a budget model comprised of a mix of federal, state, and local funds, both public and private. As stewards of public and private support, there is an ongoing commitment to measure Extension's value and impact in order for stakeholders at all levels to feel confident that investments in Extension produce a sufficient return on their investment. While many programmatic outreach efforts include process and outcome	Economic and Workforce Development

		evaluations, there was an expressed need to take a more comprehensive look at Extension as a whole in terms of economic and functional value, not only to those directly served by Extension, but to Illinois as a whole. TEConomy Partners, LLC, a firm specializing in impact assessments, conducted an analysis of documentation including financial, programmatic, and organizational records, followed by a series of targeted interviews with Extension administrators, leaders, and team members. The firm was selected based on its experience in applying sound analytic methods to economic impact studies of Cooperative Extension programs at other land-grant institutions. In September of 2020, Extension held an online event to share the results of the final report with stakeholders (see **The Economic and Functional Impact of University of Illinois Extension** located at https://extension.illinois.edu/global/economic-and-functional-impact). Its main finding values the annual economic and functional benefits of Illinois Extension at over $603 million, about 10 times the $60.9 million annual budget in 2019. The report includes 48 examples of impacts that span Extension's diverse offerings. For each thematic area (agriculture; environment; community and economic development; health, nutrition, and family development; and youth development), the authors discuss challenges and opportunities specific to Illinois and explain how Extension programs generate impact. The report quantified programmatic impact through selected examples that span the breadth of Extension, including agriculture, nutrition, health, and youth development. The annual benefit of these selected examples was $477.3 million. "Extension is a driver of economic and societal progress," adds TEConomy principal Simon Tripp, a co-author of the report. "Extension has the pragmatic, purposefully-designed mission to ensure that research-based knowledge is not confined to academic circles, but is deliberately and professionally provided to individuals and organizations, enabling them to solve problems, adapt to changes and new opportunities, make informed decisions, develop new skills, and carry innovations forward into practice."	

7.	**Midwestern Hemp Database Supports Producer and Policy Decisions**	In 2018, the USDA issued the "Interim Final Rule for the Domestic Production of Hemp," legalizing production of hemp in the United States for the first time in nearly 70 years. Industrial hemp can be grown to produce fiber, grain, and cannabinoids. Some cannabinoids determine profitability potential (CBD and CBG, for example) while one cannabinoid (THC) determines compliance. Growers must grow hemp crops which test below 0.3% THC in order to be compliant with state and federal regulation or risk crop destruction/penalties. Due to federal regulations and limitations in the past, there is a severe lack of university-published resources for industrial hemp production. As a "new" crop to Midwestern agriculture, best management practices (BMPs) and varietal performance of industrial hemp have yet to be determined including planting methods, variety performance, fertility requirements, rotational impacts, and compliance. Lack of scientific data supporting or refuting regulations outlined in the Interim Final Rule for Domestic Production of Hemp was the most common source of public complaints. Information from the Illinois Department of Agriculture (IDOA) as well as a needs-based assessment conducted by University of Illinois Extension have shown a tremendous need for information on variety performance and best management practices for industrial hemp in Illinois. In response to these needs, 30 hemp programming efforts were delivered to more than 3,000 attendees. Results of program evaluations and needs assessments revealed a strong need for further research and education in this new production area. Respondents selected "cannabinoid levels throughout the growing season" as the most pressing area of research. In April of 2020, through associations with researchers and private laboratories in the region, an Illinois Extension commercial agriculture educator (Philip Alberti) constructed the **Midwestern Hemp Database** (MHD). The MHD is a collaboration between University of Illinois Extension, University of Wisconsin-Madison, Michigan State University Extension, Purdue University, Rock River Laboratory, and Pride Analytics on Consulting. Participation in this program provided hemp growers an exciting opportunity to receive discounted cannabinoid analysis in exchange for data collection and data sharing. Data and sampling collection protocols were established and agreed upon by the MHD team in accordance with current USDA regulations. The results of the cannabinoid testing, and information on their production systems (variety, planting date, target population, fertilizer rates, etc.), were then publicly accessible through an online interface available at: https://extension.illinois.edu/global/midwestern-hemp-database .	Economic and Workforce Development

		More than 130 growers contributed 750 sample submissions for testing across the four participating states (Illinois, Michigan, Wisconsin, and Indiana). The value of cannabinoid testing supported through this partnership was valued at approximately $60,000. Data on production systems and agronomic performance of variety entries were also submitted. As a result of this "crowd sourced" and timely data, participating researchers and farmers were able to identify suitable hemp varieties and production strategies across the Midwest. When the USDA reopened the public comment period in fall of 2020 for the U.S. Domestic Hemp Production Program, comments were solicited on several topics including THC Testing and Negligence, Laboratory DEA Certification, Harvest Windows, and Exemptions for Research. Based on the unprecedented data captured in the MHD, Dr. Alberti submitted data-grounded recommendations to specifically address those issues. In January of 2021, the USDA published the "Final Rule for the Domestic Production of Hemp" that provides updated regulations for the production of hemp in the United States. The USDA Final Rule (which went into effect in March of 2021) includes several substantial rule changes. Specifically, data presented from the MHD analysis supported rule changes made regarding THC Testing and Negligence, Harvest Windows, and Exemptions for Research. In fact, specific references were made (pp 112 and 132) to the MHD findings as a source that informed policy changes. The Midwest Hemp Council shared five farmer-friendly highlights of the USDA's final rule (presented in the infographic below).	

		 This rapid response to address grower needs and inform public policy was an innovative solution that has the potential to impact grower networks across the region. Refining and expanding this program will improve a greatly underdeveloped knowledge base for hemp in our region and continue to allow science to impact policy. The resources and partnerships enable hemp producers to make informed decisions building on the combined experiences of researchers and other growers. Plans for expansion to additional Midwestern states and new partnering laboratories will be supported through a recently awarded SARE grant.	
8.	**Improving the Practice of Denitrifying Bioreactors to Mitigate Agricultural Drainage Nitrogen Losses**	Subsurface drainage networks significantly underpin agriculture across the U.S. Midwestern Corn Belt region with Illinois alone possessing more than four million hectares of tile drainage. Artificial drainage plays a vital role in regional agronomic production by improving trafficability and timeliness of spring field operations and by improving crop growth and yield. However, drainage systems are also a major contributing factor to both local and national water quality concerns. Illinois is usually the largest contributor of both nitrogen (N) and	Thriving Natural Resources

