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

Status: Accepted

Date Accepted: 08/22/2019

I. Report Overview

1. Executive Summary

The Ohio Agricultural Research and Development Center (OARDC) and OSU Extension (OSUE) are critical components of the College of Food, Agricultural and Environmental Sciences (CFAES) serving the mission of teaching, research, and extension. Together, CFAES translates cutting edge research into impactful knowledge for our stakeholders across the state. This important work could not be accomplished without the outstanding faculty, staff, educators, and students that makeup the college.
In 2018, CFAES continued down the trajectory outlined last year. This has included additional strategic planning and alignment of goals, restructuring of offices and functions, as well as working to fill vital leadership positions. With over 800 facilities and 11,000 acres of land across the state, almost 2,759 graduate and undergraduate students across two campuses, 334 faculty members and over 1,395 full-time employees, it is important that the college has a clear mission and focus guiding our research, teaching, and outreach to best serve our citizens.
The college observed several milestones in 2018. On May 1, Dean Cathann Kress celebrated her first full year with the college. Two departments within the college had anniversaries: the department of Agricultural Communication, Education, and Leadership celebrated its 100th anniversary and the School of Environment and Natural Resources celebrated its 50th. Dr. Rattan Lal, Distinguished University Professor of Soil Science, received two prestigious international awards: the Glinka World Soil Prize and the World Agriculture Prize. Ohio also won the 2nd national 4-H raise your hand campaign with over 17,770 hands raised across the state. This campaign is a national 4-H initiative asking the millions of 4-H alumni across the nation to 'Raise Your Hand' in support of providing 4-H education. Ohio won in 2017 as well with over 11,000 hands raised.
On November 8, the OSU Agricultural Technical Institute (ATI) located on the Wooster campus celebrated the success of hundreds of first-generation students and graduates who are a part of the campus' student body, faculty, and staff. Half of Ohio State ATI's students are first-generation and there are a number of first-generation graduates in positions such as tenured full professors, high-ranking campus administrators, and staff members in numerous academic and support areas. The celebration featured a panel discussion of first-generation experiences and a printed publication entitled, "I've Never Been More Proud: Stories of First-Generation Success."
ATI also received an Andrew Heiskell Award in Internationalizing the Community College for its Ghana Research and Education Abroad Programs. This program allows students to go to Ghana for one month and develop their research projects. For example, one student helped establish two 4-H groups and worked with farmers on hydroponics projects. The program has been going on for 15 years and a total of 121 ATI students have participated.
There were several key leadership changes in 2018. Dr. Steven Neal was appointed as the Associate Dean and Director of Academic Programs. Dr. Gary Pierzynski joined CFAES in July to serve as the Associate Dean for Research and Graduate Education in July. Jeanne Osborne began her new position as Assistant Dean for Academic Affairs and College Secretary. Dr. Carrie Gerber will serve as Interim Assistant Director for ATI Academic Affairs until a permanent replacement is found. Also, a National Search is underway for a Chief Advancement Officer who will be responsible for overseeing Development, Alumni Affairs, and Marketing and Communications. This structural change is planned to streamline leadership and oversight of these areas.

Dean Kress has also continued the One College mission, with the goal of better integrating the "three campuses" of Columbus, Wooster, and statewide. One part of this process has been the rebranding of CFAES to refocus our identity across OARDC, OSUE, ATI and the state so that our stakeholders can identify all of the great work that we do.
Throughout 2018 the college continued work on strategic planning. The strategic planning process continues to build upon the four Grand Challenges that were outlined in 2017:

- **Sustaining Life** - A simultaneous focus on viable agricultural production, food security and safety, and environmental and ecosystem sustainability.
- **One Health** - The intersection or interaction of human, animal, plant, and environmental health.
- **Rural-Urban Interface** - Exploration of the tensions and opportunities created in the communities, industries, policies, economies, and communications between rural and urban residents.
- **Leadership** - Preparation of the next generation of scientists and leaders.

Wooster Campus strategic planning meetings took place throughout 2018, allowing faculty, staff, and students to provide input. One of the major goals of the Wooster plan is to better integrate parts of the Wooster Campus, including improved walkways to make travel easier and integrating various Wooster departments such as facilities services in order to improve service and reduce costs. The plan is scheduled to be finalized in March of 2019 and will be rolled into the College's overall strategic plan that is currently under development.
As we plan for the future, it is clear that our infrastructure needs to be improved. As such, there are a few projects of note currently underway:

- One of the largest facilities investments currently in progress are the facilities being constructed at the Waterman Agricultural and Natural Resources Laboratory in Columbus, OH. This includes a $35M Controlled Environment Food Production Research facility, a $5.4M Multispecies Animal Learning Center, and a $5.5M Extension Building. On Friday, June 29, 2018 OSU hosted a ground-breaking ceremony for the new Franklin County Extension Building in Columbus, OH. "We envision the Kunz-Brundige Franklin County Extension Office as a hub for teaching, research and community engagement around food, health, agricultural production and sustainability," said Cathann A. Kress.
- A $2M new welcome center was built at the Secrest Arboretum in Wooster, OH. This center includes classroom space to offer additional teaching opportunities for students and the public.
- A $33.5M science building is planned for the Wooster Campus that will house laboratory space, classrooms, offices, and other amenities. Pending final approval, construction is planned to start in 2019.

With these new investments, we plan to improve our partnerships across the state and provide facilities that inspire our faculty, staff, and students to perform great work.
Another ongoing project has been addressing challenges across the research enterprise and graduate education structure. A CFAES Research Advisory Committee was created in the fall of 2018 to prioritize the recommendations from the 2016 National Council of University Research Administrators review and provide input on possible solutions. Some of the largest concerns identified have been reducing administrative burden on faculty and streamlining the grants process. One major goal will be hiring a college-level graduate coordinator to improve our efforts at increasing graduate enrollment and organization of our programs. Many more changes will be forthcoming in 2019, including standard operating procedures related to research and hiring of additional staff to process more grant applications.
A top priority for the college is building strategic partnerships within and outside of the University. The college is currently developing a Strategic Partnerships Unit to focus on building and sustaining relationships with partners and industry. A search for the director of this unit is currently underway. One example of an existing strategic partnership is the Center for Human-Animal Interactions, Research, and Education (CHAIRE), which opened in 2017. This center is a collaborative effort between 5 OSU Colleges, and external partners such as the Columbus Zoo and Aquarium, the Ohio Wildlife Center, and Philbro Animal Health Corp. CHAIRE held its first fundraiser in 2018 in coordination with the Columbus Zoo and Aquarium which had approximately 150 attendees.

The mission of the Center is "...to enhance the relationships between humans and animals and advance appropriate husbandry and management of wild and domestic species." Currently, the Center is running an animal behavioral study in coordination with the Wilds (located in Cumberland, OH), looking at African Southern white rhinos which has potential to be extended to field research in South Africa. The Center also offers specialized courses, a graduate program of study, and a minor in Human-Animal interactions. Creation of this center is supported by the fact that the fastest growing area for 4-H projects is companion animals, which increased nearly sevenfold from 39 to 300 over the past five years. These projects will help improve the welfare of animals participating in these interactions, as well as offer objective measurements to support and/or change these interactions.

CFAES uses federal and state capacity funds to leverage additional funds from a variety of sources. During the 2018 fiscal year, CFAES received 478 extramural awards valued at over $48 million. The total portfolio of all active awards consists of 897 projects valued at over $180 million. Some examples are listed below:

From the National Institute for Food and Agriculture

In 2018, OSU has won a total of $6.5 M in competitive grants, research support, and cooperative agreements to support the research enterprise, including:

- $1.1M to model farmer adaptations to a changing climate in order to guide agroecosystem management.
- $5M to develop public-private partnerships targeting legacy phosphorus fields to increase water quality and availability.
- $ 891,000 to study the ultra-shear treatment of low-acid liquid foods

Commodity specific

- $1 million from the Ohio Soybean Council to address soybean priority areas
- $553,500 from the North Central Soybean Research Program to further study management and outreach for new and emerging soybean pests

National Institutes of Health

- $2.3M to study the impact of vitamin A on enteric viral infections

National Science Foundation

- $2.4M to study the impacts of deglobalization on the sustainability of region food, energy and water systems.

One of the roles of a land-grant institution is to be responsive to current issues and stakeholder needs. In recent years, water quality (especially that of Lake Erie) has been one of the biggest issues facing our state. In 2017, Dean Kress formed a Water Quality Task Force charged with creating an inventory of water quality-related projects going on at the college so that we are better able to leverage our resources. This task force worked throughout 2018 on a comprehensive report that will allow the College to create an integrated program of waterrelated research, teaching, and outreach to address current and future water quality issues in Ohio.

CFAES researchers are working on topics related to water quality such as:

- How modern crops respond to fertilizer application rates. This research was used in the recent revision of the 25-year-old Tri-State Fertilizer Recommendations.
- How livestock diets can be modified to reduce nutrient loss through waste.
- Behavioral studies determining which factors shape farmers' ability to adopt conservation practices that improve water quality.
- OSUE provides advice and support to farmers working to develop and implement nutrient management plans.
- How aquatic ecosystem health is affected by factors such as invasive species and land-use change.
- Economic costs and benefits of reducing harmful algae blooms on Lake Erie to homeowners,

recreational users, and Ohio's citizens.
By leveraging our vast resources, we will be better able to address the complex issue of water quality. The task force's final report was submitted in January 2019 with various recommendations including the establishment of a Water Quality Advisory Board to provide oversight, making strategic investments into translational support, integrating research and OSUE efforts, and increasing coordination with other institutions to facilitate statewide projects. Additionally, organizing our resources will allow us to better collaborate with outside institutions, creating the most effective framework to solve this issue.
To emphasize the importance of this topic, the theme of the 2018 CFAES Annual Research Conference was water quality. The event highlighted various research and extension projects going on at the college. It also brought together many researchers and stakeholders to discuss this important topic. Andrew Sharpley from University of Arkansas presented on "Agriculture, Phosphorus and Water Quality: Managing Tradeoffs and Transferring Science to Farmers." Several OSU researchers presented on their research and extension projects, in addition to a stakeholder panel discussion featuring members from CFAES, the Ohio Farm Bureau, the Ohio Department of Agriculture, the Ohio Soybean Council, and OSU's Stone Lab.
Another pressing issue in Ohio and across the nation is the opioid epidemic. Ohio has consistently been among the top 5 states in the nation for drug overdoses per capita. In 2017 more than $1 billion was invested in state and local agencies to fund prevention, early intervention, and treatment resources. Fortunately, preliminary data for 2018 shows unintentional overdose deaths are decreasing in Ohio, dropping significantly in the first five months of 2018 with a reported 1,415 deaths. Some credit this decrease to Ohio's comprehensive approach to fighting the opioid epidemic.
OSU is playing an essential role in combating this issue, bringing together stakeholders and collaborators, performing research, and utilizing OSUE to address issues on a local level. Several OSU Colleges are collaborating on ways to address the issue - for example, the 2018 Buckeye Summit brought together the broader Ohio State community to address community health, focusing on understanding and preventing addiction. The summit addressed topics such as working within a community to understand the root causes of addiction and how to address the problem, and promising new ways big data could help better allocate treatment resources across communities, leading to faster, better care for patients. Another important project recently started at CHAIRE to examine the effects of animal therapy in the treatment of children affected by the opioid epidemic, while also measuring effects on the welfare of the animals involved.
OSUE is uniquely positioned to respond to such issues, as field experts can respond to crises quickly. Many OSUE educators are involved in local coalitions and task forces that are actively providing drug use and abuse education, resources for those in addiction recovery, and evolving ways to treat family issues caused by addiction. OSUE is collaborating with various partners across the state in order to address this issue. For example, OSUE and the Center for Public Health Practice at Ohio State are funding a public health specialist position located in Piketon, OH which will focus significant attention to opioid addiction recovery, prevention, and public education. This specialist will be based in Piketon and work with several of the surrounding counties.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	565.0	0.0	306.0	0.0
Actual	630.0	0.0	239.6	0.0

II. Merit Review Process

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

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

2. Brief Explanation

CFAES publishes materials that are compiled and reviewed by panels with both technical and communication expertise. Many products also have some type of administrative review. Documents such as annual reports and one-page information sheets are sent for initial review by stakeholders who are both knowledgeable and vested in the subject matter. They are asked to provide feedback on content, relevance, and presentation of the stories and impacts, which then provides a high-quality final document for stakeholder use. College materials also must be branded appropriately according to Ohio State and College guidelines to ensure the recognition of our identity.
As CFAES continuously works to maximize impact, it is important to review programs to ensure efficiency and relevance. To that end, the organization is committed to making use of both informal and formal reviews to improve programming. Over the years, the review process has been streamlined and we are seeing dramatic changes in quality, quantity, and timeliness of reviews.
Some examples of how the College used internal and external reviews in 2018 include:

• The department of Entomology had an external review, which was completed and an internal panel has been developed to assess the results and incorporate them into our program.
• An external review of the Agricultural, Environmental, and Development Economics Department was done in 2017 (published December 2017). The results of this review have been used in ongoing discussions on ways to improve the department.
• In 2018, an inventory of CFAES Programs, Facilities, and Centers was done to determine how resources are being used, and whether the college needs to reallocate resources to different areas. As a part of this process, our Centers (such as the Center for Soybean Research) are being encouraged to secure increased external funding to demonstrate stakeholder support.
• SEEDS: The CFAES Research Enhancement Competitive Grants Program promotes exploration and encourages connections across disciplines, with industry, and other external partners. SEEDS is a competitive grant program that includes a peer-review process (with external members on the panel) to allocate funding. In 2018, the program was awarded roughly $1M in funding, resulting in 19 faculty, 20 graduate, and 3 undergraduate awards. SEEDS research has produced over 1000 publications, 1700 presentations, 14 U.S. patents, 26 invention disclosures, and 6 licensing agreements using results from initial findings, while facilitating collaborations with colleagues from 16 countries. In 2018 an internal survey was sent out to collect data about the SEEDS program and possible ways to improve it. This feedback is already being incorporated to the current round of applications and more will be incorporated into the 2019 competition.
• In 2018, after an internal review, an Extension publications unit was created to better coordinate Extension publication efforts.
• Another internal review, which started in 2018, is examining the peer review process for Extension digital publications/content.
As we continue to incorporate information from each of these reviews into our programs, there will be additional reviews in 2019. One such review will be done for our animal programs, which are due for re-accreditation by The Association for the Assessment and Accreditation of Laboratory Animal Care

AAALAC.

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
- Survey of the general public
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (focus groups, public information booths at local gatherings)

Brief explanation.

CFAES consistently has wide support and active participation from our stakeholders. We use formal and informal methods to engage our stakeholders and encourage their participation. Dean Kress often discusses "land grant DNA," which is defined by translational and responsive research. This means that we are constantly looking for feedback and working to improve the service to our stakeholders.
We use external advisory committees and stakeholder groups to discuss current programs and gather input for future direction and strategic planning. Electronic messaging, social media, webinars, and blogging, as well as interactive group messaging systems have continued to expand rapidly, allowing more stakeholders to participate using communication technologies.
Organizational and leadership changes are communicated at major College events (such as the annual Farm Science Review), to advisory groups, via the CFAES website, and a weekly news release. CFAES also reaches out to public media to advertise general public events to our stakeholders. Stakeholders are often invited to participate on CFAES hosted panels, provide presentations, or offer input on processes and planning.
Multiple types of activities were used to acquire stakeholder input, however, the major activity in 2018 was a county-based statewide needs assessment survey that grew out of a 2016 pilot needs assessment process. This year 9,600 surveys (42% response rate) were distributed to individuals from all 88 Ohio counties who represented groups of OSU Extension stakeholders and OSU Extension users (e.g., Advisory committee members, volunteers, newsletter recipients, etc.). Each county office received a unique report detailing the highest priority needs for their county and the results from all 88 counties were aggregated into a statewide needs assessment report. In addition to this major activity, county offices were encouraged to extend their reach and understanding of local needs by reviewing local secondary sources of information and by seeking more in-depth understanding in conversations or focus group interviews with local program area advisory committees (e.g., agriculture, FCS, 4-H and Community Development committees), community groups (such as Family and Children First Councils, commodity and produce associations, and others).

In addition, a new plan to help reach and listen to our traditional and nontraditional stakeholders was launched in 2018. This plan includes each county office in Ohio developing a digital engagement strategy to create an online presence at the local level. Digital engagement stewards are being trained in multiple methods of electronic communication that can be tailored to local needs. Increased online presence will also allow greater communication with current OSU Extension users and will also increase our reach and communication with segments of the communities and counties we serve who are not currently aware of our presence and value.

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
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys
- Other (one on one interactions with existing and new stakeholders)

Brief explanation.

CFAES continues to make targeted efforts to find and link with all stakeholder groups. CFAES faculty and staff members, departments and schools, and various research and Extension groups within the institution use stakeholder lists that serve as their foundational contact points. Federal, state, regional, and local governments; agencies; advisory committees; commodity groups; and special interest groups add to the list of stakeholders from whom we seek input in the initial planning and execution phases of our programs.

Opportunities such as the CFAES Farm Science Review (FSR) are used to engage and garner stakeholder participation, feedback and support. FSR - Ohio's premiere agricultural event - is one of the largest in the nation of its kind and is dedicated to demonstrating the best agricultural research and best management practices with ready-access for our stakeholders. In September 2018, FSR hosted approximately 108,000 visitors and 636 exhibitors over a 3-day period. Each year at the FSR there is a "Celebration of Ohio Agriculture" luncheon which brings together both internal and external stakeholders to celebrate our accomplishments. Events such as this also provide a means to expand our clientele list, knowledge of needs, and feedback on impacts and outputs. These contacts are logged and maintained.

Advisory committees are used at various levels within the College. For example, County Extension advisory committee members help in connecting to our traditional stakeholders and expanding the list of county officials that should be contacted. OSU Extension advisory committees have guidelines that dictate how they should be composed. The membership of committees is reviewed during annual onsite audits and self-study diversity reviews are performed to ensure that involvement is sought from the broadest array of constituents feasible.

OSU Extension educators are encouraged to reach out to new and underserved target audiences as well as traditional and nontraditional stakeholders. Some of the activities and events that provided informal opportunities to engage with current and potential stakeholders included participation in County Commissioner Association of Ohio budget information dissemination meetings, informational booths at county fairs, participation in conferences and meetings such as the fair manager conference, multiple opioid summits, town hall meetings, and other community events. In addition, OSU Extension educators in every county gather relevant input from the multiple teams and committees that work to improve local conditions.

Many administrative units in CFAES also have advisory committees that continually seek to be more representative and are constantly creating new channels to new stakeholder individuals and groups. There are additional advisory committees that are created to deal with current issues, such as the Research Advisory Committee which is a group of faculty and staff being used to address the NCURA Report recommendations.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Survey of the general public
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public
- Other (focus group interviews, unobtrusive observation, qualitative data collection)

Brief explanation.

The methods noted above have all been used in some way during the past year to gather data from stakeholders. Our survey of various groups is often done in open forum interview/discussion settings that generate more qualitative data than quantitative. Surveys are sent to constituents (general and targeted groups) that inform our programming.
Although this year Extension's major activity to gather stakeholder input was a formal statewide survey, many of the efforts made by CFAES were conducted with smaller, less formal methods such as open forum interview/discussion settings that generate qualitative data. CFAES groups such as faculty and staff members, departments and schools, and various research and Extension groups within the institution use stakeholder lists that serve as their foundational contact points. In turn, there are business and industrial partners, fellow research and Extension institutions, and support organizations that are on our contact list.
CFAES leadership routinely attends external events such as the Ohio Cattleman's Association Banquet and the Ohio Agribusiness Association Conference. At these events, stakeholders can discuss emerging issues with leadership and collaborate on solutions. These events often lead to increased networking and more meetings between CFAES and our stakeholders. Many times, College leadership is also asked to participate in public panels or at conferences to address issues of public concern.
All these stakeholders are continually being re-engaged as we move forward. The ultimate goal is to have 'meaningful engagement' that will yield meaningful data, both quantitative and qualitative, and that interpretation and internalization of that data will help lead the organization to meaningful partnerships that will help foster real impacts.

