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

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I. Report Overview

1. Executive Summary

This document provides a report of Central State University's combined Research and Extension annual report of accomplishments and results for Federal Fiscal Year 2018.

Central State University (CSU), the only state-assisted Historically Black College and University (HBCU) in Ohio, became an 1890 Land-Grant Institution on February 7, 2014. Although CSU only begin receiving capacity formula funding in FY 2016, the institution was made eligible to receive Facilities Grant and allowed to participate in the competitive Capacity Building Grants (CBG) in 2014. To advance the land grant operations and to link the operations with academics, the College of Science and Engineering (CSE) was restructured as the College of Engineering, Science, Technology and Agriculture (CESTA) in November of 2017 with the approval of the Board of Trustees. Dr. Alton B. Johnson, the Dean of the College and Director of the Land Grant Programs led the efforts with numerous initiatives. For the Fiscal year 2018, CSU continued to receive 100 percent match support from the State of Ohio. On 7/17/2018, Mr. Anthony Barwick became the Interim Associate Director of the CSU Cooperative Extension Program (CEP) replacing Dr. Clarence Bunch. Mr. Barwick, until that time served in the CEP as the Program Leader for area of Community and Economic Development.

The Central State University (CSU) Land-Grant Mission is focused on the delivery of research, teaching, and extension services to the people of the State of Ohio. In Fiscal Year 2018, CSU continued to advance its 1890 Land-Grant Mission the University by structuring, organizing, building, purchasing equipment and additional vehicles, and by extending its research and extension presence across the state. In addition, research has purchase new and upgraded existing laboratory equipment for the purpose of teaching and research related to sustainable agriculture including environmental parameters and water resources for agriculture.

The CSU Land-Grant System continues to align the structure and operation of its Land-Grant Program with the mission of the Land Grant legislation to provide outreach and research- based information to Ohioans. On the research side CSU developed a Memorandum of Understanding (MOU)with the Montgomery County to collaboratively engage in research related to introducing smart water technologies and study the nutrient loading in the stream from wastewater operations of the Montgomery County Environmental Services (MCES). The CESTA appointed Dr. Kathleen Carter and Dr. Natalie Buxton in the field of health & nutrition on the basis of 50% teaching and 50% research. Mr. Mark Hoffmaster who was the farm foreman was moved up as he Assistant Director of Farm Operations. An aquaponics unit in the farm area across campus was constructed and further updating for the needed farm demonstration was completed. CSU also finalized an MOU with the City of Trotwood to offer extension related services. Formation of the Land Grant Advisory Council (LGAC) has been worked on and meetings had been set up to elect office bearers.

Extension

Our Cooperative Extension arm of Central State University Land-Grant has attracted and collaborated with

federal, state, and local entities, and we have expanded our outreach capacity with community-based groups, various industry sectors, specialty groups, and state organizations. Our Extension field staff has co-located in seven Ohio Counties which include, Cuyahoga, Lucas, Franklin, Butler, Hamilton, Montgomery, and Greene. Extension programs are focused on the needs of Ohioans and under-represented, limited resources, and socially disadvantaged individuals and families in rural, urban, and Appalachia areas in Ohio. As a result, we have had direct and indirect contact to approximately 43,000 people across the state of Ohio. We have developed over 20 Extension educational programs; created three 4-H Youth Summer Camps, engaged communities through 33 Community Events; conducted 4 Small Farm Conferences and carried out 7 agriculture education workshops; competed 4 Ag tours; worked with over 30 schools and groups with In-School and After School 4-H Youth Development programming; participated in 13 Community Economic Development workshops; provided education to over 4000 Ohioans through Family and Consumer Science events; and formed partnerships with 7 different organizations (City of Trotwood, Xenia's REACH, Montgomery County Foodbank, Greater Dayton Premier Management, Ohio Justice Policy Center, RID-ALL Cooperation, and USDA Natural Resources Conservation Service) in order to help Ohioans improve their lives and sustain communities.

CSU has entered into community partnerships with the following:

- **City of Xenia**, **Ohio** - Through an agreement between Xenia, Central State University and Central State University Extension, Greater Dayton YMCA, Clarke State Community College, and Kettering Health Network will open a new 75,200 square-foot building in January-2019. This facility will be open to the public where Extension personnel will provide free local programming within the four impact areas of Family Consumer Science, Community & Economic Development, Agriculture and Natural Resources, and 4-H. The demographics of the City of Xenia include: 83.30% White, 13.51% African American, 0.34% Native American, 0.29% Asian, 0.05% Pacific Islander, 0.53% from other races, and Hispanic or Latino,1.09% of the population. The median income for a household is $36,457, and the median income for a family is $43,046. Males have a median income of $34,497 versus $24,094 for females. 8.9% of families and 11.6% of the population were below the poverty line, including 14.8% of those under age 18 and 9.4% of those age 65 or over.
- **City of Trotwood, OH** - Central State University Extension will open a satellite office in Trotwood, OH, as part of a partnership to provide educational and community development activities. The partnership will include creating a center focused on community-based educational programming. The City of Trotwood is 2/3rds rural. Extension will also provide practical information to agricultural producers, small business owners, and consumers. Local families will be assisted through nutrition education, health and wellness activities, and youth leadership development.
- **Greater Dayton Premier Management** - As the largest public housing management entity in Montgomery County for affordable rental housing for eligible low-income individuals, families, the elderly, and persons with disabilities, CSU Extension will provide programming as it relates to healthy food nutrition, diabetes awareness and empowerment, criminal record expungement, Seed To Bloom Discovery Day Camp for youths 5th - 8th grade, and GED attainment.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	{No Data Entered}	28.0	{No Data Entered}	17.0
Actual	0.0	19.5	0.0	15.5

II. Merit Review Process

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

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

2. Brief Explanation

The CSU merit review process includes the development of Internal University Panel and Combined Internal and External Non University Panels in FY 2018 until July 2018. The Extension Program structure was rearranged in July, 2018 and efforts are underway to reorganize the panels.

Internal University Panel- For the Evans Allen Research Program the Internal University Panel included the new researchers in the program - Drs. Pratibha Gupta, Hongmei Li-Byarlay, Marcus Nagle and Sakthi K. Subburayalu. The research team was led by Dr. Subramania Sritharan and the group met as frequently as the schedule permitted to review the project progress and to determine resource allocations. Likewise, Extension created an internal merit process panel that consist of Mr. Anthony Barwick, Dr. Oliver Freeman, Dr. Prosper Doamekpor, and Dr. Mary Kershaw - CED, ANR, 4-H Youth Development, and FCS Program Leaders (respectively). The recommendations were implemented through the Dean/ Director's office.

Internal Universal Panel - Community Linkages - The researchers, Extension Specialist for Food Health and Nutrition, and the Program Leaders met often to discuss individual linkages with the different counties in Ohio.

Combined Internal and External University Panel - The joint CSU and OSU panel reviewed planned programs and served as part of the Extension Joint Internal and External Council to evaluate multi & joint program activities.

Combined Internal and External and External Non University Panel - The steering Extension committee between Ohio State Extension and Central State Extension meet monthly to discuss joint program development and discuss multi and joint program activities; to provide guidance on internal policy development and operations policy and provide advice on addressing stakeholders' feedback with co-located counties.

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 non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Survey of traditional stakeholder groups
- Survey of the general public
- Survey of selected individuals from the general public
- Other (focus groups, public information booths at local gatherings)

Brief explanation.