		phosphorus (P) to the Mississippi River Basin, which spurred the recently-released **Illinois Nutrient Loss Reduction Strategy** to call for agriculture in the state to reduce its annual nitrate-N load by 68 million kg. While Illinois' strong history of agricultural leadership perfectly positions the state to be at the forefront of environmentally-sustainable agricultural production, we need to work at a scale never before realized to meet our water quality goals. The long-term aim of this work is to refine and improve the practice of denitrifying bioreactors to mitigate agricultural drainage nitrogen losses for societally-desired clean water outcomes. Efforts along the lines of woodchip media specifications for improved design are continuing. We have finished two studies on oak and emerald ash borer-killed ash woodchips. Future planned investigations include woodchip carbon quality and microbiological aspects. Monitoring of more than ten full size bioreactors continues across the state. Our novel design sites include a bioreactor with baffles, a paired bioreactor (two operating in parallel during high flows), paired in-ditch and ditch diversion bioreactors, and a temperature enhanced bioreactor. Our network of bioreactors includes conventionally-designed bioreactors that serve as controls for the novel "treatment" bioreactors. A multi-year tracer testing campaign continued into this year. Advances include new equipment (bromide sensor) and discussions of possible use of these tracer data in bioreactor modeling efforts (e.g., using the HYDRUS model). To improve understanding of bioreactor hydraulic performance, we are doing a large scale (more than fifteen woodchips) evaluation of woodchip physical properties in the lab and compiling full-size bioreactor flow data from more than six bioreactors in Illinois.	
9.	**Using Anthocyanin From Purple Corn for More Efficient Bioethanol Production**	This project will help us develop new efficient bioprocesses that are capable of efficiently delivering multiple products: biofuels, foods, and industrial products from a wide range of conventional and transgenic feedstocks. Several strategies will be developed to recover value added products and characterize components of corn, other cereal grains, and biomass. High anthocyanin concentration in the pericarp and bioethanol coproduction from remaining fractions make purple corn an attractive source for anthocyanin extraction. Water-based anthocyanin recovery would provide “natural” anthocyanin extract with diverse applications in the food industry. However, low anthocyanin recovery with water-based extraction is not economically feasible on a commercial scale. The objective of this study was to investigate various approaches for increasing water-based anthocyanin recovery from purple corn and	Thriving Natural Resources

		assessing techno-economic feasibility of these process options for commercial scale application. Anthocyanin recoveries of 48.6, 68.6, 77.9 and 66.8% with single-stage, two-stage, three-stage, and two-stage countercurrent water-based extractions, respectively, from pericarp were higher than recoveries (30.8 %) with process conditions used in previous studies. Single-stage extraction with corn flour had 46.1% higher anthocyanin yield than single-stage extraction with pericarp due to low pericarp yields. Annual ethanol and anthocyanin yields for plants processing 1,113 MT purple corn/day were between 35.2 and 36.3 million gallons and 496 and 795 MT, respectively for processes modified for water-based anthocyanin extraction, compared to 42 million gallons for the conventional process. Capital costs for modified processes ($97.4 to $101.4 million) were higher than the conventional process ($87.2 million). Due to the high value of anthocyanins, ethanol production costs for modified processes ($0.98 to 0.48/gal) were lower than the conventional process ($1.34/gal). Internal rate of return for modified technologies was 1.9 to 3.1 times that of the conventional process, indicating an improvement in economic performance. Anthocyanin extraction process with three-stage anthocyanin recovery had the highest profitability among the processes.	
10.	**New and Experienced Gardeners Benefit from the 2020 Four Seasons Gardening Webinar Series**	With more time at home because of the coronavirus pandemic and its associated restrictions for remote work and social distancing, many people turned to gardening to pass the time, connect or reconnect with safe and healthy outdoor activities, grow their own food in light of unpredictable food supply issues, and promote both mental and physical health. Google data reported a 39% increase from 2019 to 2020 on gardening topics and seed companies, experiencing a sudden boom in seed sales, were at times unable to keep up with the demand. Media outlets even coined the term “pandemic gardens” to characterize this uptick in emphasis on home gardening in 2020. While many teams within University of Illinois Extension were faced with quickly converting programming from in-person formats to remote delivery in 2020, the **Four Seasons Gardening Webinar Series** has been a flagship online offering of the horticulture team for several years, with a typical line up of ten to twelve webinars per year. Designed to equip new and veteran gardeners with relevant research and best practices, popularity of the series has been high with 1,145 attendees across the 2019 webinar series. When demand for gardening assistance grew in 2020, the horticulture team was able to capitalize on their experience with digital delivery and maximize access to the program. They offered additional	Thriving Natural Resources

		webinar sessions (totaling 17 in 2020) in the 2020 series to meet increased demand. Topics ranged across indoor gardening, outdoor gardening, and practices to promote sustainable landscapes. All sessions were delivered in a live and interactive format with recordings subsequently posted to the University of Illinois Extension Horticulture YouTube channel (https://www.youtube.com/channel/UCUVXXZDcJox96nSvB0FotTw) accessible for viewing or reviewing. Interest and need in 2020 was at all-time high with 6,457 registrations and 3,900 attendees across the 17 session webinar series, representing a more than twofold increase over the prior year. The two most popular sessions (offered in May 2020) were *Creating a Pollinator Garden for Small Spaces* (391 participants) and *New Perennial Garden Theory* (390 participants). Session level participation across the series ranged from 109 to 391 per session. After each session, participants were asked to complete an online survey to rate their knowledge level before and after the session on three to five specific areas covered in the session, using responses of "Very Low" (1); "Low" (2); "Moderate" (3); "High" (4); and "Very High" (5). A total of 1,280 post-session evaluations were completed, resulting in a response rate of 33%. Overall, the sessions resulted in increased mastery of the covered topics. Participants reported knowledge increases for all topics covered by the webinars with differences between before and after program ratings reaching statistical significance at $p<.001$ for each session. The largest absolute knowledge change was observed for the *Winter Sowing of Seeds* session with a mean knowledge rating of 2.17 before and 4.22 after the program, reflecting a change of 2.05 on the five-point scale. Effect sizes (Cohen's d) ranged from .798 *(Gardening 101)* to 1.094 *(Illinois Monarch Action Plan*). All would be considered sufficient effect sizes, approaching or exceeding the threshold of .8 for large effects. The share of participants reporting "High" or "Very High" levels of knowledge on specific topics increased from 26.5% on average before the sessions to 87.9% after the webinars. In addition to reaching the general public, these webinars provide continuing education for Master Gardener and Master Naturalist volunteers. Along with volunteer core training, continuing education such as the Four Seasons webinars and other Extension programs helps equip volunteers to respond to informational inquiries related to plant cultivation. In 2020, Master Gardener volunteers responded to over 51,000 of these informational inquiries.	