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
- Other (Business management practices, culture of organization)

Brief explanation.

As a land-grant institution, it is important that our stakeholders inform decisions that are being made about the future of the college. To maximize the influence of stakeholder feedback, we actively engage groups at the beginning of the process, thus providing formative reviews. Stakeholders may be internal to the organization, or from outside groups such as industry, other educational institutions, governmental groups, etc.

Stakeholder input is considered at all levels of the organization. For example, OSU Extension implements several levels of advisory committees, tasked with identifying and prioritizing needs, connecting OSU Extension with potential partners or those who could fill gaps in service, educating stakeholders on OSU Extension's impacts, and advocating for OSU Extension. In addition to state-level, county-level, and program area advisory committees, we also use local and/or topical committees such as goat committee, research advisory committee, and various others.

Most emerging issues are identified in the field, as issues most often manifest themselves in our clients' daily work and social lives. Needs and issues originating from producers, processors, manufacturers, consumers, and special interest groups will continue to inform our programs. This approach influences hiring, shifts in priorities and resource allocation including budgets, and strategic planning.

OSU Extension administrators and others with statewide program leadership responsibility have initiated a departmental accountability process with campus units receiving OSU Extension funding. This process involves discussing surveys of internal and external stakeholders about their satisfaction with the content and expertise delivered from that unit and review of documented impacts. OSU Extension Advisory Committees also assist educators in prioritizing programs annually. They review information about local needs and Extension's capacity to deliver programs and guide the overall programmatic vision.

In addition, several innovative strategies have been created to build relationships with other units within the college and university that will allow OSU Extension programming and services to reach new audiences in meaningful and efficient ways. For example, an annual university wide Community Engagement Conference was initiated in 2018. Jointly sponsored by OSU Extension and the Office of Outreach and Engagement, the purpose of this conference was to bring together faculty, staff, students and community partners to focus on professional development and networking, while exploring new engagement partnerships.

A second major program that makes use of the input received is the Connect and Collaborate grant program. The Connect and Collaborate program incentivizes OSU-community teams to develop and grow meaningful partnerships that catalyze engaged teaching, research, and service programs with measurable and sustainable benefits to the community while advancing the strategic and scholarly goals of the university. Jointly sponsored by OSU Extension, extension personnel were four out of 17 grants funded in 2018 were led or conducted in partnership with OSU Extension and nearly half of the remaining grants partnered with CFAES departments or units.

Brief Explanation of what you learned from your Stakeholders

The individuals, groups, organizations, and businesses that are vested in CFAES' research and Extension activities provide a level of input that is central to our success. The primary information learned in these interactions is that:

• Stakeholders have mentioned that periodic mailings and webpage updates do not equate to staying engaged, therefore more active engagement may be needed.
• Our science and services are highly valued, and our work has many positive social, economic, ecological, and ethical impacts across the state.
• CFAES does not have unlimited resources and therefore stakeholder feedback should be used to determine priority areas. The breath of demand is so wide that the organization must be engaged in constant planning to garner and optimize resources, invest them in targeted programs, and generate impacts in a timely manner.
• Through the Water Quality Task Force, we learned that a substantial amount of the College's work is not as well known or as impactful as we'd like it to be. Stakeholders wanted easier access to CFAES research, better translation of research into policy or practical recommendations, more boots on the ground, and leadership from the College to convene and facilitate sciencebased discussions to identify effective strategies to address diverse WQ problems both in the Lake Erie and Ohio River basins.
• The image of CFAES is not always prominent on the work that we do, and sometimes it is unclear to stakeholders that our college is responsible for events or work being done in Ohio. We must actively improve our name recognition across the state to ensure that our outputs can be appropriately traced back to the college and university.

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	10000480	0	5916190	0
Actual Matching	10000480	0	18806143	0
Actual All Other	0	0	0	0
Total Actual Expended	20000960	0	24722333	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	7162543	0	0	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Climate Change

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
132	Weather and Climate	50%		0%	
133	Pollution Prevention and Mitigation	50%		100%	
	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	2.0	0.0	1.0	0.0
Actual Paid	2.0	0.0	0.2	0.0
Actual Volunteer	0.4	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**
90094	0	43229	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
90094	0	81728	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Translational/applied climate change research;

• Laboratories, pilot plants, a feedstock processing plant, greenhouses, and research plots and stations will be used for relevant experiments;
• Infrastructure and facilities will be improved over time as program needs warrant;
• Educational programming offered;
• One-on-one consultations;
• Webinars.

2. Brief description of the target audience

Targeted audiences in the Climate Change planned program include:

• Businesses and industries that have expressed a need for climate change information that resulted from new research, extracted from on-going research, or mined from the scientific literature;
• Fellow academic units that partner with program scientists to create systems and processes needed to support research and the adoption of the research findings by industrial partners;
• Ag producers and farmers;
• Federal, state or local agencies or support organizations who will not only use the information but will also be brokers for embedding it into other groups to encourage change;
• Populations who have not requested the information but will likely benefit from that information;
• Other scientists and scientific groups;
• Political entities;
• Other education, outreach, and extension personnel;
• Students from elementary school to post doctorate studies;
• News organizations.

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	6400	0	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	3	27	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of participants attending educational programs

Year	Actual
2018	2100

Output #2

Output Measure

- number of webinars / online educational and research sessions

Year	Actual
2018	33

Output #3

Output Measure

- number of acres impacted as a result of educational events on the management of natural resources

Year	Actual
2018	55000

Output #4

Output Measure

- number of individuals receiving one-on-one consultation or assistance

Year	Actual
2018	4300

Output #5

Output Measure

- number of people completing non-formal educational events on water quality and quality of surface water and groundwater supplies (OSUE)

Year	Actual

2018	4000

Output #6

Output Measure

- number of FARM app users

Year	Actual
2018	54

Output #7

Output Measure

- Number of individuals trained through climate programs

Year	Actual
2018	2200

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Create strategies / technology within our program mission to reduce atmospheric pollution that can contribute to global climate change (OARDC)
2	Proportion of climate webinar participants who indicate they have learned new information and would share their new knowledge with others (OSUE)
3	Advance knowledge of how climate change affects crops, including wildlife (OARDC)
4	Number of participants learning about climate change in Ohio and it's effects on Ohio agriculture and natural resources.
5	Number of farmers using the FARM app for fertilizer record keeping (tracking the weather conditions and nutrient application)

Outcome #1

1. Outcome Measures

Create strategies / technology within our program mission to reduce atmospheric pollution that can contribute to global climate change (OARDC)

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)
Greenhouse gasses such as carbon dioxide and methane contribute to global climate change. Approximately 2/3rds of global carbon emissions come from 90 institutions, therefore it is important to reduce pollution from industry if we hope to address climate issues. Corporate environmentalism, or voluntary pollution control by businesses, is an integral part of U.S. environmental policy. Governmental agencies use some voluntary methods, such as the international standard of ISO 14001 which outlines the process for a firm to set up, improve, or maintain an environmental management system. These programs are typically designed to help firms find solutions to wasteful and inefficient tasks; however, the effects on firm efficiency are relatively unknown.

What has been done
In this project, CFAES researchers use several types of data to determine the various effects of corporate environmentalism on business performance. Datasets were used to explore the internal benefits to a company by looking at the difference between actual and potential output levels, while controlling for effects of external production shocks (such as poor weather). We also empirically determined whether the adoption of ISO 14001 boosts export performance, and whether the effect differs depending on the destination countries that have various levels of environmental governance and interests. To look at effects on exports, we used panel data of industry exports to various destination countries from 1988-2015.

Results
We found that ISO 14001 has a positive impact on exports in the international trade market, and the size of the impact varies by the level of economic development of importing countries. Specifically, the impact is larger when the destinations are OECD members compared to non-OECD countries. These findings suggest that ISO 14001 yields an important internal cost-saving benefit above and beyond well-documented external benefits, such as improved brand name.

Additional preliminary research shows that corporate environmentalism can reduce production inefficiencies, boost profits, and generate positive spillover effects on environmental innovation. Corporate environmentalism programs should also increase awareness among employees and managers about the need to prevent waste across the entire production process. Together, this can help find the most effective ways to reduce corporate pollution emissions, slowing climate change. Future work will use statistical models to assess the impact of corporate environmentalism on measure of firm profitability and stock market performance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation

Outcome #2

1. Outcome Measures

Proportion of climate webinar participants who indicate they have learned new information and would share their new knowledge with others (OSUE)

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Advance knowledge of how climate change affects crops, including wildlife (OARDC)

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of participants learning about climate change in Ohio and it's effects on Ohio agriculture and natural resources.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Changes in climate will have an effect on future productivity of Ohio agriculture and natural resources. Training farmers and landowners in climate change can help them make their farms and lands more resilient to climate change, thereby sustaining their productivity.

What has been done
In 2018, 54 programs of the effect of a changing climate on agricultural production were conducted statewide.

Results
More than 2,000 participants learned what a changing climate may mean to their operations and what they can do to reduce the impact of that change in the future.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation

Outcome #5

1. Outcome Measures

Number of farmers using the FARM app for fertilizer record keeping (tracking the weather conditions and nutrient application)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	54

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water quality in agriculture is at the nexus of agriculture nutrient amendment applications, soils, and climate. Water quality is a concern for everyone. Farmers want to do what's best for their farms and the environment.

What has been done
The FARM app was created in partnership with the Ohio Department of Agriculture and the Ohio State University Byrd Polar Climate Research Center and Extension. The app is designed to allow farmers a place to record nutrient applications along with the weather that day, and the predicted weather in the next 24 hours. This helps farmers to remain within Ohio law concerning 12 and 24 hour weather predictions and nutrient amendment application.

Results
The FARM app was rolled out at the 2018 farm science review. To date, 54 farmers are utilizing the app. We expect that number to increase in 2019.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation

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
- Other (Social Acceptance of the issue)

Brief Explanation

Climate research can be a controversial topic, making it difficult to gain support of the public for related projects. As a land-grant institution, our goal is to serve our stakeholders and therefore research in this area may be limited.
In 2018, Ohio experienced one of the wettest years on record. Higher rainfall corresponds with warmer temperatures that are being recorded and more intense weather events such as hurricanes, tornadoes, and floods. These weather conditions are detrimental to the agricultural industry, leading to reduced yields and lower income. We anticipate that these exacerbation of these problems will lead to further research on climate issues.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We have shown commitment to this issue by collaborating with other OSU colleges at the Byrd Polar Climate Research Center. The Center will host the first annual Byrd Center Symposium on Climate Change Research at Ohio State in 2019. There are several online resources provided by the center, including a Field Application Resource Monitor which allows users to search historical weather forecasts and see 12- and 24-hour precipitation forecasts to inform fertilizer applications. The Center in coordination with the State Climate Office of Ohio performs a hydrologic and climate assessment every few weeks, releasing a total of 28 in 2018. In addition to these activities, researchers often give public presentations concerning climate change issues and also invites outside lecturers to present at the University.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
511	New and Improved Non-Food Products and Processes	10%		94%	
608	Community Resource Planning and Development	90%		6%	
	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	1.5	0.0	2.0	0.0
Actual Paid	2.0	0.0	1.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
90094	0	158641	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
90094	0	291379	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Throughout the planning period, research and Extension activities will inform sustainable energy programs. Laboratories for experiments, pilot plants, a feedstock processing plant, greenhouses, and research plots and stations throughout the state will support this program. All functional laboratories and sites will be improved over time as program needs warrant. CFAES will provide renewable energy programs to advance knowledge, promote adoption and change, develop human capital, support economic development, and create sustainable energy planning activities. The outreach from community-scale renewable energy education is planned to continue into the future, while new program development is underway for on-farm solar energy applications. CFAES faculty and staff will engage in appropriate levels of outreach and consultation, with both internal and external stakeholders, to ensure the research has the greatest chance of effecting change within society.

2. Brief description of the target audience

Targeted audiences include, but are not limited to:

- Businesses, industries, and residents that have expressed a need for sustainable energy and advanced materials information that resulted from new and on-going research, or mined from the scientific literature;
- Other stakeholders, with particular focus on consumers;
- Fellow academic units that partner with program scientists to create systems and processes needed to support research and the adoption of research findings by industrial partners;
- Federal, state and local agencies or support organizations who will not only use the information but will also be brokers for embedding it into other groups to encourage change;
- Populations who have not requested the information but will likely benefit from the knowledge, e.g. community leaders, general public;
- Other scientists and scientific groups;
- Political entities;
- Other education, outreach, and Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations.

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	816	1000	329	25

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	6	12	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- number of educational workshops / seminars on "Sustainable Energy" topics (OSUE)

Year	Actual
2018	9

Output #2

Output Measure

- number of visitor sessions to the "Energize Ohio" website (OSUE)

Year	Actual
2018	17614

Output #3

Output Measure

- number of educational programs focusing on the topic of renewable energy

Year	Actual
2018	9

Output #4

Output Measure

- number of educational programs focusing on the topic of shale energy

Year	Actual
2018	10

Output #5

Output Measure

- Number of cooperating farm operations engaged on on-farm energy monitoring and research (OSUE)

Year	Actual
2018	6

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Annually the program will report, in conjunction with industrial partners, non-proprietary research gains made to the consuming public to garner interest in adoption of new products and processes when released.
2	By 2018, the program will contribute at least two alternatives to a petroleum-based product or process that meets client needs with an acceptable point of purchase price.
3	increased understanding of energy alternatives, resources and project support (OSUE)
4	implement change in energy behavior by workshop participants (OSUE)
5	complete installation of alternative energy activity (OSUE)
6	complete plan for community, business, or farm energy activity (OSUE)
7	The program will build scientist/stakeholder cores to guide/provide biological, chemical, physical, engineering, and social research necessary to create new and improved processes and products commensurate with demand. (OARDC)
8	Increased understanding of factors that affect adoption of alternative energies

Outcome #1

1. Outcome Measures

Annually the program will report, in conjunction with industrial partners, non-proprietary research gains made to the consuming public to garner interest in adoption of new products and processes when released.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

By 2018, the program will contribute at least two alternatives to a petroleum-based product or process that meets client needs with an acceptable point of purchase price.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

increased understanding of energy alternatives, resources and project support (OSUE)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1695

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As the cost of photovoltaic (PV) solar systems continues to fall, many agricultural producers are considering investments in new energy projects to power their farms. Evaluating the financial prudence of an investment in solar requires careful consideration of system costs, design, tax impacts, value of energy production, and ongoing annual costs. Unfortunately, some proposals are hard to understand, making it difficult to execute a fully informed investment decision.

What has been done

To support farmers and businesses interested in installing solar, OSU Extension maintains an energy library on the Energize Ohio website with 56 fact sheets and/or bulletins and 23 webinars and/or short videos to support consumers interested in alternative energy. In addition, using a creative commons publication process and multi-state collaboration the University of Wyoming, Ohio State University, and the University of Nebraska recently developed a six-part bulletin series titled, Solar Electric Investment Analysis. In addition to outlining key considerations for project evaluation, the bulletin series promotes the National Renewable Energy Laboratory?s System Advisor Model (SAM) as a resource tool for consumers to evaluate projects

Results
In 2018 a total of 1,695 resources were downloaded from the Energize Ohio Website. The most popular energy resources were the ?Solar Electric Investment Analysis Bulletin Series? which was downloaded 580 times and the fact sheet titled ?An Introduction to On-Farm Solar Electric Systems? that was downloaded and additional 111 times.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
608	Community Resource Planning and Development

Outcome #4

1. Outcome Measures

implement change in energy behavior by workshop participants (OSUE)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	796

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
While in some cases PV solar projects can reduce energy cost, variables such as energy prices, net metering policy, and incentives make each farm unique. In summary, PV solar is not a good investment for every farm. Evaluating an investment in PV solar requires careful consideration of both system design and financial implications such as eclectic rate structure, compensation for net excess generation, tax impacts, and ongoing annual costs such as insurance and maintenance. Unfortunately, some proposals to install solar are hard to understand making it

difficult to make fully informed investment decisions. Many small farms are struggling with low commodity prices and high input costs. In some cases, investing in PV solar can offset increasing energy costs, while in other instances investing in PV solar may not be the best use of capital compared to other investment options. The Ohio State University Energy in Agriculture program is designed to increase participants? knowledge of solar energy development and the financial impacts to promote informed decision-making with future investments.

What has been done
Throughout 2018, the OSU Extension team has delivered the Solar Energy in Agriculture program which outlines key considerations for evaluating and investing in photovoltaic solar systems. In addition, in February 2018, Ohio State University, Michigan State University, and the University of Nebraska hosted six 1.5 hour webinars to present the ?Solar Electric Investment Analysis Bulletin Series? to participants. This approach provided farmers both the knowledge and tools to make fully informed investment decisions on energy projects.

Results
Since 2015 the OSU Extension Solar Energy in Agriculture program has been offered over 73 times reaching more than 2,770 participants. In 2018, OSU Extension offered a combined total of 25 renewable energy programs reaching more than 796 participants. In addition, there were 75 participants registered for the ?Solar Electric Investment Analysis Bulletin Series? from 12 states. Program evaluations ask participants to indicate how well the webinar series met their expectations and 6.67% indicated the webinar series partially met expectations, while 43.33% felt the webinar fully met expectations and 50% suggested the program exceeded their expectations. When asked what actions have they have taken with respect to solar since the webinar, 40 % of respondents have taken or plan to take some action towards installing solar, 11% decided that solar was not a good fit for them, 34% plan to use the information to educate someone else interested in solar, and 15% have not used the materials since the webinars.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

complete installation of alternative energy activity (OSUE)

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

complete plan for community, business, or farm energy activity (OSUE)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Evaluating an investment in PV solar is a complex process that requires careful consideration of project variables. For example, over the 30 year life cycle of the project the system design greatly influences overall electric production. In addition, variables such as electric rate structure, compensation for net excess generation, tax impacts, and ongoing annual costs such as insurance and maintenance are difficult to estimate, but will have significant impact on the financial return of a solar project.

What has been done
Using the System Advisor Model (SAM), we assisted 18 farmers in developing a solar energy simulation model for their farm operation. The SAM model considers historical weather data, load profile data, and utility rate designs to make performance predictions and cost of energy estimates for grid-connected power projects based on installation costs, operating costs, and system design parameters used to populate the model. Outputs from this modeling provides farmers a forecast of solar energy production and financial metrics such as return on investment, payback period, levelized cost of energy, and net present value to help guide informed investment decisions.

Results
Of the 18 farms that were consulted and used the SAM model results to inform decisions, at least 4 farms have moved forward and installed a solar project on their farm, while some are still considering investments in solar, and others have determined the return on investment does not justify allocating funds at this time.

4. Associated Knowledge Areas

KA Code	Knowledge Area

511	New and Improved Non-Food Products and Processes
608	Community Resource Planning and Development

Outcome #7

1. Outcome Measures

The program will build scientist/stakeholder cores to guide/provide biological, chemical, physical, engineering, and social research necessary to create new and improved processes and products commensurate with demand. (OARDC)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
{No Data Entered}

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
608	Community Resource Planning and Development

Outcome #8

1. Outcome Measures

Increased understanding of factors that affect adoption of alternative energies

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)
Ohio has historically been a leader of the production and use of energy. Ohio?s coal industry fueled the industrial revolution, while our coal and nuclear energy continue to power the region?s largest population and industrial centers. More recently, Ohio has hosted shale development via hydraulic fracturing, large wind farm development, and large-scale solar arrays. These energy transitions affect all residents though the distribution of costs and benefits from production and consumption of energy, which is spread unevenly across the state. Research is needed to guide public policy to maximize social, economic, and environmental outcomes.