Stakeholders' participation is encouraged through surveys, focus groups, public information booths, and targeted invitation to traditional stakeholders, individuals and groups in several ways. The Evan Allen Program Researchers interacted with different stakeholders as they attended different meetings. All Evans Allen researchers Attended Farm Science Review in London, Ohio. in September 2018. Every year The Ohio State University organizes a two-day event in London, Ohio that is attended by approximately 140,000 visitors and 600 exhibitors to learn and share about the recent trends in agricultural production. The project personnel were able to attend Farm Science Review and gain useful insights in agricultural research.

Project I - Optimal Agronomic Practices to Reduce Nutrient Loading in Ohio's Water Bodies
We continue to hold meetings with Community Solutions for Collaborative Research Work on their farm fields. The project provided an opportunity to discuss partnership local watershed groups including Xylem, Tecumseh Land Trust, Greene County Soil and Water Conservation District, and NRCS Greene County. This effort gives opportunities for researchers to meet the farming community in the region with a particular emphasis on soil and water quality. A survey instrument is in the process of being developed to assess the existing nutrient management practices, tillage types, crop rotation and other conversation practices. The Extension educators are expected to assist with this survey.

Researchers also attended Farm Science Review (FSR) in London which gave an opportunity to meet with farmers, other researchers in the region, soil conservationists and also various extension agents. FSR provided an opportunity to meet also research collaborators interested in the research carried out by CSU.

Project II: Enhancement of Farm Productivity; Conservation And Sustainable Utilization Of Natural Products:
Knowledge has been transferred through participation in workshops, field visits, meetings, exchanges, educational programs. Through cooperation with CSU extension activities, results have reached minority youth, inner city populations as well as women and minority farmers. Scientists have worked directly with more than two thousand people on honeybee health and pollinators including beekeepers, bee breeders, farmers, and the general public in Ohio. These meetings give opportunities for researchers to receive feedback in informal ways from the stakeholders.

The project has generated significant information for farmers, policymakers, and other stakeholders regarding production and utilization of specialty crops, ecological conservation realization and apiculture. Knowledge has been transferred through participation in workshops, field visits, meetings, exchanges, educational programs. Seven undergraduate students have been directly involved in the research, with two additional students conducting related undergraduate research projects. Scientists have worked directly with more than 2,000 people on topics of specialty crops, natural products, pollinator health, beekeeping and have changed knowledge actions and conditions for key demographic groups including farmers, breeders, beekeepers, conservationists. Activities and results have reached segments of the general public especially through cooperation with CSU extension, including minority youth, inner city populations as well as women and minority farmers.

Project III - Enhanced Crop Production Efficiency through Mechanized Integrated Pest Management Strategies.
This agricultural technology integrated pest management research will impact the following audiences:

- Individual and Institutional Researchers (university or industry): to benefit from access to

affordable technical assistance for idea generation and modeling, prototype development, independent product assessment, continuing research recommendations, and specialized facilities.

• Industry Partners: to benefit from accelerating product integration and market access while reducing risks and costs.

• Growers (farmers, community gardeners, land managers, others): to benefit from an affordable, proven non-chemical.

• Stakeholders from farmer conferences and a farmer advisory committee associated with Global Neighbor, Inc., our industry partner, are looking forward to trying a field device that kills weeds using directed energy rather than chemicals. Once farmers understand that directed energy is similar to flaming, but with less crop damage, less misapplication due to wind blow or standing water, they are excited about trying a more measured technique. Directed energy is a complimentary solution to traditional field cultivation such as mechanical till. Farmers that use GMO crops are more interested in using directed energy to kill herbicide resistant weeds, and to reduce field operations. Many of these farmers are interested in going completely organic to gain cost share for their crops. Directed energy may be a viable option for weed control.

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 with existing and stakeholder)

Brief explanation.

1. **Method to identify individuals and groups**
   - Use Advisory Committees
   - Use External Focus Groups
   - Open Listening Sessions
   - Use Surveys
   - Other (one on one with existing and stakeholder)

Brief explanation.
Multiple methods were used to identify individuals and groups to seek stakeholder input. The Evans Allen researchers in the different projects identified the stake holders through the different meeting such as the Farm Science Review, Web search and with assistance from Extension specialists. The Cooperative Extension staff utilized advisory committees, surveys, focus groups, and face-to-face meetings.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- 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 groups interviews, qualitative data,)

Brief explanation.

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- Survey of selected individuals from the general public
- Other (focus groups interviews, qualitative data,)

Brief explanation.
The Evans Allen Researchers used individual contacts, advice from Extension specialists, web search and their prior experiences to obtain stake holder input. The process employed through Extension to seek stakeholder input included having the Extension county agents to reach out to local federal, state, local, civic, and community based organizations to identify individuals and groups that are stakeholder's and partner with the organization to conduct host events to meet and issue surveys to them. These efforts were made to ensure that the stakeholders involved included representatives of the limited resource households in terms of geographic location, family status, income level, race, age, gender, disability status, and users or non-users of existing educational programs.

3. A statement of how the input will be considered

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

Brief explanation.

A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
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- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities
- Other (to collect data and conduct research)

Brief explanation.
For both Research and Extension, the stakeholders' input is critical to the development of relevant research focus and Extension programs development. The Evans Allen researchers, the input was used to collect data and conduct research. For Project I, the farms to be selected for collection of field runoff data will be through a survey and with assistance from the NRCS conservationists in the area. For Extension, the inputs were used to create Extension programs based on community needs. It was essential to focus and affirm program locations and priorities. The stakeholders' input helped CSU be adaptive to societal needs and identify emerging issues. In addition, the input helped CSU shift direction in staffing arrangement and budgetary consideration based on the greatest needs of the population.

Brief Explanation of what you learned from your Stakeholders

There are three significant things that were brought to our attention from stakeholders: 1) the importance of research, 2) the impact of our community-based programming approach and 3) there is considerable interest among the area farmers in the three research projects conducted by CSU. For the research projects under the Evans Allen Research Program, the groups we met informed us that the research projects would bring meaningful impacts. With regard to Project I, the farmers have come forward for field data collection on agricultural runoff. For project II, the Levin Foundation, a philanthropic organization and an interest group has continued to support for the project on pollinators. Area bee keepers have donated beehives and bees for research. Research has appeared to be an important consideration for stakeholders. Based on survey responses and meetings conducted by Extension through more than 50 community events, many stakeholders across the state have expressed how effective CSU community-based program delivery approach has been in terms of outcomes-related to increased awareness and inclusion; and they have

expressed how they have been impacted in terms of improve conditions and being better informed. What we have learned is that when we listen, meet with, and work directly with the people it has a more profound impact on behavioral changes and knowledge gain and addressing group and individual needs.

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	0	2507612	0	1119704
Actual Matching	0	2507612	0	1119704
Actual All Other	0	0	0	0
Total Actual Expended	0	5015224	0	2239408

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	226097	0	267771

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Improving Agriculture, Plant Pathology, and Economics

☑ 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%		5%
102	Soil, Plant, Water, Nutrient Relationships		15%		10%
111	Conservation and Efficient Use of Water		0%		5%
112	Watershed Protection and Management		0%		10%
123	Management and Sustainability of Forest Resources		5%		0%
133	Pollution Prevention and Mitigation		0%		10%
135	Aquatic and Terrestrial Wildlife		15%		5%
136	Conservation of Biological Diversity		0%		10%
201	Plant Genome, Genetics, and Genetic Mechanisms		0%		5%
206	Basic Plant Biology		10%		0%
216	Integrated Pest Management Systems		0%		20%
402	Engineering Systems and Equipment		0%		10%
405	Drainage and Irrigation Systems and Facilities		0%		5%
605	Natural Resource and Environmental Economics		25%		5%
608	Community Resource Planning and Development		30%		0%
	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	0.0	7.0	0.0	4.5
Actual Paid	0.0	3.6	0.0	15.5
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	578844	0	1119704
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	578844	0	1119704
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

Three Research Projects are to be under taken: The activities corresponding to the three projects are given below.

