

2018 Iowa State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Agriculture in the state of Iowa has grown beyond traditional production of crops and livestock to encompass the revolution in the bioeconomy, life sciences, food sciences, value-added products, environmental sciences, and social sciences. Iowa's world-class endowment of natural resources, its highly skilled and educated people, and its well-developed infrastructure supports a diverse and dynamic set of food, feed, fiber, biofuels and bioproducts, environmental and community endeavors. Maintaining high quality of life, especially in rural communities, is a priority for the state to support demographic and production changes.

Iowa's abundance is astonishing, ranking second nationally (behind California) with cash farm receipts (2017) of \$28.14 billion. This position is the result of Iowa's strong ranking in the production of several commodities. The state consistently is the nation's first- or second-largest producer of corn, soybeans, pork, eggs and ethanol, the fourth largest producer of cattle, and in the top dozen for dairy and turkey production. Iowa had 88,637 farms operating on 30,622,731 acres in 2012. Cropland accounts for 91 percent of Iowa's total farm acres (2012). The average-sized farm in Iowa has 345 acres, while the median farm size is 136 acres (2012).

Of Iowa's 99 counties, 21 are located within metropolitan statistical areas (MSAs). Iowa's nine MSAs, which include both rural and urban space, contain 60 percent of its total population (2017). Iowa had 3,156,145 residents in 2018, ranking 31st among states in total population size. Slightly more than one third of Iowa's population lives in rural areas. This 35 percent rural share ranks 12th among states in rural population percentage (2017). Urban areas contain 65 percent of Iowa's residents and about two percent of the state's total land area (2017).

The Hispanic/Latino population, which includes people of any race, is the largest minority group in Iowa, accounting for 6.0 percent of the population in 2017. The Black or African American population, both Latino and non-Latino, is the second-largest minority group with 3.8 percent of residents. The Asian race group is third with 2.6 percent (2017). Iowa's non-Latino white alone population accounts for 85.7 percent of the total population (2017). The poverty rate for individuals in Iowa was 10.7 percent (+/- 0.4%) in 2017, compared to a rate of 13.4 percent (+/- 0.1%) for the United States. Minority students comprised 24.1 percent of preK-12 public school enrollment in 2017-2018, compared to 9.8 percent in 2000-2001.

Continuing demographic change and globalization create ongoing opportunities and challenges toward achieving socially beneficial, economically successful, and environmentally sound systems for food, feed, fiber, fuel, and other value-added products.

The Iowa State University (ISU) Combined Extension and Research Plan of Work for FY 2018 continued to incorporate the five USDA priority areas into our seven current programs. Climate change work is included in Food Security. Childhood obesity work and food safety work, including food safety education for growers, food manufacturers, food service, and other professionals, have been incorporated into Health and Well-being. Therefore, we are reporting on seven broad, interdisciplinary programs:

- Community and Economic Development
- Expanding Human Potential
- Food Security
- Health and Well-being
- Natural Resources and Environmental Stewardship
- Sustainable and Renewable Energy
- K-12 Youth Development

Research is conducted across most disciplines in agriculture, defined in its broadest sense, from basic to applied, to make advances in feed, food, fiber, and fuel production, to help increase capacity and provide an adequate and nutritious food supply. The research expressed in the program areas is the result of cooperation among researchers within and between departments and colleges at all levels of activity.

Since the 2016 Plan of Work was submitted, we readjusted and refined the method of calculating research SYs. USDA guidance indicates inclusion of professional FTEs applies only to extension, while research FTEs should include only scientist years. All program FTEs, regardless of funding source, are included per USDA guidance and clarification. We classify the administrative portion of research faculty salaries (i.e., deans, department chairs, center directors, etc.) as "Professional," thus, these are now excluded from the SY total. This more closely parallels how personnel are categorized for the project financial reports submitted in REEport. To emphasize, this applies only to the calculation of research SYs.

Hatch and Smith-Lever Capacity grants provide critical funding for staffing that ultimately allows us to leverage and match other external funding sources. The Capacity grants also provide flexibility in programming to better meet current and emerging needs not being addressed by other sources of funding. Without these funds, there would be less applied research, less real world application of research, and less integration of extension and research work.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	371.0	0.0	187.3	0.0
Actual	381.2	0.0	466.2	0.0

II. Merit Review Process

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

- Internal University Panel
- External Non-University Panel
- Expert Peer Review

2. Brief Explanation

Merit review: ISU Extension and Outreach continued to monitor and adjust the plan of work through use of self-directed work teams, continuous needs assessment, and ongoing work with public and private partnerships. At the state level, state staff worked closely with key statewide constituencies. At

approximately five-year intervals, a comprehensive state-wide needs assessment is completed to inform the plan of work for coming years. Assessment of needs were done at both the local and state level to inform selected plans. Iowa County Extension Councils and local stakeholder groups annually review and prioritize needs, feeding the information back to the statewide plan of work teams. Program leaders monitor feedback from stakeholders in the above reporting mechanisms as well as through departmental reviews, program evaluation by Plan of Work teams and program evaluation as part of externally funded projects, and work with team leaders to make necessary course corrections. North Central Regional Program Directors provide periodic oversight, guidance, and course corrections on logic models and joint program implementation and evaluation.

Scientific Peer Review: Project Proposals: Each project proposal is endorsed by the department chair and Associate Director of the Experiment Station. Each proposal is sent to peers internal to Iowa State University (typically 2 to 4 faculty at Iowa State University) for a thorough review of the scientific merit. Depending upon the reviews, the project is either approved, revised based on reviewer comments, or rejected.

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Other (Comments gathered from targeted online venues)

Brief explanation.

The vast majority of events whereby stakeholder input is sought and received involve faculty in our college with joint research and extension (and outreach) responsibilities. For example, most of our top researchers addressing water quality and nutrient reduction strategies (under Food Security area in our POW) also are our top extension and outreach specialists who report on their integrated research and extension efforts.

The majority of programs use media and the internet to announce public meetings and listening sessions, and use targeted invitations to traditional stakeholder groups and individuals. In addition, the various programs have employed the following:

- Ad hoc surveys of residents in specific communities are conducted to obtain feedback.
- Team members are in regular contact with primary stakeholders at meetings, electronically, and on an individual basis.
- Producers, suppliers, policy makers, and other interested parties are invited to state-wide webcasts.
- The Dean's Advisory Council and the Dean's Executive Council, which meet twice a year to provide valuable feedback regarding the seven broad, interdisciplinary programs including refinement of ideas for projects that fit under the program areas.
- The Extension Director held 20 listening sessions across the state, with a cross-section of

community stakeholders and elected Extension Council members.

- End-of-meeting and post-program surveys consistently seek input for future research and programming needs.
- Responding to stakeholder input to encourage additional input.
- Identify existing stakeholder meetings, ask to be placed on the agenda, and ask stakeholders to answer questions or provide input.
 - Faculty and staff have developed relationships, key to quality interaction with stakeholder groups, and actively participate in a variety of events where stakeholders are present for interaction.
 - Surveys, focus groups and on-going informal assessments match program delivery methods with preferences of stakeholder groups. Decisions regarding content, delivery, and mechanisms to reduce barriers to participation are made with a goal of increasing participation.
 - Blogs and other online venues gather comments on programming.
 - Post-program site visits and one-on-one interviews with clients to measure impacts and to obtain client feedback.

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

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Needs Assessments
- Use Surveys
- Other (Media -- press releases, websites, social media; CED program's quarterly newsletter, "Community Matters")

Brief explanation.

The College of Agriculture and Life Sciences has 18 unique Dean's Advisory Groups, which are asked annually to provide guidance on research priorities. These include the Center for Crops Utilization Research Industry Stakeholder Advisory Board, Seed Science Center External Advisory Council, Iowa Pork Industry Center Advisory Committee, Wallace Foundation for Rural Research and Development, etc. In addition, faculty and Experiment Station leadership meet with and/or participate in 321 agricultural/stakeholder agencies, organizations, cooperatives and industries and 22 educational institutions.

The Dean's Advisory Council and the Dean's Executive Council meet twice a year to provide valuable feedback regarding the seven broad, interdisciplinary programs including refinement of ideas for research projects. The Associate Director of the Experiment Station meets regularly (two to three times each semester) with a group of 25 center directors from within the college to solicit feedback on research and extension/outreach activities to inform the program areas and drive refinements to the program areas.

ISU Extension and Outreach conducted a formal needs assessment in 2013, which was reported in the 2014 Annual Report of Accomplishments and Results. Such extensive efforts are undertaken on a periodic basis, and are supplemental to ongoing efforts such as these listed below for 2017-18.

- Formal advisory boards; we invite representation from the organizations and agencies that work in a given area, and may also include producers nominated by extension program specialists, campus specialists and campus researchers.
 - Web-based needs assessment and listening sessions open to the public. Targeted groups are identified and contacted. Steering committees identify key individuals to ensure that the invitation list

represents the broad spectrum of stakeholders.

- External focus groups include information from peer groups. Conduct needs assessments informally via routine contacts with target audience or formally via surveys.
- Underserved communities are engaged regarding educational program needs, beta testing materials and promotion of educational events.
- Extension state and field specialists serve on multiple county and state advisory committees where needs are identified and used to shape program efforts.
- Participants provide personal contacts for our planning process; much attention is paid to major client groups and their boards of directors and other key influences. Suggestions from university administration are an excellent source of contributors.
- Faculty and staff are members of coalitions and taskforces at the state and local level that continually review and check changing needs against operational plans.
- Meeting with representatives from federal and state agencies regularly allows for input from consultants throughout the state. Attendance at state and national meetings allow input from individuals, as do email contacts from the web site.
- Media and surveys are used to identify interested stakeholders. State staff hold conversations with individuals in more than 30 key state agencies and state organizations to share information and seek input.
- Post-program site visits and one-on-one interviews with clients to measure impacts and to obtain client feedback.

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

1. Methods for collecting Stakeholder Input

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

Brief explanation.

Efforts on an ongoing basis include:

- Meetings with College of Agriculture and Life Sciences Dean's Advisory groups, 18 groups that the Agricultural Experiment Station administrators meet with on a regular basis.
- Meetings with College of Human Sciences Dean's Advisory Council
- Faculty and Experiment Station leadership meet with and/or participate in 321 agricultural/stakeholder agencies (43), organizations (155), cooperatives (16) and industries (107), and educational institutions (22).
- ISU Extension and Outreach state and field specialists serve on multiple county and state advisory committees where needs are identified. ISU Extension and Outreach staff use this information to shape program efforts.
- Listening sessions with current and potential clients.
- Targeted and random surveys to current and potential clients.
- Contacts are ongoing by field staff, county extension staff, and state specialists who work with individual private sector partners.
- Meetings are held with professional associations and advisory boards, and other groups across

the state, providing information and asking for input both on existing and emerging issues, and to assist in better understanding local needs.

- Select stakeholders are asked to serve on advisory boards, leadership councils and work teams to help set program direction, develop innovative programs to reach new audiences, and implement strategies to reach desired outcomes.
 - Webinars share information and new program direction and receive input from stakeholders.
 - Participants are often surveyed about needs and interests.
 - Participants are often asked to complete a survey at the beginning and end of training to assess their needs and how the training series can be improved, as well as a self-assessment to identify specific knowledge and skills participants gain from the training. These data are continuously reviewed to modify the training as appropriate. Follow-up surveys sometimes occur, and website contacts for information are provided.
 - Personal contacts initiated by the stakeholders with research and extension/outreach faculty and staff.
 - One-on-one interaction, surveys from clients at public meetings, discussions with advisory board members, e-mail communication including responses to Web and other media.
 - Surveys allow those unable to attend meetings to voice opinions about needs and program planning processes. Follow-up meetings with select individuals providing 'missing voices' are conducted to gather broad-based input.
 - Each community determines how they collect input, utilizing a variety of methods, including personal conversations, web surveys, speaking to individuals and groups, and work with the media.
 - 4-H Youth Development conducted a customer satisfaction survey of internal audiences (county youth staff, county directors, regional directors), which was used to inform program priorities.

3. A statement of how the input will be considered

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

Brief explanation.

Agriculture and Natural Resources Extension:

- Expanded water quality and nutrient reduction education, based on science-solutions from experiment station researchers.
- Provided resources and support during floods and droughts.
- Responded to the emerging threat of Palmer amaranth.
- Implemented training programs regarding the Veterinary Feed Directive.
- Conducted staff professional development on the concept of community change, to support the continued development of beginning and young farmer peer groups.
 - Farm Financial Task Force met quarterly to provide objective analysis of farmers' financial conditions and options and programming on cost control and financial management.
 - Targeted programming for women in agriculture, focused on business management, human resources, grain production and livestock production.
 - State-wide local foods work group met quarterly.

Human Sciences Extension:

- Hired people of diverse backgrounds for The Buy, Eat, Live Healthy program.
- Hired a faculty member for the summer to develop programming for individuals with Parkinson's Disease and their families.
- Hired a state specialist to support programming for older Iowans and their caregivers.
- Implemented The Adventure Comes to You, a partnership with the Department of Food Science and Human Nutrition. Faculty visited four sites in Iowa and shared their innovative research and information related to mindful eating and epigenetics.
- Supported the growth and expansion of new programs launched last year, including Essentials of Child Care Preservice Online Program; Raising School Ready Readers; What About Me? My Wellbeing; Elevate: Take Your Relationship to the Next Level; and Growing Together Iowa (healthy food access for families experiencing poverty).

Community and Economic Development:

- Provided business planning and feasibility assistance to minority-owned businesses.
- Continued to add data and accessible real-time reports to Indicators Portal, a one-stop information site for local and regional community decision makers. Added systems analyst position to increase the breadth and depth of data available through the portal.
- Partnered with Community Food Systems program to promote local food systems.
- Trained local elected officials and government and nonprofit employees on issues such as budgets, planning and zoning, and nonprofit management in response to changing laws and regulations.
- Continued collaboration with Center on Sustainable Communities.
- Delivered "Navigating Difference" cultural competency training throughout the state.
- Developed a tourism workshop and trained business owners and entrepreneurs.
- Hired a retail trade specialist to provide technical assistance to retail business owners, and to communities seeking to build stronger local retail economies.
- Developed Leading Communities curriculum to strengthen communities' leadership capacity.

Youth:

The "Iowa 4-H Core Principles and Organizational Structure" document is now used in core training and orientation for new state and county youth staff, and County Extension Council members. By providing this clear and consistent framework for the roles and relationships between the state and county 4-H programs, 4-H programming in Iowa has improved greatly.

Brief Explanation of what you learned from your Stakeholders

- Continue leadership of the Monarch Consortium - Iowa has a vital role to the monarch butterfly's recovery
 - Plant, microbe, and animal genomics and phenomics
 - Genes to Fields (G2F) - translation of corn genomic information to achieve advances that generate societal and environmental benefits
 - Digital Agriculture/Precision Agriculture: making agriculture more efficient and sustainable through technological advances
 - Antimicrobial resistance
 - Studying the microbiome - the full collection of genes of the microbes that live in our bodies, to support scientific advances
 - Water quality / nutrient reduction strategy
 - Food safety and nutrition
 - Farm transition: retirement and beginning farmers

- Farm financial health and risk management
- Mental health and stress in rural areas
- Responding to and complying with legislative and marketplace mandates for livestock care

We learned from stakeholders that our focus on health and well-being and expanding human potential are aligned with the needs and desires they expressed. In particular, these specific areas were mentioned:

- Family life (examples: relationships, communication, parenting, time and stress management, mental health/disability, youth development)
- Financial stability (examples: money management, cost of living, estate planning,)
- Child Care (examples: cost, quality, access)
- Health and Health Care Coverage (examples: nutrition, obesity, physical exercise, outdoor education and recreation, healthy children, food safety, insecurity, and systems)
- Growing older (examples: health, retirement, caregiving, death)
- Community capacity (examples: access to education (literacy), jobs, social networks, and resources)

Top issues for the Community and Economic Development program include:

- Changing demographics
- Local economies
- The built environment
- Civic engagement and leadership capacity

Youth: Serving over 100,000 Iowa youth, Iowa 4-H by nature is complex. While 4-H looks different in each county it has basic assumptions and rules (the glue) that keep it cogent and effective. The "4-H Core Principles and Organizational Structure" document was developed to provide a common set of core understandings driving the Iowa 4-H program so that as a system, Iowa 4-H can meet its goal of making Iowa 4-H the best youth development program in the nation. For 2018 4-H will focus on the following programmatic efforts inclusion, civility and college/career readiness. In addition, Iowa 4-H will be reviewing and upgrading its evaluation efforts.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
{No Data Entered}	{No Data Entered}	{No Data Entered}	{No Data Entered}

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	9518910	0	8987176	0
Actual Matching	9518910	0	8987176	0
Actual All Other	18466852	0	70961932	0
Total Actual Expended	37504672	0	88936284	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	2954241	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Community and Economic Development
2	Expanding Human Potential
3	Food Security
4	Health and Well-being
5	Natural Resources and Environmental Stewardship
6	Sustainable and Renewable Energy
7	Youth Development

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Community and Economic Development

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
124	Urban Forestry	0%		1%	
403	Waste Disposal, Recycling, and Reuse	0%		7%	
501	New and Improved Food Processing Technologies	0%		7%	
502	New and Improved Food Products	0%		5%	
511	New and Improved Non-Food Products and Processes	0%		5%	
601	Economics of Agricultural Production and Farm Management	0%		39%	
604	Marketing and Distribution Practices	0%		2%	
605	Natural Resource and Environmental Economics	0%		3%	
608	Community Resource Planning and Development	100%		2%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		7%	
801	Individual and Family Resource Management	0%		3%	
802	Human Development and Family Well-Being	0%		8%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		3%	
805	Community Institutions and Social Services	0%		8%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890

Plan	8.9	0.0	1.8	0.0
Actual Paid	11.7	0.0	8.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1212168	0	427220	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1212168	0	427220	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
1427377	0	923476	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conducted workshops and educational efforts with community organizations, individuals and leaders to assist developing and implementing plans for physical and social community improvements.
 - Conducted research and outreach to communities on planning, zoning, resource management, and community and economic development activities using a variety of information dissemination methods.
 - Held training sessions to improve skills of local government officials, community leaders and individuals.
 - Conducted participatory research, outreach and training with leaders, workers and individuals to improve the effectiveness and skills of leaders and volunteers in community organizations. Conducted Leading Communities curriculum to improve communities' leadership capacity.
 - Continued to increase the data services available on the ISU Extension and Outreach Indicators data portal created in 2014 through which Iowans are able to access a wide range of products using local finance, economic, and demographic data, all available from one website.
 - Hired a systems analyst to increase the breadth and reach of data available through the Indicators Portal.
 - Conducted Navigating Difference© cultural competency training throughout the state.
 - Revamped the Iowa Retail Initiative into a comprehensive program to enhance and strengthen local retail.
 - Created a shared position with the Iowa League of Cities to find shared needs for data collection, research, and analysis that benefit local governments.
 - Hired a minority business coordinator based in Des Moines to better meet the needs of underserved populations.
 - Hired a faculty member with expertise in real estate to address housing quality issues, particularly in rural communities.
 - Began offering Marketing Hometown America to help small communities attract new businesses and population.
- Faculty participated in relevant multi-state research committees: NC140, NC1030, and NE1720

2. Brief description of the target audience

Businesses, organizations, public officials, community leaders, public and nonprofit organizations, and underserved populations (e.g., Latinos, African-Americans, refugees and the organizations that serve them), in Iowa.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	48483	182341	0	0

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

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	17

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of articles, publications, reports, plans.