What has been done
We conducted surveys, interviews, and focus groups documenting how different landowner groups perceive and are impacted by wind, shale, and coal production. We surveyed agricultural operators to better understand their decisions to allow new forms of energy development on their productive fields. We also partnered with public utilities to gather data from consumers contributing to the design of more effective interventions to reduce and/or load-shift energy use in residential buildings. Additionally, our courses use energy issues to explore the linkages between policy and the social, economic and environmental outcomes of energy transitions.

Results
These results are being used to advocate for policies that ensure the benefits of 21st century energy transitions are widely shared. We have demonstrated how industry networks and state policy approaches to regulating shale energy development shape the trajectory and impacts of new energy projects across 15 different states. In courses, students gain increased levels of energy literacy, knowledge of the social, environmental and economic aspects of energy, and learn how to apply this knowledge to real world problems and case-studies. This past year, we raised the energy literacy of hundreds of OSU undergraduate and graduate students by engaging them in hands on applications of academic theory and research to tackle real world energy

issues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)
- Other (Supply and cost of crude oil)

Brief Explanation

Greater emphasis was placed on on-farm energy monitoring and research given the decrease in farm-generated revenue.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A six week webinar series was taught in collaboration with Michigan State University and University of Nebraska that involved nearly 100 participants. Over one-third of attendees completing the program evaluation (13) have used the information from the webinar to educate others who are interested in photovoltaic solar.

Key Items of Evaluation

Use of webinar material

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Childhood Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
702	Requirements and Function of Nutrients and Other Food Components	0%		79%	
703	Nutrition Education and Behavior	50%		11%	
724	Healthy Lifestyle	50%		10%	
	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	9.0	0.0	0.5	0.0
Actual Paid	6.0	0.0	0.3	0.0
Actual Volunteer	2.0	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**
270283	0	34022	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
270283	0	175095	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Obesity research includes food science, plant sciences, and consumer research related to human health and obesity. Parallel Extension programs that address health and wellness, life styles, and consumer choice are included in this planned program as well. Given the complex nature of obesity as a subject, the area is broadly supported in scientific areas ranging from genetics for breeding plants and animals that can be processed into healthier food products, to education of school children about eating healthy. Thus, not all impacts relating to obesity are found in this planned program. CFAES advances programs that ensure nutritious foods are affordable and available, and provide guidance so that individuals and families are able to make informed, science-based decisions about their health and well-being.

2. Brief description of the target audience

Related research and Extension information will be derived through new and on-going research or will be extracted from the scientific literature. Within the 'Childhood Obesity' planned program, such research will be shared with targeted audiences including, but not limited to:

- Business, industry, and residents that have expressed a need for information that resulted from new research, extracted from on-going research, or mined from scientific literature;
- Other stakeholders, with particular focus on consumers;
- Fellow academic units that partner with program scientists to create systems and processes needed to support research and the adoption of research findings by industrial partners;
- Federal, state or local agencies or support organizations who will not only use the information but will also be brokers for embedding it into other groups to encourage change;
- Populations who have not requested the information but will likely benefit from the knowledge, e.g. community leaders, general public;
- Other scientists and scientific groups;
- Political entities;
- Other education, outreach, and Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations;
- Businesses concerned about obesity in their workforce;
- Industry groups or producers of foods and food additives that can help reduce obesity and its side effects.

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	1095	110000	2504	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	6	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- number of educational sessions held

Year	Actual
2018	1116

Output #2

Output Measure

- number of participants attending educational events related to 'Childhood Obesity' that can be defined as under-served (i.e. individuals whose needs have not been addressed in past events)

Year	Actual
2018	2045

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	To better understand human decision making; specifically with reference to how individuals make food consumption decisions.
2	Apply new knowledge to programs at the field level with a goal of significant long term weight loss and overall improvement of health in those who participate.
3	To identify research activities such as new data sources, improved techniques for data analysis, and improved hypotheses for obesity research questions.
4	Number of participants who learned new information from this program. (OSUE)
5	Number of participants who plan to increase their level of daily physical activity. (OSUE)
6	Number of participants who plan to increase their consumption of fruits and vegetables (OSUE)
7	number of participants in this event / project who actually adopted one or more recommended nutritional practices that reduce the risk of chronic disease (OSUE)

Outcome #1

1. Outcome Measures

To better understand human decision making; specifically with reference to how individuals make food consumption decisions.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Apply new knowledge to programs at the field level with a goal of significant long term weight loss and overall improvement of health in those who participate.

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)
Families, parents, and schools lack the time and resources that children so desperately need, therefore many of them are now growing up without the key ingredients for healthy development. It is important that 4-H targets members before age eight or nine as part of the 4-H youth development program to promote positive gains in youth development. By giving children direction and assistance early in life, they are more likely to be positive forces in the community as adolescents and adults.

What has been done
CFAES formed a specialization team in Preadolescent Education that consists of eight CFAES faculty and Extension professionals to inform and direct volunteer education along with curriculum and material development for the 4-H Cloverbud program. The goal of this program is to promote children?s healthy development - mentally, physically, socially and emotionally. The team ensures that delivery mechanisms include community clubs, after-school programs, and camps. New curriculum/resource development is a focus of the team?s effort and recently published 4-H Cloverbud Volunteer Guidebook.

Results
Over 9,000 children participated in the 4-H Cloverbud Program in 2018. The program is leader-directed and ?experiences? are recorded based on activities with multiple Cloverbud participants. Studies (observational analysis and stakeholder evaluations) have measured positive impacts such as increasing children?s life skills through the Cloverbud program. In one such study, 91% of the parents, 90% of the volunteers, and 98% of agents/program assistants agreed or strongly agreed that overall the program was beneficial for children. The program is expected to lead to balanced development for children, including reducing childhood obesity, as the target audience is engaged in activity areas of Healthy Lifestyles and Personal Development. Additionally, first-time 4-H clientele are typically engaged through the 4-H Cloverbud Program, increasing the reach of 4-H across the state.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #3

1. Outcome Measures

To identify research activities such as new data sources, improved techniques for data analysis, and improved hypotheses for obesity research questions.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Number of participants who learned new information from this program. (OSUE)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1603

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the "state of obesity", 13.1% of 2- to 4-year old WIC participants and 18.6% of 10- to 17-year-olds in the state of Ohio are obese. Ohio is ranked sixth highest in the United States for obesity in youth ages 10 to 17.

What has been done
In 2018, a variety of programs addressing childhood obesity were conducted including: Blender Bike Fun, Healthy Meals for Busy Families, Growing up Wild (plant a vegetable to eat), Portion Distortion (MyPlate), Rethink your Drink, Blubber Burger, and Water First for Thirst.

Results
More than half of the participants at these events (n=1603) indicated that they learned something helpful they can use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Number of participants who plan to increase their level of daily physical activity. (OSUE)

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of participants who plan to increase their consumption of fruits and vegetables (OSUE)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	790

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the "state of obesity", 13.1% of 2- to 4-year old WIC participants and 18.6% of 10- to 17-year-olds in the state of Ohio are obese. Ohio is ranked sixth highest in the United States for obesity in youth ages 10 to 17.

What has been done
In 2018, a variety of "Live Healthy, Live Well" programs addressing childhood obesity were conducted including: Blender Bike Fun, Healthy Meals for Busy Families, Growing up Wild (plant a vegetable to eat), Portion Distortion (MyPlate), Rethink your Drink, Blubber Burger, and Water First for Thirst.

Results
More than 700 participants in "Live Healthy, Live Well" programs in 2018 indicated they plan to increase their consumption of fruits and vegetables after learning the health benefits of this positive behavior.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #7

1. Outcome Measures

number of participants in this event / project who actually adopted one or more recommended nutritional practices that reduce the risk of chronic disease (OSUE)

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Ohio is one of the states that has been hit hardest by the opioid crisis, meaning that many resources have been devoted to addressing this issue. Sadly, there are many children who are a part of families suffering from addiction. Childhood obesity as an issue has not gone away, however opioid addiction must be addressed and families strengthened before children can work on leading a healthy lifestyle.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

CFAES has partnered with over 40 local organizations to carry out the objectives of the Growing Healthy Kids Columbus Coalition, which networks and collaborates on childhood obesity prevention efforts. By making small changes throughout the Columbus area, the coalition is starting to see a big difference with the way children are eating. OSU Extension has assisted in this coalition by co-authoring a "Healthy Gatherings Training" and a "Food and Beverage Targeted Marketing Playbook". Additionally, 200,000 Ohioans participated in the 2018 Great Apple Crunch, which encourages children (and adults) to collectively crunch Ohio apples and learn about buying and eating local foods. Not only does this encourage healthy eating, but it also supports the local food economy.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
502	New and Improved Food Products	0%		31%	
703	Nutrition Education and Behavior	80%		2%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	20%		67%	
	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	4.0	0.0	1.5	0.0
Actual Paid	5.0	0.0	1.1	0.0
Actual Volunteer	4.0	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**
225237	0	194275	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
225237	0	337857	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

CFAES research for advancing broad food safety goals will include both basic and applied research. Research will range from microbial studies to food processing to packaging for food safety and preservation. Laboratories, pilot plants, farms, and multiple business sites will all be available throughout Ohio to permit data gathering and to continue long-term experiments. All functional laboratories and sites will be improved over time as program needs warrant.
Additionally, food safety programs will be developed based on client demand and food safety standards set by both the industry and regulators. Food safety programs to reduce the incidence of foodborne illness and provide a safer food supply by addressing and eliminating causes of contamination will continue to be a primary program goal.
Specific activities of food safety education for consumers will include:

- Conducting food safety education classes;
- Conducting ServSafe classes with food establishment managers and employees;
- Conducting Safe Food Handling for Occasional Quantity Cooks classes with volunteer food preparers;
- Providing research-based information to consumers through various forms of media, including phone calls, fact sheets, social media, news releases, and web pages.

2. Brief description of the target audience

Targeted audiences within our food safety program will include, but are not limited to:

- Individuals or groups who have expressed a need for food safety research and Extension information that resulted from new research, extracted from on-going research, or mined from scientific literature;
- Fellow academic units that partner with food scientists to create systems and processes needed to support research and the adoption of research findings by stakeholders;
- Federal, state or local agencies or support organizations who will not only use the information but will also be brokers for embedding it into other groups to encourage change;
- Populations who have not requested the information but will likely benefit from that information, e.g. persons who engage in home canning of food;
- Other scientists and scientific groups;
- Political entities;
- Students from pre-school to post-doctorate studies;
- News organizations;
- Businesses and industrial groups;
- Food establishment managers (ServSafe manager training; food service employees ServeSafe training);
- Volunteer food preparers (general population) (Occasional Quantity Cook program);
- General consumers (via both formal or informal education).

3. How was eXtension used?

"Ask an Expert" questions from Ohio residents are wrangled to appropriate personnel to answer. Mainly questions about home canning/food preservation processes.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	7650	7763	2167	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	5	36	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational sessions held

Year	Actual
2018	268

Output #2

Output Measure

- Individual instruction on food safety through phone calls

Year	Actual
2018	3197

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Contribute to the advancement of knowledge about food packaging technologies, e.g. ultrasonic sealing, controlled environment packaging, to the extent that, annually, the risk of contamination due to packaging is reduced measurably.
2	Expand the knowledge base for contamination detection within packaged foods by developing or refining technologies such as magnetic resonance or infrared spectroscopy that will, within ten years, eliminate the problem.
3	Reduce food borne pathogens in the food supply chain.
4	Number of participants who learned new information from this program. (OSUE)
5	Number of participants who plan to adopt one or more recommended practices. (OSUE)
6	Reduce health risk by releasing at least one major study every five years demonstrating nutritional health benefits, e.g. carotenoids and cataracts, anthocyanins and colon cancer or as a substitute for artificial dyes (OARDC).
7	number of ServSafe® Level 1 attendees who indicated they plan to use the information learned in the educational program (OSUE)
8	Number of ServSafe® Level 2 attendees that answered "Agree" or "Strongly Agree" when presented with the statement, "I am comfortable talking with coworkers about increasing the safety of food in my establishment." (OSUE)
9	number of 'Food Preservation' participants who indicated that they will follow current OSUE and USDA canning and freezing recommendations after attending an educational event (OSUE)
10	number of participants who gained knowledge from Good Agricultural Practices educational events
11	number of food preservation participants who plan to make behavior changes as a result of educational intervention (OSUE)

Outcome #1

1. **Outcome Measures**

Contribute to the advancement of knowledge about food packaging technologies, e.g. ultrasonic sealing, controlled environment packaging, to the extent that, annually, the risk of contamination due to packaging is reduced measurably.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Expand the knowledge base for contamination detection within packaged foods by developing or refining technologies such as magnetic resonance or infrared spectroscopy that will, within ten years, eliminate the problem.

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Reduce food borne pathogens in the food supply chain.

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Number of participants who learned new information from this program. (OSUE)

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

Number of participants who plan to adopt one or more recommended practices. (OSUE)

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

Reduce health risk by releasing at least one major study every five years demonstrating nutritional health benefits, e.g. carotenoids and cataracts, anthocyanins and colon cancer or as a substitute for artificial dyes (OARDC).

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

number of ServSafe® Level 1 attendees who indicated they plan to use the information learned in the educational program (OSUE)

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Number of ServSafe® Level 2 attendees that answered "Agree" or "Strongly Agree" when presented with the statement, "I am comfortable talking with coworkers about increasing the safety of food in my establishment." (OSUE)

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	410

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The manner in which people handle and prepare food is a major reason why food-borne illness occurs. The CDC estimates that approximately 1 in 6 Americans (or about 48 million people) get sick each year due to food-borne pathogens. Of those that become ill from food, about 128,000 are hospitalized, and 3,000 die each year.

What has been done

OSU Extension offers the ServSafe® program to help food service industry professionals learn more about how to protect food from contamination with pathogens, and teaches them best practice skills for food preparation and handling. The program is a nationally recognized food safety training and certification program, which was established by the National Restaurant Association. Nearly 500 food service industry managers completed the ServSafe® Level 2program in 2018 through OSU Extension educators. 420 post-session evaluation instruments were collected from 2018 participants.

Results
Post-session evaluation % experiencing positive change: have a good understanding of bacteria, viruses, parasites, fungi, and their impact on the development of food-borne illness (90.1%); comfortable talking with coworkers about increasing safety of food in establishment (72.8%); clearly understand ways that food can become cross-contaminated with non-food sources (77.1%); When asked what new thing(s) were learned in the program: ?I learned more about time and temperature abuse and exactly why this is important and checking product thoroughly when arriving on the truck?

4. Associated Knowledge Areas

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

Outcome #9

1. Outcome Measures

number of 'Food Preservation' participants who indicated that they will follow current OSUE and USDA canning and freezing recommendations after attending an educational event (OSUE)

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

number of participants who gained knowledge from Good Agricultural Practices educational events

Not Reporting on this Outcome Measure

Outcome #11

1. Outcome Measures

number of food preservation participants who plan to make behavior changes as a result of educational intervention (OSUE)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	120

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A renewed interest in home gardening and purchasing of local foods across Ohio has revived consumer interest in preserving food at home through canning, freezing, and drying. However, there are areas of potential concern related to food safety in preservation and storage processes. There are an estimated 76 million cases of foodborne illnesses causing more than 5,000 deaths annually in the United States (based on 2015 CDC statistics). The USDA and US Extension services have been the recognized authority on home canning recommendations and educational materials for many years.

What has been done
OSU Extension offers Food Preservation curriculum to Ohio citizens, with the aim of teaching participants how to preserve food safely through a variety of methods, following USDA recommended safe food handling procedures. Learning objectives include: rules for good personal hygiene; use sanitary practices for food preparation areas; select and use safe food preparation practices and equipment; recognize the factors that lead to foodborne illness; recognize the impact foodborne illness could have on a quantity food event; how to keep food safe during purchasing and transport; how to safely store leftover food; use a thermometer to check for proper cooking and holding temperatures; use safe thawing methods; and select and sue safe food preparation practices / equipment. Classes covered some or all of the following preservation topics, depending on location and need: canning, freezing, drying, and pickling or fermenting.

Results
Using a post-session retrospective evaluation, the following percentages of people experienced positive changes in intended behaviors from before the program to after participating in the program: will acidify tomatoes with lemon juice or citric acid (69.5%); use the correct head space when filling jars (60.4%); use current OSU Extension and USDA canning and freezing recommendations (72.9%);. Evaluation data revealed that most individuals are getting the produce they can or freeze from their backyard garden or the farmer?s market, with other fairly common answers including the grocery store or CSAs. Common motivations for preserving foods included: saving money, controlling ingredients for health, and preserving excess garden harvest. Participants' most common preservation methods: freezing (32.6%), water bath canning (21.8%), pressure canning (12.1%), pickling (16.9%), and drying (10.6%).

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Food Safety is impacted by all sectors of agbioscience: physical, chemical, biological, social, economic, and environmental. It seems that there are increasing food recalls due to contamination with pathogens, with 70 products being recalled due to listeria contamination and 67 recalled due to salmonella in 2018. Especially in an increasingly globalized world, these pathogens can travel large distances quickly and the best solution of these issues is prevention. These events increase the need for research and outreach targeted at increasing food safety across the food chain.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

CFAES offers courses around Ohio and the US for all food processors regulated by the Food and Drug Administration (FDA). These training courses meet the requirements outlined in the FDA's Food Safety Modernization Act (FSMA). Approximately 300 Ohio food processors participated in these programs. As a consequence of this work, food companies in Ohio and across the region are better prepared to comply with written food safety plan requirements in FSMA.
There are additional impacts projects related to food safety included above, such as those reducing pathogens and contaminants in the food chain.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies	0%		25%	
503	Quality Maintenance in Storing and Marketing Food Products	35%		4%	
701	Nutrient Composition of Food	0%		22%	
702	Requirements and Function of Nutrients and Other Food Components	0%		7%	
703	Nutrition Education and Behavior	25%		1%	
704	Nutrition and Hunger in the Population	30%		0%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	5%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	5%		31%	
	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	5.0	0.0	4.0	0.0
Actual Paid	8.0	0.0	2.3	0.0
Actual Volunteer	2.0	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**
360378	0	410383	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
360378	0	953465	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

This planned program will advance broad global food security goals and will include both basic and applied research with associated outreach and Extension programs. Research will include microbial studies, packaging and shelf life, food taste tests, and analyses of consumer preferences and behavior. Laboratories, pilot plants, farms, and multiple business sites will be available throughout Ohio to permit data gathering and to continue long-term experiments. All functional laboratories and sites will be improved over time as program needs warrant. Extension will continue to have the capacity to advance knowledge acquisition, promote adoption strategies, and help build human capital to promote global food security and reduce hunger worldwide. CFAES faculty and staff will engage in appropriate levels of outreach, engagement, and consultation with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences for global food security research and Extension include, but are not limited to:

- Individuals or groups who have expressed a need for food-related information that resulted from new research, extracted from on-going research, or mined from scientific literature;
- Fellow academic units that partner with food scientists to create systems and processes needed to support research and the adoption of research findings by stakeholders;
- Federal, state or local agencies or support organizations who will not only use the information but will also be brokers for embedding the information into other groups to encourage change;
- Populations who have not requested the information but will likely benefit from that information, e.g. persons who engage in home canning of food;
- Other scientists and scientific groups;
- Political entities;
- Other extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations;
- Business and industrial groups.