		For the first time, a follow-up evaluation was conducted (after the 2020 series ended) to determine actual actions taken as a result of what participants learned. The online survey was distributed to 2,361 unique email addresses supplied at registration. A total of 168 participants completed the follow-up evaluation that included questions assessing actions taken (if any), what sessions were viewed either live or via posted recordings, relevance of the topics (98% did), prior level of gardening experience (nearly one-half reported extensive experience), county of residence (came from 46 different Illinois counties), and volunteer membership in the Master Gardener or Master Naturalist program (67% identified as volunteers). Overall, 75% of webinar views resulted in some action, and 86% of respondents took action of some sort. Some webinars were particularly effective, with up to 96% of viewers reporting having taken one or more actions based on viewing Landscape Design with Natives. Volunteer viewers were slightly more likely to take actions (87%) than public viewers (84%). Webinars in this series can be grouped into three target-intended outcomes resulting from actions reported by viewers. • **Healthy indoor environment**. One webinar session (*Create Your Own Bottle Terrarium*) contributed to healthy indoor environments - indoor plants have been shown to improve indoor air quality and have a number of benefits for resident health. Participants reported 19 actions that contribute to this outcome. • **Healthy outdoor environment.** All other webinars (16) are aimed at improvements in outdoor environments, whether they are aimed at healthier plants or at specific uses of healthy plants (such as vegetable gardens). Since planted environments have been shown to confer numerous physical, emotional, and cognitive benefits, these actions contribute to a more robust, healthy planted environment. The sixteen webinars in this category resulted in a reported 689 actions contributing to a healthy outdoor environment. • **Sustainable landscapes.** Five webinars aimed at strengthening sustainable landscapes through control of invasive species or through support for pollinators or wildlife. These webinars resulted in 280 actions. Some specific actions associated with other webinars also contributed to sustainable landscapes, for a total of 298 actions. Based on a calculated rate of 4.6 actions on average per viewer and extrapolated to the full 3,900 webinar participants, the webinar series may have contributed to more than 4,500	

		actions. While these actions have the potential to improve the lives and environments of program beneficiaries, these actions also contribute shared public good such as pollinator protection and invasive species control.	
11.	**Master Naturalist Core Training Meets Goals and Prepares Volunteers for Service**	Volunteers are the lifeblood of University of Illinois Extension. They represent a special and unique audience; with learning goals for themselves and goals to make a difference in the world around them. University of Illinois Extension's **Master Naturalist Program** provides science-based educational opportunities that connect people with nature and help them become engaged environmental stewards. The program educates and trains adult volunteers so they are better equipped to share natural resource information with others in their communities and to assist with environmental conservation and restoration activities. The Master Naturalist program covers core topics while giving local units the flexibility to tailor topics to the local area. Their journey begins with a core training that is followed by a menu of continuing education opportunities conducted by educators and specialists across the agriculture and natural resources program area. The 12-session core training covers topics including ecology, invasive species, mammals, birds, forestry, geology and much more. In the fall of 2019, a task group led by the Master Naturalist state coordinator developed a core training evaluation survey tool that would enable the first statewide evaluation of the core training offered in units across the state. Historically, local evaluations were conducted but there had been no standardization of questions or ability to compile data across units to determine program level effectiveness of the core training experience. Ten units conducted Master Naturalist core training in fall 2019, with 159 participants. As a pilot cohort, statewide evaluation surveys were administered during the final session and were completed by 116 respondents for a response rate of 73%. The Master Naturalist training increases participants' knowledge and abilities on targeted topics: Knowledge increased on all core thematic topics, including as cycles of nature, Illinois ecosystems, identification strategies, protection of natural resources, and invasive plants. The share with "High" or "Very High" knowledge increased from an average of 27% to 80% over the six questions. Similarly, participants reported an increase in core skills such as the identification and use of research-based sources for natural resources information, sharing information about the natural world with others, and practicing environmental stewardship in the community, with the share of participants rating their abilities in these areas increasing from 35% rated "High" or "Very High" before the training to 81% after the training.	Thriving Natural Resources

		Participants indicated feeling "Very Well Prepared" (59%) or "Somewhat Prepared" (41%) to begin volunteering as a Master Naturalist. Participants enter the core training with a variety of goals: Nearly all say their goals were met. Participants have a range of goals in participating in the program, with most participants interested in increasing knowledge of natural resources and the environment generally (92% of respondents) and increase in knowledge of the local area (91%). The majority (83%) cited preparation for Master Naturalist volunteer work as a goal, and nearly two-thirds (64%) cited connecting with others. One-quarter (24%) of respondents cited professional development/preparation for current or prospective work as a goal. Nearly all (94%) of respondents said that their goals were met "Fairly Well" or "Very Well". The pilot statewide evaluation results suggest that the core training program not only met programmatic goals for preparing adults to be better equipped to share natural resource information with others in their communities and to assist with environmental conservation and restoration activities, but also met participants' goals. This alignment of outcomes provides evidence that the core training has mutually beneficial value; an important factor in continually expanding the cadre of Master Naturalist volunteers. The total active pool of volunteers expanded from 913 in 2019 to 1,016 in 2020. COVID-19 related restrictions limited volunteers' ability to carry out many of their typical stewardship activities. Master Naturalist volunteers still found ways to share their talents, reporting more than 48,000 hours dedicated to the program in 2020, valued at more than $1.3M of service to their local communities.	
12.	**Improving Control of Soybean Diseases in Illinois**	One of the most effective forms of disease management is the use of host resistance. However, plant pathogens can overcome resistant cultivars. Furthermore, pathogens can also adapt to chemical means of control. Adequate management of resistance and chemical controls thus is a function of the pathogen population structure. Genomic technology allows for efficient tracking of pathogen populations that in turn should be able to inform farmers and seed companies so that adequate varieties can be planted each season. Our hypothesis is that different strains of pathogens of field crops contain distinct repertoires of pathogenesis proteins that result in advantageous interaction under the appropriate conditions. We surveyed diverse varieties of corn, soybean, and wheat for the presence of major pathogen strains. We then extracted RNA and identified pathogenesis proteins. Finally, with collected strains and molecular methods we will determine levels at which the pathogens reduce yield in Illinois. The identification of pathogenesis proteins from major diseases of corn, soybean	Safe, Plentiful, and Accessible Food Supply

		and wheat will allow us and others to make informed recommendations for the deployment of disease resistant varieties and chemical controls. A collection of 124 oomycete pathogens that cause disease on soybean and maize seedlings was collected between 2016 and 2019. Isolates were obtained from soil samples and diseased soybeans. Among the oomycete pathogens, we are finishing the characterization of Phytophthora species causing diseases on soybean in Illinois. These results will allow us to propose plant disease precision management techniques for Phytophthora root rot of soybeans. A collection of 234 fungal isolates was obtained from maturing and mature soybean plants. This isolate collection could be used to better study the end of cycle diseases of soybean. A collection of 197 Fusarium isolates was obtained from diverse wheat lines in Illinois. The isolates were processed and are now in long term storage. Among these isolates, we identified a novel species causing Fusarium head blight. The characterization of these isolates will continue funded by the U.S. Wheat and Barley Scab Initiative. We published a paper reporting molecular markers to identify strains of Setosphaeria turcica (causal agent of northern corn leaf blight) that are able to overcome the Ht1 and Ht2 resistance genes. This describes how to use molecular methods to identify S. turcica isolates that are able to overcome two of the most widely used resistance genes in maize. We have developed and validated primers and probes to identify Septoria glycines. This pathogen causes the most prevalent soybean disease in Illinois. The molecular method we developed allows further studies of a possible latent infection phase. Detection of plant pathogens could also be accomplished using microbiome techniques. We used Nanopore sequencing technology on DNA extracted from soybean field samples that had been inoculated with Septoria glycines and treated with or without fungicide. Sequencing produced 6.9 Gbp. We finalized the bioinformatics and are working on the statistical analysis. Molecular methods (specifically ARMS and RFLP PCR) were developed and validated for the identification of three variants in the Avr1k locus of Phytophthora sojae. Our objective was to develop a molecular technique that will permit pathotyping of Phytophthora sojae from DNA.	