Project I: Optimal Agronomic Practices To Reduce Nutrient Loading In Ohio's Water Bodies
Non Technical Summary: The Great Miami River basin is characterized by non-point source pollution due to runoff from agricultural runoff and urbanization. The river basin is also home for two lakes - Indian Lake and Lake Loramie.

These lakes are heavily used for recreation. Toxic algal blooms in the watershed has caused serious problems for users of River (upper) in Logan, Shelby, Mercer, Auglaize, Darke, Champaign, Hardin and Miami counties watershed in western Ohio. Land use in the Great Miami River (upper) watershed is comprised of 71% cultivated crops, 8% pasture and hay, 9% forest and 9% developed land. The project aims at developing solutions for reducing Nitrogen (N) and Phosphorous (P) in the runoff from, primarily the agricultural areas in the watershed by recommending appropriate agronomic practices for the farmers considering the climate and hydrological conditions in the watershed. Farmers are expected to benefit by the recommendations on optimal agronomic practices along appropriate timelines that will consider the effects runoff producing events under conditions of climate change. Water quality in the streams and lakes is expected to improve with the adoption of these practices which in turn will lead to better conditions for humans using the streams and lakes and the aquatic life in the system. In addition, CSU developed a partnership with Montgomery County Environmental Services (MCES) to engage in smart water technologies and assess nitrogen and phosphorous loadings by municipal systems into Miami River. The effort will assist in capital planning and support development of operational strategies for Montgomery County and the surrounding areas. MCES will optimize capital and maintenance expenditures to provide high quality water and wastewater services to its customers numbering over 530,000.

Project II - Enhancement of Farm Productivity; Conservation and Sustainable Utilization of Natural Products
Non-Technical Summary: Growing a diverse selection of crops can expand the small farmer's markets and offset commodity price swings. Profits will not depend exclusively on any one market example; such as corn or soy beans.

Therefore, strategic diversification improves the overall economic picture of the small farmer. However, help is needed to determine which alternative crop would be the best. The project aims to identify and test

novel native and exotic plants which have non-conventional uses like medicinal plants, anti-bacterial and anti-allergic properties. Apiary could be a multi-pronged benefit to the small farmer and aid the diversification. It not only produces honey wax and Propolis, but also enhances pollination and increases fruit tree production. Small animals for fiber production could also add to the diversification, such as the fiber yielding English Angora rabbit. The Ohio climate is ideal for Angora rabbits and the ease with which it is grown makes it an ideal product for diversification on an animal farm. In order to make the small farmer sustainable, it is essential to conserve natural prairies and wetland in the area. Ninety percent (90%) of the native prairies and wetlands are lost to land-use pattern changes in Ohio; therefore, what remains has to be carefully con served and managed in order them to play a role in the environment.

Natural wetlands, apart from cleaning up the water and providing a stock of underground water, also harbor rare plants and animals that aid in the sustainability of the farmer. This project proposes to develop methods to measure the biological integrity of the wetlands through long-term monitoring. It is envisaged to expand the research capability of CSU in order to 1) develop novel plant-based products and suggest alternative crops for small farmers. 2) identify varieties of rabbits for fiber and 3) develop winter-hardy mite-resistant honey bees. An integrating theme of food, nutrition and health (FNH) was added to this project to investigate the nutritional regimes and how natural products would assist along with exercise regimes for people with obesity, diabetes and other health issues.

The Mite Biting Behavior in Ohio Honey Bees: To select optimal honeybee stocks with high mite biting behavior, one undergraduate student Jada Smith conducted screening for mite biting behavior in different colonies in the Western and Central Ohio. The details of the 98 colonies and mite biting behavior are listed in Table 1 and 2. Mite samples showing in Figure 1 indicated legs missing from bees' biting behavior. The research student has read a lot of literature and reference papers on mite biting behavior and mite resistance, and also developed a workflow for mite sample observations and comparisons, and developed technical writing and scientific presentation skills for her future career. We have created a database of the 918 mites so far and plan to continue to add a lot more mites in the fall semester. The damaged mites are total of 450 on record with legs or mouthpart missing due to honeybee attacks. This is the first-hand data for scoring the mite biting behavior of each colony. This line of work will be presented as a poster for the American Bee Research Conference in Jan. 2019.

The Evolution of Honey Bee Mandibles: To understand the mite biting behavior, we need to research the evolution and functional morphology of the weapon that bees use to attack mites, which are the mandibles. The mandibles of these bees are used for biting mite legs or body parts, building combs, secreting mandible glands to feed young brood, and many other functions in the hive. We are using phylogenetic comparative methods to understand how the morphology has evolved and how it has affected patterns of honey bee's behavior. To observe the detailed structures of mandibles, one undergraduate student Jada Smith has used a microCT scanner called HeliScan at Ohio State University (Electron Microscopy and Analysis, CEMAS) to scan 12 samples from 6 colonies representing Purdue mite biting bees, and package bees (considered as less mite biting behavior) with more than 400GB of data. We plan to scan more samples from the Eastern Honey Bees which are mite resistant through evolution.

Honeybee Oxidative Stress and Aging: Oxidative stress is a redox-sensitive phenomenon that occurs when reactive oxygen species (ROS) are accumulating in a living system faster than their detoxification rate. ROS include (but not limited to) peroxyl radicals, hydroxyl radicals, hydrogen peroxides, and superoxide anions. ROS levels that exceed the capacity of antioxidant defenses, such as detoxifying enzymes and radical scavenging molecules, cause lipid peroxidation of cell membranes, crosslinking of proteins, DNA fragmentation and damage, and potential cell death. Some preliminary studies were carried in a few insect species. However, more knowledge is needed for oxidative stress in social insects. Among and within species considerable variation in ROS susceptibility and longevity exists. However, the mechanisms of this variation have not been elucidated. Specifically, survival advantages during an acute oxidative stress event or normal life history could be conferred by prevention, repair, or tolerance of

molecular damage. Feral and managed honeybees live in distinct environmental conditions including different management and natural resources. It is still unknown whether feral colony experience higher or lower oxidative stress compared with managed colonies.

To find out the answers to this question, from May 14, 2018 - June 22, 2018, one undergraduate student Brad Armstead has researched honeybee physiology and oxidative stress. We have sampled in different locations in Western and Central Ohio for existing feral colonies and managed colonies when weather permitted. We have collected in a total of 1394 individual forager bees from 15+ honeybee colonies in the summer. The student has reviewed relevant literature and reference on honeybee oxidative stress, aging. These samples will be used later for TBARS assay to measure the lipid damage as a parameter of oxidative stress. Also, current survival analysis is ongoing with a group of 20 live bees. The mortality of each colony is recorded every day including weekends. The student has gained skills in scientific research and critical thinking. Our deliverable products include sample collection of 15 colonies, material for the TBARS assay reflecting the oxidative stress and survival data.