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	85940	211	29583	0

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

Patent Applications Submitted

Year: 2018

Actual: 1

Patents listed

P2012-230-4822: METHOD OF ISOLATING BLUE ANTHOCYANIN FRACTIONS

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	3	72	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- total number of participants attending educational programs of one teaching hour or more on food security (Quality Assurance, Plant / Animal Healthy System Management, Local Foods, Farm to School, Marketing, etc) (OSUE)

Year	Actual
2018	115523

Output #2

Output Measure

- Total number of workshops offered to producers and agribusiness leaders on topics related to global food security and hunger (OSUE)

Year	Actual
2018	1494

Output #3

Output Measure

- Total number of volunteers and participants in the planning and implementation of events related to global food security and hunger (OSUE)

Year	Actual
2018	1407

Output #4

Output Measure

- number of food animal producers that completed 'Livestock Mortality Composting' training (OSUE)

Year	Actual
2018	1251

Output #5

Output Measure

- number of participants in 'Local Foods' related events (OSUE)

Year	Actual
2018	20643

Output #6

Output Measure

- number of new garden sites (OSUE)

Year	Actual
2018	8

Output #7

Output Measure

- number of youth participating in 'Assuring Quality Care for Animals' educational programming (OSUE)

Year	Actual
2018	21250

Output #8

Output Measure

- number of Local Foods-related educational events (OSUE)

Year	Actual
2018	306

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Advance processing techniques, e.g. electrostatic coating, to achieve the desired traits requested by industrial partners, that are manifested in consumer demand studies, or that are novel technologies that may meet latent needs.
2	Processing technology research will improve and optimize equipment and processing of food in such manner as meet consumer demand as or before that demand emerges.
3	Advance and document improvements in quality and quantity of food stocks to meet global food security and hunger goals.
4	Participate in the creation of a standardized model and protocols for studying functional foods for the purpose of providing consumers with more informed functional choices that are currently available (OARDC).
5	Reduce through research and development the negative processing impacts on physio-chemical or molecular properties of food within varying parameters to make foods more acceptable and higher quality commensurate with demand. (OARDC)
6	number of individuals who received certification to conduct livestock mortality composting on their farm
7	number of youth participants who increased their knowledge of producing quality and safe animal products for consumers through responsible animal handling, care, and welfare (OSUE: Assuring Quality Care for Animals)
8	number of teens trained to be leaders in Local Foods awareness with their peers
9	number of individuals experiencing increased awareness of local foods issues

Outcome #1

1. **Outcome Measures**

Advance processing techniques, e.g. electrostatic coating, to achieve the desired traits requested by industrial partners, that are manifested in consumer demand studies, or that are novel technologies that may meet latent needs.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Processing technology research will improve and optimize equipment and processing of food in such manner as meet consumer demand as or before that demand emerges.

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Advance and document improvements in quality and quantity of food stocks to meet global food security and hunger goals.

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)
Fusarium head blight is one of the most economically important diseases of wheat. The Fusarium graminearum (a fungus) damages the plant and produces toxins that are a food safety concern to humans and animals. Under wet, humid conditions, Fusarium head blight and vomitoxin (the toxin released by the fungus) may cause millions of dollars in losses to the wheat industry due to reduced yield and damaged grain. Single, well-timed fungicide applications and disease-resistant cultivars are the most widely used management approaches, but neither is 100% effective. Improved management methods are needed to reduce losses due to Fusarium head blight.

What has been done
Fusarium infects the wheat spike (grain-bearing tip) primarily during the flowering growth stage. Infections also favor wet, humid conditions, so fungicide applications are usually recommended during flowering (and are most warranted when it rains). However, under favorable conditions for vomitoxin contamination, a single fungicide application at flowering is not enough to reduce yield and quality losses. Researchers conducted field experiments to develop new fungicide application programs that will provide producers more management options. Two-treatment fungicide programs (flowering and post-flowering) were evaluated in combination with resistant cultivars as options for improving overall control of FHB and vomitoxin.

Results
Producers now have more flexible options for applying fungicides to effectively manage Fusarium head blight and vomitoxin, improving the quality of grain harvested from infected fields. Data were generated showing that under favorable conditions for Fusarium head blight, two-treatment fungicide programs may be 15-30% more effective than single-treatment programs. Compared to traditional methods that individually provide about 50% reduction in Fusarium head blight and 40% reduction in vomitoxin, the two-treatment program combined with resistance provides more than 70% reduction of both Fusarium head blight and vomitoxin. The integration of fungicide application and resistance is the most effective approach for managing Fusarium head blight and vomitoxin. This integrated approach will save the wheat industry millions of dollars in lost income and reduce the risk of vomitoxin entering the food chain.

4. Associated Knowledge Areas

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

Outcome #4

1. Outcome Measures

Participate in the creation of a standardized model and protocols for studying functional foods for the purpose of providing consumers with more informed functional choices that are currently available (OARDC).

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Reduce through research and development the negative processing impacts on physio-chemical or molecular properties of food within varying parameters to make foods more acceptable and higher quality commensurate with demand. (OARDC)

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

number of individuals who received certification to conduct livestock mortality composting on their farm

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1251

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The safe composting of dead livestock is key to maintaining the health of remaining animals, to preserve human health, and to protect water and air quality.

What has been done
Training programs have been developed in conjunction with the Ohio Department of Agriculture to train animal livestock producers in the safe way to dispose of dead animals.

Results
More than 1,200 livestock producers were trained in 2018. This training included a certificate of completion, which enables these producers to continue raising animals.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

number of youth participants who increased their knowledge of producing quality and safe animal products for consumers through responsible animal handling, care, and welfare (OSUE: Assuring Quality Care for Animals)

2. Associated Institution Types

- 1862 Extension

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)
Livestock production is under increasing scrutiny from the general public. Among the public's concerns are the procedures used for raising and handling livestock. For youth producers, there is also the issue of safety in working with in some cases large animals such as cattle and hogs. Training is required to teach these young and future farmers the safe ways in which to raise livestock.

What has been done
Working in conjunction with the OSU Department of Animal Sciences along with the OSU Extension program areas of 4-H and Agriculture and Natural Resources, youth assuring quality care for animals training has been developed and delivered statewide for youth working on animal 4-H projects.

Results
More than 19,000 youth increased their knowledge about how to produce quality food products by learning safe ways to handle and raise livestock.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

number of teens trained to be leaders in Local Foods awareness with their peers

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	252

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increasingly, fewer people know where their food comes from. This is especially true among youth. Training youth in local food awareness is critical in that youth are more likely to listen to someone their own age.

What has been done
Programs have been developed and conducted in partnership with 4-H to teach youth how to communicate local foods facts and issues with their peers.

Results
In 2018, 252 youth were trained to discuss local foods issues with their fellow teens.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

Outcome #9

1. Outcome Measures

number of individuals experiencing increased awareness of local foods issues

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	9443

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
During the last century, the number of people working on farms has fallen from nearly 40% of the population, to less than 2%. With each subsequent generation, we get further and further away from our agricultural heritage. At the same time, we?re increasingly relying on imported food grown under unknown conditions. Education on local foods helps consumers learn about agriculture in general, along with which agricultural commodities are produced in their local area and how to support those local producers.

What has been done
Programs have been developed and conducted in partnership with the OSUE program areas of Family and Consumer Sciences and Agriculture and Natural Resources and delivered to wide range of audiences statewide.

Results
More than 9,000 participants learned more about local foods and how to support their local producers.

4. Associated Knowledge Areas

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

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 (World conflict and terrorism)

Brief Explanation

Global food security is an incredibly complex issue, which must be addressed on many fronts. Increasing natural disasters can affect the food supply, trade wars between nations can lead to shortages and price increases (or surpluses and low prices on the other end), and socioeconomic factors have a large impact on food security, both domestically and abroad.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Our college has many research projects that fall under this planned program, including those improving crop yields (via genetic modification and pest/pathogen resistance), managing and reducing food waste, improving food safety and processing techniques, as well as creating functional foods that combat nutritional deficiencies.
When discussing global food security, it is important to note that many of these solutions start locally. In 2018, our researchers in coordination with Ohio Smart Agriculture, drafted a plan for Ohio agriculture to become more sustainable. This plan went up for public comment in the fall of 2018. The report mentions various pathways for improving food security across the state, including methods such as:

- Evaluate consumer needs/preferences of Ohioans, communicate value of agriculture
- Build and energize a Farm, Food and Health Partners Alliance
- Improve access to affordable and nutritious food
- Initiate Education, Outreach and Advocacy
- Research/develop emerging markets, guided primarily by consumer demand and preference

Because food security is such a multi-faceted issue, there will be many solutions that may not work in all cases. These methods to improve health and food security can be tested locally, then scaled-up depending on the needs of the specific communities in question.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Soil, Air and Water (OARDC Led)

☑ 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	0%		22%	
102	Soil, Plant, Water, Nutrient Relationships	0%		58%	
111	Conservation and Efficient Use of Water	0%		5%	
112	Watershed Protection and Management	0%		8%	
133	Pollution Prevention and Mitigation	0%		7%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.0	0.0
Actual Paid	0.0	0.0	3.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	664692	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1654584	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

On-going research activities in this program area encompass a full range of basic and applied agbioscience. Both laboratory and multiple field sites/research stations are available throughout the state to permit data gathering and to continue long-term experiments, such as the Triplett-van Doren no-till plots established in 1962. On-farm research takes place, including current studies to evaluate the effect of field-scale management practices on phosphorus loss to surface runoff and tile drainage in the Western Lake Erie Basin. National and international studies are also conducted through programs such as the Carbon Management and Sequestration Center. All functional laboratories and sites controlled by CFAES will continue to be improved over time as program needs and resources warrant. Faculty and staff engage in appropriate levels of outreach and consultation with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences for this Planned Program include, but are not limited to:

- Individuals or groups who have expressed a need for certain information that resulted from new or on-going research, or is extracted from the scientific literature. Often these requests are communicated to CFAES by an intermediary such as a staffer at the Ohio Department of Agriculture or a county Extension agent;
- Federal, state or local agencies or support organizations that will not only use the information but will also be brokers of that information, including embedding it into groups to encourage change;
- Populations who have not requested the information but will likely benefit from access, e.g. immigrant populations;
- Other scientists and scientific groups;
- Political entities;
- Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations;
- Business groups such as chambers of commerce and community coalitions.

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	0	0	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	75	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students completed
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Expand watershed and ecosystem level modeling to the extent that scientific data and watershed management protocols can bring all streams effected by agriculture and natural resource runoff into compliance with Ohio EPA standards.
2	Through the provisioning of watershed specific data, support the creation of and conservation action of community-based watershed networks in each major watershed in Ohio.
3	Advance the basic knowledge contribution so that Ohio continues to be viewed as a center of excellence in terms of soils and water sciences, and associated Extension programming.
4	Provide the necessary soil, air, weather/climate, and water research, in conjunction with actions in other planned programs KA (e.g. IPM), to permit continued adoption of conservation tillage practices in the face of problems such as climatic changes, pest, etc.
5	Provide the necessary research finding (scientific knowledge and techniques) to support stakeholder compliance with Ohio and federal EPA regulations, and future regulations, regarding odors and other air quality issues in ag production and processing.

Outcome #1

1. Outcome Measures

Expand watershed and ecosystem level modeling to the extent that scientific data and watershed management protocols can bring all streams effected by agriculture and natural resource runoff into compliance with Ohio EPA standards.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Through the provisioning of watershed specific data, support the creation of and conservation action of community-based watershed networks in each major watershed in Ohio.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Advance the basic knowledge contribution so that Ohio continues to be viewed as a center of excellence in terms of soils and water sciences, and associated Extension programming.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water is an incredibly important resource with many benefits, including habitat for flora and fauna, drinking water, recreation, and agricultural irrigation. As agricultural fields are converted into shopping centers and housing developments, impervious surfaces dominate the landscape, increasing the amount of rainfall turning into stormwater runoff, causing more pollutants to end up in water bodies. When left unchecked, stormwater runoff has caused joint sewer and sanitary sewer overflows, discharging untreated human waste to rivers and lakes. Developing novel, sustainable, and economically feasible stormwater treatment systems is vital to the long-term

health of both Ohio?s water resources and ecosystem health.

What has been done
Our researchers are working to develop novel stormwater treatment systems or provide ways to substantially improve existing stormwater control measure (SCM) performance. Examples include rain garden soil media trials in Sandusky, modeling sediment removal in SCMs for the Ohio Department of Transportation, and quantifying SCM performance at a big box store in Reynoldsburg, OH. We also have developed a large effort around characterization of stormwater runoff, specifically in trying to understand pollutant loading from various land uses. Lessons learned from these projects are also being applied in public policy, where faculty are aiding the Ohio Environmental Protection Agency update state standards for SCM design.

Results
Our efforts have led to the implementation of improved urban stormwater runoff control strategies across the state of Ohio. We have just finished rewriting the state design manual for SCMs (Rainwater and Land Development), which will further the use of innovative methods for stormwater control (such as bioretention, permeable pavement, and green roofs). In conjunction with the Summit Soil and Water Conservation District, we also have developed an SCM Inspection and Maintenance Certification which educates landscape professionals, public sector officials, engineers, and landscape architects in best methods for long-term maintenance of SCMs. Thus far, we have certified over 180 people in central and northeast Ohio and are planning to roll out this program statewide at the Ohio Stormwater Conference in 2019. In 2018, some extension efforts reached over 500 attendees from across the United States.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #4

1. Outcome Measures

Provide the necessary soil, air, weather/climate, and water research, in conjunction with actions in other planned programs KA (e.g. IPM), to permit continued adoption of conservation tillage practices in the face of problems such as climatic changes, pest, etc.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Provide the necessary research finding (scientific knowledge and techniques) to support stakeholder compliance with Ohio and federal EPA regulations, and future regulations, regarding odors and other air quality issues in ag production and processing.

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)
Ohio?s water resources provide a wide range of important services, including drinking water and irrigation, power, fisheries, scenic value and recreation, and ecosystem functions. Changes in population, land use, and climate have increased stress on water quality with large effects on environmental condition and human health. For example, the frequency and severity of harmful algal blooms (HABs) in Lake Erie and the Ohio River have resulted in losses of water supply and impact fishing and recreation in recent years. Sustaining and improving water quality is vital to Ohio?s quality of life, economy, and environment.

What has been done
We are using multidisciplinary expertise (aquatic and soil sciences, sociology, decision sciences) and applied research to advance three goals. The first is to reduce nutrient loads by using surveys and instrumented fields to develop farmer decision-support tools to guide land management decisions and inform water-quality policy. The second, to restore impaired ecosystems by monitoring water quality before and after dam removals, conducting an extensive inventory of the location, hydrology, chemistry and ecology of Ohio?s peat bogs, and comparing water quality and biodiversity in coastal wetlands to understand the effects of restoration efforts. The third is to protect biodiversity by raising rare and threatened fish in captivity to restore endangered populations.

Results
In relation to goal one, the results from our research at Lake Erie have identified efficient strategies that will contribute to Ohio?s goal of a 40% reduction in phosphorus loading to Lake Erie from the Western Lake Erie Basin. The revised Ohio Phosphorus Risk Index (On-Field Ohio!) will provide farmers with local data to make management decisions. Our educational programs about aquatic invasive species reached over 11,000 individuals, and two important policy measures were vetted through the Ohio Aquatic Invasive Species Committee. Additionally, the Olentangy River Wetland Research Park (ORWRP) hosted 150 activities in 2018, engaging 2,460 OSU students, staff, and external groups in trainings, service projects, and retreats. Related to our second goal, our work has helped managers prioritize programs to manage peat bogs and secured funding to restore a rare peat-forming wetland. And for the third goal, we have propagated and released rare juvenile fish into central Ohio waterways in coordination with USFWS and Columbus Metroparks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and 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.)
- Other (extramural funding)

Brief Explanation

Soil, air, and water are all affected by pollution related to increasing numbers of humans, buildings, businesses, farms, etc. Maintaining the integrity of these resources is highly complex and involves many stakeholders, making it more difficult to address these problems and find solutions that everyone can agree on.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

CFAES continues to prioritize these issues, for example many resources have been devoted to improving water quality (multiple examples listed in the executive summary). Also of note, Rattan Lal (one of our soil scientists) won several prestigious awards including the 2018 World Agriculture Prize from the Global Confederation of Higher Education Associations for Agricultural and Life Sciences (GCHERA). His work focuses on the ability of soil to address such global challenges as climate change, food security and water quality.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Natural Resources and Environmental Systems (OARDC Led)

☑ 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
134	Outdoor Recreation	0%		30%	
136	Conservation of Biological Diversity	0%		70%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual Paid	0.0	0.0	0.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	72766	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	233586	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The natural resources and environmental systems program includes both basic and applied research. Both laboratories and multiple field sites are available throughout the state to permit data gathering and to

continue long-term experiments, such as human-wildlife interaction studies. Extensive, in-state research takes place, as do national and international studies, such as those conducted through the Terrestrial Wildlife Ecology Program. Close working relationships with organizations such as the Ohio Department of Natural Resources and the USDA will continue to greatly enhance program capacity and impacts. For example, cooperative studies have identified small numbers of native ash trees that are resistant to the invasive emerald ash borer, and these trees are now being evaluated as a source of native germplasm for use in breeding programs. All functional laboratories and sites are improved over time as program needs and available resources warrant. Faculty and staff engage in appropriate levels of outreach and consultation with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences include, but are not limited to:

- Individuals or groups who have expressed a need for natural resources and environmental research knowledge that resulted from new or on-going research, or is extracted from the scientific literature. Often these requests are communicated to CFAES by an intermediary such as a staffer at USDA, the Ohio Department of Natural Resources, or a county Extension agent;
- Federal, state or local agencies or support organizations who will not only use the information but will also be brokers of that information, including embedding it into groups to encourage change, e.g. fish and wildlife clubs;
- Populations who have not requested the information but will likely benefit from access; e.g. people who fish for recreation;
- Other scientists and scientific groups;
- Political entities;
- Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations;
- Business groups such as Ohio Farm Bureau;
- Community groups such as watershed coalitions.

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	0	0	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	97	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students completed

Year	Actual
2018	31

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase the scientific understanding necessary to maintain flow of environmental goods and services through conservation actions commensurate with regional demand, i.e. Buffer zones in forest riparian zones, reforestation, CREP, carbon sequestration in forests and grassland biomass, outdoor recreation opportunities, urban forest zones.
2	Advance research knowledge, both basic and applied, in the areas of silviculture and horticulture to existing and emerging industry and consumer demand regarding forest genetics, forest biology, seed production, nutrition, and related topics.
3	Meet ODNR, USDA, USDI, local, commodity groups, community, and other stakeholder demands for scientific knowledge to inform existing and emerging issues/practices in aquatic and terrestrial wildlife including human wildlife use/conflicts, and human to human conflicts related to wildlife and use.
4	To contribute to the theoretical knowledge base within this planned program to ensure that where possible all applied research can be grounded in the best science and evaluation available in all knowledge areas selected.
5	Improve the biodiversity and utilization of land use in rural and urban environments.

Outcome #1

1. **Outcome Measures**

Increase the scientific understanding necessary to maintain flow of environmental goods and services through conservation actions commensurate with regional demand, i.e. Buffer zones in forest riparian zones, reforestation, CREP, carbon sequestration in forests and grassland biomass, outdoor recreation opportunities, urban forest zones.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Advance research knowledge, both basic and applied, in the areas of silviculture and horticulture to existing and emerging industry and consumer demand regarding forest genetics, forest biology, seed production, nutrition, and related topics.

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Meet ODNR, USDA, USDI, local, commodity groups, community, and other stakeholder demands for scientific knowledge to inform existing and emerging issues/practices in aquatic and terrestrial wildlife including human wildlife use/conflicts, and human to human conflicts related to wildlife and use.

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

To contribute to the theoretical knowledge base within this planned program to ensure that where possible all applied research can be grounded in the best science and evaluation available in all knowledge areas selected.

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)
Prior to European settlement, forests, prairies and peatlands occupied over 28 million acres in Ohio. As the result of land development and efforts to suppress fire, these ecosystems have diminished drastically. Oak-hickory forests form 62% of the state?s forests but are not adequately regenerating, which has negative impacts on Ohio?s wood industries and wildlife. The lack of fire and establishment of non-native plants threaten these ecosystems. Managed use of fire can restore conditions, but prescribed fires also pose risks to human communities. Despite these risks, residents have indicated cautious acceptance of prescribed fire when they understand the rationale for its use and have confidence that it will be implemented safely and effectively.