13.	**Addressing Food Insecurity in 2020: Mobilize, Partner, and Safely Connect**	According to Feeding America, as of 2018 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%). Projected impact of the coronavirus pandemic on food insecurity in 2020 is estimated to affect 14.7% of Illinoisans with several counties exceeding one out of five food insecure residents. 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 more than $1.9 billion according to data published by Feeding America Research. To systematically address food insecurity now and in the future, Illinois 4-H developed a statewide **4-H Food Advocacy Team** comprised of 4-H members who mobilize other youth in their communities to determine the local food needs and develop a plan to address food insecurities. This 21-member team represents 15 counties, spanning rural and metropolitan populations, and has plans to host a Food Action Summit in 2021. While food insecurity was heightened as a result of the pandemic, 4-H Food Advocacy Team members found ways to coordinate and assist local food access efforts including drive-through mobile food markets, food drives to collect and distribute food donations, and custom-made "pop-up" produce stands. The **Illinois SNAP-Ed** program pivoted to serve families in new ways by mobilizing food access efforts to broaden healthy food equity through mobile food distributions and grant application assistance in addition to connecting and strengthening community partnerships. With a robust network of partners (including food pantries) banding together to address food insecurity, these networks distributed food, funds, and resources more effectively in highest need communities with over 200 food pantries across 28 Illinois counties. SNAP-Ed supported food banks and community organizations facilitating 37 mobile food distribution markets. These efforts resulted in over $237,000 of funding distributed in three regions of Illinois, which included providing technical assistance to partners and helping to secure funding for the USDA Farmers to Families Food Box. Staff then assisted setting up box distribution to food pantries and community organizations. Staff helped design novel distribution methods for the boxes including direct delivery and mobile pantries. Strong partnerships allowed SNAP-Ed to support local hunger relief organizations in accessing healthy food to serve an increased number of pantry clients, by directing and re-directing	Safe, Plentiful, and Accessible Food Supply

		grant funds, supporting infrastructure needs, obtaining fresh food, and supporting the transition of food distribution models. Although COVID-19 restrictions impacted the ability of **Illinois Extension Master Gardener** volunteers to coordinate support of food donation gardens at levels experienced in past years, Extension was able to actively support 81 food donation gardens in 2020. Despite the challenges associated with prohibited or limited gatherings during the 2020 growing season, volunteers found a way to cultivate more than 63,000 pounds of produce from supported food donation gardens. For those who were unable to support public gardens during the pandemic, Master Gardener volunteers generated and organized donation of nearly 10,000 additional pounds of produce from home gardens. Research has documented the critical importance of food banks in alleviating food insecurity. With produce donations valued at more than more than $100,000, Master Gardeners contributed to increased availability of nutritious options for food insecure individuals and families in Illinois. Harnessing the power of technology, collaborations, and "real time" data, the **Find Food Illinois Community Food Map** (https://eat-move-save.extension.illinois.edu/#find-food-il) launched in August 2020 in response to the escalating food insecurity crisis associated with the COVID-19 pandemic. The tool was produced with concept design and data input from a variety of state partners include Feeding Illinois and its network food banks, Midwest Foodbank Network, the Illinois State Board of Education, the Illinois Department of Human Services, the Illinois Department of Aging, and FoodFinder, Inc. The comprehensive new tool combines all of the resources a food insecure family might need, together in one geo-locating mapping tool, making it particularly convenient for those with limited access to transportation. In addition to locating food pantries, soup kitchens, and school and summer meal sites, households seeking food support can find the nearest grocery stores, food retailers, farmers markets, and roadside stands that accept SNAP, WIC, or senior food benefits. Illinois SNAP and WIC offices, where individuals can sign up for these programs, are included as well. The tool has garnered widespread support from local communities, state and federal leaders including USDA Deputy Undersecretary Brandon Lipps, U.S. Congressman Rodney Davis, Illinois Lt. Governor Juliana Stratton, the Cook County Department of Public Health, and Feeding Illinois. To date, 24 local partners have requested to host a link (or have already hosted a link) to the map on their agency's website. During FFY 2020, 1,510 unique users accessed the Find Food Illinois Community Food Map application with a total of 3,289 page views.	

		Through these combined efforts, Extension blended high tech with mobilization strategies to meet the needs of those with increased vulnerability to food insecurity as a result of the pandemic. Collectively, these efforts have the potential to contribute to a reduction in the negative consequences and excess health care costs associated with food insecurity in Illinois.	
14.	**Illinois Crop Producers and Advisors Find Value in 2020 Annual Crop Management Conferences**	Illinois is a key producer 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. The **2020 Illinois 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. An integrated research and Extension effort, ACES faculty Extension specialists and Illinois Extension commercial agriculture educators collaborated to deliver workshops across four locations. Specific topics addressed weed, pathogen, and pest management as well as nitrogen management and factors affecting tile nitrate loads. Hemp production for grain, fiber, and CBD markets and supporting farmers by promoting mental health were timely topical areas covered for the first time in 2020. A total of 294 conference participants represented those primarily employed in agri-business (74%), as certified crop advisers (54%), and as crop producers (31%). The vast majority (98%) of the 113 Crop Management Conference evaluation respondents reported that they intend to use information from the conference and 72% replied that they would implement a new technique or practice. Increased knowledge of “hemp production for grain, fiber, and CBD markets” was noted by 86% of respondents, increased knowledge of “impacts of cover crops on soybean cyst nematode” was reported by 78% of respondents, and 71% of respondents indicated a knowledge increase associated with “disease management of tar spot in corn.” Nearly all respondents (98%) indicated that in the coming year they intend to implement a new crop management technique or practice as a result of	Safe, Plentiful, and Accessible Food Supply

		what they learned. Evaluation respondents who identified as farmers (and reported the number of acres they farm) collectively estimated an economic value of conference information and techniques at over $100,000 to their operations. Even this estimate is based on just a subset of conference participants. In fact, one out of five participants who advise producers (with the potential to influence far more acreage given the multiple farmers with whom they consult) estimated that 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, 73% reporting making a change in one or more management practices as a result of attending the conference. Weed management practices were the most commonly implemented (59% of respondents). Adoption of new pest management and fertility management practices were each reported implemented by 36% of respondents. Given reported changes in management practices and the estimated value of the conference by participants, the 2020 Crop Management Conferences has the potential for significant impact on food production in Illinois.	
15.	**Reducing Crop Losses to Maize Diseases Caused By Biotic Stress**	Over 184 million hectares of maize were planted in 2013 resulting in production of over one billion tonnes of grain (FAOSTAT). Crop losses caused by maize diseases, excluding viruses, have been estimated to be 4-14% of the global annual harvest. Productivity of maize can be improved by reducing losses due to biotic stress. Foliar pathogens of maize can cause significant yield losses and are one of the main causes of yield loss in corn. Some foliar diseases, such as northern leaf blight (NLB) and gray leaf spot (GLS) remain important year after year both in the U.S. and internationally, while others such as Goss' wilt have reemerged as a disease of major importance in the Midwest. Also of high importance are ear rot diseases which can produce mycotoxins. While fungicides can offer protection against some diseases, they are not always cost effective. Host resistance remains one of the most effective means of disease management in maize. It is important to identify sources of resistance, map disease resistance, and identify the allelic variation at known disease resistance loci. Determining the molecular mechanisms of plant-microbe interactions and understanding the evolutionary forces acting on genetic variation will enable the development of durable resistance. While the mechanisms of qualitative resistance are well understood, the mechanisms of quantitative resistance remain largely elusive. In Arabidopsis it is known that both qualitative and quantitative resistance are associated with fitness costs and are under balancing selection. Two loci conferring a strong decrease in disease severity in maize have been evaluated for their effect on yield both with and without disease pressure and the results were mixed with a yield penalty associated with some loci but not others. Until	Safe, Plentiful, and Accessible Food Supply