Year	Actual
2018	2803

Output #2

Output Measure

- Number of communities receiving planning and design assistance.

Year	Actual
2018	418

Output #3

Output Measure

- Number of jobs created/retained.

Year	Actual
2018	176

Output #4

Output Measure

- Number of people in underserved populations assisted.

Year	Actual
2018	348

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Community visioning and design: Number of communities receiving planning and design assistance.
2	Community economic development: Number of jobs created or retained.
3	Minority community and economic development: Number of people in underserved populations served.
4	Knowledge increased and tools developed that assist agricultural decision-makers with decisions that affect community and economic development in rural Iowa

Outcome #1

1. Outcome Measures

Community visioning and design: Number of communities receiving planning and design assistance.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	418

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A gap exists between the demand for planning and design services to rural Iowa communities and the availability of those services. Many smaller communities in Iowa face issues that they are unable to address due to lack of planning personnel and/or resources. Issues facing communities include Iowa's changing demographics: the population is aging and at the same time becoming more diverse. A combination of factors such as aging infrastructure, resistance to additional taxation, depopulation, and lower population density are pushing small local governments' budgets to their limits. Legislative and economic issues also impact nonprofit organizations.

What has been done

The ILR Community Visioning program assists small towns in developing design plans reflecting the values and identity of the community. The Community Food Systems program uses agricultural urbanism tactics to promote local food system revitalization in communities. CD-DIAL conducts surveys for communities as part of their long-term planning activities. Extension CED trains local governments, COGs, and nonprofits. CED specialists now offer the Marketing Hometown America program to rural communities interested in attracting new businesses and population. Six CED staff received training on Navigating Difference, a cultural competency program. CED faculty and staff deliver Leading Communities, a place-based leadership program, to communities throughout the state.

Results

Ten visioning communities received conceptual design plans, feasibility studies, and implementation planning assistance. Visioning program staff conducted participatory evaluations in four former visioning communities. CED specialists presented the CED leadership program, Leading Communities to 69 people from 13 communities. CED staff delivered Navigating Difference© training to 142 people in five communities/counties. CD-DIAL conducted surveys in two towns. Forty-six people from 11 towns attended GIS workshops conducted by CED's

Geospatial Technology program. CED delivered Introduction to Planning and Zoning Workshops to 527 government officials, city and county employees, and planners from 75 towns. The Office of State and Local Government Programs provided training to representatives from 260 communities through 2018 Municipal Professionals Institute/Academy, budget workshops, and township trustee training. Marketing Hometown American was conducted in two towns. Grant Writing 101 was taught in 15 counties. Tourism training was conducted in 19 towns. Fifty-eight people from two towns participated in Developing Dynamic Leaders.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Community economic development: Number of jobs created or retained.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	176

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The overall health of Iowa's rural communities is vital to the long-term success of the state. However, there is a lack of affordable housing for workers, as well as a lack of licensed childcare providers. In order for rural Iowa communities to thrive, they must be attractive targets for investment by the private sector. Local leadership should be effectively developed, must strategically plan, and must set a vision to make Iowa an attractive place to live and work.

What has been done

CED specialists work with small business owners and entrepreneurs to start or strengthen their businesses, to assist them with writing business plans and navigating the business permit process. Extension CED revamped the Iowa Retail Initiative into a comprehensive program to enhance and strengthen local retail. Extension CED shares a joint position with the Keokuk Area Chamber of Commerce. CED hired a minority business coordinator to provide technical assistance to minority business owners and entrepreneurs. CED is conducting the Northeast Iowa Business Network Workforce Attraction Study to learn of the barriers to, and opportunities for

attracting a vibrant workforce to the six-county study region, and to develop an action plan for improving workforce attraction and the housing supply in the study region, based on the findings.

Results

In 2018, 176 jobs were created or retained within the businesses with which CED specialists worked. More than 109 businesses were started or expanded with help from Extension CED. Of those, 25 were minority entrepreneurs. CED specialists trained 361 business leaders/entrepreneurs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #3

1. Outcome Measures

Minority community and economic development: Number of people in underserved populations served.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	348

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The percentage of Iowa's population identified as minority has grown from 3.1% in 1980 to 13.8% in 2016. Minorities as a percentage of total population have increased in 98 of 99 counties. Over the last 6 years, more than 3,000 refugees have arrived in Iowa. The influx of immigrants to the state creates the need for support to New Iowans, as well as the need for long-time residents to adapt to their communities' changing demographics. Iowa also faces significant challenges in dealing with mental health, and ranks 49th out of 50 in terms of available beds for mental health patients. During the 2017 session, the Iowa Legislature passed Senate File 504, instructing stakeholder work groups to meet and create collaborative policies to support individuals with mental health needs.

What has been done

ISU Extension CED continues to aggressively employ outreach strategies for underserved populations. Through programs such as JUNTOS, we educate underserved youth on career

options as well as strategies for pursuing higher education. CED hired a minority business coordinator to provide technical assistance to minority business owners and entrepreneurs. CED is building relationships with minority populations in the urban areas in Iowa broadly, and Des Moines and Cedar Rapids specifically in partnership with the Black Business Coalition, Black Business Consortium, NAACP, and others. Six CED Extension staff are trained on Navigating Difference, a cultural competency training program.

Results

CED specialists presented the CED leadership program, Leading Communities, featuring an additional module addressing immigrant social capital to 31 people. Seventy-three business leaders and entrepreneurs from underserved populations were trained. CED specialists assisted 25 entrepreneurs from underserved populations start or improve businesses. CED staff delivered Navigating Difference training to 142 people in five communities/counties. CED specialists provided JUNTOS training for 77 Latinos.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #4

1. Outcome Measures

Knowledge increased and tools developed that assist agricultural decision-makers with decisions that affect community and economic development in rural Iowa

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As farming changes and consumers demand healthier and more varied foods, understanding the complexities of the food system through economic modeling is crucial.

What has been done

We examined food choices, food safety, industry changes, production methods and the impacts of trade. Researchers ascertained the impacts on consumer welfare and producer profitability and

developed decision tools to aid Iowa farmers. We completed a study evaluating the viability of switchgrass in Iowa. We developed and used a model to characterize optimal livestock hedging with and without reference to price dependence. Our livestock marketing research provided 23 fact sheets, 12 decision tools, and two websites which help producers make production, marketing, or other management adjustments based on enterprise-specific resources.

We also developed a state-level modeling system to analyze the impacts of international trade disruptions (tariffs and non-tariff measures) on state economies. Specific application was made to the quantification of the 2018 US tariff escalations and retaliations. Through a multi-state effort among co-op experts, we examined the effect of the Tax Cuts and Jobs Act of 2018 on producers and cooperatives. Our analyses were shared with producers, cooperatives, lenders, and tax professionals.

Results

Extension articles, media, workshops and presentations increased knowledge of the economic trade-offs of agricultural consolidation and the impacts on producers' finances and market power. We increased knowledge of the economic viability of switchgrass in Iowa. Our livestock marketing tools helped producers make production, marketing, or other management adjustments based on enterprise-specific resources. Increasing and sharing knowledge regarding the impacts of international trade disruptions assisted with stakeholder decision-making.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

The economy is a major external factor affecting ISU Extension Community and Economic Development outcomes, because not only has it led to a shrinking state budget, but because more communities need assistance with budgeting and financial management, and some local businesses are struggling. That said, the economic climate is good for entrepreneurship. CED specialists have been working with communities on issues such as affordable housing, land use practices, and population shifts. The immigrant population of Iowa continues to grow and CED has responded with diversity training, and providing training on parenting skills, budgeting, and language. Minority-owned businesses are the fastest growing source of small-town entrepreneurship. Hence, assistance to immigrant entrepreneurs is a key component of CED's economic development strategy. More communities are trying to re-invent themselves from agricultural towns to tourist destinations, and CED has responded by developing training for the tourist industry. Changes in local, state, and federal law require ongoing training for state and local

government officials and employees.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

End-of-program and long-term (one-year) evaluations of the follow programs has led to material changes in content and delivery: Municipal Professionals Institute and Academy, budget workshops, tourism workshops, and planning and zoning workshops. Evaluations from multiple programming efforts and from stakeholder input has led to developing a community-based leadership program (Leading Communities), cultural competency training (Navigating Difference), and housing needs assessment and planning for smaller cities.

Key Items of Evaluation

Community programming is often not intuitively related to what is seen as Agricultural Extension. Our Community and Economic Development (CED) program continued to publish its quarterly newsletter and improve the CED website and social media strategies for the purpose of gaining visibility of our programs to community leaders. Several CED initiatives addressed healthy communities (the Sustainability Collaborative, Community Visioning, Community Food Systems program. Six CED specialists are trained in Navigating Difference, a cultural competency training program. CED specialists delivered Leading Communities, a curriculum designed to build leadership capacity in communities. CED faculty and staff went through TOP (Technology of Participation) training to improve their facilitation skills. CED continues to develop programming for the growing minority and refugee population in Iowa.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Expanding Human Potential

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
604	Marketing and Distribution Practices	0%		3%	
608	Community Resource Planning and Development	100%		2%	
801	Individual and Family Resource Management	0%		4%	
802	Human Development and Family Well-Being	0%		32%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		8%	
901	Program and Project Design, and Statistics	0%		7%	
903	Communication, Education, and Information Delivery	0%		44%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	12.1	0.0	3.6	0.0
Actual Paid	12.2	0.0	6.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
1142146	0	149653	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
1142146	0	149653	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
2276848	0	872510	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Short-term and in-depth sequential educational programs were directed toward individuals, families, professionals, and community leaders through one-on-one education, workshops, meetings, conferences, online learning, and social and mass media. Professionals were trained to delivery early childhood, parenting which included substance and opioid misuses, relationship, financial and family caregiver education. Community volunteers were trained to provide income tax preparation assistance to families with moderate and low incomes in underserved, rural communities. Agency personnel were trained to provide individualized financial education to their clientele. Programs were designed to strengthen financial knowledge and skills regarding family financial management. We developed products, curricula, on-line tools, and other educational resources for use in training, technical assistance, and facilitation of community-based processes.

Faculty participated in relevant multi-state research committees: NC1171, NC1030, NC2172, and W3191

2. Brief description of the target audience

Parents of children, teens, and young adults, families with low- and moderate-incomes, child and family caregivers, family serving professionals, health professionals, worksite employees, policy makers, businesses, community members and leaders, adults, older adults, education professionals, and employers.

3. How was eXtension used?

Iowa State Extension and Outreach websites are linked to eXtension resources (e.g., Science of Parenting blogs, podcasts, FAQs, publications, archived webinars and web-based tools). Additionally, eXtension resources were actively promoted to Iowa early care and education and family support professionals through social media and shared with newly trained class leaders. The eXtension Family Caregiving resource is linked on our Powerful Tools for Caregivers web page and selected eXtension websites were linked on Iowa State Extension and Outreach financial management webpages (e.g., the Ask the Expert link on the Finances of Caregiving webpage connects learners to eXtension's Health Insurance Literacy faculty group and FAQs from eXtension are linked on an Iowa State Extension and Outreach family finance webpage).

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	53312	180657	855	2035

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

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	16

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of parents and family members participating in educational programs related to child care, parenting, couple relationships, and aging.

Year	Actual
2018	13979

Output #2

Output Measure

- Number of professionals or volunteers trained to work with programs related to child care, aging, couple relationships, and parenting.

Year	Actual
2018	35646

Output #3

Output Measure

- Number of individuals participating in family finance educational programs.

Year	Actual
2018	6775

Output #4

Output Measure

- Number of professionals or community volunteers trained to work with families on financial management.

Year	Actual
2018	189

Output #5

Output Measure

- Number of adults participating in educational programs that increase awareness of public issues.

Year	Actual
2018	913

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percent of parents improving parenting skills.
2	Number of professionals trained to provide education and/or support to families.
3	Percent of early child care providers improving learning environments and teaching strategies.
4	Percent of caregivers better able to manage later life issues.
5	Percent of individuals improving personal and family financial management practices.
6	Percent of individuals making progress toward financial goals.
7	Percent of professionals or volunteers who are better prepared to apply or teach financial management skills.

Outcome #1

1. Outcome Measures

Percent of parents improving parenting skills.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	94

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Parenting education reduces tax dollar expenditures by creating stable families, reduces reliance on public assistance and reduces risky youth behaviors - substance abuse including opioid misuses, and early sexual activity. The Partnership in Prevention Science Institute research found a community can expect for every dollar spent on the Strengthening Families Program for Parents and Youth ages 10 to 14 (SFP 10-14), that \$9.60 comes back to the community as benefits in less jail time, less time off work, and less time in treatment. Parent involvement and academic support are important for youth to succeed in school.

What has been done

Extension staff and community partners Extension staff trained delivered research- and evidence-based parenting education curricula across Iowa to 1,066 parents. Curricula included: Strengthening Families Program for Parents and Youth ages 10 to 14 (SFP)10-14/Familias Fuertes, Family Story Teller, Small Talk, Raising School Ready Readers, Together We Can: Creating a Healthy Future for Our Children, Growing Strong Families, and Juntos Para Una Mejor Educación (Together for a Better Education).

Results

Ninety-four percent (94%; n=777) of parents completing an evaluation survey after participating in sequenced research- and/or evidence-based extension parenting education curricula improved their parenting skills (N=828). The majority of parents (69%; N=147) improved their parenting skills after participating in Strengthening Families Program for Parents and Youth ages 10 to 14 (SFP) 10-14/Familias Fuertes over a 7-week period. 63% of youth (N=150) who participated in SFP: 10-14 engaged in more positive behavior (e.g., resist peer pressure, delay onset of substance use). Parents (N=98) and youth (N=83) who completed program evaluation surveys before and after they participated in Juntos significantly increased communication with each other about youth's goals for their future (p=.000). Parents became more confident in helping their youth graduate

from high school and pursue higher education (p=.001). Youth felt more comfortable talking to school staff when they had questions about their education or resources they need (p=.002). After participating in Juntos, 89 youth participated in 4-H, and 87 youth and their parents visited one or more colleges.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Number of professionals trained to provide education and/or support to families.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3555

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Effective family life education relies heavily on quality implementation; specifically how individuals are trained, supervised, and supported in their work with families. Professionals must learn to work across cultures, disciplines, and systems, master a growing and diverse body of knowledge, be adept at processes and methods that truly strengthen families, and produce results in short periods.

What has been done

3,555 professionals were trained by Iowa State Extension and Outreach staff on research- and evidence-based family life education curricula for direct delivery to families.

Results

These Iowa State Extension and Outreach staff and volunteers implemented family life education across the state of Iowa.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Percent of early child care providers improving learning environments and teaching strategies.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	95

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Iowa currently ranks first in the nation for the percentage of young children with employed parents. More than 70% of Iowa children from birth through age 6 are in child care. Demand is high for quality early childhood programs. The average annual income for a child care worker is \$18,930. Workforce turnover is reported at 52% annually and most child care professionals have limited training in early childhood education. Research has shown that the early years in a child's life represent a critically important window of opportunity to develop a child's full potential and shape key academic, social, and cognitive skills that determine a child's success in school and in life.

What has been done

I-Learn Early Childhood Education (ECE) Online programs were developed to meet the increasing need for accessible online education in the area of health and safety practices. Early Childhood Environment Rating Scale (ERS) classes provide a self-assessment, instruction, and guidance in developing an improvement plan to strengthen program quality with the option of a follow-up formal assessment. The New Staff Orientation (NSO) program provided 16 hours of instruction for child care center staff and program directors. Child Care Resource and Referral consultants participated in a consultant credential and mentor credential program. Over 70 single topic child care provider workshops on early learning topics were conducted across the state. Websites, Family Child Care Environment Rating Scale (FCCERS) Pinterest, and Let's Talk Child Care Blog supported training.

Results

A total of 30,486 professional participants reported individual and program improvements. 11,228 Essentials Online participants successfully demonstrated knowledge gains in health, safety, and child development. Three hundred and eighty-six teachers and 47 directors participated in the

NSO program, and completed portfolios with statistically significant ($p < .001$) gains in each of the 11 NSO outcomes. Four hundred and forty-five Environment Rating Scale participants completed self-assessments and began program improvement plans. A retrospective survey of Early Childhood Environment Rating Scale participants ($n=445$) indicated that 95% of participants could better identify strengths and limitations, prioritize changes and had initiated a workable plan for program improvement. Environment Rating Scale assessments were conducted to document quality of 173 child care classrooms. In the I-Consult program, 41 early childhood education consultants learned and demonstrated skills in coaching and consultation, and 9 consultants earned an I-Consult credential. An additional 2,197 early childhood professionals participated in child care community and online workshops. Of the surveyed participants ($n=1,258$), 95% reported or demonstrated improving learning environments or teaching practice.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Percent of caregivers better able to manage later life issues.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Eighteen percent of the U.S. population provided unpaid care to an adult or a child in the prior 12 months (National Alliance for Caregiving and AARP). These 43.5 million family caregivers help care for an adult with chronic conditions. They provide a vast array of services (e.g., emotional, financial, nursing, homemaking) on a daily or intermittent basis. The impact on caregivers is threefold: physical, emotional, and financial. One in five caregivers indicate their health is fair or poor and one in four say their health has declined from caregiving. One in five report a high level of physical strain. Two in five consider their caregiving situation emotionally stressful. Improved self-care practices by family caregivers leads to reduced reliance by caregivers on health care and public services.