What has been done
This project focuses on several questions: (a) how variation in fire regimes influences the structure and function of prairie and oak forest ecosystems; (b) how drought affects the severity of peatland fires and how this drives changes in patterns of vegetation regeneration and carbon dynamics; and (c) the role of fire in shaping the balance between invasive and native tree species. We are studying public acceptance of prescribed fires and developing effective public communication and engagement strategies for encouraging fire preparedness on private property. We also explore the factors that shape resource management agency decision-making in fire-prone landscapes.

Results
Our work has provided state resource managers vital information to guide their use of prescribed fire to restore oak-hickory, prairie, and peatland ecosystems. We have also included expanded information about the use of fire in our courses, where the next generation of resource managers received information and certification that meet Federal requirements for wildland firefighter certification. Students who completed our program have taken seasonal and permanent positions in fire crews and are regularly employed by organizations that use prescribed fire as part of their ecosystem management. Through workshops, demonstrations, and face-to-face meetings, CFAES faculty have also provided critical leadership and guidance to the Lake States Fire Science Consortium (LSFSC), which coordinates regional fire planning efforts in the region. Our collaborations with the College of Engineering have also produced a prototype of a mission planning platform using drones for monitoring and predicting fire behavior in real-time.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity

Outcome #5

1. **Outcome Measures**

Improve the biodiversity and utilization of land use in rural and urban environments.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Similar to the soil, air, and water planned program, natural resource issues are very complex, requiring a lot of expertise and collaboration to find viable solutions.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The School of Environment and Natural Resources (SENR) at OSU includes over 40 faculty members that are working on problems ranging from coyotes in urban landscapes to studying the effects of gypsum on crop yields. One laboratory, the Terrestrial Wildlife Ecology Lab, is a collaborative effort between our college, the Ohio Department of Natural Resources, Division of Wildlife (ODNR-DOW), and the U.S. Fish and Wildlife Service. Relationships such as these ensure that the best available research is being incorporated into agency policies. For example, several OSU faculty are assisting the ODNR-DOW in writing their 2021-2030 tactical plan which creates specific objectives for wildlife management in the state. Additionally, these collaborative relationships give OSU an opportunity to connect natural resource professionals with students (through presentations, internships, etc) while giving the agencies a resource for answering research questions and informing best practices.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Plants Systems (OARDC Led)

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		16%	
202	Plant Genetic Resources	0%		14%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
204	Plant Product Quality and Utility (Preharvest)	0%		2%	
205	Plant Management Systems	0%		19%	
206	Basic Plant Biology	0%		4%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		1%	
212	Pathogens and Nematodes Affecting Plants	0%		26%	
213	Weeds Affecting Plants	0%		3%	
216	Integrated Pest Management Systems	0%		10%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	22.5	0.0
Actual Paid	0.0	0.0	15.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	2609184	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	10726975	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The goals of our on-going research activities to advance plant systems include both basic and applied research. Both laboratory and multiple field sites/research stations are available throughout Ohio to permit data gathering and to continue long-term experiments, such as commodity yield trials and public breeding programs. Computational science and information technology are being used in a complementary fashion to improve our ability to analyze and utilize giant sets of molecular and genomic data. Bioemergent materials research is focused on the discovery, manipulation, and utilization of unique crops as alternatives to synthetic materials. On-farm research takes place, as do national and international studies. All functional laboratories and field sites are improved over time as program needs and available resources warrant. Faculty and staff engage in appropriate levels of outreach and consultation, with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences include, but are not limited to:

- Individuals or groups who have expressed a need for plant systems information that resulted from new or on-going research, or is extracted from the scientific literature. Often, these requests are communicated to CFAES by an intermediary such as a staffer at a USDA office, the Ohio Department of Agriculture, or a county Extension agent;
- Federal, state or local agencies or support organizations who will not only use the information but will also be brokers of that information, including embedding it into groups to encourage change;
- Populations who have not requested the information but will likely benefit from access, e.g. home gardeners;
- Other scientists and scientific groups;
- Political entities;
- Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations.

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	0	0	0	0

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

Patent Applications Submitted

Year: 2018

Actual: 1

Patents listed

P2015-033-02: Modulators of Clavibacter Michiganensis and Methods of Making and Using Thereof

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	88	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students completed

Year	Actual
2018	30

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Meet or exceed the demand of fellow scientists and stakeholders within the next ten years for materials relating to plant genetics and plant breeding technologies, including identification of molecular markers for elite germplasms.
2	Enrich the gene pool and knowledge thereof in disease/pest resistance, and gene recombination and interaction studies
3	Enrich the gene pool and knowledge thereof in the areas of molecular studies to better understand how immune systems in plants inhibit diseases and how bacteria perturb the immune system.
4	Develop cultivars and crop management strategies that limit the potential negative impacts of weather variations on crop yields.

Outcome #1

1. Outcome Measures

Meet or exceed the demand of fellow scientists and stakeholders within the next ten years for materials relating to plant genetics and plant breeding technologies, including identification of molecular markers for elite germplasms.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Enrich the gene pool and knowledge thereof in disease/pest resistance, and gene recombination and interaction studies

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Enrich the gene pool and knowledge thereof in the areas of molecular studies to better understand how immune systems in plants inhibit diseases and how bacteria perturb the immune system.

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)
Plant pathogens cause significant crop losses in Ohio and throughout the world. A study published by the Royal Botanic Gardens in 2015 estimated that spread of pests and pathogens could cost global agriculture $540 billion a year in lost crops due to the increase in globalization and international trade. Efforts to breed or engineer disease resistant crops are limited by our poor understanding of the ways that the immune systems of plants recognize and combat pathogens. Knowledge is also limited on how severely certain pathogens affect the immune function and physiology of their hosts. Therefore, we must improve our understanding of plant

immune systems to better combat these potentially costly pathogens.

What has been done
Our team used various plant models and pathogens to advance fundamental understanding of the conflicting interaction between plants and potential pathogens. We focused on two main factors: those that suppress plant immune function and those that remove water and nutrients from host cells. Plant species studied include thale cress (Arabidopsis thaliana), a relative of tobacco native to Australia called Nicotiana benthamiana, as well as model and crop corn plants (Zea mays). Model plant pathogens include the causal agents of bacterial speck of tomato, halo blight of beans, and Stewart?s wilt and leaf blight of corn.

Results
This work is advancing the understanding of fundamental principles that shape the interactions between plants and pathogenic microbes and their outcomes. Our work is revealing emergent properties of plant signaling networks that maintain immune function and structural integrity necessary to resist against potential pathogens. These pathogens deploy many virulence factors that affect the severity of infection and diversely target those very same networks. Because the immune and structural function of crops and the virulence mechanisms of agriculturally relevant pathogens are closely related to the organisms studied, this work is providing a knowledge base for the deployment of new strategies for improving disease resistance in crops. Work in this area will reduce the economic and social impacts caused by plant diseases, saving farmers thousands annually.

4. Associated Knowledge Areas

KA Code	Knowledge Area
206	Basic Plant Biology
212	Pathogens and Nematodes Affecting Plants

Outcome #4

1. Outcome Measures

Develop cultivars and crop management strategies that limit the potential negative impacts of weather variations on crop yields.

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)
Phytophthora and Pythium are water molds found in soils that infect soybean seeds and seedlings, greatly reducing yield. Additionally, late to mid-season root rot caused by Pythium or stem rot caused by Phytophthora can add to these losses. In Ohio, surveys have identified over 35 different species of Pythium associated with seed and seedling rot of soybean. Losses to these diseases have exceeded 90 million bushels nationwide during wet springs. The long-term solution to these losses is to develop and plant cultivars with increased resistance.

What has been done
To develop disease resistant varieties, we studied quantitative resistance. This involves looking at several genes with small resistance effects with the goal of combining these genes to multiply their effects. We used the Soybean Nested Association Mapping (SoyNAM) populations developed by breeders at the Univ. of Illinois and Univ. of Nebraska to analyze various genetic profiles. We identified 33 quantitative disease resistance loci (a location on a chromosome that corresponds to a gene) towards 4 water mold pathogens.

Results
Interestingly, 30 of the resistant loci were unique, with each contributing resistance to a different pathogen. This indicates the need to combine this resistance into new cultivars for the broadest protection towards soil borne pathogens. Incorporating high levels of resistance may reduce or eliminate the need to replant soybeans after rain or heavy soil moisture. This is a huge savings both to the seed producer and the farmer, who saves money by avoiding the costs associated with replanting that include seed, production costs and losses due to later planting times. More importantly if this resistance is translated to high yielding regionally adapted varieties, seeding rates could be reduced because losses due to these seedling pathogens will be minimized.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources

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

One major external factor affecting plant systems in the past year is an increase in severe weather and precipitation. 2018 was the third wettest year in Ohio on record, and this creates many problems for farmers who are faced with flooded fields and reduced yields.

Another issue that has been an increasing problem in the last decade is rose rosette disease, which causes deformed foliage on roses and is detrimental to plant health. This disease has recently led to the removal of the nearly 50 year old rose garden at Secrest Arboretum in Wooster, OH.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

CFAES is doing a wide variety of research on plant systems ranging from genetic studies of plants to understanding how pollinators interact with various plants in different ecosystems. One major highlight this reporting year is improvement in biocontrol methods using Pseudomonas bacteria. There is tremendous interest in beneficial microorganisms and biopesticides for growing markets in organic food and as environmentally friendly alternatives to synthetic pesticides.
Over 100 hydroponics growers, industry representatives and regulatory professionals were interviewed to assess market needs and interests. Market research documented promising commercial potential for the global hydroponics industry globally - nearly 95% of the growers and consumers surveyed favored the use of biocontrols for limiting plant diseases.
In this project, approximately 50 strains of Pseudomonas isolates were isolated from water, plant and soil samples. Promising greenhouse and field trials are underway for soybean cyst nematode and Agrobacterium spp and the most active strains are being studied for mode of action study and field trials. Additionally, an OSU start-up company is using this research to develop new commercial products for plant growth promotion and disease management in agronomic and greenhouse crops.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Animals Systems (OARDC Led)

☑ 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%		17%	
304	Animal Genome	0%		1%	
305	Animal Physiological Processes	0%		25%	
307	Animal Management Systems	0%		5%	
311	Animal Diseases	0%		46%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%		5%	
315	Animal Welfare/Well-Being and Protection	0%		1%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	9.5	0.0
Actual Paid	0.0	0.0	5.7	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**
0	0	1049631	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	2501105	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

CFAES researchers seek to advance global food security by integrating animal agriculture into food production systems. Both basic and applied agbioscience research is conducted throughout Ohio to permit data gathering and to continue long-term experiments, such as fish genetic improvement research in the aquaculture facilities at South Centers in Piketon, OH. Ohio on-farm research is conducted as part of this program as are national and international studies. Effective research requires a mixture of laboratory, animal enclosure, and on-farm research to maximize knowledge. Emerging disease threats now require more advanced facilities, such as our bio-security lab, which is particularly useful for studies of infectious animal diseases, such as the recent outbreak of avian flu that has seriously impacted the nation's poultry industry. All functional laboratories and sites are improved over time, as program needs and available resources warrant. Our faculty and staff engage in appropriate levels of outreach and consultation with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences include, but are not limited to:

- Individuals or groups who have expressed a need for food animal systems information that resulted from new and on-going research, or extracted from the scientific literature. Often, these requests are communicated to OARDC by an intermediary such as a staffer at a USDA office, the Ohio Department of Agriculture, or a county Extension agent;
- Federal, state or local agencies or support organizations who will not only use the information but will also be brokers of that information, including embedding it into groups to encourage change;
- Populations who have not requested the information but will likely benefit from access, e.g. small or recreational farmers;
- Other scientists and scientific groups;
- Political entities;
- Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations;
- Business groups such as the Ohio Farm Bureau or commodity groups.

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	0	0	0	0

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

Patent Applications Submitted

Year: 2018

Actual: 3

Patents listed

P2012-159-126 and P2012-159-042:COMPOSITIONS AND METHODS RELATED TO VIRAL VACCINES
P2011-100-08: Compositions and Methods for Preventing Porcine Reproduction and Respiratory Syndrome

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	85	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students completed

Year	Actual
2018	12

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Improve reproduction efficiency and enhanced application of new technologies over the next five years to fully meet the competitive demands faced by OARDC's stakeholders in areas such as early maturation, estrus, fertility, and ovulation
2	Increase dietary research and nutrition utilization for the purpose of increased growth and quality of products commensurate with consumer demand.
3	Meet the demand of fellow scientists and stakeholders within ten years for materials relating to genetics and breeding, including id of molecular markers for improved animal health and reproductively, and increased quality and quantity of products
4	Improve management for multiple animal farm types, including organics, that will produce higher yields for and lower costs to the producer and consumer
5	Animal disease researchers will provide the necessary research to inform producers in a timely manner how to protect against known and present diseases, e.g. bovine mastitis
6	Animal disease researchers will advance the research frontiers in emerging disease investigations to the extent that OARDC continues to serve as a center for excellence.

Outcome #1

1. **Outcome Measures**

Improve reproduction efficiency and enhanced application of new technologies over the next five years to fully meet the competitive demands faced by OARDC's stakeholders in areas such as early maturation, estrus, fertility, and ovulation

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Increase dietary research and nutrition utilization for the purpose of increased growth and quality of products commensurate with consumer demand.

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Meet the demand of fellow scientists and stakeholders within ten years for materials relating to genetics and breeding, including id of molecular markers for improved animal health and reproductively, and increased quality and quantity of products

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Improve management for multiple animal farm types, including organics, that will produce higher yields for and lower costs to the producer and consumer

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

Animal disease researchers will provide the necessary research to inform producers in a timely manner how to protect against known and present diseases, e.g. bovine mastitis

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Animal disease researchers will advance the research frontiers in emerging disease investigations to the extent that OARDC continues to serve as a center for excellence.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Salmonella is the leading cause of bacterial foodborne disease in humans. In 2015, the World Health Organization attributed roughly 550 million cases of acute gastroenteritis and diarrhea to salmonella infection, leading to over 100,000 deaths. Vaccines containing live salmonella bacteria elicit a strong antibody response but could contaminate poultry meat and eggs. Vaccines using killed salmonella are safer, but must be injected 3-5 times yearly making it more difficult in commercial settings, as it causes stress to chickens and is time consuming. Furthermore, there are many strains of salmonella and no existing vaccine works for all strains. A potent vaccine using killed salmonella that can be delivered via oral drinking water is needed.

What has been done
We developed a biodegradable oral salmonella vaccine called NP-Sal vaccine that provides mucosal immunity and reduces bacterial shedding in poultry. when delivered orally in laying hens, the NP-Sal vaccine was found stable in acidic stomach conditions and the vaccine was efficiently targeted to intestinal lymphoid tissues (the desired target). Importantly, the vaccine induced specific antibody response and reduced the challenge bacterial load in the intestines of birds by over 30%. Studies are in progress to improvise the vaccine formulation to further augment the efficacy and for large-scale drinking water application.

Results
Our research will address whether the NP-Sal vaccine leads to appropriate responses in the intestines and protects the birds against various live salmonella virus infection. The technology has been successfully tested in laying hens and the researchers are currently developing an option for broiler birds. Since the NP-Sal vaccine is safe with no live bacteria in it, our results will support the value of starting a company at in Wooster, OH to perform necessary field trials in large commercial farms and develop a saleable vaccine formulation. Having a potent salmonella oral vaccine that is effective, safe, and can be easily delivered through drinking water in

commercial farm settings is likely to save millions of dollars and countless lives every year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

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

Animal systems are affected by all of the factors mentioned above. These living systems are particularly susceptible to poor weather conditions (i.e. cold winters or increased precipitation). One major issue in this past year is related to high levels of rain this past year: underweight cows. This can cause issues with dairy cows not producing enough milk, or beef cattle that weigh less (and are therefore worth less money to producers and processors).

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The recently created Center for Human-Animal Interactions, Research, and Education (CHAIRE) is one example of how CFAES is meeting its goals related to Animal Systems. CHAIRE has created an interdisciplinary community of experts researching, teaching, and working in this diverse area of study. CHAIRE's goal is to provide a venue for discussions of the opportunities and challenges, as well as setting research, education, and outreach agenda.
In areas related to animal nutrition, our researchers are working on improving dairy cow feed to improve nutrition and also reduce nutrient excretion. Ongoing research in the area has found that supplementing dairy cattle feed with spray dried plasma protein can increase milk yield, energy efficiency, and protein content in milk. This ingredient is already commercially available. Additionally, adding distillers grain to feed was found to decrease the pH and ammonia released in excrement.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Food, Agricultural, and Biological Engineering Systems (OARDC Led)

☑ 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
402	Engineering Systems and Equipment	0%		49%	
403	Waste Disposal, Recycling, and Reuse	0%		36%	
404	Instrumentation and Control Systems	0%		9%	
405	Drainage and Irrigation Systems and Facilities	0%		3%	
723	Hazards to Human Health and Safety	0%		3%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual Paid	0.0	0.0	1.2	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**
0	0	213701	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	644500	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Engineering research activities to advance our goals includes both basic and applied research. For example, CFAES scientists are working with farmers, industry groups, and government agencies to improve access to field data gathered from new-generation farm machinery and remote-sensing tools to better support real-time management decisions by producers. Laboratories, construction sites, farms, and multiple field sites/research stations are also available throughout Ohio to permit data gathering and to continue long-term activities. All functional laboratories and field sites are improved over time, as program needs warrant. Faculty and staff engage in appropriate levels of outreach and consultation with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences include, but are not limited to:

- Individuals or groups who have expressed a need for engineering information that resulted from new and on-going research, or is extracted from the scientific literature. Often these requests are communicated to CFAES by an intermediary such as a staffer at a USDA office, the Ohio Department of Agriculture, Soil and Water Conservation Districts, or a county Extension agent;
- Fellow academic units that rely on engineers to create systems and processes needed to support their research and the adoption of research findings by stakeholders;
- Federal, state or local agencies or support groups who not only use information but broker that information by embedding it into clientele groups supportive of change;
- Populations who have not requested the information but will likely benefit from access, e.g. recreational animal owners;
- Other scientists and scientific groups;
- Political entities;
- Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations;
- Business groups such as small town administrators, county commissioners, or commodity groups.

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	0	0	0	0

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

Patent Applications Submitted

Year:	2018
Actual:	1

Patents listed
P2013-215-03: Bioprocessing of Harvested Plant Materials for Extraction of Biopolymers and Related Materials and Methods

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	46	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students completed

Year	Actual
2018	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Provide appropriate facilities design and engineering processes commensurate with stakeholders demand, including fellow research units demands, to the extent that they have all the information necessary for making adoption decisions
2	Develop enhanced systems to support integrated plant growth systems that will annually result in increased productivity at reduced costs for the industry
3	Improve mechanical devices and instrumentation needed by stakeholders
4	Advance development of state of the art integrated waste management systems to the extent that OARDC and Ohio are viewed as one of the top ten programs/states in this area nationally
5	Advance the knowledge of ecological based engineered systems for waste management to the extent that, where cost effective and appropriate, they will be adopted over mechanical systems
6	Develop improved systems to aid in meeting new or yet to emerge or novel needs

Outcome #1

1. Outcome Measures

Provide appropriate facilities design and engineering processes commensurate with stakeholders demand, including fellow research units demands, to the extent that they have all the information necessary for making adoption decisions

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Develop enhanced systems to support integrated plant growth systems that will annually result in increased productivity at reduced costs for the industry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Natural rubber (NR) is a critical raw material with annual world consumption of almost 13 million tons. NR demand is expected to exceed current production in the near future, meaning that alternate sources of rubber are needed. The U.S. currently imports about one million tons of NR per year, accelerating efforts to produce NR domestically. Rubber dandelion, which can be farmed in the northern U.S. states, requires improved herbicide resistance before it can be planted in large amounts. Additionally, the rubber extracted from field-grown roots is contaminated with dirt, requiring extensive processing. Production is also more time consuming than NR because it can only be harvested as an annual crop.