		recently very few genes involved with resistance in crop species had been cloned to allow for a fine-scale evaluation of the costs of resistance. We have made significant progress in understanding host resistance to bacterial diseases in maize and multiple disease resistance. We identified sources of resistance for both diseases. For Goss's wilt we demonstrated that genomic prediction could accurately predict disease severity in a panel of diverse inbred lines. The genetic architecture of resistance to Goss's wilt is complex, and these efforts have contributed to our understanding of host resistance to this disease. Using several related populations, we mapped previously identified quantitative trait loci (QTL) as well as novel QTL for resistance to Goss's wilt. We identified QTL that were of small and moderate effect. Some of these are of interest for further study, including fine mapping and could be of use for marker-assisted selection. Bacterial leaf streak is a recently emerged disease in the United States and there was no previous knowledge when this project began about host resistance to this disease. We published the first study examining bacterial leaf streak resistance. In this publication we reported the evaluation of a small panel of inbred lines. Based on those results we selected and evaluated three mapping populations. Resistance was heritable, indicating that breeding progress can be made. We identified small and moderate effect QTL for this newly emerged disease. This work provides the foundation for breeding for bacterial leaf streak resistance. We examined the relationship among resistance to fungal and bacterial diseases. We combined the Goss's wilt data generated as part of this project with previously published data. We found that resistance to bacterial diseases is largely independent of resistance to three common foliar diseases of maize (NCLB, SCLB, and GLS). Furthermore, we identified genomic regions that confer resistance to multiple diseases. In some cases, alleles conferring resistance to some diseases conferred susceptibility to other diseases. This could have implications in breeding for multiple disease resistance in maize. Several promising loci were selected for confirmation, which is ongoing. We contributed to a manuscript on vascular disease resistance conferred by the pan1 region. We evaluated several alleles of the pan1 gene in different genetic backgrounds and analyzed the data. We found a significant difference between the wild-type lines and mutants for Goss's wilt. These findings further support the role of the pan1 region in vascular disease resistance.	

16.	**Food Preservation in a Digital Landscape: What Can I Do with All These Tomatoes?**	Increased time at home and fears of uncertain food supply chains during the early months of the COVID-19 pandemic created the motivation to cultivate "pandemic gardens" and purchase food (and other supplies) in bulk. Bumper crops from gardens and high-volume purchases of seasonal produce (when prices were lowest) created the need to identify safe ways to preserve perishable items like fresh produce in order to maximize its shelf-life and limit food waste, impacting not only the gardeners and consumers but also the environment. Enter University of Illinois Extension's Nutrition and Wellness Team, with a long history of providing educational outreach and technical assistance on safe food preservation to consumers. The team quickly mobilized to plan an effort to maximize reach and impact, developing an eight part **Fill Your Pantry: Home Food Preservation Webinar Series** during the peak of harvest season (July-August 2020). Each one-hour session featured a different type of seasonal produce or best practices for a specific preservation method (drying, canning, freezing, pickling, and fermenting). The series covered current research-based food preservation and safety practices, supplemented with scientifically-tested recipes to enable adoption of practices. After the live broadcast, each session was converted to a YouTube recording and can be found on Extension's YouTube site: https://www.youtube.com/channel/UCUVXXZDcJox96nSvB0FotTw. In an effort to strategically layer interventions as a way to reinforce learning and catalyze action, the team capitalized on social, print, and mass media to release a coordinated **31 Days of Food Preservation** media campaign during the same time period. The media campaign provided daily fact-based tips on current food preservation methods through 39 posts distributed via the University of Illinois Extension's Around the Table Facebook page located at https://www.facebook.com/Family.Finances.Food/. These daily posts were supported by weekly news releases covering food preservation, monthly radio segments and podcasts, and access to an online food preservation toolkit with ready graphics that other Extension staff and partners could use to promote food preservation messages. The layered and intentional focus on un-biased, timely, and accessible food preservation outreach resulted in high levels of engagement. Social media analytics revealed more than 51,000 individuals were reached with Facebook and Twitter media campaign posted content. Distribution of food preservation content through mass media channels (news-releases, radio	Safe, Plentiful, and Accessible Food Supply

		segments, and podcasts) potentially reached one million viewers. Facebook Event posts to promote the Fill Your Pantry webinar series reached more than 425,000 people. This was a powerful recruitment strategy with 5,600 registrations for the series, signaling a high degree of interest and demand. Nearly one-half of registrants (2,380) viewed one or more webinars during the live broadcasts. Participants were encouraged to use the chat box for comments and questions. More than 200 questions were submitted and addressed during the live webinars, indicating a high degree of engagement. Following each webinar in the series, participants were invited to complete an evaluation to share their feedback and self-report how the session impacted them. Session handouts were automatically sent to those who completed the post-session evaluation as an incentive. This incentive netted 1,009 evaluation respondents with a response rate of 42% - considered extremely high in the world of online survey participation. Evaluation results suggested high levels of learning and strong potential that safe food preservation techniques were integrated into home practice. The majority of respondents reported increased knowledge (79%) and increased confidence to follow recommended safe home preservation methods (84%). In addition, 75% agreed that they were "Very Likely" or "Extremely Likely" to implement one or more food preservation practices and 91% reported an increased ability to practice safe food preservation techniques as a result of the webinar(s). If outcome evaluation findings can be extrapolated to the full webinar series audience, increased capacity to practice safe food preservation techniques benefited more than 2,000 individuals. Secondary positive impacts are likely if beneficiaries are part of families or other group living situations where food preparation, storage, and meals are shared. Adoption of safe food preservation techniques has the potential to reduce foodborne illness, unnecessary food waste, and to increase health benefits of longer-term access to nutritious produce long after harvest or purchase.	
17.	**Improving the Profitability of Wheat Production in Illinois**	Winter wheat plays an important role in the agroecosystem in Illinois because it acts as both a cover crop and a cash crop. Cover crops are beneficial because they help to control weeds, reduce erosion, and improve soil quality. Over the past century, acreage of wheat has been on the decline in Illinois because planting continuous corn or corn in rotation with soybean has become more economically favorable. Improving the profitability of wheat production is needed to ensure that wheat remains an economically viable crop in the state of Illinois. Each year about 500,000 acres of wheat are planted and harvested in Illinois and the majority of these acres are in the southern half of the state where wheat can be planted and	Safe, Plentiful, and Accessible Food Supply