Honeybee Grooming Behavior between European Honey Bees and Eastern Honey Bees.: The Eastern Honey Bee (Apis cerana) is Varroa mite resistant because this species has evolved with slightly different biology from the European Honey Bee (Apis mellifera) better grooming and hygienic behavior. In order to understand the mite resistance and accelerate the selection of mite resistance of Ohio bees (A. m.), PI performed an critical experiment to compare the individual and allogrooming behavior between A. m and A. c from July 16-July 29 in the Institute for Apicultural Research (IAR) of the Chinese Academy of Agricultural Research (CAAS). In total, more than 500 bees were marked for age on the first day of our experiment. On day 8, we collected 8-days old marked nurse worker bees and filmed their grooming behavioral assays with a total of 236 bees and 118 videos. Among these bees, 124 of them were A. c, and 112 of them were A. m. All the videos are saved in our lab's hard drive.

Project III: Enhanced Crop Production Efficiency through Mechanized Integrated Pest Management Strategies

Non-Technical Summary: Agriculture producers have long sought cost-effective, labor friendly methods to maximize crop yield by controlling weeds and pests sustainably as part of an integrated pest management strategy. This is especially true for specialty crop and organic producers. Current research into pest management strategies and precision agriculture at Central State University includes smart vision machines to kill weeds using directed energy - a non-chemical, high energy method of eradication. This research will develop and evaluate precision agriculture, sensors and smart vision, robotics and automation technologies. Central State University intends to extend current research from a Capacity Building Grant into a mechatronics, integrated pest management research program. New, non-chemical methods for controlling weeds, such as directed energy, will be evaluated and tested for use in agricultural and conservation settings. Directed energy mimics the power of the sun with artificial light (40-80 times of sun power) to kill weeds. Research into pest management machinery and weed identification software will continue to be integrated with smart vision to allow machines to distinguish weeds from crop plants to improve efficiency of mechanized weed control. Alternate uses for this technology will be evaluated for controlling tree crop diseases of the bark including bacterial, insect and viral infections.

Major activities completed: The research objective for agricultural technology was to promote research in integrated pest management weed control. Directed energy may serve as a weed control option that is beneficial for farmers to increase crop efficiency and decrease economic burden due to weeds. Specific goals for the summer 2018 were to: 1) develop an experimental design and test the ability of light energy to kill weeds in a soybean field; and 2) complete tests on killing Japanese Knotweed, an invasive weed along waterways in Ohio, using light energy. In addition, five undergraduate students worked on the overall project objective and were mentored by one of the three faculty members (Drs. Morris, Lowell and Cao) on their own project related to agricultural technology. These projects included: 1) design and build small-scale hydroponic systems for consumers to evaluate cost and ease of use; 2) Training software to

distinguish crops and developing phone applications; 3) dandelion root respiration changes in response to directed energy and glyphosate; 4) control of Japanese Knotweed in riparian corridors; and 5) investigation of Japanese Knotweed extracts of resveratrol as a value added commodity from an invasive weed.

In 2018, Central State University Extension (CSUE) conducted a number of workshops, presentations, field days, and community programs to provide knowledge and engagement opportunities to Ohioans in both urban, rural, and Appalachia. CSUE continued to implement programs involving soil, plant, water, nutrient relationships, community resources and planning, natural resources and environmental economics, aquatic and terrestrial wildlife. In June 2018, we hired Ms. Jamie Dahl, who began working in Appalachian Ohio and educating and engaging Ohioans in natural resources and and forest management practices including: oak-hickory ecosystems, youth programming, woodland legacy planning, and Women Owning Woodlands.
CSUE's Extending Your Growing Season program, which was developed in partnership with NRCS in 2017, continues to impact the urban community. One of our first graduates of the program, Steve, constructed his 2160 square foot high tunnel in August through assistance of the EQUIP program.
He plans to utilize it for season extending, growing spinach, tomatoes, and cucumbers. He stated, "[the high tunnel] will allow us to provide fresh spinach during the winter and perhaps one other cold hardy leafy green crop. ... We should be very early to market with short harvest varieties of tomatoes".
CSUE sponsored and hosted the Minority, Women, and Small Farmers' (MWSF) Spring Conference which brought together nearly 200 farmers from across Ohio for 20 technical presentations and panel discussions pertaining to sustainable agriculture and ways to improve small farming practices.
CSUE participated in additional large-scale community events (10), county fairs (7), the Ohio State Fair, and the 2018 Farm Science Review, sponsored by The Ohio State University. At these events, CSUE provided outreach education for both adults and youth on agricultural topics ranging from pollinator health, to aquaponics and sustainable agriculture, to cover crops and soil nutrients. These events yielded potential educational opportunities to the hundreds of thousands of individuals in attendance.

2. Brief description of the target audience

The targeted audiences are farmers, small farmers, general public, new beginning farmers, limited resource growers and families, and women and minority farmers from rural and urban communities. AFWRC and CEP information will be shared with fellow scientists from STEAM programs, fellow agencies such as USDA, ODA, Ohio DNR, and EPA, political entities, K-12 administrators and counselors and fellow scientists and students in the fields of sustainable agriculture, water resources management, environmental engineering, manufacturing engineering, and agricultural education and food science.
Specifics:
Project I: The primary target audiences are farmers, crop advisors, extension personnel and other stakeholders who make management decisions on farm fields. The project goal of identifying optimal agronomic practices that will reduce nutrient loading in the Great Miami River (GMR) Watershed through establishment of edge-of-field water quality monitoring at farmer's fields was communicated to stakeholders that are actively pursuing agricultural sustainability and environmental quality in the GMR watershed and other areas of the state. Specifically, through personnel meetings the goals were communicated to Miami Conservancy District (MCD), Community Solutions, Tecumseh Land Trust, and County soil and water conservation districts in the GMR watershed. The goals were also communicated to other on-farm researchers and extension personnel in the state during the annual Farm Science Review hosted by The Ohio State University and at the annual Crop, Agronomy and Soil Science society of America meeting.

Project II: Small farmers and under-represented farmers of the area.

- Ohio Department of Natural Resources
- US Fish and Wildlife Services

- US Army Corp of Engineers
- Industry Partners will benefit from accelerating product integration and market access, while reducing risks and costs.
- Growers (farmers, community gardeners, land managers, others) will benefit from the development of new, economically viable agricultural products.
- Undergraduate students directly involved in the research
- Beekeepers/queen breeders in Ohio
- Small farms/natural product businesses
- Local organizations in Yellow Springs OH working on land conservation
- Sustainable Agriculture Undergraduate students at CSU
- Local farms, businesses and communities in southwestern Ohio
- Dieticians
- Healthcare Providers
- Individuals interested in improving health

Project III: The target audience included organic farmers and gardeners, scientists and undergraduate students. The directed energy technology is non-ionizing and therefore, organic. Directed energy is an integrated pest management strategy. Any farmer, conventional to organic, interested in methods to reduce herbicides is the target of this technology. Machinery built to house directed energy with selective computer visualization to kill weeds focused on farmers in organic farm fields such as soybeans. Information was shared in a variety of venues that included organic farmers, Ohio state legislators, and fellow scientists. Impacted target audiences are listed below.

- Individual and Institutional Researchers (university or industry) Industry Partners
- Growers (farmers, community gardeners, land managers, others) CSU Faculty and Research Faculty
- CSU Undergraduate Students
- Prospective CSU Undergraduate Students

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	1874	11082	818	7466

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	10	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Educational demonstrations for farmers in general and small, limited-resource, and minority farm families in particular on best management practices and best available technologies on sustainable agriculture.