What has been done
CFAES scientists have developed a hydroponic system for the rubber dandelion crop in Ohio which permits multiple harvests of the rubber-containing roots of the same plants per year. Roots regrow in half the time required for new seedlings to reach harvestable root size, increasing production potential. This system is weed and dirt free, reducing processing times while allowing the growth conditions to be easily optimized. This method also provides rapid screening of improved seeds and plants.

Results
There is one existing pilot plant located in Wooster, OH where rubber is currently extracted from roots. A new U.S. company has been formed to commercially produce rubber using hydroponics in Ohio, and two European companies have also picked up the technology. This technology complements the ever-increasing hydroponic production of fruit and vegetable crops in Ohio. Once optimized, this system can be quickly scaled up to provide useful quantities of rubber for Ohio and U.S. manufacturers of rubber products (especially premium products). Additionally, the optimal nutrient requirements for the hydroponically-grown plants will guide development of field crop fertilization protocols. These improvements could lead to the development of a new industry in Ohio, farming rubber dandelion, to supplement the international market for NR.

4. Associated Knowledge Areas

KA Code	Knowledge Area
402	Engineering Systems and Equipment

Outcome #3

1. Outcome Measures

Improve mechanical devices and instrumentation needed by stakeholders

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Advance development of state of the art integrated waste management systems to the extent that OARDC and Ohio are viewed as one of the top ten programs/states in this area nationally

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Advance the knowledge of ecological based engineered systems for waste management to the extent that, where cost effective and appropriate, they will be adopted over mechanical systems

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Develop improved systems to aid in meeting new or yet to emerge or novel needs

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)
Crop producers in Ohio are often faced with low margins, highly variable growing conditions, and environmental concerns. Grain prices have been level since 2014 while increased input prices have resulted in higher production costs for Ohio farmers. At the same time, water quality issues have resulted in new policies governing the management of fertilizers and manure for field crops, and the public continues to add pressure for farmers to reduce nutrient runoff. Therefore, farmers are looking for ways to better manage costs such as using less fertilizer, while implementing practices to minimize environmental risks.

What has been done
An on-farm research effort created by the CFAES Digital Agriculture Team (called eFields) is dedicated to advancing production agriculture using field-scale research. The team includes 48 people such as county educators, state field specialists, students and on-campus faculty. A total of 96 studies were conducted in 25 counties with 39 partnering farms. The effort also included 39 industry partners that helped support various projects. Projects covered six focus areas including precision seeding, precision nutrient management, precision crop management, soil compaction, remote sensing, and data analysis and management.

Results
Results highlight how technology and input management decisions can improve crop production and profitability. The 2017 eFields report was distributed through 2,500 printed copies and via 12,584 interactions with the e-version during 2018. Research results indicate that farmers could plant fewer seeds while maintaining yield, with an optimum seeding rate of around 140,000 seeds per acre compared to typical Ohio seeding rates between 150,000 and 180,000 seeds per acre. For corn, the optimum and most profitable seeding rate was between 34,000 and 36,000 seeds per acre. Feedback from farmers and consultants was excellent with suggestions used as improvement to the 2018 studies. The eFields program is dedicated to delivering timely and

relevant, data-driven, actionable information to our stakeholders which can be used to improve farming methods and profitability.

4. Associated Knowledge Areas

KA Code	Knowledge Area
404	Instrumentation and Control 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.)

Brief Explanation

Agricultural and biological engineering is often dependent on the desires of industry or agricultural commodities. Therefore, research and outreach in this area will typically reflect the needs of industry and commodity groups, rather than those of the general public.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This planned program focuses on creation of databases, technologies, and systems that enable those in agricultural industries to increase efficiency and profits. The eFields program (reported above) is one great example of how CFAES is addressing this planned program. Another example is Techno-economic analysis (TEA), a rigorous methodology for evaluating the technical performance, economic viability, and environmental impacts of a product or technology. Our researchers are working to increase communications and collaborations to disseminate the knowledge of the use of the TEA process and its importance in identifying the inputs, processes or impacts that could affect scale-up of the technology.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Economics and Social Dimensions (OARDC Led)

☑ 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
601	Economics of Agricultural Production and Farm Management	0%		20%	
602	Business Management, Finance, and Taxation	0%		6%	
604	Marketing and Distribution Practices	0%		6%	
606	International Trade and Development	0%		21%	
607	Consumer Economics	0%		6%	
608	Community Resource Planning and Development	0%		3%	
609	Economic Theory and Methods	0%		15%	
610	Domestic Policy Analysis	0%		2%	
611	Foreign Policy and Programs	0%		3%	
801	Individual and Family Resource Management	0%		1%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	0%		17%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	7.0	0.0
Actual Paid	0.0	0.0	1.9	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	328037	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	648663	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

To fulfill the goals of the Economics and Social Dimensions Program, CFAES supports both basic and applied research initiatives. Extensive in-state research occurs, as well as national and international cooperative studies. For example, the Agro-ecosystems Management Program is working with colleagues in many other states to harness the power of social media to help agricultural entrepreneurs map assets, find potential supply chain connections, and launch cooperative networks of businesses supplying food, energy, and bio-based products. Close working relationships with multiple industries and organizations will continue to provide real-world settings and data, greatly enhancing the program's capacity and its impacts. Faculty and staff supporting this program engage in appropriate levels of outreach and consultation with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences include, but are not limited to:

- Individuals or groups who have expressed a need for social, educational, and economic findings related to some aspect of human capital that resulted from new or on-going research, or is extracted from the scientific literature;
- Fellow academic units that depend on scientists in this program for support information and for the approaches/measures they generate;
- Federal, state or local agencies or support organizations who will not only use the economic information but will also extend that information;
- Populations who have not requested the information but will likely benefit from access;
- Other scientists and scientific groups;
- Political entities;
- Extension personnel;
- Students from junior high school to post doctorate studies;
- News organizations;
- Business and industry groups.

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	0	0	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	78	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students completed

Year	Actual
2018	44

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Business management knowledge, including policy analysis, in targeted areas, e.g. risk management, weather insurance, impacts of land use shifts, grant management that are necessary for and result in increased profitability for stakeholders.
2	Market economies and efficiencies studies relating to factors such as pricing, finance, supply and demand, exchange rates, trade policies, etc. ensuring that stakeholders are informed and their identified needs.
3	Advance basic and theoretical knowledge in sociological, educational, and human capital dimensions related to food, agriculture and environment topics
4	Advance human capital and sociological studies that will inform strategies for expanding and strengthening individual and family well-being, community stability, and agricultural workforce leading to improved quality and quantity of life.
5	Study rural education systems relative to educational resources, curriculum, instructional delivery, and student learning to the extent necessary to inform decision-makers how to improve rural education systems as requested.
6	New knowledge of production variations in markets, including vertical markets, that help producers, processors, and distributors have requisite information for enhanced decision making leading to decreased costs of inputs and an increase in profits/outputs.

Outcome #1

1. **Outcome Measures**

Business management knowledge, including policy analysis, in targeted areas, e.g. risk management, weather insurance, impacts of land use shifts, grant management that are necessary for and result in increased profitability for stakeholders.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Market economies and efficiencies studies relating to factors such as pricing, finance, supply and demand, exchange rates, trade policies, etc. ensuring that stakeholders are informed and their identified needs.

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Advance basic and theoretical knowledge in sociological, educational, and human capital dimensions related to food, agriculture and environment topics

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

Advance human capital and sociological studies that will inform strategies for expanding and strengthening individual and family well-being, community stability, and agricultural workforce leading to improved quality and quantity of life.

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)
As complex and contentious issues become more prevalent in society, it becomes critical that individuals can make informed decisions. Low science literacy rates among Americans suggest that most individuals do not have the information needed to make a sound scientific decision. When searching for information about a complex and contentious issue, much information in the mainstream media may not be based on fact. This is partially because much of the science-based research conducted at universities is reported in academic journals inaccessible to the public. Thus, many individuals form attitudes and make decisions about complex issues based on little or inaccurate information.

What has been done
We researched consumer opinions of agricultural and natural resource issues, specifically exploring opinion formation, media channels, trusted sources, and decision-making. Additionally, we tracked media coverage to understand influences and assess communication barriers among scientists and industry. We also trained science and industry communicators in story telling techniques, understanding consumers? opinions, harnessing social media tools, and identifying audiences. Our 2018 efforts resulted in five national and state invited presentations.

Results
This work has led to better understanding of barriers to science communication, understanding information processing and attitude formation around contentious issues, the training and development of communicators, and the training and development of science consumers. Preliminary research has started to inform larger, collaborative projects to further understand issues surrounding effective science communication. We have discovered that even with adequate information consumers rely on and consider emotions when making decisions on complex issues. Consumers cannot process information about science without adequate knowledge of the issue. Scientists need to connect with the public and communicate in a way they understand. In cases when information is presented that contradicts previous knowledge, consumers possess levels of cognitive dissonance that prevent them from processing new information. We also learned that social media coverage of complex issues spikes with significant events and thus these events commonly influence consumer awareness of these issues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #5

1. Outcome Measures

Study rural education systems relative to educational resources, curriculum, instructional delivery, and student learning to the extent necessary to inform decision-makers how to improve rural education systems as requested.

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

New knowledge of production variations in markets, including vertical markets, that help producers, processors, and distributors have requisite information for enhanced decision making leading to decreased costs of inputs and an increase in profits/outputs.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Economic and political factors have greatly affected farmers in the last year, with issues such as trade wars affecting crop prices, imports, and exports. Additionally, an uncertain political landscape has made it more difficult for farmers to plan their crop plantings.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Our department of Agricultural, Environmental, and Development Economics houses the Anderson's Program in International Trade, which focuses on research and outreach in international trade and public policy. Our researchers have conducted extensive outreach this past year in an effort to break down the complexities of the current trade situation and educate stakeholders on why trade and free trade agreements are integral to U.S. agriculture. Over 35 published stories have reached stakeholders, producers, policy makers and the community.
Another important issue is making sure that there are enough trained workers for various agricultural industries and markets. This number is falling short as many youth cannot see themselves entering careers related to agriculture sciences. Thus, a set of camps was developed to engage high school youth and allow them to explore agriculture. A total of 42 freshman, sophomore and junior high school students participated in the two sessions of ExploreAg. The students were also split evenly between traditional ag students and students with no current connection to agriculture. Students remarked after the camps that the week-long experience changed their view on job possibilities related to agriculture and food sciences. Many indicated where they may not have looked for a college degree and career in the field previously, they now will.
Other research was done to determine how much farmers value information on farm

management. The current Farm Management Program began in September of 2017 and farmers around the state use this research to have the most accurate information when selling their commodities in the market. The program manager held programs in 21 counties, and attendance ranged from 25 to 140 people (average 60). Surveyed participants shared these responses:

- Knowledge prior to presentation was average to poor, whereas it was rated good to excellent afterwards.
- 93% of respondents rated the presentation either "excellent" or "very good."
- Nearly 80% said they intended to adjust or change management plan(s) for this season based on knowledge they gained.
- When asked, economically speaking, what was the presentation worth or how much do participants think they might save this season based on new knowledge, response range was $40 to $5,000, with an average of $1,170.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Human Health (OARDC Led)

☑ 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
502	New and Improved Food Products	0%		44%	
703	Nutrition Education and Behavior	0%		3%	
721	Insects and Other Pests Affecting Humans	0%		47%	
723	Hazards to Human Health and Safety	0%		4%	
724	Healthy Lifestyle	0%		2%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.5	0.0
Actual Paid	0.0	0.0	0.9	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	137629	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	557206	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

On-going research activities to advance human health and societal well-being include both basic and applied research, such as that conducted through the CFAES Center for Advanced Functional Foods Research and Entrepreneurship (CAFFRE). Examples include the identification, extraction and commercialization of natural, cancer-fighting food dyes from berries. Effective food science research requires a mixture of laboratory and gathering places for human subjects to undergo sensory evaluations of experimental food products. Emerging health threats now require more advanced facilities--such as bio-security labs--particularly needed in the study of infectious animal, plant and insect-vectored diseases that may directly impact humans. All functional laboratories and sites are improved over time, as program needs warrant. Faculty and staff engage in appropriate levels of outreach and consultation with both internal and external stakeholders.

2. Brief description of the target audience

Targeted audiences include, but are not limited to:

- Individuals or groups who have expressed a need for health, obesity, and safety information that resulted from new or on-going research, or is extracted from the scientific literature;
- Fellow academic units that depend on scientists in this program for support information and for new health and safety technologies and approaches;
- Federal, state or local agencies or support organizations who will not only use the information, but will also extend that information;
- Populations who have not requested the information but will likely benefit from access;
- Other scientists and scientific groups;
- Health workers/organizations;
- Political entities;
- Extension personnel;
- Students from pre-school to post doctorate studies;
- News organizations;
- Business and industrial groups.

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	0	0	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	25	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of graduate students completed

Year	Actual
2018	21

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Release studies on insects, ticks, and mites to protect human health that will provide a set of alternatives leading to health gains with lowered risks, and within economic realities, for the affected populations.
2	Advance the understanding of means and methods related to transmission of zoonotic diseases to humans, including prevention, that meets consumer demand/health threat, as or before such emerges.
3	Reduce through research, development, and outreach the exposure to biohazards, pathogens, and similar to the extent that annually such are reduced per capita with an overall time and economic savings to those who may be affected.
4	Create a growing base of knowledge that supports improving human health as it relates to food, environment, and lifestyle
5	Expand utilization of products with known functionality or nutraceutical value and give consumers greater informed choices, including the bioavailability of the desired substance in food, than they presently have.

Outcome #1

1. **Outcome Measures**

Release studies on insects, ticks, and mites to protect human health that will provide a set of alternatives leading to health gains with lowered risks, and within economic realities, for the affected populations.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Advance the understanding of means and methods related to transmission of zoonotic diseases to humans, including prevention, that meets consumer demand/health threat, as or before such emerges.

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)
Pathogens such as viruses and bacteria are constantly evolving to adapt to their changing environments, which sometimes results in the emergence of new pathogens or pathogens that can cross into different species or humans (zoonotic diseases). One key way viruses spread is by binding to and infecting new cells. Porcine delta coronavirus (PDCoV) is an emerging pathogen in the swine industry discovered in 2013 in China followed by its detection in the U.S. soon after. This virus causes illness and death in nursery piglets but how the virus spreads is not fully understood. If we understand how this virus enters new cells, we may be able to prevent the spread of the virus to additional species or humans.

What has been done
This collaborative effort between OSU and The University of Utrecht in the Netherlands is aimed to decipher what host receptors were being used by PDCoV to infect pig cells. Biochemical and molecular techniques were used to identify a protein named aminopeptidase N as the primary host protein the virus used to enter new cells. Further analysis determined that the virus was capable of infecting cells from commercial poultry species as well as human cells, suggesting the

virus could be zoonotic. This research will shed light on a new potential pathogen to the commercial poultry industry as well as a potential zoonotic threat to humans.

Results
An article was published in The Proceedings of the National Academies of Science (Broad receptor engagement of an emerging global coronavirus may potentiate its diverse cross-species transmissibility). It showed the potential for the emerging pathogen porcine deltacoronavirus to cross species barriers and potentially jump to commercial poultry and humans. This article received a top 5% Altmetric score (a score relating to how many times the article has been viewed), being picked up by at least 99 news outlets. We have spread the word about this potentially dangerous new pathogen and created new avenues for researching how this pathogen effects commercial poultry and humans. Surveillance for these pathogens and studies to determine how these pathogens might be transmitting between species is very important to prevent these types of outbreaks across the world, increasing food safety and human health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Reduce through research, development, and outreach the exposure to biohazards, pathogens, and similar to the extent that annually such are reduced per capita with an overall time and economic savings to those who may be affected.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Create a growing base of knowledge that supports improving human health as it relates to food, environment, and lifestyle

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Expand utilization of products with known functionality or nutraceutical value and give consumers greater informed choices, including the bioavailability of the desired substance in food, than they presently have.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Human health can be affected by a range of factors, including socioeconomic status and major weather events as well as public policies and programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Our college is looking at human health through various lenses including, but not limited to:

- Effects and prevention of zoonotic diseases
- Human-animal relationships and their role in health and wellness
- Addiction
- Food safety and functional foods
- 4-H and childhood/ youth development

Research and outreach in each of these areas is serving our stakeholders while providing resources and data to inform policies surrounding health. This past year, the Center for Advanced Functional Foods Research and Entrepreneurship (CAFFRE) hosted six educational seminars which were attended by 160 students, staff and faculty. CAFFRE also launched the first annual Arnold Expo Nutrition Challenge - a unique opportunity for students in food science and nutrition to explore supplements and other products promoting health and wellness at the Arnold Fitness Expo in Columbus.

Since 2005, faculty involved in CAFFRE have been awarded more than $20M in federally funded research and over $2M in industry-sponsored projects. In addition to funding, CAFFRE research has generated over 325 publications. Most recently, CAFFRE collaborators from the OSU Comprehensive Cancer Center and Food Science & Technology were awarded a $1.9M NIH grant to study the impact of soy components on the immune system and its role in regulating prostate cancer development.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Advancing Employment and Income Opportunities (Extension)

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
602	Business Management, Finance, and Taxation	50%		0%	
608	Community Resource Planning and Development	50%		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	6.0	0.0	0.0	0.0
Actual Paid	6.0	0.0	0.0	0.0
Actual Volunteer	10.0	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**
270283	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
270283	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- On-site workshops
- Meetings
- Curriculum development and maintenance
- Educational programming
- Development and maintenance of online resources
- Establishment of collaborative partnerships
- One-on-one client consultations
- Volunteer organizational efforts
- Conduct tax education workshops for practitioners, attorneys, CPAs, CFPs

2. Brief description of the target audience

- Community leaders
- Economic development professionals
- Community residents (families and individuals)
- Business owners/operators
- Professional economic developers
- Extension partners
- Attorneys
- Certified public attorneys
- Certified financial planners
- Enrolled agents with the Internal Revenue Service
- Tax return preparers

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	15347	13163	5801	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	3	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- number of people participating in 'Business Retention and Expansion' programming

Year	Actual
2018	225

Output #2

Output Measure

- number of formal 'Business Retention and Expansion' presentations of findings to communities

Year	Actual
2018	3

Output #3

Output Measure

- number of multi-state partnerships for 'Business Retention and Expansion' programming efforts

Year	Actual
2018	1

Output #4

Output Measure

- number of formal training workshops

Year	Actual
2018	4

Output #5

Output Measure

- number of program planning and implementation volunteer hours donated

Year	Actual

2018	82

Output #6

Output Measure

- number of companies visited (to discuss opportunities for growth or possible hindrances to growth)
  Not reporting on this Output for this Annual Report

Output #7

Output Measure

- number of in-person, two-day OSU Income Tax School events offered
  Not reporting on this Output for this Annual Report

Output #8

Output Measure

- number of participants in OSU Income Tax school in-person events (single day)

Year	Actual
2018	816

Output #9

Output Measure

- number of two-hour "Ethics" webinars offered through the OSU Income Tax School program

Year	Actual
2018	2

Output #10

Output Measure

- number of participants in "Ethics" webinars offered through the OSU Income Tax School program

Year	Actual
2018	297

Output #11

Output Measure

- number of five-hour "Agriculture and Natural Resource Tax Issues" webinars offered

Year	Actual
2018	1

Output #12

Output Measure

- number of participants in "Agriculture and Natural Resources Tax Issues" webinars offered through the OSU Income Tax School program

Year	Actual
2018	183

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	number of community plans developed and adopted
2	number of local leaders and community residents that have indicated they are using knowledge gained from 'Business Retention and Expansion' programming to make better informed community decisions
3	number of participants in OSU Income Tax School educational sessions who experienced an increase in knowledge on at least one subject as a result of attending an educational program
4	number of local government leaders reporting a gain in knowledge as a result of OSUE leadership training

Outcome #1

1. Outcome Measures

number of community plans developed and adopted

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

number of local leaders and community residents that have indicated they are using knowledge gained from 'Business Retention and Expansion' programming to make better informed community decisions

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	225

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Local community leaders in Ohio frequently lack an understanding of issues related to their economy. The Business Retention and Expansion (BR&E) program program helps to inform community leadership about their economy and assist in decision making.