		harvested prior to soybean planting in the same growing season. This double-cropping system can be more profitable than growing a single crop of either soybean or wheat. The main traits driving the profitability of wheat in the double-cropping system in Illinois are yield, earliness, test-weight, and deoxynivalenol (DON) content of the grain caused by the Fusarium head blight (FHB) pathogen, Fusarium graminearium. Early maturing wheat varieties enable earlier planting of soybean which in turn leads to higher soybean yields. Test weight and DON content are used by grain purchasers to adjust the price paid to farmers at the time of sale. High test-weight and low DON are needed to achieve the full commodity price. Yield, earliness, test-weight, and DON can be improved to some extent through management; however, over the long-term, greater progress can be made through genetic improvement of these traits in combination with improvements in management. Although this project focuses on improving the profitability of wheat in Illinois, it will have broader impacts. Wheat varieties developed in Illinois often perform well in other states such as Kentucky, Indiana, Missouri, and Ohio, thus we anticipate that the varieties we develop through the project will be grown across the north central Midwest. Breeding programs across the eastern U.S. also use Illinois wheat lines as sources of FHB resistance and early maturity. This leads to faster progress in wheat improvement in the entire eastern region. Lastly, Illinois will be the first wheat program in the U.S. to develop and/or implement new selection methods such as economic selection indices. By being a leader in breeding method advancement, we will promote the use of quantitative breeding methods across the wheat community thereby accelerating wheat improvement in the U.S. and beyond. New crosses were made, early generation breeding populations were advanced, new breeding lines were developed, and advanced and preliminary testing was conducted to evaluate all traits of interest including grain yield across multiple locations. By continuing to conduct these processes effectively, we ensured that the University of Illinois winter wheat breeding germplasm will continue to improve. We also began routine genotyping of all stage-1 breeding lines to initiate GS. Lastly, we identified and selected superior wheat lines for release with high expected profitability based on their performance for yield, test weight, DON, and earliness. These lines were licensed to a seed company and they are being increased on a large scale for commercialization.	

18.	**Identifying Effective Safeners for Protecting Grain Sorghum and New Genes and Proteins That Confer Safener-Induced Tolerance**	Safeners are frequently used with herbicides that normally cause injury in unsafened cultivated grain sorghum [Sorghum bicolor (L.) Moench], and are typically applied as seed treatments to avoid safening weedy sorghum relatives such as Johnsongrass (Sorghum halepense). However, the precise mechanisms underlying this safening response remain largely unknown. The overall goals of this project are to identify effective safeners for protecting grain sorghum from the soil-appiled preemergence (PRE) herbicides, pyroxasulfone and *S*-metolachlor, and to identify new and important genes and proteins that confer safener-induced tolerance in grain sorghum using a diverse array of methods. Pyroxasulfone, a pre-herbicide used in soybeans and corn, has demonstrated excellent grass and broadleaf control. However, pyroxasulfone is not labeled for grain sorghum because crop injury is a major limitation. We evaluated five herbicide safeners in the greenhouse to determine their ability to protect sorghum from pyroxasulfone. Growth data indicated seed-applied fluxofenim provided the highest level of protection to emerging seedlings. A second objective of this study was to evaluate fluxofenim for protecting sorghum from single and sequential pyroxasulfone applications in the field. A single pretreatment of *S*-metolachlor, an untreated-weedy control, and weed-free control were compared with pyroxasulfone to assess weed control, crop injury and stand count, and grain yield. Pyroxasulfone provided greater weed control than *S*-metolachlor. However, as pyroxasulfone rates increased both weed control and crop injury increased, regardless of safener. In contrast, sequential pyroxasulfone applications (90/120 or 120/90 g/ha) did not elicit as much crop injury or stand reductions as a single PRE application at the same total rate (210 g/ha) and maintained weed control, which resulted in higher yields. Despite increased crop tolerance and yield with sequential relative to single pyroxasulfone applications, however, these findings indicate a more effective herbicide safener for protecting grain sorghum from pyroxasulfone injury is required. This project also aimed to shed new light on important genes and proteins that confer safener-induced tolerance in grain sorghum seedlings. Few published studies have characterized expression profiles in response to safener treatment in cereal crops. We utilized and incorporated results from several molecular-genetic and biochemical approaches to investigate mechanisms involved in safener-signaling pathways in grain sorghum seedling tissues. 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 genes glutathione *S*-transferase (SbGSTs) identified via GWAS were investigated further via gene-specific RT-pPCR. Transcript profiling identified numerous	Safe, Plentiful, and Accessible Food Supply

		safener-induced GSTs, cytochrome 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. 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, this research elucidated a new direction for studying both constitutive and inducible mechanisms for chemical defense in cereal crop seedlings. 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 has facilitated the discovery of new crop protection chemicals for enhancing herbicide tolerance in cereal crops, as well as assisted 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.	
19.	**Improved Calcium Management in Dairy Cows**	Dairy cows are susceptible to "milk fever" (parturient paresis; low blood calcium) at calving. This is a life-threatening disorder where the cow is unable to restore her blood calcium concentration to normal as the mammary gland begins to make milk, which rapidly removes calcium from the blood to secrete in milk. Unless intravenous calcium is provided, the cow will die. Several effects of subclinical hypocalcemia, lowered blood calcium without the clinical signs, also have been documented (lower feed intakes, lower milk production, decreased reproductive function). Subclinical hypocalcemia is often described as a "gateway disorder" because in turn it can increase the likelihood of other disorders around calving, including retained placenta, displaced abomasum, ketosis, metritis, and mastitis. Calcium management in the time before and after the sudden demand for calcium at calving, therefore, is a critical challenge facing nutritionists, veterinarians, and farm managers. One way to help cows avoid hypocalcemia after calving is to feed a very low calcium diet before calving. This restores the sensitivity of hormonal signals to mobilize calcium from the	Safe, Plentiful, and Accessible Food Supply