Year	Actual
2018	15

Output #2

Output Measure

- Number of Educational programs, activities, or events on ecosystem services and sustainable agriculture

Year	Actual
2018	85

Output #3

Output Measure

- Research publications related to different components of sustainable agriculture

Year	Actual
2018	10

Output #4

Output Measure

- Research-based, reader-friendly pamphlets, and fact sheets on sustainable agriculture and farm economics

Year	Actual
2018	12

Output #5

Output Measure

- In each output measure, we will take inventory on total number of participants.

Year	Actual
2018	2692

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	To identify new knowledge, techniques and improved hypothesis on questions related to Natural Resources and Environment
2	To identify research activities Plant Health, Plant production and Products as to generate new knowledge, information, techniques, and tools.
3	To identify research activities related to Agricultural Systems and Technology such as new knowledge, techniques, improved hypothesis on questions.
4	To identify research activities such as new knowledge, techniques and improved hypothesis on questions related to Agricultural Economic and Rural Communities

Outcome #1

1. Outcome Measures

To identify new knowledge, techniques and improved hypothesis on questions related to Natural Resources and Environment

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	250

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many of the urban, rural, and Appalachian Ohio participants which have attended our formal and informal programs, workshops or outreach events have gained new fundamental knowledge pertaining to agriculture.

What has been done
We have conducted farm visits, educational workshops, field days, attended Farm Science Review, the Ohio State Fair and other large-scale community events.

Results
Participants have described that through our community-based approach, they have learned and improved their knowledge.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

123	Management and Sustainability of Forest Resources
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
201	Plant Genome, Genetics, and Genetic Mechanisms
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment

Outcome #2

1. Outcome Measures

To identify research activities Plant Health, Plant production and Products as to generate new knowledge, information, techniques, and tools.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

To identify research activities related to Agricultural Systems and Technology such as new knowledge, techniques, improved hypothesis on questions.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	150

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many of the social disadvantaged participants which have attended our workshops or events have gained new fundamental knowledge. Other scientists and extension specialists have gained knowledge of the research elements of our research work

What has been done
We have conducted educational workshops, meetings and participated in events related to agriculture and natural resources.

Results
They have described that, through our community-based approach, they have learned and improved their knowledge.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
201	Plant Genome, Genetics, and Genetic Mechanisms
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
405	Drainage and Irrigation Systems and Facilities

Outcome #4

1. Outcome Measures

To identify research activities such as new knowledge, techniques and improved hypothesis on questions related to Agricultural Economic and Rural Communities

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	30

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Farmers are interested in eliminating weeds in agricultural weeds without applying chemicals. There is a growing demand for organic agricultural produce. The bee keepers in the area are very cooperative with our honey bee program. Community organizations in the area such as Agraria, Propolis and few others are actively interacting with our researchers to develop sustainable agriculture in the region. Farmers in the area are interested in cooperating with our researchers in agricultural runoff studies as they see the benefits.

What has been done

We are partnering with farmers and community organizations to establish a network of water quality monitoring systems both in-stream and edge of fields. Numerous studies related pollinators have been initiated with beehives set in in the areas Researchers from CSU have been engaged in applying directed energy in eliminating weeds in agricultural fields. Particular attention was given to Japanese Knock weed- an invasive species.

Results

The monthly analysis of P and N concentration levels from the Greater Miami River stretch for each year showed variations with much lower values in August and September. Important results include: a N level drop from 6.78 mg/l in site #6 (upstream) to 1.97 mg/l in site #1 (downstream) for March 2017 ; and a sudden decrease of P levels in sites #2 and #3 for years 2015 and 2017 in the month of April . Research areas have been established in the CSU greenhouse as well as at the newly formed agricultural research station. Permanent collections have been expanded at both sites and first rounds of experiments were completed at the research station in summer 2018. Completed limited tests on killing Japanese Knotweed, an invasive weed along waterways in Ohio, using light energy

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
136	Conservation of Biological Diversity
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology
216	Integrated Pest Management Systems
402	Engineering Systems and Equipment
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Government Regulations
- Competing Programmatic Challenges
- Other (support in school for programs)

Brief Explanation

CSU is a new 1890 Institution and relies totally on the appropriations of Federal funding to conduct its Land Grant activities. There have been government regulations and uncertainties in the level of funding CSU is expected for its capacity grants. There are competing programmatic changes when the state releases its match after seeing the Federal allocation. The delays in the arrival of funds from the Federal side slows down the project activities and ability to hire staff.
Funding is a significant external factor affecting outcomes.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

CSU is a new 1890 Land Grant program and the evaluation of the research activities has not begun since we are still setting up instruments and the research faculty are getting trained in the use of the new equipment. Field research components are being just set up. We could engage in evaluation only after achieving some maturity in the research activities.
CSU Extension conducted 45 programs to educate Ohioans. Participants responses from these events were that they received new knowledge. In addition, the evaluation from the population surveyed resulted in behavioral changes as they learned about specific programs for new and beginning urban clients interested in farming.

Key Items of Evaluation

The need to develop specialized evaluations instruments to capture cognitive social changes for the planned program is a key item of evaluation. However, timely allocation of funding for the research and extension land-grant programs would be most helpful for having the financial ability to hire specialized staff that can prepare, distribute, and retrieve better evaluation instruments for the planned program.

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V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Developing Better Socio-Economic and Sustainable Communities

☑ 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		30%		0%
607	Consumer Economics		20%		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	0.0	7.0	0.0	4.5
Actual Paid	0.0	3.5	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	526042	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	526042	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

The development of the CSU Land Grant planned program Developing Better Socio-Economic and Sustainable Communities has been a four-phase approach with the goal of transcending social, economic, political, and academic boundaries, all in the interest of assembling wide-ranging expertise in the delivery of services to vulnerable and under-served communities in the state of Ohio. From recent engagements with local residents and community partners, there is a strong interest in small business entrepreneurship and per the Ohio revised code of 125.081 with Ohio is a set-aside law state, programs are in the process of being developed. The scope of entrepreneurship programming will range in categories from business start-ups, to existing firms, to established companies. For business start-ups, the areas of focus will include: Business Plan Development, Business Entity Creation, Filing with the Secretary of State with the Appropriate Business Entity, Acquiring Business Tax ID's with the Internal Revenue Service, and Product/Service Development. For existing firms, the areas of focus will be: Business Certifications, Business Website Design, Procurement & Contracting with the State of Ohio, Business Development Strategies, and Available Funding Sources. In regards to establish companies, the areas of focus will be: Understanding Balance Sheets, Employee Withholdings, FICA & FUTA, Federal Contracting, Business Pitch Opportunities, Marketing Strategies, and Partnership Expansion.

Record Expungement

One of the common barriers to employment is a person with a criminal record. A criminal record can create difficult consequences, whether the record is for having been arrested or convicted (or both). Employers and landlords commonly ask job applicants and rental applicants whether they have ever been convicted of (or perhaps even arrested for) a criminal offense. Employers might not hire and landlords might not rent to people who answer "yes" to these questions. In September 2018, we designed a program called the Second Chance Legal Clinic, where we educated individuals on the terminology, procedures, and the actual record expungement process for qualified applicants. Expungement refers to the process of sealing arrest and conviction records. Virtually every state has enacted laws that allow people to expunge arrests and convictions from their records. Though the details can vary from one state to the next, most states' laws provide that once an arrest or conviction has been expunged, it need not be disclosed, including to potential employers or landlords. The Second Chance Legal Clinic consisted of a partnership with a local legal firm who provided private 1-on-1 expert legal assistance. Trained legal staff (attorney(s), paralegal(s)) screened and researched each applicant for information regarding record sealing, expungement, juvenile and adult records, collateral consequences, background-check errors, mitigation of fines, fees and costs. The appropriate legal forms were provided, and the legal firm provided laptop computers for the clinic. There was no cost or fee to the applicant for this program.