What has been done
As part of a structured approach to assessing and addressing business needs, 225 individuals participated in BR&E programming. Through a community engagement process, local community socio-economic data and resident input have been collected and compiled by OSU Extension professionals in community plan / report formats that can be referenced to better inform local decision making. BR&E sessions are hosted as either one-on one individual instruction or as a small group workshop.

Results
Program participants anticipate improved working relationships; county and city officials indicated plans to meet regularly to discuss community and economic development issues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development

Outcome #3

1. Outcome Measures

number of participants in OSU Income Tax School educational sessions who experienced an increase in knowledge on at least one subject as a result of attending an educational program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1113

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The tax schools are intermediate-level courses that focus on interpreting tax regulations and changes in tax laws to help tax preparers, accountants, financial planners and attorneys advise their clients. The schools offer continuing education credit for accountants, enrolled agents, attorneys, annual filing season preparers and certified financial planners.

What has been done
Nine OSU Income Tax School session were held in 2018 and two webinars on ethics. This year was important for tax education as the new tax law created some challenges for tax practitioners to prepare themselves for the next filing season. Each participant received a 700 page workbook to assist them as they prepare to serve their clientele during this transition to the new tax law.

Results
More than 1,100 participants who attended OSU Extension Income Tax School educational sessions experienced an increase in knowledge about the new tax laws.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation

Outcome #4

1. **Outcome Measures**

number of local government leaders reporting a gain in knowledge as a result of OSUE leadership training

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Public Policy changes

Brief Explanation

Continued economic expansion (i.e. historic low rate of unemployment) reduced local government and community officials' emphasis on local and regional economic development (i.e. job creation and private investment). Public works focused more on investment in infrastructure than in generating new economic growth ('advancing employment and income opportunities').

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Fayette County has done BR&E in the past to inform economic development strategies. Yet, it has been used little to strengthen the linkages among the various community and regional development organizations. The most recent BR&E program included strategies to cultivate connections between the Fayette County Chamber of Commerce, the OhioMeansJobs county office, Dayton Development Coalition, and the City of Washington Court House. Participants indicated a better understanding of the organizational partners and expressed a desire to work more closely together in the future.

Key Items of Evaluation

Organizational knowledge, motivation

V(A). Planned Program (Summary)

Program # 14

1. Name of the Planned Program

Enhancing Agriculture and the Environment (Extension)

☑ 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	15%		0%	
112	Watershed Protection and Management	20%		0%	
123	Management and Sustainability of Forest Resources	5%		0%	
133	Pollution Prevention and Mitigation	15%		0%	
205	Plant Management Systems	5%		0%	
216	Integrated Pest Management Systems	10%		0%	
307	Animal Management Systems	10%		0%	
601	Economics of Agricultural Production and Farm Management	10%		0%	
602	Business Management, Finance, and Taxation	5%		0%	
723	Hazards to Human Health and Safety	5%		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	60.0	0.0	0.0	0.0
Actual Paid	65.0	0.0	0.0	0.0
Actual Volunteer	60.0	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**
2928068	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
2928068	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Maintain educational websites on related topics (e.g., Crop Observation and Recommendation Network; PestEd and Fertilizer Applicator Certification Training websites);
• Create and distribute educational materials / information (via fact sheets, field guides, manuals, webinars, tv spots, radio broadcasts, conference presentations, social media, etc);
• Enhance the adaptation of production techniques through utilization of on-farm research to work directly with producers to evaluate practices to enhance productivity and profitability;
• Organize and conduct workshops and educational activities targeting 4R Nutrient Management ("Nutrient Stewardship for Cleaner Water") and Ohio's waterways in response to phosphorus water quality concerns
• Organize and conduct 'Women in Agriculture' / 'Annie's Project' seminars;
• Extend the reach of OSUE programming by organize and conduct educational workshops, training sessions, and seminars for Master Gardener Volunteers;
• Conduct education on fertilizer and for private and commercial pesticide application best practices (including potential certification);
• Organize / host / present at conferences, such as Farm Science Review, the Conservation Tillage Conference, Small Farm Conference, Women in Agriculture Conference, etc;
• Educate Ohioans on forestry stewardship best management practices;
• Provide agricultural emergency management training for first responders and farm operators;
• Promote independence for Ohio farm families who have family members with disabilities that impact their ability to function in farm operations;
• Organize and conduct 'Transitioning Your Farm Business to the Next Generation' workshops;

2. Brief description of the target audience

The target audience for efforts under the 'Enhancing Agriculture and the Environment' programs include:

• Ohio farm families;
• Commercial green-industry companies;
• Consumer horticulture advocates;
• Commodity/farm advocacy groups;
• Federal / state and agricultural / environmental agencies;
• State-wide consumer groups;
• Volunteer groups;
• Community leaders;

- Business leaders;
- Elected and appointed officials;
- Non-government organizations;
- Female agricultural or agricultural-related business owners / partners;
- Pesticide application license holders.

Included in the reporting of the NIFA planned program, 'Enhancing Agriculture and the Environment', OSU Extension has a number of programs that have more specific audiences, which are detailed separately below.

The target audience for programs which seek to increase profitable crop yields:

- Grain producers
- Fertilizer chemical retailers
- Input company representatives
- Crop advisory, agency and soil water conservation districts
- Natural Resources Conservation Service
- Ohio Department of Agriculture
- Environmental Protection Agency

The OSU Extension 'Ohio Master Gardener Volunteer Program' targets the following audiences:

- Ohio citizens;
- Community leaders and officials;
- Master gardeners.

"Ask a Master Gardener" targets the following audiences:

- New and beginning gardeners;
- Gardeners with distressed gardens, plants, new / unusual problems with plants and / or diseases.

The 'Ohio Certified Volunteer Naturalist' program targets the following individuals:

- Ohio citizens
- Community leaders and officials
- Certified naturalists

3. How was eXtension used?

Questions from eXtension from Ohio residents are "wrangled" to appropriate OSU Extension personnel to answer.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	55125	3419	2100	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	12	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- number of volunteers involved in delivery and implementation of the 'Ohio Master Gardeners' and 'Certified Volunteer Natural Program' programming

Year	Actual
2018	3462

Output #2

Output Measure

- number of multi-state partnerships in agriculture, horticulture, and natural resources

Year	Actual
2018	21

Output #3

Output Measure

- number of subscribers to the 'Crop Observation and Recommendation Network' (CORN)

Year	Actual
2018	5009

Output #4

Output Measure

- number of people completing the 'Transitioning Your Farm / Agricultural Business to the Next Generation' workshops
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- number of hits to the "Crop Observation and Recommendation Network" (CORN) website

Year	Actual
2018	81405

Output #6

Output Measure

- number of people attending 'New and Small Farm College' events

Year	Actual
2018	1128

Output #7

Output Measure

- number of people attending the 'Small Farm Conference and Trade Show'

Year	Actual
2018	323

Output #8

Output Measure

- number of new Master Gardener Volunteers

Year	Actual
2018	486

Output #9

Output Measure

- number of people attending the 'Farm Science Review' event

Year	Actual
2018	114000

Output #10

Output Measure

- number of Certified Crop Advisers (CCAs) certified to provide consulting in Ohio

Year	Actual
2018	565

Output #11

Output Measure

- number of attendees at the 'Conservation Tillage and Technology Conference'

Year	Actual
2018	845

Output #12

Output Measure

- number of individuals participating in nutrient stewardship educational programming

Year	Actual
2018	3518

Output #13

Output Measure

- number trained in producing quality meat products

Year	Actual
2018	2825

Output #14

Output Measure

- number trained in "Beef Quality Assurance"

Year	Actual
2018	7300

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	total number of people indicating an increased knowledge of current practices and emerging technology in conservation tillage as a result of attending the Conservation Tillage Conference
2	number of female farm operators or partners completing the Annie's Project course, where they gained knowledge about issues related to women in agriculture
3	number of attendees at Ohio Women in Agriculture conferences who indicated the intent to implement at least one skill learned during the conference
4	number of Ohioans who learned new information about forestry / woodland stewardship
5	number of individuals attending commercial pesticide applicator training (PAT) who learned new information
6	number of participants in 'Nutrient Stewardship for Cleaner Water' programming who indicated they have improved their knowledge about nutrient management as a result of attending an OSUE educational event on fertilizer application
7	number of participants in Agricultural Emergency Management programming who experienced knowledge gains as a result of educational programming
8	number of Ohio youth and adults gaining knowledge on topics related to agricultural safety and health
9	number of individuals gaining information on assistive technology and other disability services to aid in farm operations
10	number of individuals gaining knowledge of farm processes and practices
11	number of individuals gaining knowledge on best management practices to treat nonpoint source pollution before it reaches Ohio's waterways
12	number of participants in private pesticide applicator training (PAT) programming who indicated they have improved practices to protect the environment as a result of attending an OSUE educational event
13	number of new or small farmer operators receiving education that can help improve their: production practices, land use choices, assessment of personal and natural resources, or identification of marketing alternative

Outcome #1

1. Outcome Measures

total number of people indicating an increased knowledge of current practices and emerging technology in conservation tillage as a result of attending the Conservation Tillage Conference

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	845

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Water quality in the western Lake Erie basin has become of critical importance in recent years with algal blooms and the shutdown of the Toledo water system in 2014.

What has been done
The Conservation tillage conference held annually in western Ohio provides educational opportunities for farmers and certified crop advisors in the areas of precision agriculture, no-till, nutrient management, and agronomy.

Results
In 2018, more than 800 participants improved their knowledge of nutrient management, no till and precision agriculture resulting in improved agricultural production, environmental protection, and water quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
205	Plant Management Systems
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #2

1. Outcome Measures

number of female farm operators or partners completing the Annie's Project course, where they gained knowledge about issues related to women in agriculture

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	25

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increasingly, family farms are being managed or owned by women. Annie's Project was developed to train these women in an environment designed to meet their unique needs.

What has been done
A number of Annie's projects have been conducted across Ohio, including sessions on: risks (human resources, financial, legal, market, and production), work/life balance, diversification, emergency planning, focusing your ag business, estate planning/succession, and "Real Colors" training. Weekly sessions and two retreats took place in 2018.

Results
Twenty-five female participants graduated from the 2018 Annie's project class and learned about all aspect of farm management and production through these programs. This training is helping these farms to remain productive and in some cases, within the family.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #3

1. Outcome Measures

number of attendees at Ohio Women in Agriculture conferences who indicated the intent to implement at least one skill learned during the conference

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	87

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Much like Annie's Project, the Ohio Women in Agriculture project is designed for women owners of farm operations. These women often inherit their farms from departing spouses or parents, and do not have the training required to operate the farm. This program is important to keeping the farms productive and within families.

What has been done
A women in agriculture conference was held in northeast Ohio in April and was attended by almost 100 women. In March 2018, the ?Women in Ag: An Empowerment Celebration? drew in 125 female attendees.

Results
Participants of the northeast Ohio conference learned many details of farm operations including farm business management, livestock handling issues, nutrient management, and numerous other projects. Ninety percent (n=87) of participants indicated that they would implement practices learned in the conference on their own farms.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

Outcome #4

1. Outcome Measures

number of Ohioans who learned new information about forestry / woodland stewardship

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1025

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Woodlands comprise 30% of the Ohio Landscape. As such, these woodlands provide multiple values including timber, wildlife habitat, water quality, recreation, and aesthetics. Management of these lands is critical to the maintaining the values these lands provide.

What has been done
Educational programs were conducted across Ohio for forest landowners, natural resource professionals, and the general public on many natural resource management subject areas.

Results
More than 1,000 landowners and natural resource professionals across Ohio were trained in a number of natural resources-related areas. This training impacted the management activities on more than 312,000 acres of Ohio forestland.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
216	Integrated Pest Management Systems

Outcome #5

1. Outcome Measures

number of individuals attending commercial pesticide applicator training (PAT) who learned new information

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	4486

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Professional pesticide applicators treat private residences, commercial property, and other locations. It is essential that these individuals be trained in procedures for safe handling and application of pesticides.

What has been done
Four commercial applicator training schools and a number of smaller events were conducted statewide to train professional applicators

Results
Close to 4,500 professional applicators were trained in 2018. This training not only help secure human and environmental health and safety, but also enabled these applicators to be licensed through the Ohio Dept. of Agriculture.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems
216	Integrated Pest Management Systems
723	Hazards to Human Health and Safety

Outcome #6

1. Outcome Measures

number of participants in 'Nutrient Stewardship for Cleaner Water' programming who indicated they have improved their knowledge about nutrient management as a result of attending an OSUE educational event on fertilizer application

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3500

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The addition of fertilizer nutrients is critical to ensure the productivity of the largest industry in the Ohio economy, Agriculture. However, increased nutrient loading in ground water and runoff can cause downstream water quality problems including algal blooms and potability of water.

What has been done
In conjunction with the Ohio Department of Agriculture, OSU Extension developed the Fertilizer Applicator Certification Training (FACT) program to train farmers in proper techniques for applying and managing fertilizer.

Results
More than 3,500 farmers were FACT trained in 2018. This training enables them to continue to apply fertilizer on their farm under the liability protection of state law.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
723	Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

number of participants in Agricultural Emergency Management programming who experienced knowledge gains as a result of educational programming

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	851

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Work on a farm is among the most dangerous of professions. Accidents on farm are often catastrophic, and the better trained first responders and farmers are to these kind of injuries the greater likelihood of survival.

What has been done
Twelve training events were conducted statewide at county extension offices, with volunteer fire departments, and at "Farm Science Review".

Results
More than 800 first responders and farmers increased their knowledge of how to prevent/address agriculture-related accidents and injury.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #8

1. Outcome Measures

number of Ohio youth and adults gaining knowledge on topics related to agricultural safety and health

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	251

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Work on a farm is among the most dangerous of professions. Youth are especially at risk, given their lack of experience in dealing with issues on the farm. Training these youth is critical to keeping them safe and in preserving family farms.

What has been done
Trainings around the state have been conducted to train youth and adults in how to deal with several common dangerous situations which occur on farms including falling into grain bins.

Results
More than 200 youth (and accompanying adults) were trained in ways to avoid and get out of dangerous situations on the farm.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #9

1. Outcome Measures

number of individuals gaining information on assistive technology and other disability services to aid in farm operations

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	753

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As our farming population ages, the need for assistive technology to aid farmers conduct day to day tasks is increasing. This technology keeps people active and working, and increases quality of life.

What has been done
Trainings have been conducted state wide for farmers with disabilities, including county fairs, the farm science review, and in conjunction with programs on disabilities.

Results
More than 750 farmers have received information on technological advances in assisting with disabilities on the farm. Information was also provided on programs to assist farmers with securing this technology.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #10

1. Outcome Measures

number of individuals gaining knowledge of farm processes and practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	112895

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
One of Extension?s missions dating back to 1914 was to help farmers improve the productivity and profitability of their farms to ensure a sustainable food supply. This is still true today, with most Extension agriculture and natural resources programming geared towards improving farm process and productivity.

What has been done
Hundreds of programs including the farm science review, field days, pesticide applicator training, agronomy days and countless others have been conducted across Ohio. These programs cover all areas of agricultural production including, but not limited to livestock, dairy, farm business management, agronomy, fruit and vegetable production, animal health, precision agriculture, and aquaculture.

Results
More than 100,000 direct contacts gained knowledge of farm processes and practices across all of Extension agriculture and natural resources.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #11

1. Outcome Measures

number of individuals gaining knowledge on best management practices to treat nonpoint source pollution before it reaches Ohio's waterways

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	9150

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are a number of practices that have been identified as being ?best? at maintaining nutrient quality from water runoff of agricultural and forestlands. These Best Management Practices

(BMP) are aimed at reducing nutrient loading of ground water and surface runoff.

What has been done
More than one hundred training programs have been conducted state wide to train farmers and agricultural and natural resources professionals in all areas of BMP implementation and evaluation.

Results
In 2018, more than 9,000 farmers and professionals were trained in BMP implementation and evaluation. The result of these trainings, when combined with other related programs, is a reduction in fertilizer application on agricultural lands and a decrease phosphorus levels in Lake Erie.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
723	Hazards to Human Health and Safety

Outcome #12

1. Outcome Measures

number of participants in private pesticide applicator training (PAT) programming who indicated they have improved practices to protect the environment as a result of attending an OSUE educational event

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	3600

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Private applicators range from homeowners to farmers applying pesticides to their own lands. Training of these individuals in the proper application methods of pesticides is critical to protecting human and environmental health.

What has been done
Annually, private pesticide applicator trainings are held in county extension offices across Ohio.

Results
In 2018, more than 3,600 private applicators who were trained, indicated they had adopted one or more pesticide use practices to safeguard the environment within the past three years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
205	Plant Management Systems
216	Integrated Pest Management Systems
723	Hazards to Human Health and Safety

Outcome #13

1. Outcome Measures

number of new or small farmer operators receiving education that can help improve their: production practices, land use choices, assessment of personal and natural resources, or identification of marketing alternative

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	351

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increasingly, there is interest in many to start farming operations as a side business, hobby, or for a main source of income. The goals of these small farm programs is to help new and existing small farmers succeed in the farming operations.

What has been done
Small farms programs, including a number of multi-day small farm colleges, are held statewide annually.