		bone and increase calcium absorption from the diet after calving. This practice is often difficult to achieve in the field because many common cattle feeds contain too much calcium for this approach to be effective. Another proven practice to increase the degree of hypocalcemia is to feed an "acidifying" diet, one in which the balance of positive cations (sodium plus potassium) is less than the negative anions (chloride and sulfate) in the diet. This negative dietary cation-anion difference (DCAD) causes physiological changes in the cow that enable her to mobilize calcium from the bone reserves, decrease urine calcium loss, and increase absorption of dietary calcium more rapidly after calving and the start of milk synthesis. Although this practice is well established in the industry, controversy remains about the degree of acidification and the best amount of dietary calcium to feed along with the negative DCAD. Cows fed high Ca (HIGH) and low Ca (LOW) in a fully-acidified diet prepartum had improved days to first ovulation than cows not fed a fully acidified diet (CON). Cows fed HIGH tended to be more likely to become pregnant than cows fed CON. Overall, cows fed a fully-acidified, negative DCAD diet prepartum had improved reproductive performance postpartum. Cows fed HIGH had improved glandular epithelial cells, greater SOD activity, and lower GPX activity than cows fed LOW indicating an improved redox environment in the uterine tissue, which may lead to improved post-partum fertility. Our results showed that feeding RPL around parturition results in modulation of genes involved in inflammatory and immune responses, likely due to the potential antimicrobial activity of Lys. This improvement in the uterine immunity resulted in maintaining a proper inflammatory response, decreases in PMN counting and increasing anti-inflammatory cytokine IL10 by the fourth week postpartum, which indicates the resolution of the inflammatory process associated with clearance of pathogens and uterine involution. Therefore, cows that received RPL were less likely to develop purulent vaginal discharge. Additionally, a stimulus to cell proliferation was evident as a response to RPL through the trend to increased number of glandular epithelial cells. There was no effect of feeding RPL on the follicle size at the time of ovulation, but a lesser variation in growth rate of the dominant follicle was evident. Overall, feeding RPL throughout the transition period proved to be beneficial to the uterine immune function of the cow.	

20.	**Reducing Malnutrition Through Improved Iron Fortification Quality Control in Low-Resource Settings**	Malnutrition, due to over and undernutrition, continues to undermine public health agendas all around the globe. A rapid transition in the continuum of diet adequacy (i.e. nutrients/energy) from poor to adequate and then to poor again can now be observed in most countries, where on one end protein/energy and micronutrient deficiencies are the hallmark of undernutrition, and micronutrient deficiencies and chronic diseases such as diabetes, cardiovascular illnesses, and metabolic syndrome abound in the other. Although the strategies to bring adequate nutrition to individuals within this continuum are present, these often conflict with our limited understanding of the individual's needs, the socio, cultural and economic determinants of food consumption, and the delivery vehicles and matrix effects on nutrient/bioactive absorption. We sought to design, evaluate and implement strategies and technologies that will assess nutrition status of and maximize nutrition delivery to individuals and populations at different stages in the nutrient/energy adequacy continuum. Technologies will be low-cost, stealth or culturally accepted, simple to use, adaptable to current deficiencies, of limited energy input, and environmentally friendly. The target populations to use or benefit from these technologies would be low-income populations, food fortification facilities, food processing facilities, Extension officers, and staff at laboratories and clinics. Micronutrient fortification of staple foods has resulted in improved nutritional status of populations worldwide. Lack of laboratory techniques and quality control tools, however, have limited the implementation of and compliance with fortification policies, especially in low-resource settings. We published our method to determine iron in fortified corn samples in the journal Nutrients. This iron sensor provides an accurate, reliable, and sensitive alternative to measure iron in fortified corn in low-resource settings. With the support of a Fulbright fellowship, a member of our team traveled to Mexico to validate the assay. With the support of peers from the Universidad Autonoma de Queretaro, we obtained the necessary data to validate the iron sensor in its ability to accurately and reliably measure three types of iron used in the fortification of corn flour. In addition, we have optimized the sensor to measure other types of iron as well as zinc. We have improved the paper platform and expanded the linearity of determinations for iron.	Safe, Healthy Environments and Behaviors

21.	**High Demand for Brain Health Programs Results in a Cost-Efficient Digital Delivery Model**	Alzheimer's disease affects roughly 5.8 million people in the U.S. and is the fifth leading cause of death among Americans age 65 years and older (https://www.alz.org/alzheimers-dementia/facts-figures). By 2030, more than 24% of Illinois' residents will be 60 years of age or older. Currently the biggest risk factor for dementia is age. Research shows that positive lifestyle and wellness choices and effective management of other health conditions are contributing factors to brain and body health, potentially increasing the length and quality of a growing population in Illinois. Through a variety of in-person and virtual programming formats, the family life team made brain health a primary focus of their programming in 2020. The overall goal of the **Illinois Extension Brain Health Initiative** is for participants to adopt long-term health-promoting behaviors to enhance physical and mental wellness. The team's brain health programs center around research that supports lifestyle factors that contribute to brain health, some of which include rest, diet, socialization, stress management, intellectual engagement, and physical activity. With the onset of COVID-19 and the subsequent halt to in-person programming in March of 2020, the family life team quickly adapted their delivery focus to a virtual platform. A six-week *Discover Brain Health webinar series* was held in May/June 2020. Webinars in the series included, *Hold That Thought, Fit Wits, Head Strong, Two Heads are Better than One, Understanding Alzheimer's Disease, and Communication Challenges and Strategies for People with Dementia.* In July/August 2020 the *Illinois Municipal Retirement Fund (IMRF) Brian Health webinar series* was offered to IMRF retirees. These virtual offerings were designed to help participants understand the brain as we mature, and tips and strategies were provided to maintain and improve brain health and function, including activities to challenge the brain. A total of 2,863 participants engaged in these two brain health webinar series, tuning in from 41 states and three countries. To provide context, across all 117 brain health programs offered in 2019, the programs collectively reached 1,491 participants. These series offered high demand programming to about twice the number of attendees (compared to 2019) with a high degree of cost-efficiency due to less program delivery time and reduced travel costs for the family life team. Across 2020, the team facilitated 135 brain health programs, through a variety of in-person and virtual programming formats, directly reaching more than 3,000 participants. Research-based information released via news articles, social media posts, the Extending Wellness texting program, radio interviews, podcasts, and newsletters had an estimated audience	Safe, Healthy Environments and Behaviors

		reach of 317,501. Most notably, the **Family Files Blog** garnered 10,248 page views, with many of the articles featuring a brain health related topic. Participant outcomes (highlighted below) were gathered through a post-webinar and post-series online surveys. Some of the most important and relevant information participants reported learning from one or more webinars: • How critical brain health is, and how important it is to do everything possible, especially as a senior, to do anything in my power to lead a healthy brain lifestyle • I shouldn't be scared or nervous to talk about dementia or Alzheimer's with my family. My grandmother is showing signs and I feel more confident and comfortable approaching the subject with my mom and her siblings, thanks to this webinar • How many different types of dementia there are including Alzheimer's and their causes • Better understanding of risk factors of Alzheimer's Actions series participants intended *to take* as a result of one or more webinars included: • Keep in touch with friends, don't wait to hear from them, call them, challenge the brain • Regularize my sleep hours; socialize more online until the pandemic restrictions are lifted • Play more games with my family to stimulate brain cognition • Encourage others in my life to make efforts at social connections in a variety of ways • Make sure I learn something new every day! I'll start with a new vocabulary word • Try to eat more fruits and vegetables and reduce sugar intake • Bump up my exercise routine • Wear a helmet when bike riding • Work on stress management and mindfulness Action participants *actually implemented* or changed as a result of the three-part brain health series included: • Signed up/now attending an online exercise class twice a week • Accepted a leadership position to engage positively in social interaction	