Ready, Set, Grow! - Business Basics for Start-Up, Small, and Agribusinesses

One of our signature CED programs that has been disseminated is our Ready, Set, Grow! business development platform, which is designed for aspiring start-up, small, and agri-businesses who are seeking basic business assistance as they embark upon their new journey in entrepreneurship.

Each workshop is developed to help beginning entrepreneurs realize the dream of business ownership, and assist existing businesses to remain competitive in a complex and ever-changing global marketplace. Along with each program are business advisors to provide a variety of free business consulting and no-cost training services, including: Business Plan Development, Identifying Your Customer, Business Certifications, Access to Capital, and a round-table discussion with an existing and successful small business owner(s).
The curriculum outlined into four areas below:
Business Plan Development

- Increase knowledge and confidence concerning entrepreneurship

- Proper formation of the participant's business
- Business plan development
  - Assigned Small Business Development Center (SBDC) Representative
    - 30 to 60-minute presentation

Identifying Your Customer

- Creating a customer profile
- Your initial assessment of your customer with market research
- Tailoring your business to speak to your customer
  - Local marketing expert representative
    - 30 to 60-minute presentation

Business Certifications

- How to do business with the State of Ohio
- MBE/EDGE Minority Certifications
- Business Strategies
  - Assigned State of Ohio - Minority Business Assistance Center Representative
    - 60-minute presentation

Access to Capital

- Small business loan options - pros & cons
- SBA loans
- Marketplace lenders
- Business credit cards
- Merchant cash advances
  - Local Bank Representative / Bank Loan Officer
    - 30-60-minute presentation

2. Brief description of the target audience

More than 340,000 poor families live in Ohio; this represents 11.6 percent of the families in the state. 16.0 percent of the population or 1,797,000 people who fall below the poverty line. Much of the cause of this poverty is lack of opportunities in the local communities for jobs. According to the 2015 Ohio Poverty Report, families with children ranging from 7.3% among married couples to 55.3% for those headed by female single parent experienced poverty during the last year.

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	997	1032	62	125

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Demonstrate how consumer behavior affects purchasing decisions. Conduct seminars on family economics and spending and their effect on local markets
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- Conduct and evaluate seminars on poverty, welfare, and economic discrimination

Year	Actual
2018	0

Output #3

Output Measure

- Conduct training for small, minority, farmers, and participate in small business development training with local partners (DDC, TEC, etc.)

Year	Actual
2018	47

Output #4

Output Measure

- Conduct and evaluate seminars on poverty, welfare, and economic discrimination

Year	Actual
2018	0

Output #5

Output Measure

- Establish urban farms within local (Greene and Montgomery County) municipalities.
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Conduct Personal Finance Seminars, Retirement Seminars
  Not reporting on this Output for this Annual Report

Output #7

Output Measure

- Conduct Seminars in predatory lending and protecting the consumer.
  Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Conduct seminars in building better relationships and reducing household stress.
  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	Demonstrate how consumer behavior affects purchasing decisions. Conduct seminars on family economics and spending and thier effect on local markets. The Planned Program will interface with local and regional relief agencies in order to sponsor seminars on selected topics including shopping in your neighborhood, consuming products grown and raised by local farmers, making better economic decisions, and leveraging the distribution of labor in the family.
2	Conduct and evaluate seminars on poverty, welfare, and economic discrimination in underserved and economically at-risk communities. These seminars will cover a variety of topics including fair housing, economic discrimination, equal pay in the workplace, job availability, and the availability of economic opportunities in the geographic area. Seminars will also be used to teach participants to dress for interviews, interviewing skills, completing employment applications, and career planning.
3	Engage economic development & entrepreneurial partners in Greene & Montgomery counties to conduct quarterly education workshops to promote sustainable agriculture development in urban areas Partner with Dayton Development Coalition & Dayton Entrepreneur Center to provide information on sustainable business formation by embedding agriculture specific business development with standard financial business management skills. Collaborate with the Greene County & Montgomery County Small Business Development Centers to provide group discussions to urban farm entrepreneurs to learn about funding sources and small business loans. Conduct yearly one-day seminar with County stakeholders with breakout sessions to include the following: entrepreneurial urban farming workshops with case studies, commercial food marketing, managing a startup business, and how to successfully transition from farm to market in an urban setting.
4	Programs in this area will develop business educational workshops to engage minority farmers in Ohio over a five year period resulting in effective farm to table management practices to benefit urban communities. Engage with municipality stakeholders to target green spaces in targeted food desert areas to develop community urban farming plots. Conduct group discussions in faith based locations to educate individuals how to raise their own gardens in urban settings and promote healthier food choices Conduct train-the-trainer demonstrations with agriculture partners on the most effective urban gardening techniques on an on-going basis.
5	Conduct Personal Finance Seminars teaching participants how to develop household budgets. Conduct seminars on retirement planning. Teach participants the benefit of having good credit ratings and how to develop banking habits that will result in having good credit.
6	Conduct seminars in building better relationships and reducing household stress and in relationship management focused on keeping children in functional households. Plan activities with the child support advocate groups. This outcome can also benefit from teen parenting seminars, alcohol and drug abuse resistance, and attending college.
7	Gain technical skills and knowledge in entrepreneurship programming in categories ranging from business start-ups, to existing firms, to established companies

Outcome #1

1. **Outcome Measures**

Demonstrate how consumer behavior affects purchasing decisions. Conduct seminars on family economics and spending and thier effect on local markets. The Planned Program will interface with local and regional relief agencies in order to sponsor seminars on selected topics including shopping in your neighborhood, consuming products grown and raised by local farmers, making better economic decisions, and leveraging the distribution of labor in the family.

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Conduct and evaluate seminars on poverty, welfare, and economic discrimination in underserved and economically at-risk communities. These seminars will cover a variety of topics including fair housing, economic discrimination, equal pay in the workplace, job availability, and the availability of economic opportunities in the geographic area. Seminars will also be used to teach participants to dress for interviews, interviewing skills, completing employment applications, and career planning.

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Engage economic development & entrepreneurial partners in Greene & Montgomery counties to conduct quarterly education workshops to promote sustainable agriculture development in urban areas Partner with Dayton Development Coalition & Dayton Entrepreneur Center to provide information on sustainable business formation by embedding agriculture specific business development with standard financial business management skills. Collaborate with the Greene County & Montgomery County Small Business Development Centers to provide group discussions to urban farm entrepreneurs to learn about funding sources and small business loans. Conduct yearly one-day seminar with County stakeholders with breakout sessions to include the following: entrepreneurial urban farming workshops with case studies, commercial food marketing, managing a startup business, and how to successfully transition from farm to market in an urban setting.

2. **Associated Institution Types**

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2018	200

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done
CSUE sponsored and hosted the Minority, Women, and Small Farmers' (MWSF)Conference on the CSU Main campus (Greene). The conference provided insight into traditional agriculture challenges, urban agriculture opportunities, and barriers facin new farmers, small farmers, women, veterans, socially disadvantaged groups, and communities. Sessions where offered pertaining to agriculture finance and government assistance programs, as well as agri-business start-up programs.