Results
Four such event were conducted in 2018 with 351 farmers trained in a wide variety of subject areas relevant to small farm operation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
205	Plant Management Systems
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

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
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 15

1. Name of the Planned Program

Preparing Youth for Success (Extension)

☑ 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	87.0	0.0	0.0	0.0
Actual Paid	96.0	0.0	0.0	0.0
Actual Volunteer	300.0	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**
4324532	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
4324532	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct workshops
- Face-to-face and virtual meetings

- Develop curriculum
- Provide training to professionals, volunteers and youth
- Media and web site creations
- Partnering with businesses and other organizations
- Fair (county and state)
- Camping
- Conduct educational programs with youth
- Conduct in-school and after-school enrichment

2. Brief description of the target audience

- Youth: 5-19 years of age
- Parents and families of youth
- Volunteers working with youth audiences
- Teachers / educators working with youth audiences
- Youth development professional staff
- Community leaders
- General public who have interest in positive youth development

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	137101	1000000	380223	1000000

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	20	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- number of youth enrolled/engaged in organized community 4-H clubs

Year	Actual
2018	69826

Output #2

Output Measure

- number of youth enrolled/engaged in after school 4-H programs

Year	Actual
2018	4434

Output #3

Output Measure

- number of youth participating in special interest and short-term programs

Year	Actual
2018	39993

Output #4

Output Measure

- number of youth participating in school enrichment programs

Year	Actual
2018	66650

Output #5

Output Measure

- number of youth participating in 4-H overnight camping programs

Year	Actual
2018	12404

Output #6

Output Measure

- number of youth participating in 4-H day camping programs

Year	Actual
2018	3419

Output #7

Output Measure

- number of adult volunteers contributing to 4-H programming and events

Year	Actual
2018	15988

Output #8

Output Measure

- number of teen volunteers contributing to 4-H programming and events

Year	Actual
2018	6074

Output #9

Output Measure

- number of adult volunteers contributing to the planning and implementation of the 'Real Money. Real World.' financial literacy program

Year	Actual
2018	5086

Output #10

Output Measure

- Number of youth participating in the "STEM Pathways" signature program

Year	Actual
2018	13772

Output #11

Output Measure

- number of youth participating in 'Real Money Real World' youth financial literacy programming

Year	Actual

2018	47366

Output #12

Output Measure

- number of youth participating in the 4-H CARTEENS ("Caution and Responsibility" teen safe driving) research project

Year	Actual
2018	1326

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	number of youth indicating an increase in understanding of decision making processes
2	number of youth who have indicated an increased knowledge of the educational topic being presented
3	number of youth who have demonstrated decision making and problem solving skills
4	number of youth who have indicated the intention to practice improved basic life skills
5	number of youth who have participated in 4-H programs and indicated that they now possess transferable workforce skills
6	number of participants who increased awareness about what it costs to maintain a household (RMRW)
7	number of participants who increased feeling of importance about waiting to have children until financially ready (RMRW)
8	number of participants who indicated their likeliness to make changes relative to getting more education or training after high school (RMRW)
9	number of participants who indicated they will think through how every spending decision affects other spending opportunities and choices (RMRW)
10	number of participants who increased awareness about how the type of job they have affects how much money they will make / their earning potential (RMRW)
11	number of participants who indicated their likeliness that they have a plan for spending that includes both wants and needs (RMRW)
12	number of youth participants who indicated the likelihood of considering how their spending decisions affect / impact other people (RMRW)
13	number of youth participating in the 4-H CARTEENS ("Caution and Responsibility" Teens safe driving program) research project who increased their knowledge, attitudes, and / or skills relative to safe automobile driving habits
14	number of Ohio youth who increased their STEM knowledge / skills

Outcome #1

1. **Outcome Measures**

number of youth indicating an increase in understanding of decision making processes

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

number of youth who have indicated an increased knowledge of the educational topic being presented

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

number of youth who have demonstrated decision making and problem solving skills

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

number of youth who have indicated the intention to practice improved basic life skills

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

number of youth who have participated in 4-H programs and indicated that they now possess transferable workforce skills

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

number of participants who increased awareness about what it costs to maintain a household (RMRW)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	21061

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many teens leave high school ill equipped to make responsible spending and saving choices or understand basic financial tools needed to manage their money successfully. They lack a foundational knowledge about and have few financial management skills they can apply. This can result in overspending, debt, stress, and default- all having negative socio-emotional consequences for the individual, their partners, and community.

What has been done
This OSU Extension program provides students the opportunity to make lifestyle and budget choices similar to those they will make as adults. The program consists of four classroom lessons, a hands-on budget management and decision making simulation, and a post-session evaluation of spending choices made. Real Money. Real World. programs are designed to be a partnership of the county Extension Office, the school, and the business community.

Results
More than 21,000 participants indicated on end of program evaluations that they increased their awareness of how much it costs to maintain a household.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

number of participants who increased feeling of importance about waiting to have children until financially ready (RMRW)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	18024

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Teen pregnancy is associated with many negative outcomes for mother, father, and child. These include increased health care and other social service support costs to the community and family.

What has been done
This OSU Extension program provides students the opportunity to make lifestyle and budget choices similar to those they will make as adults. The program consists of four classroom lessons, a hands-on budget management and decision making simulation, and a post-session evaluation of spending choices made. Real Money. Real World. programs are designed to be a partnership of the county Extension Office, the school, and the business community.

Results
More than18,000 program participants indicated on end of program evaluations that they increased their feelings that they should wait until they are financially ready to have children.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #8

1. Outcome Measures

number of participants who indicated their likeliness to make changes relative to getting more education or training after high school (RMRW)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	16897

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many teens do not understand the correlation between educational attainments and earning power. In addition, many leave high school ill equipped to make responsible spending and saving choices or understand basic financial tools needed to manage their money successfully.

What has been done
This OSU Extension program provides students the opportunity to make lifestyle and budget choices similar to those they will make as adults. The program consists of four classroom lessons, a hands-on budget management and decision making simulation, and a post-session evaluation of spending choices made. Real Money. Real World. programs are designed to be a partnership of the county Extension Office, the school, and the business community.

Results
Nearly 17,000 participants indicated on end of program evaluations they intend to pursue training or education after they graduate from high school.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #9

1. Outcome Measures

number of participants who indicated they will think through how every spending decision affects other spending opportunities and choices (RMRW)

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

number of participants who increased awareness about how the type of job they have affects how much money they will make / their earning potential (RMRW)

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	19085

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many teens do not understand the correlation between educational attainments and earning power. Helping young people become aware of the consequences of the educational, training, and career choices they will be making can help to improve their ability to plan more effectively for a financially secure future.

What has been done
This OSU Extension program provides students the opportunity to make lifestyle and budget choices similar to those they will make as adults. The program consists of four classroom lessons, a hands-on budget management and decision making simulation, and a post-session evaluation of spending choices made. Real Money. Real World. programs are designed to be a partnership of the county Extension Office, the school, and the business community.

Results
More than 19,000 program participants indicated on end of program evaluations that they increased their awareness about job choices and future earning potential.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #11

1. **Outcome Measures**

number of participants who indicated their likeliness that they have a plan for spending that includes both wants and needs (RMRW)

Not Reporting on this Outcome Measure

Outcome #12

1. **Outcome Measures**

number of youth participants who indicated the likelihood of considering how their spending decisions affect / impact other people (RMRW)

Not Reporting on this Outcome Measure

Outcome #13

1. **Outcome Measures**

number of youth participating in the 4-H CARTEENS ("Caution and Responsibility" Teens safe driving program) research project who increased their knowledge, attitudes, and / or skills relative to safe automobile driving habits

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	9200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Crashes are the leading cause of teen deaths. As teens start driving and gain independence, they don't always make the smartest decisions regarding their safety. In 2015, six teens ages 16?19 died every day from motor vehicle injuries. In 2016, speed was a factor in 32% of teen deaths and 58 percent of all passenger fatalities of 15- to 18-year-old passenger vehicle drivers were

unrestrained. In Ohio, this group has the 2nd highest number of accidents and the highest percentage of accidents where the driver was at fault. Fortunately, teen motor vehicle crashes are preventable.

What has been done
In 2018, 60 of Ohio?s 88 counties held (or starting) 4-H CARTEENS programs. Three additional counties are collaborating with local leaders to implement the program. 4-H CARTEENS programs are held weekly, monthly, bi-monthly or quarterly and last 1 to 3 hours. Programs involve the offenders and, in some cases, their parent/guardian. Most 4-H CARTEENS participants are juvenile traffic offenders. Programs are held in: Extension offices/buildings, county courthouse, fire departments, schools or other public sites. Two County Coordinator trainings were held (north and south) with 22 counties represented. State-wide classes were held at the Ohio 4-H Conference. Non court-ordered 4-H CARTEENS programs were taught at 4-H club and County Junior Leadership Club meetings. Extension professionals teach 4-H CARTEENS programs in school health programs, county events (i.e., county fair), and other venues.

Results
Participants increased knowledge on driving consequences and risks/hazards. They increased driver confidence and pledged toward more positive driving behavior/improved decision making. Teen instructors developed skills in team building, interpersonal skills, & improved teaching effectiveness. Program coordinators adapted curriculum as needed to develop effective teaching methods for instructors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #14

1. Outcome Measures

number of Ohio youth who increased their STEM knowledge / skills

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

From CARTEENS program evaluation: the greatest positive offender "change":
I know which Ohio laws govern teen drivers (51.2%);
I adjust all things that might distract me before I drive a car (41.6%);
I think about my responsibility as a safe driver (47.66%);
I do not engage in distracting behavior while driving (41.1%);
I think about my behavior as a driver (37.2%);
I think about the consequences of engaging in risky driving behavior (32.9%);
I think about what could go wrong if I am not careful when I drive (32.9%);
I understand the relationship between vehicle speed and stopping distance (32.9%);
I think about my behavior as a driver (37.2%).
When responding to, "How likely is this program to change your driving habits? (89.2% very likely/somewhat likely)
Overall, how would you rate the 4-H CARTEENS program? (96.5% excellent or good)
To what extent do you agree with the statement, "I am less likely to be a repeat traffic offender as a result of attending this CARTEENS program" (88.8% strongly agree or agree);
How would you rate the teaching of the CARTEENS instructors? (96.3% Excellent/Good).
In at least four counties that recorded long-term program data, the number of repeat juvenile traffic offenders has decreased; 2) A drop in traffic violations and vehicle crashes from youth in the county and 3) Participation in a 4-H CARTEENS program correlates to a decline in teen driving fatalities. Collaborations, networks and partnerships among OSU Extension and community safety partners are continuing and/or strengthened (i.e., 4-H program, law enforcement, juvenile court, others). Juvenile traffic offender fees were utilized as a mechanism toward hiring additional Extension staff and expanding programming outreach.

Key Items of Evaluation

Participant responses to program evaluation; Parental feedback; Community member feedback.

V(A). Planned Program (Summary)

Program # 16

1. Name of the Planned Program

Strengthening Families & Communities (Extension)

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	25%		0%	
724	Healthy Lifestyle	25%		0%	
801	Individual and Family Resource Management	25%		0%	
802	Human Development and Family Well-Being	25%		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	32.0	0.0	0.0	0.0
Actual Paid	32.0	0.0	0.0	0.0
Actual Volunteer	22.0	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**
1441511	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1441511	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Conduct formal and informal needs assessments
- Develop programming materials and curricula
- Conduct meetings, workshops and educational sessions
- Conduct program evaluation and applied research
- Form and sustain community partnerships
- Train volunteers, paraprofessionals, and other community agency/organization professionals

2. Brief description of the target audience

'Strengthening Families and Communities' programming is tailored to meet the needs of each audience we engage. School programming is age appropriate, whereas programs at Senior Centers are targeted to inform on safe food preparation for individuals living alone or with one other person. The end result is a program that has the potential to encompass all residents of the state. Below is a listing of the specific groups we intend to reach with targeted awareness, educational and skills-development programming:

- Parents of children ages birth to 18, including, but not limited to: teen, step, adoptive, foster, single, divorcing, incarcerated, fathers who have not yet established paternity, and grandparents;
- Adults in, or thinking about entering, intimate relationships;
- Young adults;
- Older adults and those who care for them;
- Baby boomers, especially women;
- Limited resource families, including mothers with young children and food stamp recipients;
- New employees;
- Bankruptcy filers;
- Debt burdened individuals and couples;
- First time homebuyers;
- Individuals with diabetes and their caregivers/family support members;
- Food establishment managers and food service employees;
- Volunteer food preparers;
- Child care providers;
- Teachers;
- Social service professionals;
- General consumers (other formal or informal education).

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	44716	45881	26478	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	14	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Educational sessions held with two or more participants

Year	Actual
2018	2010

Output #2

Output Measure

- number of volunteer hours given

Year	Actual
2018	0

Output #3

Output Measure

- number of Dining with Diabetes classes taught

Year	Actual
2018	32

Output #4

Output Measure

- total number of volunteers participating in the planning and / or implementation of 'Strengthening Families and Communities' programming

Year	Actual
2018	0

Output #5

Output Measure

- number of visits to the blog for the OSUE signature program, "Live Healthy Live Well"

Year	Actual
2018	28747

Output #6

Output Measure

- number of individuals participating in the 'Live Healthy Live Well' program

Year	Actual
2018	10374

Output #7

Output Measure

- number of 'Likes' on posts to the "Live Healthy Live Well" OSUE signature program Facebook page

Year	Actual
2018	2024

Output #8

Output Measure

- number of individuals who participated in a 'Strengthening Families and Communities' event / project that are defined as under-represented individuals (i.e., individuals who may not have participated fully - e.g., women, minorities, persons with disabilities, small farm owners, etc).

Year	Actual
2018	22748

Output #9

Output Measure

- number of participants in 'Live Healthy Live Well' email challenges

Year	Actual
2018	4381

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	number of participants who increased their financial literacy
2	number of participants who have developed an integrated plan for achieving financial security
3	number of 'Successful Co-Parenting' participants who plan on using information learned in the educational event they attended
4	number of 'Live Healthy Live Well' participants who reported using the information they learned during the email challenge, which may help reduce the risk of chronic disease
5	percentage of 'Dining with Diabetes' (DWD) participants that report engaging in cooking activities to help take control of their diabetes - using healthy oils in cooking, substituting herbs and spices for salt and using nutrition labels
6	Number of individuals participating in the 'Successful Co-Parenting' program who feel more prepared to co-parent as a result of the program.
7	Number of individuals participating in 'Healthy Finances' programming who indicated the intent to change one more behaviors as a result of attending an educational session.
8	Number of 'Dining with Diabetes' (DWD) participants who report engaging in physical activities to help take control of their diabetes - fitting exercise into their daily routine, exercising continuously for at least 30 minutes at least three times per week, and being physically active on a daily basis.

Outcome #1

1. **Outcome Measures**

number of participants who increased their financial literacy

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

number of participants who have developed an integrated plan for achieving financial security

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

number of 'Successful Co-Parenting' participants who plan on using information learned in the educational event they attended

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

number of 'Live Healthy Live Well' participants who reported using the information they learned during the email challenge, which may help reduce the risk of chronic disease

2. **Associated Institution Types**

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1271

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to the Ohio Department of Health, In 2016, 57% of Ohio deaths were attributed to chronic diseases ((heart disease, cancer, chronic lower respiratory disease, stroke, diabetes and kidney disease).

What has been done
Twelve email messages to participants with wellness information and additional resources.

Results
In 2018, 29% of the participants (n=1271) in the 6-week email challenge reported they made ½ of their plate vegetables and fruit after participating in the challenge.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

percentage of 'Dining with Diabetes' (DWD) participants that report engaging in cooking activities to help take control of their diabetes - using healthy oils in cooking, substituting herbs and spices for salt and using nutrition labels

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Number of individuals participating in the 'Successful Co-Parenting' program who feel more prepared to co-parent as a result of the program.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1122

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Current estimates indicate that about 40,000 Ohio marriages end each year. Of those divorces, approximately 45% involve families with minor children. The OSUE Successful Co-Parenting (SCP) curriculum is developed to equip divorcing parents with the knowledge, skills, tools, awareness, and strategies which will enable them to best help their children adjust to divorce. The primary audience of the SCP program are parents of minor children currently going through the divorce process. Though not the majority, parents of minor children who are never married, going through separation or providing kinship care are also included in the program.

What has been done
The Successful Co-Parenting class is delivered in a single two and a half hour session to the divorced parents of children. Topics discussed include: maintaining healthy parent-child relationships through the divorce process; teaching parents to identify and deal with their own grief and loss during the divorce period and how to maintain their own mental health; how and why to avoid conflict with their co-parent; how and why to maintain healthy communication with their co-parent and child(ren); the importance of creating a stable environment for the child(ren). A youth-based divorce education program (called What About Me??) was developed in 2018 and is being rolled out throughout Ohio.

Results
n 2018, 90.9% of participants (n=1122) completing evaluations for the Successful Co-Parenting program, feel more prepared to co-parent.

4. Associated Knowledge Areas

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

Outcome #7

1. Outcome Measures

Number of individuals participating in 'Healthy Finances' programming who indicated the intent to change one more behaviors as a result of attending an educational session.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	235

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It is not uncommon for individuals and families to experience financial troubles. Unexpected life events, such as losing a job, declining health, or loss of adequate health insurance can impact personal economic well-being. While these events are sometimes unavoidable, having financial management skills and a solid financial plan in place can help make coping with those life events more manageable. OSUE Healthy Finances education helps individuals and families improve their present and future economic well-being.

What has been done
In 2018, evaluation tools were collected from most participants attending Healthy Finances programs.

Results
On a post-session retrospective evaluation, more than 97% of the respondents indicated they plan to change one or more behaviors within the next one to six months after attending the program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being

Outcome #8

1. Outcome Measures

Number of 'Dining with Diabetes' (DWD) participants who report engaging in physical activities to help take control of their diabetes - fitting exercise into their daily routine, exercising continuously for at least 30 minutes at least three times per week, and being physically active on a daily basis.

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)

Diabetes costs Ohio $4.6 billion annually. According to 2015 state of Ohio data, more than 11.7% of Ohio adults have been diagnosed with diabetes. Since 2000, the number of Ohioans with diabetes has increased nearly 37%. Those with diabetes can develop serious health complications, including cardiovascular disease, blindness, kidney failure, and non-traumatic lower extremity amputations; diabetics lose an average of 10 - 15 years of potential life as a result of their disease.

What has been done
OSU Extension offers nutrition education for pre-diabetic individuals, which helps them to learn how to better manage their food intake and meals. Educational programs include live cooking demonstrations, menu planning, diabetes management, carbohydrate counting, insights on portion control, label reading, and healthy recipe taste-testing. The Dining with Diabetes (DWD) course is a three-part series, with three distinct modules.
DWD uses a pre-post evaluation tool, which matches responses from before the program to post-program. In 2018, 123 matched evaluation tools were returned (though the number of participants in the program was higher). Pre-test and post-test to measure knowledge (gains). Also 3-month follow-up conducted.

Results
In 2018, 97 'Dining with Diabetes' (DWD) participants reported engaging in physical activities to help take control of their diabetes - fitting exercise into their daily routine, exercising continuously for at least 30 minutes at least three times per week, and being physically active on a daily basis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle

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

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Successful Co-Parenting Evaluation Results:
In 2018, there were 1,248 individuals (completing evaluations); more than that attended programming. As of the end of 2018, this program was being offered in 11 of 88 Ohio

counties. The average age of participants was 36.2 years. Most of the participants (78.3%) were employed full-time. 78.0% of participants were experiencing their first divorce. Post-program retrospective evaluations revealed that 92.7% of individuals believed that they learned new information from the SCP program. 95.8% of participants indicated that they plan to use the information they learned in the program. 90.9% of participants feel more prepared to co-parent; 92.9% believed the class was helpful. 53.4 % of participants experienced a positive change related to how to use healthy communication techniques such as problem saving with co-parents.

Healthy Finances Evaluation Results:
On a post-session retrospective evaluation used in the "healthy finances" programs mentioned in this planned program, the following percentages of people experienced a positive change from 'before' to 'after' the educational intervention: 82.0% use written goals to guide financial decisions; 41.7% know their net worth; 78.7% set aside money for occasional expenses; 77.0% set aside money for emergencies. Following percentages of people indicated either 'agree' or 'strongly agree' on a 4-point scale: Learned new information from this program (98.4%); plan to use information I learned in this program (99.2%).

Dining with Diabetes Evaluation Results:
In comparison of the pre-test and post-test measuring knowledge, evaluations showed that 74.0% of participants scored better on the post-test (this is up from 2017, which was 66.7%). On the pre and post program evaluation, participants were given a list of several healthy behaviors, and asked how often they engaged in these behaviors. After the DWD program: 41.0% of participants reported eating a variety of fruits and vegetables more often; 65.6% considered portion sizes when making meal choices more often; 55.9% reviewed the food label before eating more often; 39.3% checked their feet more often. Additionally, 41.4% reported eating five or more servings of fruits and vegetables in a day more often; 31.0% reported eating baked fish more often. Over 88% reported cooking more at home; 92.7% reported eating smaller portions; over 66.7% are using the recipes provided by the program at home. Group A1C average decreased by 1.3.
Comments: "Am understanding that Diabetes is a very serious condition. Never realized how bad my diet was - especially when I was working. My B/P is under control, but I am really trying hard to get the Diabetes under control", "How I treat myself is very important! I think (feel) I knew the majority of the information in the class but you have made me think of myself & my health", "I've learned watching what you eat is very important. I've learned I'm the one that controls my future health. I've learned how important exercise is very important. I've learned you can have a healthy life if you want to."

Key Items of Evaluation

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 whit climate adaptive traits.
Global Food Security and Hunger (Outcome 1, Indicator 4.a)	
0	Number of participants adopting best practices and technologies resulting in increased yield, reduced inputs, increased efficiency, increased economic return, and/or conservation of resources.
Global Food Security and Hunger (Outcome 2, Indicator 1)	
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.