What has been done

Fifteen new Class Leaders were trained by Iowa State Extension and Outreach master trainers to co-lead Powerful Tools for Caregivers programs in their communities. They join a team of 100+ class leaders prepared to deliver the program throughout Iowa. Powerful Tools for Caregivers (PTC) is a series of six classes designed to empower family caregivers to take better care of themselves so they can thrive, not just survive. The program is now delivered to two target audiences: caregivers of adults with chronic conditions and caregivers of children with special health and behavioral needs. Currently the PTC program is being modified. A refresher course for this program is scheduled and planned.

Results

Seventy family caregivers participated in the Powerful Tools for Caregivers series and 100% of the caregivers who completed the evaluation survey reported increased self-care practices (increased exercise, use of relaxation techniques, health self-care) after participation. They also reported increased self-confidence in their caregiver roles. The participants indicated an increased knowledge of resources and how to access them.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Percent of individuals improving personal and family financial management practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	96

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Iowa's median household income is lower than the national average despite a very low unemployment rate. Twenty percent of Iowa children live below 125% of the poverty line (American Community Survey, 2017). Roughly one in 12 Iowans hold multiple jobs compared to one in 20 nationwide (Monthly Labor Review, 2017), reflecting in part low wages which push

families into extended work hours to make ends meet. Time and financial pressures result in family stress. Empirical studies show high proportions of lowans lack knowledge and skills to manage family financial resources effectively. Improving knowledge, skills and behaviors that reduce financial stress and increase satisfaction will improve quality of life. Iowa State Extension and Outreach's research-based, non-commercial education facilitates informed decision making leading to greater financial security.

What has been done

Financial management skill-building programs were attended by 6,775 individuals, including 217 youth. Timely financial information indirectly reached 25,873 adults through social media, downloads of Iowa State Extension and Outreach publications, a blog, and other web-based resources. 2,035 youth were reached indirectly by linking financial literacy educators with the National Endowment for Financial Education (NEFE) High School Financial Planning curriculum. Research-based programs targeted families with low- and moderate-incomes to improve basic management skills. Workshops also targeted new immigrants, incarcerated individuals, women, those nearing retirement, and older lowans. Webinars, online and blended courses targeted first-time homebuyers, young families, library staff and educators.

Results

At the conclusion of programs composed of at least two sequential workshops, 96% (159 of 165) of participants surveyed reported improved money management skills. This average includes 94% of participants in Making Ends Meet, two-part workshops who reported improved skills in recordkeeping, planning, evaluation and assessment of information sources; 94% of women attending a series of five workshops on financial management skill building; 98% of participants in a five-part workshop on Finances of Caregiving; and 100% of those nearing retirement who attended a two-part Writing Your Retirement Paycheck course.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #6

1. Outcome Measures

Percent of individuals making progress toward financial goals.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Consumers face headwinds in making informed financial decisions in a complex marketplace. Stagnant incomes and ever-increasing needs and wants make it difficult for many to make progress toward financial goals. Studies show that those who set specific goals are more likely to achieve them. Those who close the gap between current and desired conditions are more likely to report satisfaction or higher levels of economic well-being. Failure to set goals often leads to mismanagement of scarce resources, increased stress, and significant social and economic costs to families and society.

What has been done

Behavior change, even when people are highly motivated to set and achieve financial goals, takes time and effort. Financial management skill-building programs were attended by 6,775 individuals, including 217 youth. Research-based, sequential programs targeted families with low- and moderate-incomes to improve basic management skills and new immigrants, incarcerated individuals, women, those nearing retirement, and older lowans. Webinars, online and blended courses targeted first-time homebuyers, young families, library staff and educators.

Results

On average, 76% (112 of 148) of surveyed participants in sequenced, in-depth workshops reported behavior change: making progress toward specific financial goals. Sixty percent of the participants in the Finances of Caregiving reported progress toward their goals; 76% of those attending the Writing Your Retirement Paycheck workshop series reported progress; 80% of those attending the Making Ends Meet workshops reported success in moving toward their goals; and all of the women attending the Money Talk workshops made progress toward at least one goal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #7

1. Outcome Measures

Percent of professionals or volunteers who are better prepared to apply or teach financial management skills.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Training professionals and volunteers who, in turn, teach financial skills and provide support to consumers in non-formal settings is a long-standing effective mechanism for effective adult education. Studies also support integration of financial education into existing, on-going programs and venues that consumers frequent. Integration of programming and train-the-trainer strategies are often much more effective than stand-alone, one-time educational offerings. Social service and other family-serving professionals and volunteers see financial challenges facing clients, but often are not equipped to help. Rural communities recognize the value of providing free volunteer income tax preparation services to low- and moderate-income families, but value the technical assistance and training the IRS and Extension provides to initiate a Volunteer Income Tax Assistance (VITA) program.

What has been done

Conference displays, workshops and newsletters were used to make Iowa teachers aware of National Endowment for Financial Education's (NEFE) High School Financial Planning program (HSFPP) curriculum, resulting in 76 teachers ordering instructor materials and lessons for 2,035 students. Extension trained 55 community volunteers who prepared 1,357 tax returns at no cost to the income tax filers. Thirty community-based professionals and volunteers completed a six-hour training on the Consumer Financial Protection Bureau's Your Money, Your Goals toolkit.

Results

All Volunteer Income Tax Assistance (VITA) volunteers successfully completed IRS certification exams and prepared 1,357 returns which resulted in \$667,044 of Earned Income Tax refunds. VITA helps many low- and moderate-income Iowans avoid tax preparation fees and secure sizable refunds that circulate in the local economy and bolster family financial well-being. All (10 of 10) professionals and volunteers who completed the Your Money, Your Goals pre- and post-surveys reported increased knowledge about personal finance and teaching tools appropriate to address specific client needs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

A continued period of slow economic growth constrains Iowans' incomes and their abilities to achieve financial goals. While those 65 years and older have experienced significant real growth in median income and net worth since 2000, younger individuals have experienced stagnant incomes and actual declines in wealth. Uncertainty created by trade negotiations and tariffs, and low commodity prices have had negative impacts on the overall state economy and the ability of households to make long-term plans and build financial security. The high proportion of Iowans working multiple jobs creates competition for time to be allocated to lifelong learning. Changing demographics add complexity to the development of culturally appropriate educational interventions.

Iowa has a shortfall of more than 350,000 child care slots across the state and the number is growing particularly in rural areas. Almost one-fourth of Iowans live in areas that have an undersupply of licensed or registered child care options. Many communities now have a child care desert designation. Iowa has lost 40% of its child care providers over the past 5 years. Individuals who are not US citizens or legal residents in the US may have selected not to participate in educational programs due to concerns for their safety.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Pre- and post-survey evaluations of sequential programs that build financial management skills and facilitate behavior change suggest that high proportions of participants are building financial security for themselves or among the clients and/or family members. Motivation to change is key. Developing strong partnerships to reach targeted audiences at "teachable moments" increases the likelihood that behavior change will occur.

In Iowa, 828 parents who participated in parenting education via research and/or evidence-based curricula completed a survey before and after the sequenced workshop series (e.g., Strengthening Families Program (SFP) 10-14/Familias Fuertes and Juntos Para Una Mejor Educación (Together for a Better Education)). The majority of parents who completed the surveys improved their parenting knowledge and/or skills (94%; n=777).

30,486 child care professionals successfully demonstrated increased knowledge gains in health and safety practices and child development. Youth demonstrated more pro-social behaviors after participating in Juntos.

Key Items of Evaluation

On average, 76% of surveyed participants in sequenced, in-depth financial education workshops reported behavior change--making progress toward specific financial goals. Community volunteers were trained to complete tax returns as part of Volunteer Income Tax Assistance (VITA) programs in rural Iowa communities. These volunteers saved low- and moderate-income tax filers the cost of commercial tax preparation and yielded more than \$650,000 in Earned Income Tax Credit refunds that circulate in the local economy.

The I-Learn Early Childhood Education (ECE) Online programs provided 28,825 child care professionals with vital information on health and safety practices which leads to safer child care environments and improved health outcomes for young children. In turn, this benefits families and employers by reducing employee leave and creating a more stable workforce for Iowa communities.

The Future Care Program (FCP) reached 70 older adults over the age of 60. The results show that older adults were able to prepare for their own health care and hospital visits after the program. It also led to positive outcomes such as preparation of end of life documentation (i.e., POA). Most participants reported changes in their views about future care planning and end of life decisions.

Analysis of Juntos program data via paired t-tests related to youth pro-social behavior, empathy, decision-making, and critical thinking suggests that before the youth participated in Juntos, they showed a decrease in attitudes and behaviors associated with these constructs. After youth began participation in Juntos, attitudes and behaviors associated with these constructs stopped going in a negative direction and, in contrast, stabilized or moved in a positive direction. After youth started participating in Juntos, they showed greater prevalence of attitudes and behaviors that are theoretically linked to completion of high school and pursuit of post-secondary education. These findings suggest that Juntos is having a positive effect on youth's attitudes and behaviors that are linked to their future educational attainment.

V(A). Planned Program (Summary)**Program # 3****1. Name of the Planned Program**

Food Security

 Reporting on this Program**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
202	Plant Genetic Resources	0%		4%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		4%	
204	Plant Product Quality and Utility (Preharvest)	0%		4%	
205	Plant Management Systems	15%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		6%	
212	Pathogens and Nematodes Affecting Plants	6%		16%	
216	Integrated Pest Management Systems	13%		4%	
302	Nutrient Utilization in Animals	4%		15%	
303	Genetic Improvement of Animals	0%		4%	
305	Animal Physiological Processes	0%		4%	
401	Structures, Facilities, and General Purpose Farm Supplies	7%		0%	
402	Engineering Systems and Equipment	0%		7%	
404	Instrumentation and Control Systems	0%		8%	
405	Drainage and Irrigation Systems and Facilities	5%		1%	
601	Economics of Agricultural Production and Farm Management	8%		4%	
602	Business Management, Finance, and Taxation	7%		0%	
603	Market Economics	8%		4%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	7%		2%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	21.3	0.0	30.8	0.0
Actual Paid	25.3	0.0	275.9	0.0
Actual Volunteer	40.9	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
3264501	0	4337871	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
3264501	0	4337871	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
9658001	0	45903396	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Continue to be a leading research institution on basic and applied questions impacting Iowa's ability to increase agricultural production capacity.
 - Proactively respond to legislative mandates by providing training and certification for livestock producers to ensure their continued operation and production of safe food products.
 - Maintain and strengthen extension education programs targeting Iowa farmers that develop their skills to evaluate and adopt emerging technologies, including regional food production and distribution, and best management practices.
 - Deliver business management resources that help farmers develop plans and procedures that support fiscally-sound operations.
 - Foster integrated research/extension teams to address issues facing Iowa farmers and assist with risk management when making decisions for their operations.
 - Educate producers, policy makers, and the public regarding the interaction between farming practices and water quality.
 - Assist farmers and landowners in adapting to the impacts of extreme weather fluctuations (drought and high temperatures and excessive and unseasonable rainfall) on crop and livestock production.
- Faculty participated in relevant multi-state research committees: NC7, NC213, NC246, NC1023, NC1029, NC1034, NC1170, NC1173, NC1177, NC1180, NC1182, NC1183, NC1184, NC1194, NC1197, NC1198, NC1203, NC2040, NE1334, NE1442, NE1720, NE1727, NRSP8, S1032, S1055, S1062, W2006, W2009, W2010, W3150, W3168, AND W3171.

2. Brief description of the target audience

- Agricultural producers and landowners in Iowa and the agribusinesses and agencies that interact with them
- Existing and beginning farmers are increasingly interested in producing value-added crops and livestock and market them in such a way as to retain a larger share of consumer expenditures on food
- Processors, distributors, retailers and institutions interested in buying more locally produced food products
- Agricultural professionals who serve farmers and influence their decisions regarding production and marketing options
- Rural public health officials and service providers
- State and federal agricultural and natural resource agencies, and environmental groups
- Rural citizens and homeowners

Targeted audiences were those with whom research and education can make a difference, and who can benefit from and apply research-based information, such as those whose production systems have been affected by extreme weather, as well as those who consult or influence the decision-makers of these growers and producers. For example, audiences included farmers and landowners working to reduce the loss of nutrients to surface water using science-based strategies, and crop and livestock farmers impacted by drought or excessively wet conditions in 2017 and/or previous years.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	153482	8898214	0	0

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

Patent Applications Submitted

Year: 2018
 Actual: 8

Patents listed

Crop Stand Analyzer Using Reflective Laser Proximity Sensors. Tang et al. Patent 9,804,097 issued 10-31-2017.

Materials and Methods for Characterizing and Using KASIII for Production of Bi-Functional Fatty Acids. Nikolau et al. Patent #9,809,804 issued 11-7-2017.

Insecticidal Toxins for Plant Resistance to Hemiptera. Bonning et al. Patent pending; filed 11-9-2017.

Grain Mass Flow Rate Determination. Darr et al. Patent 9,826,683 issued 11-28-2017.

Nucleotide Sequences Encoding Fasciated EAR4(FEA4) and Methods of Use Thereof. Vollbrecht et al. Patent 9,850,495 issued 12-26-2017.

Arabidopsis Nonhost Resistance Gene(s) and Use thereof to Engineer Disease Resistant Plants. Bhattacharyya et al. Patent #10,045,499 issued 8-14-2018.

miRNA396 and Growth Regulating Factors for Cyst Nematode Tolerance in Plants. Baum et al. Patent #9,896,698 issued 2-20-2018.

Materials and Methods for Using an Acyl-acyl Carrier Protein Thioesterase and Mutants and Chimeras Thereof in Fatty Acid Synthesis. Nikolau et al. Patent #9,868,942 issued 1-16-2018.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	168

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of producers and agribusiness professionals who attended face-to-face educational activities, including individual consultations.

Year	Actual
2018	114877

Output #2

Output Measure

- Number of producers and agribusiness professionals who subscribed to newsletters and access web-based resources.

Year	Actual
2018	6022927

Output #3

Output Measure

- Number of producers receiving ISU research based information from their ag retail or professional consultant.
Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of producers or agribusiness professionals who gained knowledge in safe pesticide application through attending pesticide applicator Continuing Instructional courses or pesticide safety education programs.

Year	Actual
2018	24761

Output #5

Output Measure

- Number of local food producers attending extension programs.

Year	Actual
2018	3001

Output #6

Output Measure

- Number of popular press articles and publications authored by Extension specialists.

Year	Actual
2018	1382

Output #7

Output Measure

- Number of lowans receiving food safety certification.
Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of adult participants in Extension programs on food safety.
Not reporting on this Output for this Annual Report

Output #9

Output Measure

- Number of visits on Iowa State University Extension and Outreach food safety project websites.
Not reporting on this Output for this Annual Report

Output #10

Output Measure

- Number of meetings, contacts, and one-on-one interactions with board members, policy makers, and other decision-makers

Year	Actual
2018	1809

Output #11

Output Measure

- Number of "Food Security" extension publications that were distributed as downloads and printed materials

Year	Actual
2018	1494343

Output #12

Output Measure

- Number of attendees at 89 leasing meetings that addressed new trends and issues related to land and leasing

Year	Actual
2018	1597

Output #13

Output Measure

- Number of attendees at Iowa Swine Day

Year	Actual
2018	470

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of producers indicating adoption of recommended practices.
2	Number of producers reporting increased dollar returns per unit of production.
3	Number of producers and landowners who adopt BMPs to address extreme weather events.
4	Number of increased efficiencies _____ (i.e. % pregnant; increases in yield/unit, such as bushels/acre; lbs product (meat, protein, milk) per animal; lbs feed per gain).
5	Increased knowledge of animal nutrition to improve animal health and wellbeing, production and management efficiencies
6	Increased knowledge that can strengthen fruit and vegetable production systems in Iowa
7	Increased knowledge and technologies that contribute to the rapid identification and rapid deployment of genetics
8	Increased knowledge of how plants adapt to various environments.
9	Increased knowledge of the current and potential severity and geographic extent of Western corn rootworm resistance to Bt technologies.
10	Increased knowledge that can be used to develop policies that ultimately increase agricultural productivity
11	Knowledge increased that supports new/non-traditional agricultural crops/industries in the upper Midwest
12	Percent of certified crop advisors reporting that increased knowledge learned by attending the Integrated Crop Management Conference helped them to make management decisions for their or their customer's operations
13	Percent of producers reporting Extension meetings helped them make better informed decisions related to extreme weather events and their operations
14	Percent of producers reporting improved animal health within their herd
15	Percent of producers likely to make a change in their operation as a result of beef and dairy workshops
16	Percent of agricultural lenders who anticipate direct economic benefits from knowledge learned by participating in Agricultural Lender seminars
17	Average savings (dollars) of producers realized as a result of knowledge gained by attending ventilation training

18	Percent of lowans receiving plant problem, weed or insect diagnostic information who were satisfied or very satisfied with the usefulness of the management information
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Outcome #1

1. Outcome Measures

Number of producers indicating adoption of recommended practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A... Crop production is a major Iowa industry. According to the USDA's 2017 Crop Production Report, Iowa produced 2.61 billion bushels of corn and 561 million bushels of soybeans. As with all industries, there are annual challenges and new technologies continually being introduced. In order to meet the challenges of each growing season crop, producers need to become familiar with research conducted under changing climatic environments. Our goal is to prepare producers for managing potential issues when they arise, or even in advance of the problem occurring, by sharing the scientific knowledge that is currently available.

B... Iowa is home to 4.2% of the U.S. beef cattle inventory, with the tenth-largest beef cow inventory and has the fourth-largest cattle finishing state. Cash receipts from the beef industry in Iowa is \$3.8 billion dollars, and directly employs more than 19,000 people. Iowa's cattle industry contributed in excess of \$6.3 billion in business activity to Iowa's economy.

What has been done

A... Fourteen Crop Advantage conferences were held across the state of Iowa during January 2018. Attendance at these sessions totaled 2,062. Survey data showed that just over 65% were active crop farmers, and 29% were agribusiness crop advisors. Topics varied by the needs of the region where each conference was located and presented a wide range of issues. However, due to the adoption of dicamba-tolerant soybean and related application issues, all sites included at least one session on managing dicamba in soybean. Soil fertility, insect management, crop disease management and other crop production topics were also presented. Additionally, proceedings were printed and shared so attendees at sites where the topic was not presented could still receive the resource information provided.