Results
Approximately 200 participants from across Ohio and northern Kentucky attended the conference. Surveyed participants reported that they improved their knowledge and plan to implement one or more things they learned at the conference.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development

Outcome #4

1. Outcome Measures

Programs in this area will develop business educational workshops to engage minority farmers in Ohio over a five year period resulting in effective farm to table management practices to benefit urban communities. Engage with municipality stakeholders to target green spaces in targeted food desert areas to develop community urban farming plots. Conduct group discussions in faith based locations to educate individuals how to raise their own gardens in urban settings and promote healthier food choices Conduct train-the-trainer demonstrations with agriculture partners on the most effective urban gardening techniques on an on-going basis.

2. Associated Institution Types

- 1890 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)

What has been done

Results

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

Conduct Personal Finance Seminars teaching participants how to develop household budgets. Conduct seminars on retirement planning. Teach participants the benefit of having good credit ratings and how to develop banking habits that will result in having good credit.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Conduct seminars in building better relationships and reducing household stress and in relationship management focused on keeping children in functional households. Plan activities with the child support advocate groups. This outcome can also benefit from teen parenting seminars, alcohol and drug abuse resistance, and attending college.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Gain technical skills and knowledge in entrepreneurship programming in categories ranging from business start-ups, to existing firms, to established companies

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	750

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done
Developed informative Ready, Set, Grow! workshop series which provides business basics for small and start-up businesses. Varying modules of the program were offered in five counties.

Additional single-meeting programs, including Intro to LLCs and Corporations, and Crowdfunding for Entrepreneurs continued to be offered.

Results
Each workshop is developed to help beginning entrepreneurs realize the dream of business ownership, and assist existing businesses to remain competitive in a complex and ever-changing global marketplace. Participants have described that through our community-based approach that they have learned and improved their knowledge.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Other (Staffing limitations)

Brief Explanation

CSU is a new 1890 institution and relies totally on the appropriations of Federal funding to conduct its Land Grant activities. There have been uncertainties in the level of funding CSU is expected for its capacity grants. However, there are competing public priorities for participants with seeking education assistance. But, funding is a significant external factor affecting outcomes because a lack of funding enables CSU to hire additional staff.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The CSU Extension conducted approximately 60 educational programs and hosted one conference to educate socially disadvantaged, limited-resourced, under-served and under-represented groups. Participants' responses from these events were that they received new knowledge.

Key Items of Evaluation

The need to develop specialized evaluations instruments to capture cognitive social changes for the planned program is a key item of evaluation. Timely allocation of funding for the research and extension land-grant programs would be most helpful for having specialized staff prepare, distribute, and retrieve better evaluation instruments for the planned program.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Building Families and Communities

☑ 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
701	Nutrient Composition of Food		15%		0%
702	Requirements and Function of Nutrients and Other Food Components		10%		0%
703	Nutrition Education and Behavior		40%		0%
704	Nutrition and Hunger in the Population		20%		0%
724	Healthy Lifestyle		5%		0%
801	Individual and Family Resource Management		10%		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	0.0	7.0	0.0	4.0
Actual Paid	0.0	5.8	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	691405	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	691405	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

Building Families and Communities program area targets families and individuals with limited resources and living in underserved communities. Programs have been conducted in the five largest metro counties Cuyahoga, Franklin, Hamilton, Lucas and Montgomery. Many of the programs have targeted the health and wellness of the community.

The Expanded Food and Nutrition Education Program (EFNEP) has expanded into two counties, A new Program Assistant was hired, Stacey Stangel for the Cuyahoga county program. The Montgomery County program has continues to expand throughout the year as Program Assistant Donna Kuykendall raised awareness with new audience of the importance of good nutrition. The adult EFNEP utilizes a curriculum Eating Smart - Being Active. The 9 week program focus on improving dietary choices, food resource management, food safety, improved food preparation skills and physical activity. 70% of the adults enrolled complete a minimum of 6 classes and graduate at the end of the 9 week program. The youth EFNEP program target middle and high school age students in afterschool programs and clubs. The curriculum used is Teen Cuisine, a six session program that focuses on making wise food choices, food safety, food preparation and physical activity. Participants completing the Teen Cuisine program report improved fruits and vegetable consumption (78%) and are able to prepare their favorite fruits and vegetables at home (77%). In addition, the youth EFNEP program uses MyPlate curriculum for younger children attending camps and in-school enrichment programs. The program plans to expand to an addition county in FY2019.

According to the Centers for Disease Control (CDC) more than 1 out of 3 American adults have elevated blood sugar levels. This serious health condition is associated with an increase risk of developing type 2 diabetes, heart disease and stroke. In addition, individuals of color are at a higher risk than non-Hispanic white Americans. To respond to this growing health problem the Building Families and Communities team attended a three day train-the-trainer Diabetes Empowerment Education Program™ (DEEP™) training during FY2018. Programming began in the summer of 2018. This program targets individuals, with pre-diabetes, diabetes or a family member of someone with diabetes to assist them in understand this chronic illness and learn behaviors to prevent complications, develop positive self care skills and learn about available resources.

To address the diabetes problem in the African American male population in Dayton the BFC and CED Team organized a men's health event "Men Take a Stand for your Health during men's health month. A panel of health care providers discussed complications and prevention strategies of diabetes. Families took advantage of health screenings, seminars and learned about resources available to them in the community. A local chef demonstrated healthy grilling techniques.

Additional programming in the metro areas included eating Right on a Budget, importance of Family Meal Time for improving communication, financial literacy, addressing childhood obesity with a program series called "Let's Get Turned Up to Turn It Around, the program includes nutrition, wise beverage choices and physical activity. The program targets elementary school children participating in school enrichment programs. The Art of Food Preservation is a 5-part series to demonstrate safe food preservation techniques, salt free food preparation, stress management, and building successful teams.

CSUE partnered with CSU Counseling Service to conduct a food security survey of CSU students and surrounding community. Of the respondents 79% shared the food they purchase does not last through the month, 63% indicated they cut the size of their meals or skipped a meal to make the food last. To help alleviate food insecurity of students and community. CSUE has partnered with Dayton Food Bank to bring a mobile food pantry to campus once a month. Student volunteers and CSUE staff assist with the

distribution of food each month. Each month a greater number of participants take advantage of the pantry regardless of the weather, demonstrating a huge need and impact on food security.

2. Brief description of the target audience

The Building Families and Communities planned program will be shared and made available to under-represented, limited resourced, and socially disadvantaged individuals and families in rural and urban areas in Ohio,

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	1285	4212	903	618

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational sessions held. Total number of participants in this event/project who are defined as under-represented individuals (e.g. women, minorities, individuals with disabilities, small farm owners, etc.) Total number of participants in this event/project who are defined as under-served individuals (i.e. individuals whose needs have not been addressed in past events)

Year	Actual
2018	132

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Participants will identify influences on food intake and dietary patterns specifically in relation to decision making
2	Participants will describe and identify elements of a healthy lifestyle
3	Participants will describe elements of individual and family resource management
4	Participants will identify characteristics of human development related to social, cognitive, emotional, and physical development of individuals and families over the human lifespan

Outcome #1

1. Outcome Measures

Participants will identify influences on food intake and dietary patterns specifically in relation to decision making

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	425

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many of the participants which have attended our workshops or events have gained new fundamental knowledge.

What has been done
We have conducted educational workshops.

Results
Participants have described that through our community-based approach they have learned and improved their knowledge.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Participants will describe and identify elements of a healthy lifestyle

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	400

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many participants which have attended our workshops or events have gained new fundamental knowledge.

What has been done
We have conducted educational workshops.