		• Try to remember my grocery lists without writing them down! Try to make new words out of a group of words. Signed up for an online word puzzle/game as brain teasers Private value to participants means a potential delay in the onset of cognitive decline, thus increasing their ability to age in place longer, to remain socially engaged, to maintain independence, and to continue as valuable contributors to their communities. Public costs can be potentially averted including Medicare and Medicaid expenditures associated with both treatment of mild cognitive decline and Alzheimer's disease. Plans are underway for 2021 to conduct a more systematic evaluation of outcomes given the high degree of popularity and promising qualitative responses.	
22.	**Improving the Ability of Courts to Adequately Consider Intimate Partner Violence in Divorce and Custody Proceedings**	Intimate partner violence (IPV) is common among divorcing parents in the U.S. who are unable to develop custody and visitation agreements on their own and thus require judicial intervention. Custody and visitation agreements refer to physical and legal custody determinations as well as visitation orders for nonresidential parents in final divorce judgments. Courts are mandated to factor IPV into decisions about custody and visitation, and researchers and advocates urge courts to prioritize safety in agreements, defined by limiting father's access to children, protecting mothers during exchanges, and including general safety contingencies and provisions. Despite mandates, however, studies indicate that courts often fail to adequately consider IPV. A number of factors may contribute to this pattern, including legal preference for joint custody and cooperative co-parenting relationships, family courts not being made aware of previously documented IPV, and difficulty in substantiating IPV allegations or, when corroborated, the tendency to ignore or minimize the relevance of IPV to custody and visitation agreements. This is of concern given the ample evidence that IPV poses ongoing safety and health risks to mothers and children after separation. The current study seeks to build upon two existing datasets that include self-reports from divorcing mothers from rural and suburban communities in central Illinois and administrative data extracted from 628 divorce cases. The specific aims are to: 1. Investigate family court decisions regarding custody and visitation of minor children when IPV has been documented in civil and/or criminal court records; 2. Explore the association between self-reported IPV and the documentation of IPV in civil and criminal records (using a subset of divorce cases for which we have self-report data); 3. Examine family court and legal professionals' current approaches and perceived barriers to addressing IPV in custody cases; and 4. Identify (or develop) evidence-based training materials that address barriers.	Safe, Healthy Environments and Behaviors

		The purpose of the first phase of this study was to investigate when and how mothers' self-reported intimate partner violence (IPV) is documented in divorce cases and how IPV documentation relates to decisions regarding custody and visitation of minor children. Courts are mandated to consider IPV in custody and visitation decisions and should prioritize safety in those agreements. Despite mandates, family courts may not be made aware of IPV in divorce cases or may minimize or ignore its relevance to custody decisions. Understanding the role of IPV in custody decisions is critical for protecting mothers and their children after separation. In a previous study on divorce and IPV, we collected self-reported data longitudinally over five time points from 195 mothers early in the divorce process. In the current study, we collected administrative data from 620 divorce cases and associated civil protective order (N = 180) and criminal (N = 195) cases, which included matched administrative records for the 195 mothers who participated in our earlier self-report study. Findings from the subset of 195 mothers with both administrative and self-reported data demonstrate that a substantial number of cases with IPV go undetected or unaddressed in the divorce process. Not all divorces with past violence present ongoing risks after separation that warrant unique responses. Nonetheless, we found minimal differences in outcomes for divorcing mothers with and without self-reported IPV despite variations in violence severity, danger, harassment, and protective order and criminal histories. Past studies have documented minimization of IPV in family courts. This is the first study, to our knowledge, to obtain abused and non-abused mothers' self-report data early in the divorce process and then related court record data in the years following. The combination of these two datasets allowed us to have a broad impact on the field by examining when and how self-reported IPV "shows up" in divorce cases and its association with custody outcomes. The findings demonstrate that family courts are often not made aware of a history of IPV, despite documentation in other civil and criminal cases, or when made aware, minimize or dismiss its relevance to custody and visitation. Routine screening for IPV in family courts is needed but currently is required by only one state. Reliance on voluntary self-disclosure results in courts not being made aware of IPV, including, as we found, among mothers with elevated danger and post-separation harassment. Routine screening must be paired with mandatory training of judges and other family court professionals. The state from which the data were collected along with 38 other states do not currently require IPV training for judges. Family courts must be able to recognize and understand the dynamics of IPV, its effects on victims and children, and potential risks after separation to ensure safe and protective custody and visitation outcomes. Subsequent analyses using the full phase one	

		dataset (N = 620 cases) will identify patterns of IPV documentation in civil and criminal records, explore how documented IPV is (or is not) reflected in custody and visitation agreements, and examine when and how documented IPV results in safer custody and visitation agreements. Taken together, these analyses will prepare us for the second phase of the study involving in-depth interviews with legal professionals.	
23.	**Evidence-Based Solutions to Reduce Food Waste and Improve Health Outcomes in Schools**	In order to increase positive food decision making and improve health outcomes, we examined policies, systems and environmental factors that influence the consumption and waste behaviors of children and their families, particularly in the school setting. A systems perspective is utilized to investigate the tensions children, schools and families face when attempting to make healthy eating choices and reduce food waste. For example, public health professionals encourage their patients or clients not to overeat, but at the same time discourage people from wasting food. The American public is not provided with guidance on how to address these competing priorities. Evidence-based solutions are needed in order to simultaneously promote human health and environmental sustainability. The number of food choices available to students and time available to eat are key environmental factors that may influence child dietary intake and waste. The Healthy Hunger-Free Kids Act mandates strict nutrition standards for all school nutrition programs. Yet, an estimated 19-45% of each school lunch meal is wasted on average, limiting the impact of healthier school menus. Limited time available for school meals has been linked to higher amounts of food waste. At the same time, the impact on the number of food choices children have at lunch on their consumption and waste behaviors has not been empirically evaluated. It is possible that increasing the number of choices students have at lunch will increase the amount of time they spend in the lunch line, adding to meal time constraints. More research is needed to understand the role of time constraints and number of food choices on positive food decision making and diet quality. Lastly, this research seeks to identify and disseminate best practices for preventing landfill disposal of food, also known as food recovery. Despite working hard to reduce waste, it is unrealistic for schools and other institutions to have zero food waste. It is important to identify uses for both inedible and edible food waste to best utilize our natural resources and reduce the greenhouse gases emitted when food is landfill disposed. Edible food waste that can be re-directed to feed hungry people is an important opportunity to reduce food insecurity. There is very little research on school food recovery programs, and evidence-based	Safe, Healthy Environments and Behaviors

		food recovery programs that align with the unique policy constraints of school meal programs are needed. Under Objectives 1 and 2, we have identified key food safety concerns by local health inspectors that limit school food recovery; hand contamination is the primary concern and will be the focus of future research and outreach efforts. In the **Time for Lunch Study**, we have found causal evidence that lunch time constraints disproportionately limit fruit and vegetable consumption relative to other school meal components. Results from our systematic review suggest that placement and convenience nudges have the most evidence of being positively associated with improved vegetable consumption, particularly those who provide opportunities for vegetables to be served in isolation of other meal components, such as fruits.	

OPTIONAL	
Youth Development Expenditures (dollars)	FY 2020 Expenditures ($)
State and/or Institution: University of Illinois	
1862 Smith-Lever	**$ 812,750**
1890 Extension	