B... A pair of three-day, intensive, hands-on short courses were held, one for feedlot operators and one for cow-calf operators. The cow-calf course focused on nutrition, reproduction, calving management, calf health, antibiotic use, and record keeping. There were 19 participants in the cow course from three states. The feedlot course focused on feed bunk management, health management and treatment, antibiotic use, quality assurance and data management. There were 23 participants in the feedlot course from five states plus Canada.

Results

A... Post-meeting surveys were given to participants, with 568 responses received. Since the dicamba topic was presented at all sites, that was the focus of most of the survey tool. Five hundred and sixteen said they better understood the risk of using dicamba near nondicamba tolerant beans and other sensitive crops as a result of what they learned. Five hundred and twenty-four indicated they better understood factors that increase the risk of using this technology. Fifty-one participants said that they were going to change their dicamba use plans in 2018 based on information presented, and 252 said this information confirmed their decision for the next growing season. When asked what changes they will make, answers included: not using in 2018, manage timing and weather at application time closely, apply earlier in the season to reduce risk of movement off site, pick the lowest volatility product, scout more, only used as a burn down, altering which fields to use it to reduce risk, and planting a buffer between fields. The survey results from 236 participants who noted that they used this information for decision-making showed they used this decision on an average of 604 acres.

B... End-of-meeting evaluations were used to determine increases in knowledge and planned management changes. Twenty surveys were completed for the cow-calf course. Seventy percent of participants plan to improve treatment and health records, 65% plan to implement body condition scoring, and 60% plan to change their nutrition and reproductive management program. Half of the participants said participating in the short course will improve their cow return by \$25 per cow. The feedlot short course had 26 completed evaluations. Sixty-nine percent of participants plan to develop a low-stress acclimation strategy for new cattle, and using date for decision making, and 65% plan to change their approach to bunk management. Participants estimated the program will increase their returns by \$10 or more per head. Fourteen attendees plan to adopt recommended practices discussed in the meetings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
601	Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

Number of producers reporting increased dollar returns per unit of production.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of producers and landowners who adopt BMPs to address extreme weather events.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of increased efficiencies _____ (i.e. % pregnant; increases in yield/unit, such as bushels/acre; lbs product (meat, protein, milk) per animal; lbs feed per gain).

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Increased knowledge of animal nutrition to improve animal health and wellbeing, production and management efficiencies

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Many livestock production systems are under constant pathogenic and inflammatory stresses that antagonized animal performance, productivity and wellbeing. As such, our research is attempting to identify nutritional strategies to maximize productivity during times of stress.

What has been done

This project period we evaluated different types of feedstuffs (corn byproducts, fats byproducts) to determine benefit to poultry. Work was conducted to investigate the effects of phytase on phosphorus digestion and metabolism in swine. We also evaluated the digestibility of insect meals for swine. And we conducted studies to improve understanding of how trace minerals support growth induced through hormone implants.

Results

This project period our research increased our understanding of how certain feed ingredients interact with and support or retract from growth, the immune system, and microbiome in livestock. We also increased understanding of energy and nutrient partitioning in immune-stressed livestock. Our research results may provide insight into more effective feeding and management strategies.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals

Outcome #6

1. Outcome Measures

Increased knowledge that can strengthen fruit and vegetable production systems in Iowa

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Strong demand for locally grown produce, including organic produce, and an extensive network of farmers markets create substantial opportunities for Iowa fruit and vegetable growers. To take full advantage of increasing market opportunities, conventional and organic growers need more sustainable and cost-effective methods to meet market demands while suppressing key diseases,

arthropod pests, and weeds as well as protecting soil and conserving pollinators and natural predators.

What has been done

We evaluated two row-cover types on their potential use as a season long pest management. This study, showed that Protek pest netting and Agribon-19 could be successfully utilized to mitigate insect pest damage in broccoli production. The study also highlighted the importance of soil micronutrient fertility, especially Boron concentration, in broccoli production as it has direct impact on head quality. Field research was conducted over two years (2017 and 2018) to compare the effect of grafting on tomato cultivar 'BHN 589' (hybrid determinate tomato). Results of this study showed that five rootstocks (Arnold, Beaufort, DRO141TX, Estamino, and Maxifort) should improve plant growth and fruit yield when grafted to a hybrid tomato cultivar. A 3-year (2016-2018) field experiment evaluated the potential of nylon-mesh-covered tunnels (mesotunnels) to protect against cucumber beetles, squash bug, squash vine borer, bacterial wilt, and cucurbit yellow vine disease on muskmelon and acorn squash in organic production. Marketable yield of both crops was substantially higher with the use of full-season mesotunnels compared to standard low tunnels or non-covered controls, with sharply reduced reliance on insecticides in the mesotunnels. A variety of trials were also conducted on various varieties of maize, peppers, and hops.

Results

Field trials, outreach, and publications increased knowledge of sustainable production practices and pest management strategies for fruit and vegetable production in Iowa.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

Outcome #7

1. Outcome Measures

Increased knowledge and technologies that contribute to the rapid identification and rapid deployment of genetics

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
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2018

0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Genetic improvements in the future will require identification and rapid deployment of genetics, enabling crops to predictably adapt to a broad range of environments. Adaptation refers to the inheritance of plasticity in growth and development, also known as reaction norms. Such plasticity provides resilience to unstable environmental conditions.

What has been done

We conducted research to identify genetics associated with adaptive agronomic traits, developed predictive models for adaptive agronomic traits, and designed and optimized accelerated genetic improvement strategies. Outputs include: 1) development of innovative technologies enabling automated data acquisition and image processing for reaction norms from field trials, 2) development of technologies enabling expanded publicly-available genome-wide association studies, 3) development of automated categorization of plant diseases recorded as images in smartphones.

Results

We received international recognition of our innovative technologies that resulted from collaborations between plant breeding scientists and engineers at Iowa State University. Other internationally recognized academic plant breeding programs (e.g., Cornell, Wageningen, Edinburgh) are beginning to do the same and have asked our faculty to provide workshops on how to orchestrate successful collaborative research and development with engineers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
402	Engineering Systems and Equipment

Outcome #8

1. Outcome Measures

Increased knowledge of how plants adapt to various environments.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Detailed information of cell wall biosynthesis is fundamental to a greater understanding of how plants develop and adapt to their environment. This knowledge will open the door for numerous biotechnological applications relative to these adaptive processes. Plant cell walls provide the raw materials for textiles, paper, lumber, films, thickeners and other products. Cell wall organization as a system is essentially unknown. Our understanding of the formation and modifications of cell walls and their adjustments to environmental conditions is fundamental to successfully creating plants with desired cell wall compositions and their efficient utilization for industrial applications, such as feedstock, biofuels, and biomaterials.

What has been done

Our research further demonstrated that post-synthetic modifications of plant cell walls, which usually occur during pathogenesis, can significantly impact plant development and stress responses. Thus, results obtained during this project period demonstrate that reduction of cell wall methylation significantly impairs plant growth, however, it increases plant salt tolerance.

Results

This research increased knowledge of cell wall-mediated responses to environmental stresses and might assist, in the future, in finding directions for plant biomass improvements.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

Outcome #9

1. Outcome Measures

Increased knowledge of the current and potential severity and geographic extent of Western corn rootworm resistance to Bt technologies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Western corn rootworm is the most damaging pest of corn in the U.S. Corn Belt. Each year U.S. farmers suffer economic losses in excess of one billion dollars, as a result of yield losses and management costs associated with corn rootworm. The challenges associated with management of this pest have increased over time due to the evolution of resistance to various management practices including crop rotation, conventional insecticides, and corn that produces insecticidal proteins derived from the bacterium *Bacillus thuringiensis* (Bt).

What has been done

As part of this project, extensive research has been conducted on resistance to Bt corn by western corn rootworm, using both laboratory-selected strains and strains with field-evolved resistance. Research on Bt resistance has included monitoring field populations for the development of resistance and measuring features associated with resistance, specifically inheritance and fitness costs, which enable scientists and regulators to estimate the spread and persistence of resistance in the landscape.

Results

Research and outreach conducted as part of this project has provided farmers with timely information on the effectiveness of current management tools for corn rootworm, policy makers and biotechnology companies with data on the long-term durability of Bt technologies for management of corn rootworm, and scientists with new information on interactions between corn and one of its primary agricultural pests. Also, some research results this project period increased knowledge concerning the geographic distribution of resistant genotypes. This data will make it possible for public sector scientist and scientists from industry to monitor populations of western corn rootworm in Iowa for changes in Bt resistance. Thus, allowing farmers to adjust their management approaches before they suffer severe yield losses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants

Outcome #10

1. Outcome Measures

Increased knowledge that can be used to develop policies that ultimately increase agricultural productivity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Strategies to increase agricultural output to feed a growing world population include public investments in agricultural research and development (R&D), and investment in extension aimed at promoting the diffusion of new technologies.

What has been done

We studied key issues underlying the economics of agricultural innovation and diffusion, and the role of R&D investments to increase agricultural productivity. For example, one study examined the role of "mandates" as an incentive for innovation. Mandates that establish minimum use quotas for certain goods are becoming increasingly popular policy tools to promote renewable energy use. We found that mandates create relatively strong incentives for R&D investment in low quality innovations, but relatively weak incentives to invest in high-quality innovations.

Results

Our research increased the objective knowledge base needed to inform policy debates concerning new agricultural technologies, increased understanding of barriers to agricultural productivity growth, and revealed possible ways to incentivize, and thus increase, agricultural research and innovation.

4. Associated Knowledge Areas

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

Outcome #11

1. Outcome Measures

Knowledge increased that supports new/non-traditional agricultural crops/industries in the upper Midwest

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The introduction of new, interspecific hybrid cultivars has allowed for the development of grape industries in regions not previously considered possible. As new wine grape cultivars emerge, continued growth of the industry, and the economic impact that comes with it, is dependent on evaluating their suitability for various climates and improving quality and quantity of grapes and wine produced.

What has been done

We completed year three of replicated field trials of new wine grape cultivars and selections to evaluate which perform best for maximized grapevine growth, crop productivity, cold hardiness, and juice quality. Results were disseminated to grape growers, researchers, and extension specialists.

Results

Three years of field evaluations led to increased knowledge about growing cold hardy grapes. This new knowledge will aid not only Iowa growers but also growers throughout the upper Midwest and northeastern United States.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #12

1. Outcome Measures

Percent of certified crop advisors reporting that increased knowledge learned by attending the Integrated Crop Management Conference helped them to make management decisions for their or their customer's operations

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	93

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In Iowa, corn and soybean are grown on 13.3 million and 10 million acres, respectively (USDA-NASS), worth approximately \$14 billion. Iowa farmers purchase approximately \$4.9 billion annually in crop inputs from about 1,100 ag retailers. Survey data suggests that individual farmers obtain their crop production information primarily from employees of these ag retailers; however, ag retailers report that they obtain their information from ISU Extension and Outreach. ISU Extension and Outreach "trains-the-trainer" with the most up-to-date and relevant production information at the annual Integrated Crop Management Conference. Data suggests that nearly 10% of corn and soybean acres in Iowa are impacted by information presented at this annual conference.

What has been done

The ISU Extension and Outreach crops team annually offers the Integrated Crop Management (ICM) Conference, a two-day conference used to fulfill needs for commercial pesticide applicators, certified crop advisers (CCAs), other agronomists, and farmers in crop production. The 2017 conference was the 29th annual event. In 2017, this conference consisted of 39 fifty-minute breakout sessions providing relevant sessions on emerging and innovative issues such as legal issues with dicamba, Monarch conservation and crop production, digital agriculture, and sustaining public trust in agriculture and more. 881 agronomists, CCAs, commercial pesticide applicators, and farmers attended this conference in 2017 and 84% of them have attended this conference in a prior year.

Results

The ICM Conference attracts roughly 900 participants annually from Iowa and across the Midwest. At the 2017 conference there were 39 presentations awarding 6,026 hours of continuing education credit to Iowa certified crop advisers. Of the 881 attendees in 2017, 123 responded to a

survey. Ninety-three percent of survey respondents shared that the information they gained from attending the conference positively helped them to make management decisions for their or their customers' operations. These respondents farmed or advised clients on 1.8 million acres of corn and soybeans in Iowa and estimated their profit per acre increase was between \$5 and \$10 dollars per acre for a collective benefit of \$14 million dollars to these operations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
402	Engineering Systems and Equipment
405	Drainage and Irrigation Systems and Facilities
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics

Outcome #13

1. Outcome Measures

Percent of producers reporting Extension meetings helped them make better informed decisions related to extreme weather events and their operations

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	47

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Throughout the summer of 2017, counties in southeast Iowa reached D2 (severe drought) status or worse for several consecutive months. Pastures dried up and forced producers to feed stored hay supplies during the summer. Many farmers turned to their corn crop to fill the void in feed shortages for their cattle operation. This raised immediate concerns with elevated nitrate levels in

the corn plant and potential toxicity concerns if fed directly to livestock.

What has been done

Six drought meetings were held in southeast Iowa to assist in determining the safety of the corn crop for feeding. Attendees were encouraged to bring corn samples from fields for testing for nitrates. Topics discussed included weaning, culling, government programs, and feeding planning.

Results

Two hundred and fifty-seven farmers attended the meetings. A follow-up survey was sent to 160 participants six months following the meetings. 45 completed surveys were returned (28% response rate). Sixty-two percent of the survey respondents said the meetings increased their knowledge of the importance of testing for nitrates before chopping, 73% increased their knowledge about the economic outlook, and 69% increased their knowledge of crop insurance. Forty-seven percent said the meeting helped them make better informed decisions about maintaining or culling the herd. Based on the survey results from 45 respondents, the program had a total economic impact of over \$408,000.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
302	Nutrient Utilization in Animals

Outcome #14

1. Outcome Measures

Percent of producers reporting improved animal health within their herd

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	33

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Sixty percent of the cost of production in beef cow herds is feed cost, and the biggest component of that is in stored feed fed during the winter. Winter feeding also has a major impact on the

health and reproductive capacity of the beef cow. Nutrition during the winter directly impacts the cows' ability to calve unassisted, produce high quality colostrum for the calf, and recuperate post-calving to breed back for the next year.

What has been done

Two workshops were held in northeast Iowa in February 2018 and focused on feeding the beef cow herd, including factors that affect winter feed supplies and nutrient requirements, minimizing feed losses, balancing rations, and mineral requirements. In addition, a survey was sent to 113 beef producers who received ration assistance by a beef field specialist in the last three years to determine changes made as a result of the individual assistance.

Results

Thirty-nine producers and 10 veterinary technician students attended the workshops in northeast Iowa, and 29 completed end-of-meeting evaluations. Participants increased their knowledge of factors affecting feed costs 57%, controlling feed cost 64%, ration balancing 56% and mineral nutrition 66%. Half said they planned to separate their cow herd into different feeding and management groups, and half planned to adjust their current ration plans. 40% said they would reduce their feed costs by \$0.10 per cow per day, 35% would save \$0.25 per cow per day and 5% would save \$0.50 per cow per day. Twenty-one of the 113 surveys sent to individuals receiving individual ration assistance were returned (18.6% response rate). Seventy-six percent of the respondents asked for help with a cow ration, 81% said the ration reduced their feed cost, and 76% said it help stretch their current feed supply. Sixty-two percent said the ration helped improve the body condition of their cows, 33% saw improved animal health, and 24% had increased daily gains. As a result of the individual assistance, 43% said they switched the less expensive feeds, added new feeds to the ration, and changed from feeding hay bales to a mixed ration.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals

Outcome #15

1. Outcome Measures

Percent of producers likely to make a change in their operation as a result of beef and dairy workshops

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	97

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Northwest and northeast Iowa are home to the majority of beef cattle and dairy operations in Iowa, as well as the highest-producing corn silage acres in the state. Corn silage can be an economical feed resource for both beef and dairy cattle, but is also at risk for harvest, storage, and feeding loss. Producers need to understand steps to ensure high quality and quantity of production, storage methods and feeding practices to ensure profitability.

What has been done

Two silage conferences were held in Iowa in 2018, one in northeast Iowa in June and another in northwest Iowa in August. One hundred and twenty-one participants attended, including producers and industry representatives. The approach and presenters differed in the two areas, but topics were similar. Iowa also partnered with the University of Nebraska to offer a bi-state silage conference in August.

Results

Forty-four of the 121 attendees completed end-of-workshop evaluations. The greatest increases in knowledge were for pricing/valuing silage, kernel processing, machinery effectiveness, digestibility, and improving fermentation. Participants plan to make changes in harvest moisture, chop length, kernel processing, using inoculants, improved corn varieties, management of the silage face, developing a budget, and improving safety. Twenty-eight percent valued the knowledge gained at \$2.50 per ton of silage harvested and 19% valued it at more than \$10 per ton. Six members of the media attended, resulting in at least 10 follow up articles in major ag media outlets including Hoard's Dairyman, Hay & Forage Grower, Dairy Star, AgriNews, The Country Today and Farm News. One industry representative said the conference will help them teach customers about proper silage storage and processing methods, and provided them the opportunity to network. The proceedings from the Iowa/Wisconsin conference has been downloaded 532 times. Of the 197 participants in the Iowa/Nebraska conference, 76 completed the end-of-meeting evaluation. Ninety-seven percent said they are likely to make changes to their operation and 70% anticipate improved silage characteristics and improved cattle performance as a result of their participation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
601	Economics of Agricultural Production and Farm Management

Outcome #16

1. Outcome Measures

Percent of agricultural lenders who anticipate direct economic benefits from knowledge learned by participating in Agricultural Lender seminars

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	91

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farm financial stress, market reality, and profit margins are issues of concern for ag lenders, especially in the dairy industry. Trends show profit margins continuing to dwindle as dairy cycles prolong themselves on the low price side. Producers are under severe financial strain and lenders need to protect portfolios and help reduce price risk on the farm. Well-informed and updated lenders provide critical risk management of farm loans both for the producer and the protection of assets for the bank as well. Ag lenders aggressively seek continuing education opportunities to enhance their abilities to understand and evaluate regulatory and government programs (Farm Bill), risk management tools and options, dairy technologies, and dairy trends and metrics that help them effectively evaluate and manage dairy enterprise profitability and options.