Results
Participants have described that through our community-based approach they have learned and improved their knowledge.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Participants will describe elements of individual and family resource management

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	550

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many participants which have attended our workshops have gained new fundamental knowledge.

What has been done
We have conducted educational workshops.

Results
Participants have described that through our community-based approach they have learned and improved their knowledge.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #4

1. Outcome Measures

Participants will identify characteristics of human development related to social, cognitive, emotional, and physical development of individuals and families over the human lifespan

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	100

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Participants that have attended our workshops or events have gained new fundamental knowledge.

What has been done
We have conducted educational workshops.

Results
Participants have described that through our community-based approach they have learned and improved their knowledge.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Other (Staffing turnover/limitations)

Brief Explanation

CSU is a new 1890 Land Grant Institution and relies totally on the appropriations of Federal funding to conduct its Land Grant activities. There have been uncertainties in the level of funding CSU is expecting for its capacity grants. However, there are competing public priorities for participants with seeking education assistance.
Additionally, unforeseen staffing turnover has created setback for programming.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Parents are learning the benefits of regular meal planning skills, how to save more money on groceries and how to prepare simple yet healthy meals for their families. Parents are also having an enjoyable time while learning. After the program, some have had attitude changes by expressing their willingness to help their spouse more and put the responsibility on them.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Creating Youth Pathways to Success

☑ 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
801	Individual and Family Resource Management		5%		0%
802	Human Development and Family Well-Being		5%		0%
806	Youth Development		90%		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	0.0	7.0	0.0	4.0
Actual Paid	0.0	5.5	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	711321	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	711321	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

The Central State University 4-H and Youth Development Program currently addresses societal need by providing strong and resilient individuals, families, and communities in Ohio. The program goals include:

- Enable youth to build positive relationships with caring adults and peer groups.
- Build a youth leadership program that creates a multi-cultural experiences in urban and rural communities.
- Create opportunities that will enhance and engage youth in experiential learning activities and events that foster their skills and competencies.
- Help youth identify and make informed choices to contribute to their families and community.

The CSUE Creating Youth Pathways to Success planned program is working to achieve these goals through hands-on inquiry-based learning opportunities offered through in-school, afterschool, and summer camp programming. Our programs offer experiential learning opportunities which sensitize and stimulate interest in the Science, Technology, Engineering, Agriculture, Math (STEAM) curriculum while also promoting leadership, problem solving, and critical thinking in a team setting.
In 2018, nearly 4,000 youth participated in a CSUE 4-H and Youth Development program. We completed approximately 125 programs in six counties (Butler, Cuyahoga, Franklin, Greene, Hamilton, and Montgomery). We have partnered schools, organizations, and faith based Institutions.
In addition to our on-going in-school and after school efforts, CSUE offers several programs in the summer to engage youth from across the state in STEAM science and 4-H youth development. Specific programs include:

- Partnered with The State Ohio Baptist General Assembly to conduct a three-day agricultural education workshop for 50, 6th-11th grade youth from across the state. This year, the students learned about healthy soils and created a composting container. Students also learned about how healthy soil contributes to growing healthy food and made a healthy snack.
- Held the Seed to Bloom Ag-STEM Institute (80 students) - a two-week residential summer camp which exposes 6th, 7th and 8th grade youth to all major areas of STEM science courses and their inter-connectivity to Agriculture in addition to the Youth Professional Development courses in alignment with nationally recognized 4-H standards. All STEAM courses are focused on Agricultural based projects.
- The Central State University Research and Extension Programs are committed to bringing awareness to youth showcasing opportunities in STEM sciences.

The Research and Extension Apprentice Program (REAP) was initiated in the summer of 2018 to attract high school students to Central State University and provide hands-on research opportunities with faculty and extension staff. In its first year, the program hosted 27 high school students from across the state of Ohio. After two weeks, students prepared posters and gave an oral presentation on the research projects they completed.
- Twenty 2nd-6th grade students came to the CSU main campus for Discovery Day Camp - a day camp which meets once a week for five weeks and explores a new STEAM inspired theme each day. This year, youth participated in lessons exploring concepts of flight, healthy food choices, the agriculture industry, clean water, and urban gardening, as well as positive youth development.

2. Brief description of the target audience

Three groups from public and private schools, FFA, and 4H clubs will be targeted:

- Elementary School (K-5) : discovery of science and its importance to every day life.
- Middle School: (6-8): exploring science (building skills) and leadership development
- High Schools (9-11): skill's applications and leadership 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	717	2126	3847	2366

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

Patent Applications Submitted

Year: 2018

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Technical skills development (STEM): Discovery , exploration and application of STEM (Ag-STEM connectivity)

Year	Actual
2018	2750

Output #2

Output Measure

- How to obtain and use available resources of time, money, and human capital to achieve and improve quality of life.

Year	Actual
2018	150

Output #3

Output Measure

- Understand the factors that affect decision making processes such as availability of resources, life events, living patterns, values, goals, interests, and external issues such as public issues, policies and programs.
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Get an understanding of the social, cognitive and emotional development of individuals
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- Promotion of positive youth development

Year	Actual
2018	0

Output #6

Output Measure

- Promotion of positive youth development

Year	Actual
2018	0

Output #7

Output Measure

- Understanding Civic, public and academic structures. Civic engagement

Year	Actual
2018	110

Output #8

Output Measure

- Community service/ Volunteerism

Year	Actual
2018	110

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Technical skills development Science, Technology, Engineering, Agriculture, and Math (STEAM): Discovery , Exploration, and Application of STEM (Ag-STEM connectivity)

Outcome #1

1. Outcome Measures

Technical skills development Science, Technology, Engineering, Agriculture, and Math (STEAM): Discovery , Exploration, and Application of STEM (Ag-STEM connectivity)

2. Associated Institution Types

- 1890 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	1875

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
All young people should be prepared to think deeply and to think well so that they have the chance to become the innovators, educators, researchers, and leaders who can solve the most pressing challenges facing our nation and our world, both today and tomorrow. But, right now, not enough of our youth have access to quality STEM learning opportunities and too few students see these disciplines as springboards for their careers.

What has been done
In 2018, CSUE conducted 75 in-school, afterschool, and camp programs in six counties in Ohio (Butler, Cuyahoga, Franklin, Greene, Hamilton, and Montgomery). Programs provided hands-on learning opportunities to students, K-12th grade, in a wide variety of STEM related topics.

Results
Participants had positive experiences during programming and cite having fun while learning critical STEM skills. During STEM programming, students are creating their own research questions and following a process that helps them learn to investigate multiple perspectives and connect ideas to solve a problem. Whether it?s the Engineering Design Process, the Design-Thinking Process, or the Scientific Method, your kids are going to be collaborating with others; asking important questions; taking leadership in their roles; and testing many ideas to reach a solution.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes
- Public Policy changes
- Competing Public priorities

Brief Explanation

CSU is a new 1890 institution and relies totally on the appropriations of Federal funding to conduct its Land-Grant activities. There have been public policy changes and uncertainties in the level of funding CSU is expected for its capacity grants. However, there are competing public priorities for participants in engaging with our program. But, funding is a significant external factor affecting outcomes because a lack of funding enables CSU to hire additional staff.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Students have expressed a behavioral change as a result of their learning of leadership skills and STEAM science education while learning.

Key Items of Evaluation

The need to develop specialized evaluations instruments to capture cognitive social changes for the planned program is a key item of evaluation. Timely allocation of funding for the research and extension land-grant programs would be most helpful for having specialized staff prepare, distribute, and retrieve better evaluation instruments for the planned program.

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.