What has been done

Two annual Agricultural Lender seminars were developed and conducted by ISU Extension and Outreach dairy team with important topics selected by lenders, agri-business, and extension personnel. The northeast Iowa seminar (in existence for 30 years) encompassed lenders from Iowa, Wisconsin, and Illinois (n = 170). The Siouxland Agricultural Lenders seminar in northwest Iowa is in its second year and encompassed Iowa, Minnesota, Nebraska, and South Dakota; (n = 58). Topics included understanding accrual accounting benefits, understanding dairy marketing and risk management, USDA Farm bill and impact on dairy economics, how dairy milk components affect milk price, how commodity factors affect prices, and benchmarks for considering automatic milking systems.

Results

A post-seminar learning survey was sent to participants. Of those who returned the survey, 97% rated the seminar as excellent, beneficial or of high value. The survey asked lenders if they had increased knowledge in five different areas for the Ag Lenders Seminar and six areas for the Siouxland Agricultural Lenders Seminar, with all areas for the two sessions showing knowledge improvement. Lenders who attended the seminars intended to make recommendations to their clients, with 91% anticipating direct economic benefits from the workshop, with the most common response showing an expected \$101-500 per client benefit. Lenders estimated a total projected client benefit of over \$190,000 from the seminars.

4. Associated Knowledge Areas

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

602 Business Management, Finance, and Taxation
603 Market Economics

Outcome #17

1. Outcome Measures

Average savings (dollars) of producers realized as a result of knowledge gained by attending ventilation training

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4341

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Iowa is the top pork producing state annually in the United States, marketing around 50 million hogs. State swine production creates approximately 165,000 jobs and generates approximately \$11.7 billion dollars of economic activity (GDP). Proper ventilation of swine buildings is important for more than GDP growth. Producers and consumers benefit from healthy pigs which lead to higher profits for pork producers and lower cost of pork for consumers. Heat energy loss in swine facilities is directly linked to ventilation management, everyone benefits when carbon footprint is lowered because of ventilation education. Additionally, proper ventilation increases pig productivity and reduces the need for costly treatment medication, lowering antibiotic usage.

What has been done

The swine extension specialists with the Iowa Pork Industry Center partnered with Dr. Jay Harmon, the Iowa Pork Producers Association, and other allied industry partners to develop and deliver hands-on ventilation training and education to pork producers throughout the state. A portable trailer demonstrating state-of-the-art technology was transported across the state to deliver seven training workshops. The workshops were attended by 171 operations and system flows. The number of pigs influenced by those attending the workshop was over 63 million pigs and over 1.2 million sows.

Results

A total of 171 individual producers participated in the workshops. A survey to evaluate workshop impact was developed and submitted approximately six months following the workshop to measure changes implemented. Of the 91 returned surveys, collectively 95 ideas/concepts related to ventilation were identified indicating that an average of more than one important concept was learned per participant. Learning was also documented into changes. Survey

participants collectively identified 72 changes implemented in their operations following workshop attendance. The workshop has been shown to help producers improve animal health while using less energy while decreasing production cost. Participants estimated an average value of \$4,341 from the program. Sixty-seven percent of respondents indicated they were able to reduce the ambient temperature set point in their building, which allows for better utilization of feed ingredients and uses less energy in heating the building, both of which reduce the carbon footprint and minimizes emitted greenhouse gas. Fifty-eight percent of respondents indicated they learned how to adjust air inlets to optimize air velocity and reduce the incidence of chilling pigs, which can allow for animal disease

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment

Outcome #18

1. Outcome Measures

Percent of lowans receiving plant problem, weed or insect diagnostic information who were satisfied or very satisfied with the usefulness of the management information

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	68

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A proper diagnosis of a plant problem or identification of an insect or weed is the foundation of any management program. The role of the ISU Plant and Insect Diagnostic Clinic is to provide our clients with an accurate diagnosis as well as management information. Our clients are dealing with an immediate plant or insect problem that they have a personal investment in and are seeking knowledge and actions they can take. Ensuring that the information we provide is understandable and increases knowledge is critical to ensure proper action.

What has been done

In 2018, we interacted with a total of 3,190 clients via physical samples, phone consultation and email consultations. We survey clients who send us a physical samples (1,496) since the best contact information is available for these clients. Clients were surveyed on how satisfied they were with the amount of information and management suggestions they receive and how useful

the management options are. They were also asked how difficult it was to understand their report with management information.

Results

In 2018, 68% of survey respondents (40 clients) were satisfied or very satisfied with the amount of information they received and 74% were satisfied or very satisfied with the usefulness of the management information. Eighty-eight percent of our clients felt the report was easy or very easy to understand.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The 2018 Farm Bill had relatively few changes that impact Iowa farmers and the educational programming was embedded into ongoing programs. The weakening farm economy has lessened farmers interest in investments in new technologies. Increased market price risk associated with short-term trade uncertainty is also causing financial and mental health stress in rural communities. Rapid advances in digital agriculture and effectively using big data to make sub-field management decisions is an ongoing research and education need.

Interest in high value crops and livestock has increased as commodity prices have weakened. This includes growing interest in locally produced produce and methods for expanding markets for this local produce in regional population centers. There is also interest in industrial hemp resulting from changes in the 2018 Farm Bill. Sound research and education about regulation, production, harvest, processing and markets is not keeping up with interest from producers, investors and consumers.

Online and social media information delivery continue to grow among farmers and agribusinesses that use our information. We continue to improve our effectiveness via this media. Often it is the same written publication that is promoted through social media and downloaded online. We are also growing the use of podcasts as an educational delivery method.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Farmers and consultants surveyed following an educational event can place a dollar value on the information gained and that they plan to implement. For some topics, the participants are surveyed a year later to determine which practices they implemented and what they observed as the value gained. Typically, participants will receive similar information multiple times throughout the year that builds their confidence in making a decision to implement a practice.

Key Items of Evaluation

Decisions to change management and production practices are difficult as they are often costly to switch and the outcomes are uncertain due to variables beyond the farmer's control. It is easier to make changes in this environment when farmers trust the source of information. The fact that 84 percent of the 881 agronomists, CCAs, commercial pesticide applicators, and farmers that attended the 2018 Integrated Crop Management Conference also attended in 2017 indicates that they place significant value in the conference.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Health and Well-being

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
302	Nutrient Utilization in Animals	0%		23%	
307	Animal Management Systems	1%		0%	
308	Improved Animal Products (Before Harvest)	1%		0%	
315	Animal Welfare/Well-Being and Protection	2%		1%	
501	New and Improved Food Processing Technologies	1%		10%	
502	New and Improved Food Products	0%		32%	
503	Quality Maintenance in Storing and Marketing Food Products	17%		1%	
511	New and Improved Non-Food Products and Processes	0%		2%	
701	Nutrient Composition of Food	0%		3%	
703	Nutrition Education and Behavior	33%		2%	
704	Nutrition and Hunger in the Population	12%		2%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	9%		1%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	17%		8%	
721	Insects and Other Pests Affecting Humans	0%		4%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		5%	
723	Hazards to Human Health and Safety	7%		1%	
724	Healthy Lifestyle	0%		2%	
802	Human Development and Family Well-Being	0%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	4.9	0.0	1.4	0.0
Actual Paid	8.2	0.0	38.7	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
766230	0	1103511	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
766230	0	1103511	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
851581	0	5712795	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct workshops and meetings. Workshops include ServSafe® Certification food safety, food preservation, HACCP implementation, GAPS preparation, childcare provider training, etc.
- Provide nutrition, wellness, food preservation, and food safety education to general consumers.
- Develop educational materials, resources and curriculum including web-based tools, social media and Extension publications.
- Provide training and technical assistance such as fundamental food safety training for volunteer staffed events, line level employees, and childcare providers, and respond to specific questions related to application of food safety principles.
- Provide nutrition and food resource management education through EFNEP and SNAP-Ed programs.
- Promote access to healthy food at food pantries.

Faculty participated in relevant multi-state research committees: NC170, NC1023, NC1194, NC2172, NE1439, NE1443, S294, S1056, W3002, W3045, W3150, and W3191.

2. Brief description of the target audience

- Food growers, foodservice management and staff in commercial and noncommercial operations.
- School aged youth, child care providers, school staff and other adult mentors of youth.
- Adult Iowans in the workforce, participating in food assistance programming and community health outreach programs.
- Consumers and food stand volunteers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	27793	1436391	1565	400

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

Patent Applications Submitted

Year: 2018
 Actual: 2

Patents listed

A Novel Vegetable Oil-based Material as a Substitute for Carnauba Wax. Want et al. Patent pending. Filed 3-20-2018.

Fatty Acid Ester-Based Wax Compositions and Methods of Making Thereof. Wang et al. Patent pending. Filed 1-19-2018.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	64

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of youth receiving educational programming related to nutrition, physical activity, and health promotion.

Year	Actual
2018	1965

Output #2

Output Measure

- Number of adults who impact youth receiving educational programming related to nutrition, physical activity and health promotion.

Year	Actual
2018	1849

Output #3

Output Measure

- Number of adults receiving educational programming related to nutrition, physical activity, and health promotion.

Year	Actual
2018	274421

Output #4

Output Measure

- Number of professionals working with youth and/or adults receiving training related to nutrition, physical activity, and health promotion.

Year	Actual
2018	822

Output #5

Output Measure

- Number of unique visitors on Iowa State University Extension and Outreach nutrition/health websites and publication downloads.

Year	Actual
2018	633689

Output #6

Output Measure

- Number of lowans receiving education related to home food preservation.

Year	Actual
2018	3899

Output #7

Output Measure

- Number of lowans receiving food safety certification.

Year	Actual
2018	2227

Output #8

Output Measure

- Number of adult participants in Extension and Outreach programs on food safety.

Year	Actual
2018	12371

Output #9

Output Measure

- Number of unique visitors on Iowa State University Extension and Outreach food safety project websites.

Year	Actual
2018	77676

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percent of youth participants reporting increased knowledge/intake of vegetables.
2	Percent of youth participants reporting increased physical activity.
3	Percent of childcare training participants reporting preparedness to apply or teach health promoting dietary behaviors.
4	Percent of adults reporting increased fruit and vegetable intakes.
5	Percent of adults reporting increasing minutes of physical activity.
6	Percent of adult EFNEP/SNAP-Ed graduates who made a positive change in food resource management skills such as not running out of food.
7	Number of people receiving food safety certification.
8	Percent of adults reporting increased knowledge of safe home food preservation techniques.
9	Percent of adult EFNEP/SNAP-Ed graduates with a positive change in food safety practices.
10	Number of food handlers receiving food safety training and education in safe food practices.
11	Percent of youth participants reporting increased knowledge/intake of fruit.
12	Pounds of fruits and vegetables donated to Iowa food pantries
13	New knowledge unearthed, and new processes, technologies, and strategies developed to improve human nutrition.
14	Increased knowledge of linkages among economic hardship, stress exposure, food insecurity and health outcomes across the lifespan
15	Increased knowledge that can ultimately be used to lower worker fatality rate in the agricultural industry.
16	Increased understanding of consumer acceptability and knowledge of the health benefits of beans
17	Increased knowledge and new tools that can be used to protect consumers from pathogens in fresh/uncooked produce.

Outcome #1

1. Outcome Measures

Percent of youth participants reporting increased knowledge/intake of vegetables.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	28

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The 2016 Iowa Youth Survey data show that only 52% of youth ate green salad, carrots, potatoes or other vegetables (not counting French fries, fried potatoes, or potato chips) one time or less per day.

What has been done

Beginning in 2016, Iowa State University EFNEP began delivering the Kids in the Kitchen youth nutrition and cooking education program. The program is delivered in two counties with particularly high populations of children from families with low incomes. The seven-lesson series provides basic nutrition and food safety education as well as basic cooking skills for children in grades K-5. The lessons are delivered outside of school time in after-school programs and summer enrichment or child care settings.

Results

Self-reported behavior is measured with older program participants (grades 3-5) and 28% indicated increased vegetable consumption. One challenge with measuring impact of this program is a high rate of ideal responses at program entry when using the required youth EFNEP tool.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Percent of youth participants reporting increased physical activity.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The 2015 Dietary Guidelines for Americans and the Physical Activity Guidelines for Americans recommend 60 minutes of active play every day for children. The 2016 Iowa Youth Survey data show that just 30% of 6th grade youth in Iowa indicate being active for 60 minutes per day over the past week. Additionally, 49% of Iowa 6th graders indicate being active for one hour on fewer than five days per week.

What has been done

Beginning in 2016, Iowa State University EFNEP began delivering the Kids in the Kitchen youth nutrition and cooking education program. The program is delivered in two counties with particularly high populations of children from families with low incomes. The seven-lesson series provides basic nutrition and food safety education as well as basic cooking skills for children in grades K-5. The lessons are delivered outside of school time in after-school programs and summer enrichment or childcare settings. Each lesson includes a period of active play that can be replicated outside of the lesson environment. The lessons and activities stress the notion that active play does not have to involve organized sports, but can be whatever types of activity the child enjoys.

Results

Twenty percent of Kids in the Kitchen participants in grades 3-5 reported increased physical activity. It is worth noting that 81% of children indicated they were active on most days or every day at program entry. This ceiling effect limits our ability to show change using the required youth EFNEP tool. We are part of a national committee interested in improving the youth EFNEP evaluation processes.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Percent of childcare training participants reporting preparedness to apply or teach health promoting dietary behaviors.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	82

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Research suggests early feeding habits influence diet and health later in life. The establishment of food preferences begins during infancy and toddlerhood, influenced by exposure to breast milk, timing of introduction to solids, and types of first foods offered. These factors play important roles in laying the foundation for healthy eating habits. Early dietary choices have also been linked to immune function and weight status during childhood as well as cardiometabolic health into adulthood. Despite these significant implications, nutrition guidance for toddlers and preschool children has been limited, particularly in the child care setting. Child care providers play an important role in the development of food behaviors and choices in young children.

What has been done

Currently, 14 different child care provider trainings are offered throughout the state. Topics range from food safety to physical activity and bottle feeding. This past year 889 child care providers attended training throughout the state.

Results

Eighty-two percent of child care providers reported preparedness to implement at least one best policy and practice related food and nutrition in their child care setting.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #4

1. Outcome Measures

Percent of adults reporting increased fruit and vegetable intakes.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	47

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Current program data show that at entry EFNEP and SNAP-Ed clients consumed one cup of fruits per day and one and one-half cups of vegetables, which is well below the Dietary Guidelines for Americans recommendation. Additionally, 31% of program participants ate no fruit at program entry.

What has been done

EFNEP and SNAP-Ed direct education in Iowa is a series of nine to eleven nutrition lessons taught by paraprofessional nutrition educators to families with low income and children age ten and under as well as pregnant or parenting teens. These lessons show participants how to choose nutritious foods, stretch their food dollars, handle food safely, be physically active, and prepare nutritious recipes. Lessons 3 through 8 all focus on practicing healthy nutrition behaviors: Fruits and Veggies, Half Your Plate; Make Half Your Grains Whole; Build Strong Bones; Go Lean with Protein; and Make a Change (addresses sodium, fats, and added sugars).

Results

Following participation in at least nine lessons, 47% of participants increased their consumption of fruits or vegetables. On average, combined fruit and vegetable consumption among EFNEP and SNAP-Ed graduates increased by 0.6 cups.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Percent of adults reporting increasing minutes of physical activity.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	45

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The 2015 Dietary Guidelines for Americans recommend that adults participate in moderate physical activity for 30 minutes per day on five days per week. The Physical Activity Guidelines for Americans echo this message with a recommendation of 150 minutes of activity per week. The 2015 Behavioral Risk Factor Surveillance System data show that 19.4% of adult Iowans meet aerobic and strength training physical activity recommendations. For those with an income below \$15,000 just 14.1% meet aerobic and strength training physical activity recommendations. This item was not included in the 2016 BRFSS survey and 2017 data is not yet available.

What has been done

EFNEP and SNAP-Ed direct education in Iowa is a series of nine to eleven nutrition lessons taught by paraprofessional nutrition educators to families with low income and children age eighteen and under as well as pregnant or parenting teens. These lessons show participants how to choose nutritious foods, stretch their food dollars, handle food safely, be physically active, and prepare nutritious recipes. Each lesson has a physical activity component. In particular, lesson two (Get Moving) focuses on physical activity.

Results

Following participation in at least nine lessons, 45% of participants increased the amount of physical activity in which they regularly participate. In addition, by the completion of the program, 70% of participants reported meeting the physical activity recommendations set by the 2015 Dietary Guidelines for Americans.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

704 Nutrition and Hunger in the Population

Outcome #6

1. Outcome Measures

Percent of adult EFNEP/SNAP-Ed graduates who made a positive change in food resource management skills such as not running out of food.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	87

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Effective food resource management is critical to healthy eating behaviors among families with low-incomes. Whether their food resources consist of public benefits or earned income, families need to build skills to maximize available resources to gain the most nutrition for their dollar. Nearly 13% of Iowans are food insecure.

What has been done

EFNEP and SNAP-Ed direct education in Iowa is a series of nine to eleven nutrition lessons taught by paraprofessional nutrition educators to families with low income and children age eighteen and under as well as pregnant or parenting teens. These lessons show participants how to choose nutritious foods, stretch their food dollars, handle food safely, be physically active, and prepare nutritious recipes. Participating families learn shopping and meal planning strategies that minimize waste and stretch expensive ingredients.

Results

Among families graduating from the EFNEP and SNAP-Ed lesson series, 87% improved their food resource management. This data point is measured through questions related to frequency of planning meals, comparing prices, using a grocery list and running out of food at the end of the month.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

Number of people receiving food safety certification.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1888

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is estimated that 48 million people experience a foodborne illness each year with 3,000 deaths resulting from these illnesses. Providing food handlers and decision makers involved in food preparation and service with knowledge about risks can help in reducing incidents of foodborne illness by leading to better practices.

What has been done

More than 2,000 Iowans (n =2,227) participated in an 8-hour workshop about safe food handling practices.

Results

Of the 2,227 who participated in the 8-hour certification course workshop, 85.5% (n = 1,888) were successful in earning certification as Certified Food Protection Managers.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

Percent of adults reporting increased knowledge of safe home food preservation techniques.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Interest in home food preservation has increased due to the local food movement and economy. According to the National Center on Home Food Preservation, one in five U.S. households can their own food; however, many are unaware of the food safety issues that home food preservation encompasses.

What has been done

Of the 3,899 people who received food preservation assistance, 663 adults participated in food preservation education programming. Of these 663 adults, 57 completed the statewide comprehensive food preservation program, 30 took a hands-on workshop and 576 attended a general food preservation class. Additionally, 2,912 individuals called with food preservation questions.

Results

Of those who took part in the online food preservation lessons, all (100%) reported an increase in high to very high post-program knowledge about canning processing times, foodborne illness (e.g. causes, high risk foods), safe food handling practices, and recommended canning practices.

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

Percent of adult EFNEP/SNAP-Ed graduates with a positive change in food safety practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	84

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Previous EFNEP and SNAP-Ed data show that families with low income do not, seldom, or sometimes (as opposed to most of the time or almost always) practice food safety management skills such as thawing and storing food properly. These skills can prevent or alleviate illness.

What has been done

EFNEP and SNAP-Ed direct education in Iowa is a series of nine to eleven nutrition lessons taught by paraprofessional nutrition educators to families with low income and children age eighteen and under as well as pregnant or parenting teens. These lessons show participants how to choose nutritious foods, stretch their food dollars, handle food safely, be physically active, and prepare nutritious recipes. Each lesson includes a component related to food safety with particular focus on minimizing food waste without compromising food safety.

Results

Eighty-four percent of program participants improved at least one practice related to safe food handling including:

- Washing hands before preparing food
- Washing items and surfaces after contact with raw meat or seafood
- Thawing frozen food at room temperature
- Using a meat thermometer

4. Associated Knowledge Areas

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

- 712 Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 723 Hazards to Human Health and Safety

Outcome #10

1. Outcome Measures

Number of food handlers receiving food safety training and education in safe food practices.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	13364

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is estimated that 48 million people experience a foodborne illness each year, with 3,000 deaths resulting from these illnesses. Providing food handlers and decision makers involved in food production and service with knowledge about risks can help in reducing incidents of foodborne illness by leading to better practices. Knowledge about safe food handling will help food entrepreneurs develop markets for their products.

What has been done

More than 13,000 (n= 13,364) people participated in food safety sessions related to produce safety, general food safety, and safe handling of food when working in retail outlets and food stands.

Results

Participants indicate food safety training prepares them to minimize risks of food borne illness in their work settings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
503	Quality Maintenance in Storing and Marketing Food Products
703	Nutrition Education and Behavior
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

723 Hazards to Human Health and Safety

Outcome #11

1. Outcome Measures

Percent of youth participants reporting increased knowledge/intake of fruit.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	24

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The 2016 Iowa Youth Survey data show that 17% of 6th graders statewide consumed fruit (not counting fruit juice) less than one time per day. 50% consumed fruit one or two times per day and 33% consumed fruit three or more times per day. Fruit and vegetable consumption in Iowa among all ages is well below recommendations.

What has been done

Beginning in 2016, Iowa State University EFNEP began delivering the Kids in the Kitchen youth nutrition and cooking education program. The program is delivered in two counties with particularly high populations of children from low-income families. The seven-lesson series provides basic nutrition and food safety education as well as basic cooking skills for children in grades K-5. The lessons are delivered outside of school time in after-school programs and summer enrichment or child care settings.

Results

Self-reported behavior is measured with older program participants (grades 3-5) and 24% indicated increased fruit consumption. One challenge with measuring impact of this program is a high rate of ideal responses at program entry when using the required youth EFNEP tool.

4. Associated Knowledge Areas

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

Outcome #12

1. Outcome Measures

Pounds of fruits and vegetables donated to Iowa food pantries

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	299294

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Nearly 13% of Iowa's population is food insecure. According to a 2014 Feeding America study conducted with Iowa food pantry clients, the most desired item by pantry clients that is not available at pantries is fresh produce. Iowans of all income levels eat fewer fruits and vegetables than recommended and consumption is lowest among those with low income.

What has been done

Iowa State University SNAP-Ed and Master Gardener programs have created a collaborative project to improve access to fruits and vegetables in Iowa's food pantries. Master Gardeners across the state received training on working with food pantries and food safety in donation gardens. They were provided with an opportunity to receive mini-grants to fund donation gardens in partnership with their local food pantries. Additionally, ISU Extension and Outreach's SNAP-Ed program partners with Grow Johnson County and Table to Table Food Rescue to increase access to fruits and vegetables in food pantries in Southeast Iowa.

Results

A total of 351 Master Gardener volunteers participated during the third year of the project (2018). Master Gardeners raised and donated more than 90,000 pounds of fruits and vegetables for their partner pantries. The partnership with Table to Table led to more than 209,294 pounds of fruits and vegetables distributed through food pantries. In total, the project yielded 299,294 pounds of fruits and vegetables for food pantry clients in Iowa, which equates to nearly 900,000 servings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population

Outcome #13

1. Outcome Measures

New knowledge unearthed, and new processes, technologies, and strategies developed to improve human nutrition.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In the United States, an unhealthy diet is a leading contributor to several chronic diseases, including cardiovascular disease, type 2 diabetes mellitus, and certain types of cancer. Strategies that support a healthy diet are important to reduce the risk of developing chronic disease and optimize long-term health.

What has been done

Our research included examining new processing approaches for milk and new processing approaches to producing high-protein nutrition bars. We developed batch sonification to improve the shelf-life of skim milk. Research was conducted to determine how extrusion and milling change the physicochemical properties of milk protein concentrate powders. Studies were conducted that demonstrate the potential of novel food ingredients to increase satiety and mitigate health problems associated with type 1 diabetes. Novel sources of iron were developed that may contribute to new approaches to reducing iron-deficient anemia. We began a diabetes education study for Latinos.

Results

This work has contributed new knowledge regarding the influence of diet on human health, including obesity, type 1 diabetes and iron bioavailability. Several publications also contributed new knowledge that improves food function or safety. Our work contributed new knowledge regarding communication strategies to improve health through diet or physical activity lifestyle changes including studies to improve bean consumption in low socio-economic groups. Novel sources of iron were developed that may contribute to new approaches to reducing iron-deficient anemia.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
502 New and Improved Food Products

Outcome #14

1. Outcome Measures

Increased knowledge of linkages among economic hardship, stress exposure, food insecurity and health outcomes across the lifespan

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our research focus is on three environmental factors that are known to influence child, adolescent, and adult health in the US: exposure to economic hardship, stress, and food insecurity.

What has been done

One study examined the effects of economic pressure on maternal depressive symptoms, marital conflict, and mother harsh parenting during the adolescent years on offspring depression levels in adulthood. Another studied the long-term effect of family economic pressure on later offspring binge drinking. Other published work examined the impact of neighborhood racial discrimination and financial strain on the development of major depressive disorder in a sample of 499 African American women who were followed for 9 to 11 years. Another study assessed the unique influences of family economic hardship in early and late midlife on husbands' and wives' body mass index (BMI) and the influence of BMI on the onset of cardiometabolic (CM) disease in later adulthood. We also examined the association between food insecurity and BMI from early adolescence (age 15) to middle adulthood (age 31).

Results

We increased knowledge regarding the impacts of economic pressure on maladaptive health outcomes, and identified intervention points. By using observational data, as well as mother, father, and adolescent reported variables, we have a more complex understanding of how each parent uniquely contributes to the role of their adolescent's alcohol use in late adolescence into emerging adulthood. Findings from this research have identified BMI as a modifiable leverage point for the long-term reduction of CM disease risk and indicate the importance of the role of

spouses as buffers against this detrimental stress-health association. Study results argue for increasing access to food during key developmental periods such as in adolescence, which could help reduce the long-term implications for health, particularly high BMI for girls. This new knowledge to create policies and programs that help reduce negative health outcomes for at-risk families in America across a variety of diverse populations.

4. Associated Knowledge Areas

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

Outcome #15

1. Outcome Measures

Increased knowledge that can ultimately be used to lower worker fatality rate in the agricultural industry.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

While not the largest workforce population for an industry in the United States, the agricultural workforce received the distinction as the most-deadly industry with a worker fatality rate of 24.6 deaths per 100,000 workers (NSC 2013). Other US industries, like construction or manufacturing, employ risk assessment techniques to assist safety managers in identifying tasks that produce high risk of injury or even death.

What has been done

This project was focused on identifying tools to use in estimating the risk associated with worker actions during corn production and biofuel switchgrass production. We identified a standardized risk assessment tool for Midwest agriculture; its limitations and uncertainties were explored. We identified over 300 human actions necessary for corn and biofeedstock production, which could be assessed for worker risks, and categorized them as either establishment, management or harvest. Harvest was identified as the greatest contributing factor to worker injury risk in each production system.

Results

This study has shown that risk can be modeled and the model can produce logical results with limited agricultural data. Increased knowledge produced from our research can be used to assist safety instruction for corn and biofeedstock producers in the US. Ultimately, this knowledge can be used to begin the process that the other U.S. industries have accomplished by lowering the death rate of workers and number of medically consulted injuries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #16

1. Outcome Measures

Increased understanding of consumer acceptability and knowledge of the health benefits of beans

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The *Phaseolus vulgaris* L. species of the legume family have high genetic diversity, climate adaptability, disease resistance, and multiple human health benefits. Consumer acceptance studies are needed to better understand food intake choices and to justify the expansion of these important crops into marginal lands.

What has been done

We conducted research to evaluate knowledge, attitudes, and practices regarding bean food items and food-related behaviors. We conducted a focus group study with low-income women who participate in Federal nutrition assistance programs. We identified distinct barriers and motivators to bean consumption, such as preparation and household member taste preferences. We published our findings on the knowledge of Registered Dietitians on the health benefits of beans (Winham et al., 2018), and our focus group research with low-income White and African American women on barriers and motivators to dry bean use (Palmer et al., 2018).

Results

This increased knowledge of the health benefits of beans and their consumer acceptability. Findings will aid Extension professionals in developing nutrition education materials to help increase bean consumption.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food

Outcome #17

1. Outcome Measures

Increased knowledge and new tools that can be used to protect consumers from pathogens in fresh/uncooked produce.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Even with current food safety interventions such as produce sanitizers, good agricultural practices, and employee training, there is continuously recalls and outbreaks with fresh produce that kills, hospitalizes, and sickens hundreds of people each year. Improved tools are needed for detecting pathogens in food production settings. Human pathogens cannot be utilized in a food production setting to determine if a food safety intervention is effective. Therefore, the use of surrogate microorganisms that act like the human pathogens are critical for the fresh-cut industry to have an accurate model.

What has been done

We have been working to identify potential surrogate microorganisms that can be used within a produce field setting and in a fresh-cut processing setting. To date, two of our labs have identified 5 strains that can be utilized for microbial risk assessment that mimic the attributes of Escherichia coli O157:H7. As of December 1st, 2018 these strains have been cited in 52 peer-reviewed journal articles as being used in other food safety research.

In 2018, seven peer review articles were published, 11 peer-reviewed extension publications, and seven products (i.e. videos, checklist, spreadsheets) were released to aid in education of produce growers on the risk factors that impact the safety of the produce they grow, harvest, process, and distribute. Additionally, there were 10 produce safety alliance grower trainings provided in Iowa to educate growers and 10 on-farm food safety visits to produce farms. All of this research has been presented at conferences through the U.S. It is estimated that over 1,000 food industry, academics, and government agencies have been exposed to this research and extension publications.

Results

Five new surrogate microorganisms are available to be used in food production settings to determine if a food safety intervention is effective. With so few of options for surrogate available, this is a major contribution to the field of food safety.

Knowledge assessments taken from the produce safety alliance grower trainings indicate a significant increase in knowledge related to the food safety modernization act produce safety rule ($p < 0.001$) and changes in behavior were observed through on-farm visits at all 10 farms in 2018. These include adoption of new produce sanitizers, employee training, facility upgrades and technology.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Our state plan of work has identified and implemented priority programming based on: timeliness, relevance, uniqueness (services not offered by other organizations) and impact. In addition, sequential programming was prioritized based on the ability to demonstrate impact. To evaluate priority programs, online surveys are capturing evaluation/impact data.

Economic constraints continue to influence program planning and participation rates. Citizens and organizations may wish to participate in programs but lack resources of time and transportation. Federal and state legislation continues to impact appropriations and

policy for nutrition and health programming initiatives. In this state, a grocery store chain employs Registered Dietitians in stores throughout the state. This trend has created competition for programming in rural communities that had been traditionally served by ISU Extension staff. Healthcare reform will also modify the landscape for programming in this plan of work; additional opportunities in preventive health care may be available for ISU extension.

There is a growing demand for more programming via technology. In response, ISU Extension has designed several websites and social media pages. Educational materials are available in online format, such as streaming videos to meet needs of lowans. We monitor the use of these pages through "unique visitors" rather than page "hits." Several of the education materials are available on the Spend Smart. Eat Smart., Food Safety, and Nutrition and Health websites.

The Iowa demographic continues to change and requires programming efforts that are sensitive to various cultures. We implemented a diabetes education program for Latinos and offer ServSafe in Spanish.

The Food Safety Modernization Act has raised awareness about risks from improper handling of food along the food chain, particularly proposed standards related to fresh produce. Further, Iowa's adoption of Food Code 2011 Supplement requires one employee at each foodservice establishment to have certification in food safety through an approved program (i.e., ServSafe). Economic challenges and increasing numbers of New lowans led to our investigation of food entrepreneurs and ways to grow food based businesses.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

EFNEP and SNAP-Ed participants showed high rates of behavior change this year with the majority of participants increasing consumption of fruits, vegetables or dairy. Participants also demonstrated strong improvements on critical health and nutrition measures including physical activity, food resource management and food safety practices. Program success stories include participants increasing their confidence with cooking, reading labels and providing healthy foods for their children.

Key Items of Evaluation

Through high pass rates (**85.5%**) on the national ServSafe certification exam and food preservation knowledge surveys we know our food safety programs have led to increases in knowledge, with ultimate goal of changes in behavior. Increases in numbers of lowans participating in food safety programming, beyond our targets, indicates there is considerable interest in improving safe food handling practices at all links of the food chain.

V(A). Planned Program (Summary)**Program # 5****1. Name of the Planned Program**

Natural Resources and Environmental Stewardship

 Reporting on this Program**V(B). Program Knowledge Area(s)**

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	6%		3%	
102	Soil, Plant, Water, Nutrient Relationships	11%		17%	
111	Conservation and Efficient Use of Water	5%		3%	
112	Watershed Protection and Management	6%		10%	
121	Management of Range Resources	11%		1%	
123	Management and Sustainability of Forest Resources	3%		1%	
131	Alternative Uses of Land	6%		0%	
132	Weather and Climate	4%		3%	
133	Pollution Prevention and Mitigation	6%		3%	
135	Aquatic and Terrestrial Wildlife	4%		16%	
136	Conservation of Biological Diversity	4%		11%	
141	Air Resource Protection and Management	4%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		3%	
202	Plant Genetic Resources	0%		4%	
205	Plant Management Systems	0%		8%	
307	Animal Management Systems	0%		2%	
403	Waste Disposal, Recycling, and Reuse	5%		3%	
405	Drainage and Irrigation Systems and Facilities	10%		3%	
605	Natural Resource and Environmental Economics	10%		3%	
608	Community Resource Planning and Development	5%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)**1. Actual amount of FTE/SYs expended this Program**

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	15.6	0.0	7.0	0.0
Actual Paid	15.5	0.0	92.6	0.0
Actual Volunteer	13.6	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
2001743	0	1914903	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
2001743	0	1914903	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
2166276	0	12536000	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Addressed air and water quality, and other environmental issues of Iowa through research, education, and extension programs targeted at solving environmental problems of producers, citizens, public health officials, and regulators.
- Increased research and adoption of best management conservation practices, crops, and cropping systems that control soil erosion, minimize sediment transport, and reduce nutrient export.
- Approached water quality and quantity issues from a watershed perspective using adaptive management principles that link the private and public sectors.
- Developed better models and tools to be used to evaluate the effects of changes in the mix and location of crop and livestock systems due to climate change and the impacts of those changes on native plants and animals (wildlands and wildlife).
- Targeted programming to address policy issues as they arose, including response to public comment documents and development of hard copy materials and resources for regulators and policy makers.
- Produced, updated and revised handbooks, newsletters, and publications on a variety of topics including nutrient management, soil health/erosion, and commercial horticulture crop production.
- Developed and delivered strategies and programs to increase community involvement, especially related to private and public natural resources.

Faculty participated in relevant multi-state research committees: NC7, NC213, NC1173, NC1178, NC1180, NC1181, NC1182, NC1189, NC1190, NC1195, NC1205, NE1438, NE1442, NE1720, S1032, S1063, S1065, W2006, W3004, W3045, W3188, and W4133.

2. Brief description of the target audience

The program focuses on the private and public sectors. Stakeholders engaged with research and extension activities associated with this program include: crop and livestock producers, private citizens, public health officials, state and federal agricultural and natural resource agencies, environmental groups,

landowners, homeowners, agricultural and natural resource scientists and engineers, agribusiness, and policy makers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	122708	1552246	0	0

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

Patent Applications Submitted

Year: 2018

Actual: 1

Patents listed

Biodegradable Fertilizer. Grewell et al. Patent #9,988,318 issued 6-5-2018.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	125

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of producers, agribusiness professionals, and land-owners who attend face-to-face educational activities, including individual consultations.

Year	Actual
2018	77911

Output #2

Output Measure

- Number of producers, agribusiness professionals and land-owners who subscribe to newsletters and access web-based resources.

Year	Actual
2018	176047

Output #3

Output Measure

- Number of research articles and technical papers available for download that outline the research and best management practices for nutrient management practices.

Year	Actual
2018	160

Output #4

Output Measure

- Number of consumers who engage with Natural Resources and Environmental Stewardship extension programs and specialists in social media, including video.

Year	Actual
2018	133234

Output #5

Output Measure

- Number of producers who participated in bus tours and field days to better understand how cover crops can improve water quality

Year	Actual
2018	170

Output #6

Output Measure

- Number of attendees at six Monarch butterfly conservation field days to learn about BMPs for monarch habitat conservation

Year	Actual
2018	300

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of acres where the adoption of BMPs, Nutrient Reduction Strategy and conservation practices were implemented.
2	Number of producers increasing the efficiency of manure and crop nutrient utilization while minimizing surface run-off and preserving ground water quality.
3	Percent of attendees who intend to continue taking Master Conservationist courses after 2018's pilot sessions
4	Percent of farmer manure applicators who either have a plan, plan to develop one, or plan to update their emergency action plan to increase environmental protection
5	Percent of partner educators increasing knowledge and skills
6	Increased knowledge that can be used to support conservation and management of rare or declining species
7	Increased knowledge that can be used to develop policies and practices that protect water quality in Iowa and waters downstream
8	Increased knowledge and tools developed that support nitrogen use efficiency

Outcome #1

1. Outcome Measures

Number of acres where the adoption of BMPs, Nutrient Reduction Strategy and conservation practices were implemented.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of producers increasing the efficiency of manure and crop nutrient utilization while minimizing surface run-off and preserving ground water quality.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Percent of attendees who intend to continue taking Master Conservationist courses after 2018's pilot sessions

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Rural communities benefit from improved water quality, outdoor recreational opportunities for economic development, and improved quality of life. Landowners and farmers are concerned with water quality, wildlife habitat conservation, and soil health. Downstream landowners, municipalities, and industries can be affected by water quality impairments.

What has been done

ISU Extension and Outreach hosted field days and organized educational curriculum with the Master Conservationist Program to reach landowners and influencers in local communities with

information about conservation BMPs.

Results

The Master Conservationist Program informs participants of conservation practices and priorities throughout the state (3 offerings, 51 participants, 1,581 contact hours). One hundred percent of attendees who returned surveys after the programs' completion said they intended to continue participating in Master Conservationist offerings.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Percent of farmer manure applicators who either have a plan, plan to develop one, or plan to update their emergency action plan to increase environmental protection

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	70

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Manure from livestock farms is an economic and environmental asset when properly handled and applied to crop fields, efficiently recycling needed crop nutrients. If manure is mishandled or improperly applied, it can become a liability, contaminating the environment

What has been done

ISU Extension and Outreach helps farmers better manage their manure resources through personal advising, educational meetings, field days, manure applicator certification training and articles and interviews in the press. In only the manure applicator certification training portion, 2,055 farmers and 2,371 commercial manure applicators were trained on topics including manure storage, nutrient retention, application safety, and emergency response.

Results

In follow-up surveys of participants, 64% of farmer manure applicators reported having an emergency action plan in place for manure spill emergencies. Thirty-nine percent of these farmers intend to update their plan within a year based on information received at the training. Of those farmers reporting they did not currently have an emergency action plan, 18% intend to develop a plan within a year based on information received. In total, 1,448 farmer manure applicators (70% of those trained) either have, plan to develop, or plan to update their emergency action plan to increase environmental protection.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #5

1. Outcome Measures

Percent of partner educators increasing knowledge and skills

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Watershed coordinators are valuable partners in water quality and environmental stewardship outreach, often serving as front-line contacts in Iowa's targeted water quality practice implementation projects. The success of these community-based projects and eventual water quality improvement, hinges on the skill and knowledge of these coordinators to reach, teach and support individual landowners and managers as they apply improved practices.

What has been done

Iowa State University Extension and Outreach helped train and equip watershed coordinators to increase their success and the resulting success of community-based watershed improvement projects. Training sessions for watershed coordinators were held in two different locations in spring and fall of 2018, reaching 70 coordinators with information about practices such as constructed wetlands, saturated buffers, bioreactors, prairie strips, and cover crops, along with information about land easements, wildlife benefits, outreach resources, communication methods, and conservation for livestock systems.

Results

Participants were surveyed using pre- and post-training self-assessment of knowledge and self-efficacy using a 4-point scale ranging from little to no knowledge, needs improvement, proficient, and exemplary. Increase in knowledge and self-efficacy increased by an average of 0.96 rating points, with knowledge ranking in the majority of topics increasing one full scale measure, most often from needs improvement to proficient, or from proficient to exemplary. One hundred percent of watershed coordinators and conservation professionals reported growth in knowledge when comparing topic knowledge and efficacy indicators before and after both of the 2018 academy sessions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #6

1. Outcome Measures

Increased knowledge that can be used to support conservation and management of rare or declining species

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Measuring and understanding factors that influence vertebrate and invertebrate populations has always been an important consideration in conservation and management, especially for rare or declining species.

What has been done

Through monitoring, demographic studies, and wildlife inventories, we investigated wildlife in Iowa and their response to management and conservation actions. Our research increased knowledge about needed management practices for the Mountain Plover in a plague-affected ecosystem and understanding the ecology of waterfowl and upland game birds in an agricultural ecosystem. We used this increased knowledge to advise the U.S. Army Corps of Engineers on water management actions to benefit migratory shorebirds, summarized wildlife use of temporary sheetwater wetlands in Iowa's Prairie Pothole Region. We provided advice to the Iowa Department of Natural Resources regarding the Iowa Wildlife Action Plan which guides long-term management of Iowa's natural resources; to propose changes to Iowa's waterfowl breeding surveys that are used to allocate federal funds for habitat restoration; to recommend strategies for monitoring northern bobwhite populations; and recommend approaches to conserving spring-migrating waterfowl habitat in agricultural landscapes.

Results

The work completed under this project has increased understanding of the current status of wildlife populations, estimates of wildlife diversity and abundance, and how wildlife species and communities respond to management and conservation actions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

Outcome #7

1. Outcome Measures

Increased knowledge that can be used to develop policies and practices that protect water quality in Iowa and waters downstream

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Wetlands that occur in topographic depressions are known as enclosed depressional wetlands. There is a need for a tool and a strategy to assess the connections of enclosed depressions located downstream of water bodies, in order to clarify whether or not these depressional wetlands should be defined as "Waters of the U.S." as per the Clean Water Act, and include impacts of enclosed depressions in watershed planning efforts.

What has been done

We successfully instrumented seven artificially drained, enclosed depressions to monitor the frequency, duration and extent of ponding in the instrumented depressions, as well as the water quality during times of ponding. We gathered this data for all of the 2016 and 2017 growing seasons. We developed and validated a functional AnnAGNPS model for each of the monitored potholes, capable of simulating the patterns of inundation (depth, duration, and frequency of occurrence). These models were then used to generate a long time series of modeled output, to be used as the basis for development of the empirical model.

Results

The studies and modeling we conducted this period have increased our knowledge and bring us closer to creating a tool and strategy. The tool will be made available to the public along with training materials to educate decision makers on a method to potentially integrate enclosed depressional wetland protection and restoration efforts into watershed planning. The tool will also be adapted for use in estimating the frequency of drown-outs in farmed potholes, so that producers can consider the net cost of farming these features, and shared with producers in field days and other outreach.

4. Associated Knowledge Areas

KA Code **Knowledge Area**
112 Watershed Protection and Management

Outcome #8

1. Outcome Measures

Increased knowledge and tools developed that support nitrogen use efficiency

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A key component to improved fertilizer N efficiency and reduced environmental impact in corn production systems is the development of tools and dissemination of information and instructions that can help corn growers make good N fertilization decisions.

What has been done

We conducted research on soil N testing, N response across diverse soils and crop rotations, and on nitrogen models, and published our findings in scientific journals, Extension and Outreach publications, soil fertility conference proceedings, and research farm reports; Extension and Outreach soil fertility web sites and the online Corn Nitrogen Rate Calculator; popular press articles; and presented at the American Society of Agronomy annual meetings and Extension and Outreach soil fertility meetings and conferences. To engage the general public, growers, and crop advisers in learning about N cycling in Iowa agricultural systems and N reduction strategies, a website was created, which contains worksheets that guide users in testing ideas about different management options.

Results

Our research and extension provided improved tools and increased understanding of the relationship between proper soil fertility management, N fertilizer use efficiency, and soil health.

4. Associated Knowledge Areas

KA Code **Knowledge Area**

V(H). Planned Program (External Factors)**External factors which affected outcomes**

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

The weakening farm economy has lessened farmers' interest in investments in practices that do not have an economic return. Increased market price risk associated with short-term trade uncertainty is also causing financial concerns. If practices that improve water quality and conserve top soil also provided an obvious economic return, farmers would already have adopted them. The challenge is to show a benefit to the farmer and/or land owner to adopting these practices. As more research is completed uncertainty about the effectiveness and cost of the practices is reduced.

The state of Iowa has increased cost share programs to encourage farmers and land owners to adopt an approved list of in-field, edge-of-field and land use changes proven to improve water quality. The amount of state dollars available will increase in future years. Educating farmers, completing promising research, increasing the technical capacity to advise farmers and develop conservation plans, and investing in the construction infrastructure will also influence the rate of adoption.

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

Participation and high evaluation of the watershed academy suggests that the program met a critical need. The number of watershed coordinators has increased as the state builds capacity to support more watershed projects and the increasing amount of cost share funds. Many of the newly hired, state watershed coordinators come from an environmental science background and have not worked with farmers prior to this job. The watershed academy teaches communication skills, agronomic skills and a holistic watershed approach to working with farmers and land owners in addition to technical aspects of individual practices.

Key Items of Evaluation

One-hundred percent of watershed coordinators and conservation professionals reported growth in knowledge when comparing topic knowledge and efficacy indicators before and after both of the 2018 academy sessions. The increase in knowledge ranking increased by one full point on a 4-point scale in the majority of topics addressed in the academy. In addition to increased knowledge across several components of watershed coordination, the participants developed a connection with their cohort and instructors that they can draw

upon in the future.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Sustainable and Renewable Energy

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	25%		11%	
132	Weather and Climate	0%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		14%	
202	Plant Genetic Resources	0%		22%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		11%	
205	Plant Management Systems	25%		6%	
402	Engineering Systems and Equipment	25%		18%	
601	Economics of Agricultural Production and Farm Management	0%		6%	
605	Natural Resource and Environmental Economics	25%		7%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	2.6	0.0	4.2	0.0
Actual Paid	1.6	0.0	45.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
199656	0	1054018	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
199656	0	1054018	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
8864	0	5013755	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Iowa State University focused resources and efforts on developing improved crops and plant materials for use as feedstocks to produce biofuels and biobased products while still producing adequate food and feed supplies; developing agronomic practices to produce these feedstocks in sustainable ways to mitigate environmental risks; developing new harvesting, storing and transporting systems for these new feedstocks; and adopting new conversion processes that are more efficient, use less energy and water, and produce value-added co-products. The ISU BioCentury Research Farm played a key role. Extension programming focused on advising farmers interested in biomass production on the risks and benefits of crops as biofuels.

Faculty participated in relevant multi-state research committees: NC7, NC213, S1041, S1054, and W2006.

2. Brief description of the target audience

Stakeholders to be engaged with research and extension activities associated with this program include: crop producers and landowners, beginning and early career farmers, private citizens, state and federal agricultural and natural resource agencies, environmental groups, landowners, agricultural and natural resource scientists and engineers, agribusinesses, and policy makers. A targeted audience also includes developers of building construction materials, plastics, and adhesives; rural communities with new employment opportunities and economic development, and processing companies with advanced conversion technologies.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	709	2926	0	0

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

Patent Applications Submitted

Year: 2018
 Actual: 1

Patents listed

Photobioreactor Systems and Methods. Wen et al. Patent 9,932,549 issued 4-3-2018.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	61

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of people who attend an educational activity to learn about energy sustainability.

Year	Actual
2018	565

Output #2

Output Measure

- Number of growers reached, with new research findings on perennial energy crops, through workshops and farm visits

Year	Actual
2018	400

Output #3

Output Measure

- Number of extension publications on this topic that were distributed as downloads and printed materials.

Year	Actual
2018	16025

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of producers who increase their awareness of crop production strategies appropriate for bioenergy production.
2	Number of individuals who increase their knowledge in production/harvesting systems related to biomass crops.
3	Number of people reporting increased knowledge of solar power
4	Acres of fuel crops in Iowa
5	Increased knowledge that supports environmentally-friendly removal of crop biomass for energy production

Outcome #1

1. Outcome Measures

Number of producers who increase their awareness of crop production strategies appropriate for bioenergy production.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Number of individuals who increase their knowledge in production/harvesting systems related to biomass crops.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Number of people reporting increased knowledge of solar power

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Renewable energy alternatives continue to be of great interest to many lowans most commonly using either solar or wind energy across the State. In Southeast Iowa solar seems to have be a more common application for many electrical users due to available sunlight hours available and installation/maintenance costs for smaller installations.

What has been done

Upon request, a meeting was planned and held in Louisa County. A brief comparison between wind and solar was presented but most of the program focused on solar. The program went into

detail of the physics of how solar energy is converted to electrical use as well as different ways to harvest the generated power. Cost of construction, common pitfalls, potential energy harvest, and size of system were addressed. The evening also included actual production from systems which have been in use for several years. As has been the case with most of these meetings participants had many questions.

Results

The meeting had 25 participants that were surveyed afterward. Twenty evaluations were received after the meeting that indicated that 18 out of 20 felt they had increased their knowledge of solar power. When asked if they were planning to install solar panels, one stated yes, three stated no and 15 stated maybe they would.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Acres of fuel crops in Iowa

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1000

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Among renewable energy sources, only biomass can provide fuel and electricity in a form and scale that is compatible with existing transportation and power generation infrastructure (DOE, 2006). However, several factors are limiting farmer adoption, particularly lack of best management practices (BMPs) that would optimize yields and maintain ecological resources.

What has been done

We continued research to identify BMPs for *M. × giganteus*. The three-year establishment period

for *M. × giganteus* in this project has now been successfully completed and results are revealing new understanding of *M. × giganteus* nitrogen fertilizer needs. Contrary to previous reports, we found *M. × giganteus* N demands do not change during the three-year establishment phase. On good Iowa soils, N fertilizer is necessary in about 25 percent of plantings, especially those with low soil organic matter. We found 100 lbs per acre is a sufficient rate to maximize yields, and increased yields by up to 100 percent in some cases. Our research and outreach has had a major impact on biomass production in Iowa by increasing knowledge associated with crop choice and best management practices.

Results

As a result, farmers in Iowa have now planted more than 1,000 acres of *Miscanthus × giganteus* with 200 more planned for 2019. Since the project began, \$1,430,000 has gone to *M. × giganteus* supply chain stakeholders through our partners in the Iowa Biomass Fuel Project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems

Outcome #5

1. Outcome Measures

Increased knowledge that supports environmentally-friendly removal of crop biomass for energy production

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Corn production in Iowa annually exceeds 10 million acres, and, along with other crops, is viewed as a significant potential source of cellulosic feedstock for energy production. However, the impacts of large-scale corn stover or other crop biomass removal on the soil resource, sustainability of crop production and environmental conservation are not well known. These issues can be impacted by type of tillage and crop rotation practiced on the farm level for annual crop productions.

What has been done

Our project work includes field studies that are providing information about the impacts of reduced tillage and crop rotations on Iowa farm fields and how they compare economically to each other and to other types of tillage. To date our studies have shown that conservation tillage (i.e., No-till and strip-tillage) is highly competitive with conventional tillage systems (i.e., chisel-plow, deep-rip, and moldboard-plow) in terms of yield and economic returns in most regions in Iowa. The results show an advantage of conservation tillage by reducing input cost in the range of \$25-30/acre over conventional tillage. Also, our studies showed that conventional tillage such as moldboard plow, chisel plow and deep rip contributed to soil carbon loss of 0.30 to 0.50 Mg/ha on average as compared to base line and NT and ST contributed to carbon gain of 0.25 to 0.50 Mg/ha of soil organic carbon.

Results

These findings can be used by farmers and farm managers in managing their fields to sustain soil productivity. This research also provides critical information for researchers, soil conservation planners, farmers, agriculture industry, and government agencies responsible for establishing management practices and soil conservation or environmental regulations.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Public Policy changes
- Competing Public priorities

Brief Explanation

National energy policy has lessened the emphasis on renewable energy compared to earlier years. The Renewable Fuel Standard target for corn-based ethanol has been met and there has been policy discussions about expanding to year round E-15 that would expand the market for corn based ethanol. Cellulosic ethanol continues to struggle to be economically viable. One cellulosic ethanol plant built in Iowa did not become operational and was sold in 2018 to a company that will switch to renewable natural gas made from corn stover.

Research is underway to evaluate the water quality implications of converting portions of farmed wetlands that typically are less productive than other regions of the field to perennial energy crops. This option becomes more economically viable if there is a market for energy crops.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Nothing to report.

Key Items of Evaluation

Nothing to report.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Youth Development

Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
806	Youth Development	100%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	9.7	0.0	0.0	0.0
Actual Paid	11.2	0.0	0.0	0.0
Actual Volunteer	195.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
932466	0	0	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
932466	0	0	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
2077905	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Based on the success of the Culturally-Based Youth Accelerator Program at the state level, new regional CYLAs were created in 2018. GRIT was held at Buena Vista University in Storm Lake, IA and

RISE was held at Grand View College in Des Moines, IA.

- Iowa completed its pilot of Common Measures 2.0 with a grant from the Bechtel Foundation via the National 4-H Council. Moving forward, Iowa will use Common Measures 2.0 for its program evaluation. Between February and December 2018, 1,685 surveys were completed.
- Iowa continues to invest in providing data to the state on the number of youth in K-12, race and ethnicity of youth, achievement gap indicators, and 4-H program participants. In 2018, a statewide Data for Decision Makers report was created to show overall indicators.
- Iowa has fully implemented a blended learning model for its 4-H volunteers. In addition to in-person new volunteer and annual volunteer training, Iowa has developed a series of videos on a variety of topics for volunteers at their convenience. Volunteers can track completion in 4-HOnline. New short, weekly videos for staff for their role as volunteer managers but also can be shared with volunteers. These videos are accessible via YouTube.
- Global Citizenship efforts consisted of organizing the annual Global Citizenship Day at the Iowa State Fair, a webinar for 4-Hers and staff to encourage and promote a partnership with the World Food Prize, a county workshop centered around global issues and much more. The Global Citizenship area within Iowa 4-H is student led by an Iowa State University student who has an interest in global aspects. The goal of the Global Citizenship program with Iowa 4-H is to educate and strengthen initiatives surrounding global concepts such as issues, agriculture, culture, language, traditions, etc. with both 4-Hers and 4-H staff across the state. Global Citizenship Day at the Iowa State Fair brought in nearly 300 fairgoers to experience cultural entertainment, activities, and a capstone speaker and the partnership between Iowa 4-H and the World Food Prize continues to blossom.
- The State Science and Technology Fair of Iowa showcased 792 students with 526 projects from 53 schools in Iowa. The Fair is held on the campus of Iowa State University. Of the participants, 81 percent attend public school and 19 percent attend private school. Of the presenters, 14% presented for the first time and 34 percent won awards. There were seven finalists for the national competition. Total scholarships earned was \$50,000.

2. Brief description of the target audience

- ISUEO Youth Program Specialists
- County Extension youth staff
- 4-H volunteers
- ISU faculty
- Youth-serving organizational partners
- K-12 Iowa youth

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6967	57629	93135	33939

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

Patent Applications Submitted

Year: 2018
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	2

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Enrollments in 4-H Citizenship and Leadership curricula areas.

Year	Actual
2018	20073

Output #2

Output Measure

- Enrollments in 4-H Communications and Arts curricula areas.

Year	Actual
2018	27977

Output #3

Output Measure

- Enrollments in 4-H Foods, Nutrition, Physical Health, and Fitness curricula areas.

Year	Actual
2018	48469

Output #4

Output Measure

- Enrollments in 4-H Science, Engineering, and Technology (SET) curricula areas.

Year	Actual
2018	132048

Output #5

Output Measure

- Number of 4-H livestock exhibitors certified in Food Safety and Quality Assurance (FSQA).
Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of children and youth who participate in 4-H Afterschool.

Year	Actual
2018	11080

Output #7

Output Measure

- Number of 4-H partnerships initiated or strengthened.

Year	Actual
2018	4246

Output #8

Output Measure

- Number of volunteers completing one professional development training per year.

Year	Actual
2018	2778

Output #9

Output Measure

- Percentage of 4-H club members in their senior year of high school who will be attending a college/university/professional school/trade school/institute of higher education within 12 months of their high school graduation.

Year	Actual
2018	90

Output #10

Output Measure

- Number of children and youth who participate in the camping delivery mode.

Year	Actual
2018	7575

Output #11

Output Measure

- Number of youth reached by programming in health, physical fitness, and/or nutrition targeted towards impacting Childhood Obesity

Year	Actual
2018	2237

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Average percentage of youth who self-report improved healthy living practices after engaging in 4-H learning experiences.
2	Average percentage of youth in grades 4 - 6 who self-report improved food safety and quality assurance practices after engaging in 4-H learning experiences.
3	Average percentage of youth who self-report improved STEM processing practices after engaging in 4-H STEM learning experiences.
4	Average percentage of youth who self-report improved communication practices after engaging in 4-H learning experiences.
5	Average percentage of youth who self-report improved citizenship and leadership practices after engaging in 4-H learning experiences.
6	Average percentage of youth who self-report improved learning practices after engaging in 4-H educational experiences.
7	Measure: Average percentage of youth who self-report improved citizenship practices after engaging in 4-H learning experiences.
8	Measure: Average percentage of youth who self-report improved leadership practices after engaging in 4-H learning experiences.

Outcome #1

1. Outcome Measures

Average percentage of youth who self-report improved healthy living practices after engaging in 4-H learning experiences.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	34

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

On Jan. 1, 2019, the Iowa Department of Public Health reported the state's obesity rate climbed from 32 percent in 2016 to more than 36 percent in 2017, the steepest increase in more than a decade. The problem is statewide in almost every town and across every socioeconomic sector. The department reports obesity costs \$149 Billion in annual health care spending. Childhood obesity is one of the department's research priorities.

What has been done

Over 2,000 youth took part in a Healthy Living Club Challenge making healthy changes during their club meetings in 2018. They earned miles as they consumed water, fruits and vegetables, and engaged in physical activity during their meetings to make their way across the route in a Race Across Iowa. Clubs elected Wellness Officers, a new role to help coordinate these healthy changes and advocate for the fourth "H" among their peers. Another tactic is a 4-H Healthy Living Ambassador program. Last year, 7 youth were selected and created and coordinated the 1st annual Healthy Living Retreat, which brought together youth across Iowa for a weekend immersion into wellness. For 2019, 11 ambassadors were selected. This new group will lead wellness initiatives to educate youth about nutrition and overall wellness and wellbeing.

Results

Thirty-four percent reported an average one-point change on making healthy food/snack choices, while 9% reported an average two-point change. For safety in food preparation, 32.6% reported an average one-point change, and 10% reported a two-point change. In eating a variety of healthy fruits and vegetables, 28.8% reported an average one-point change, with 5.5% reporting a two-point change. For helping their family make healthy meals or food choices, 29.2 percent reported an average one-point change and 11.6 reported a two-point change. For participating in physically active events, 25.3 percent reported a one-point change and 6.4 percent reported an average two-point change. There was a positive and significant difference in the gain score

overall. See the evaluation section for the method used to reach these results.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Average percentage of youth in grades 4 - 6 who self-report improved food safety and quality assurance practices after engaging in 4-H learning experiences.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	77

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Providing a safe and healthy food supply has always been a key issue, but it has become even more important to consumers, wholesale distributors, restaurant chains, and foreign export markets. Livestock producers continue to improve management practices to ensure American citizens have the safest food supply in the world. Recent reports indicate that 50 percent of antibiotics prescribed for people are not needed or are not optimally effective (Center for Disease Control, Sept. 2013). Livestock producers strive for the judicious use of antibiotics in animals and only use them when necessary. Iowa produces more than \$13 billion in livestock sales across all commodities, and ranks no.1 in both egg layer and hog production (Iowa Department of Ag Statistics, 2012).

What has been done

A comprehensive food safety and quality assurance curriculum program is conducted each year with 4-H'ers. In 2018, a new, national program was developed called YQCA (Youth for the Quality Care of Animals). This curriculum is replacing the current FSQA (Food Safety and Quality Assurance) curriculum. Both programs focus on educational materials, including video tutorials, hands-on learning, learning about animal identification, source verification (when and where the animals are born and raised), biosecurity measures (cleanliness techniques, disease contamination, on-farm disease transmission), drug treatments and injections, quality record keeping, and appropriate animal handling and welfare requirements.

Results

For medications knowledge, 26.63 percent reported practices have changed "quite a bit," with another 19.57 percent reporting a "great deal." For animal handling, 23.08% reported "quite a bit" of change in techniques of bedding and space for animals, with another 20.33% reporting "a lot." Another 28.96% reported "quite a bit" of change in using care to load/unload animals to reduce muscle tissue bruising, with 19.13% reporting "a lot" of change. In utilizing different ID methods, 29% reported "quite a bit" of change, and 13% reported "a lot." For feed additives, 27% reported "quite a bit" of change, and 10% reported "a lot." Females reported the highest percentage of "a lot" of change in record keeping and tracking sick animals. Participants were approximately equally split between male and female. There was not a reliable difference between newer and veteran club members. Of the respondents, 91 percent reported some or better improvement in their general overview of science. The majority of respondents were in 4th and 5th grades (94% of respondents). See the evaluation section for the method used to reach these results.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Average percentage of youth who self-report improved STEM processing practices after engaging in 4-H STEM learning experiences.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	39

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Iowa's Academic Standards provide local school districts and accredited nonpublic schools a guide for what K-12 students should know and be able to do as a result of instruction. The Iowa Department of Education adopted new science standards in August 2015 and approved a four-year implementation plan with full implementation expected by the fall of 2019. According to a 2011 ACT report, only 30% of U.S. high school graduates in 2011 were ready for college coursework in science.¹ Iowa's science standards demand the kind of teaching and learning that will support college and career readiness.

What has been done

Monarchs on the Move, the 2018 Ag Innovators Experience from National 4-H Council, was successfully implemented across Iowa. 1,200 youth in grades 2-12 learned about monarch butterfly conservation through hands-on activities using modeling, problem solving, teamwork, and critical thinking. Iowa 4-H's State Science and Technology Fair of Iowa (SSTFI) provides a poster session where experts conduct interview judging and evaluate the students' research and provide constructive criticism. 792 students, grades 6-12 exhibited at SSTFI 2018.

Results

In Monarchs on the Move programming, 90% of surveyed youth reported an understanding of how science and engineering can solve problems after participating in the program. As a first-year baseline of the new SSTFI evaluation, 64% of respondents who did a science project indicated a strong interest in STEM and 91% indicated an interest in a science job. Youth with engineering projects indicated a 69% strong interest in engineering and a 92% interest in an engineering job. 98% of respondents indicated they can communicate results from an experiment and 81% indicated they would like to study STEM after high school. These indicators demonstrate positive results in developing a STEM-literate population. In the club assessment, 54.9% reported no change in STEM aspirations and attitudes, with another 38.9% averaging a 1 point change. There was a positive and significant difference in the gain score for STEM aspirations and attitudes overall. More information on the club assessment is found in the evaluation section.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Average percentage of youth who self-report improved communication practices after engaging in 4-H learning experiences.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	47

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In 2007, the Iowa Legislature set the 21st Century framework for K-12 public education. Within this framework are the common strands of learning and innovation; communication, information, and technology; and, life and career skills. Sources used for this work included the 1991 SCANS report, What Work Requires of Schools, and Framework for 21st Century Learning, from the Partnership for 21st Century Skills. The Iowa Core includes concepts, dispositions and habits of mind believed essential for success in the 21st century.

What has been done

All 99 Iowa counties offer a communication event program. Nearly 2,000 members participated in public speaking and performance events at the 2018 Iowa State Fair. Competitive events, including Robotics Challenge, Livestock Judging contests, and Awardrobe Clothing Event, included oral communication opportunities. 4-H members competing for state-level awards and trips had a personal interview as part of the selection process. More than 20,000 4-H members demonstrated written, oral and visual communication skills through preparation and presentation of fair exhibits. Approximately 300 youth created exceptional photographs each month as part of Iowa 4-H Camera Corps leading to hundreds of photographs being publicly exhibited in communities around the state in visual communication.

Results

For communication practices, 46.5% of respondents reported an average 1 point change, with 19.4% reporting an average 2-point change. There was a positive and significant difference in the gain score for communication overall. There were significant differences in gain scores by grade level. Seniors reported higher gain scores than both junior and intermediate 4-Hers. Seniors reported higher gain scores on "Feel confident when speaking in front of others" and "Use technology to express your ideas." Seniors reported higher gain score than intermediates on "Use good listening skills when others are talking," "ask questions," and "Create products to share ideas/information." The largest percentage of 1 point change reported was "Create products to share ideas/information." The largest percentage of 2-point change reported was "Feel confident when speaking in front of others."

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Average percentage of youth who self-report improved citizenship and leadership practices after engaging in 4-H learning experiences.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Average percentage of youth who self-report improved learning practices after engaging in 4-H educational experiences.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	46

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to United Way of Central Iowa's Education team, children who cannot read at grade level by the end of third grade are 4 times less likely to graduate from high school (Annie E. Casey Foundation). This is the number one predictor of high school graduation. Reading proficiency is less for low-income students. Middle school students who participate in after-school programs attend more school and perform better on tests compared to their peers (Durlak, et al).

What has been done

STEM-Lit to Go! supports that development of STEM and literacy skills for K-3 children. The program utilizes a unique instructional framework that integrates inquiry-based STEM activities and carefully selected children's literature. Each integrated experience presents youth with multiple opportunities to read, write, speak and listen about a variety of STEM topics. The literacy skills targeted by the program include (1) comprehension, (2) vocabulary, (3) phonological awareness, (4) nonfiction writing and (5) oral communication. Home connection letters from the program share ideas with families on ways to support literacy development at home, such as includes a list of books, tied to the topic of the day, that could be gotten from the library. This supports and extends the development of key early childhood literacy skills.

Results

The learning constructs in the club survey were "Create learning goals," "Review a variety of resources related to a topic," "Identify the strengths and weaknesses of different ideas, solutions, or approaches," "Identify what is going well and what needs to change to achieve goals," and "Apply what was learned to new or different experiences." The percentage of average one-point change was 45.9% and the percentage of average two-point change was 23.4%. The largest percentage of one-point change was with the construct "Review a variety of resources," at 40.3 percent. The largest percentage of two-point change was with the construct "Create learning goals." There was a positive and significant difference in the gain score for learning overall.

Seniors reported higher gain score than intermediates and juniors on "Identify what is going well," "Apply what was learned?," and "Create learning goals." Seniors reported higher score than intermediates on "Review a variety of resources..." and "Identify the strengths and weaknesses."

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

Measure: Average percentage of youth who self-report improved citizenship practices after engaging in 4-H learning experiences.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	55

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the study "Digital Citizenship with Social Media: Participatory Practices of Teaching and Learning in Secondary Education," by Benjamin Gleason of ISU and Sam von Gillern of Texas A&M, social media use in formal and informal learning spaces can support the development of digital citizenship for secondary school students. As students increasingly spend large amounts of time online (e.g., an average of six hours of screen time per day, excluding school and homework), it is critical that they are developing skills enabling them to find, evaluate, and share information responsibly, engage in constructive conversation with others from diverse backgrounds, and to ensure their online participation is safe, ethical, and legal. Of course, Iowa 4-H also supports interpersonal communication apart from social media.

What has been done

This past year Iowa hosted a regional youth summit called, "Youth Voice in Action," involving 6 counties, 10 schools and 60 middle school-aged youth. This summit engaged the students and their adult mentor in youth voice, sharing of ideas, developing a community action plan, leadership development and hearing from active community members who engage in service as a career. The goal of this pilot program was to encourage our youth to become involved and engaged within their communities through their schools, churches, 4-H or other organizations.

This pilot program will be packaged and vetted for further use by staff and volunteers across the state to utilize within their own counties.

Results

In the club assessment, 54.5% reported a one-point average change, with 22.8% reporting an average two-point change. There was a positive and significant difference in the gain score for citizenship overall. There were significant gain scores by grade level. Seniors reported higher gain score than junior 4-H'ers. The specific constructs with difference were "Work on service projects to meet a need in your community," "Gain skills through serving your community that will help you in the future," "Listen to everyone's views whether I agree or not," "Enjoy learning about people who are different from me," and "Gain skills through serving your community that will help you in the future." The largest one-point average change was "Make a difference in your community through service learning projects" at 45.2%. That construct also had the highest two-point average change at 31.1%.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #8

1. Outcome Measures

Measure: Average percentage of youth who self-report improved leadership practices after engaging in 4-H learning experiences.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	45

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Wingenbach and Kahler (1997) suggest secondary school students have the ability to develop leadership skills via decision-making, getting along with others, learning the organization of self, self-awareness, and working with groups through taking part in many youth leadership organizations in school and/or community activities. Today, promoting and understanding leadership among young people is attracting more attention as the lines between the teen years and young adulthood becomes blurred. Indeed, improved technology and greater mobility has "shortened" the distance between countries and as a result,

leadership is about the local and the global (Lee & Olszewski-Kubilius, 2014; Lee, S.-Y., & Olszewski-Kubilius, P. (2014).

What has been done

Iowa offers a 3-day Youth Conference for grades 8-12 at ISU to experience service learning, educational workshops, keynote speakers and leadership experiences for approximately 700 youth. It is planned, organized and facilitated by the 39-member State 4-H Council. State Recognition Day provides over 100 4-H'ers from across the state the opportunity to apply for and interview for state recognition awards. In addition to conferences and events, curriculum such as Ricochet, which teaches youth about team building skills, decision-making processes and to learn by doing as they develop leadership skills. Leadership is also prevalent within the State 4-H Council experience where high schoolers act as 4-H ambassadors to all the counties across the state.

Results

The results here are based on the club assessment. There was a 45.4% average one-point change, with another 22.7% average two-point change. The largest percentage of one-point change was reported in the construct "Work together in a team." The largest two-point average change reported was "Listen and talk to others before making decisions." There was a positive and significant difference in the gain score for leadership overall. There were significant differences in gain scores by grade level on "Work together as a team," "Listen and talk to others before making decisions," "Able to lead a group in making a decision," and "Treat everyone fairly and equally when I am in charge of a group." Seniors reported higher than intermediate and junior 4-H'ers for "Able to lead a group in making a decision."

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Iowa 4-H Youth Development is aware it has competition in the marketplace for youth programming and the opportunities youth have access to. Iowa continues to push for inclusion of all Iowa youth in its programming, regardless if a family has any previous knowledge of 4-H. Iowa also continues to support rural and urban programming. Iowa 4-H has seen no change in appropriations support from either the Iowa Legislature or the United States Congress. These funding sources have been offset by program fees collected by the program. In addition, Iowa continues to pursue and receive grants and contracts from a variety of sources. Iowa 4-H also has tried to leverage relationships with colleges at Iowa State University in order to provide subject matter and curriculum expertise to the

program. This has allowed Iowa 4-H to provide new and research-based curriculum. Iowa 4-H is aware changes in the economy can impact participation or, in some cases, project work of the youth. In order to continue to reach all Iowa youth, champion groups have been established to support outreach to vulnerable populations. The Culturally-based Youth Accelerator programs have been renamed as 4-H Connect events.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

There were 479 respondents to a survey of 34 Likert scale items of before and after programming. The survey population represented 42 clubs. Statistical tests were used to examine differences overall and by grade level. A paired-sample T test was conducted to compare the overall change participants experienced before and after participation. A one-way analysis of variance (ANOVA) test was conducted to examine differences by grade level. A Tukey post-hoc test was conducted to determine which pairs of means differed significantly after a significant F ratio was found with the ANOVA. Statistical comparisons of "Now" and "Before" responses used paired sample t-tests were conducted for each construct, as well as for individual items within the constructs. Youth reported statistically higher "Now" scores than "Before" scores for each of the six constructs and 34 individual items. There were statistically significant differences by grade level in all constructs *except* Healthy Living. It should be noted the analyses were conducted on surveys completed by club members, which does not necessarily relate to the program highlights in this report.

Key Items of Evaluation

Healthy Living programming expanded greatly in 2018 with the addition of a full-time specialist. One new result in 2018 was the Healthy Living Club Challenge, which brought 2,000 youth into a 4-H club experience. While this report does not ask for outcomes for K-3rd grade youth, Iowa has been aggressive in supporting its Clover Kids program with more research-based curriculum. In 2018, STEM-Lit to Go! supported development of STEM and literacy skills for K-3 children. The program utilizes a unique instructional framework that integrates inquiry-based STEM activities and carefully selected children's literature. Each integrated experience presents youth with multiple opportunities to read, write, speak and listen about a variety of STEM topics. The literacy skills targeted by the program include (1) comprehension, (2) vocabulary, (3) phonological awareness, (4) nonfiction writing and (5) oral communication. Home connection letters from the program share ideas with families on ways to support literacy development at home, such as includes a list of books, tied to the topic of the day, that could be gotten from the library. This supports and extends the development of key early childhood literacy skills.

VI. National Outcomes and Indicators

1. NIFA Selected Outcomes and Indicators

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