2018 University of Maryland - Eastern Shore and University of Maryland Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The 2018 Accomplishment Report consists of the University of Maryland Extension (UME) at University of Maryland College Park (UMCP) and University of Maryland Eastern Shore (UMES), Maryland Agricultural Experiment Station (MAES), and Agricultural Experiment Station (AES) results and accomplishments. UME and MAES at the University of Maryland College Park are in partnership with AES at the University of Maryland Eastern Shore, and, as such, they coordinate their research and extension activities to the maximum extent possible.

The 2014-2019 UME Strategic Plan was developed based on extensive data collection that reached out to all stakeholder groups: faculty and staff, clientele, and partnering organizations. Based on the data, specific goals, objectives, and strategies in four major areas were identified: Identity, Innovation, Infrastructure, Marketing & Visibility. The programmatic foundation for the 2014-2019 Strategic Plan builds on the four impact areas from the 2009-2014 Strategic Plan: Agriculture and Food Systems, Environment and Natural Resources, Healthy Living, and Resilient Communities and Youth Development. Programming to address these areas is developed in the traditional disciplines of 4-H Youth Development; Agriculture; Family and Consumer Sciences; and Environment, Natural Resources, and Sea Grant. In 2018, listening sessions were held across the four traditional program areas of Agriculture & Food Systems, Environment and Natural Resources, Family and Consumer Sciences, and 4-H Youth Development to update program foci areas.

Similarly, MAES and AES developed its POW for 2015-2019 using the framework identified by NIFA. In addition, the College of AGNR's strategic plan identifies four core research areas that MAES is leading and those are agriculture, natural resources and environment, human health and nutrition, and international engagement.

The plan for UME emphasizes key outcomes, impacts in critical areas, and "marshaling our intellectual resources" into non-formal educational programs that work together to deliver measurable results for the economy, the environment, and the community. This approach parallels that of UMCP, UMES, MAES, AES, and the College of Agriculture and Natural Resources to achieve impact on the big societal issues important to Maryland and, ultimately, to the global community.

The UME focus areas (referred to as Initiatives 1-4) represent major programmatic initiatives that UME directs resources to accomplish. These focus areas are a broad-based method of dividing the critical needs identified by the planning process into manageable units. Key outcomes are the goals within each impact area. Focus Area leadership teams consist of field-based Extension Educators, Extension Specialists, and other program assistants who work together to provide overall statewide leadership for programmatic efforts. These teams are responsible for collectively achieving the goals, measuring the impacts using suitable evaluation methods and tools, and reporting findings to stakeholders. Focus teams are linked to each other through common target and primary audiences served, the topics and subjects taught, and outcomes and impacts achieved. Focus Area leadership teams, across the major programmatic initiatives, develop signature programs that are replicable, measurable, and recognized at

the state and national levels.

The MAES and AES coordinate research projects in the challenge areas identified by the USDA-NIFA. The research focus ranges from plant and animal genomics to nutrients, health, environment, and economics of production systems. Both basic and applied research are conducted by faculty and graduate students to cover topics of important value to animal and plant production systems with both environmental and economic sustainability.

The four major program areas in the UME and MAES strategic plans are:

Initiative 1: LOCAL FOOD & AGRICULTURE SYSTEMS
Key Outcome: Agriculture and food production will be sustainable and profitable and produce a safe, abundant, affordable, and accessible food supply. This initiative is reported under Planned Program, "Global Food Security and Hunger."

Initiative 2: ENVIRONMENT AND NATURAL RESOURCES
Key Outcome: Individuals and communities will become stewards to manage the environment for the mutual benefit of people, ecosystems, wildlife, natural resources, and economic interests. This initiative is reported under Planned Programs, "Climate Change" and "Sustainable Energy."

Initiative 3: HEALTHY LIVING
Key Outcome: Youth, individuals, and families will make informed decisions about their health, finances, food, housing, and overall well-being. This initiative is reported under Planned Programs, "Childhood Obesity," "Food Safety," and "Family & Community Resiliency."

Initiative 4: RESILIENT COMMUNITIES & 4-H YOUTH DEVELOPMENT
Key Outcome: Improve human capacity to achieve desired community outcomes and be prepared to respond to uncertainties of economics, health, climate, and security. This initiative is reported under Planned Programs, "Childhood Obesity, Food Safety," and "Family & Community Resiliency."

Further complementing the UME and MAES AES program plans of work, the College of Agriculture and Natural Resources () engaged in an extensive strategic visioning process with listening sessions that collected over 40,000 data points that reflected important trends and issues affecting the college, the State of Maryland, industries, and society. This work resulted in five strategic initiatives for AGNR: 1) Establish a healthy food system and ensure global food and nutritional security; 2) Ensure a clean and healthy Chesapeake Bay; 3) Advance innovative, profitable, and sustainable agricultural production systems; 4) Improve human, animal, and environmental health; and 5) Optimize urban environments through design, green technology, and community engagement.

The 2014-2019 University of Maryland Extension Strategic Plan carries forward the land grant university mission; the goals of the University of Maryland, College Park, the College of Agriculture and Natural Resources, and the University of Maryland Eastern Shore 1890 Extension Programs; and the spirit of the Smith-Lever Act. Also, MAES carries forward the responsibilities of the Hatch Act in finding solutions posed to agricultural systems following USDA-NIFA's national priority areas and according to the research strategic plan of the College of AGNR, while UMES implements the Evans-Allen Agricultural Research Program. The AGNR, with its new strategic initiatives, complements and completes a college-wide, comprehensive approach to serving the residents of Maryland.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	107.0	14.5	54.0	24.6
Actual	151.0	18.5	46.0	29.1

II. Merit Review Process

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

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

2. Brief Explanation

The merit review processes did not change from 2017. On July 1 of each year, UME faculty and staff receive a memo from the Associate Dean/Associate Director of Extension outlining the process and requirements.
The merit review process for UME faculty occurs annually when the faculty member is formally evaluated by the Program Leader (Assistant Director). The Agriculture Program Leaders evaluate Agriculture Educators and Specialists; FCS Program Leader, the FCS Educators and Specialists; the Environment and Natural Resources (ENR) Program Leader, the ENR Educators and Specialists; and the 4-H Program Leader, the 4-H Educators and Specialists. Input is obtained from the Area Extension Director (AED). Emphasis is placed on program impacts and the difference made to constituents and the residents of Maryland during the preceding 12 months. Each faculty member is evaluated on individual merit. Documents used for the merit review are approved Individual Extension Plan (IEP), Curriculum Vitae, UMERS reports, and Teaching Effectiveness Summary. Faculty at UMES follow similar procedures with the inclusion of overall review from the Associate Extension Administrator for 1890 Programs.
All research faculty at UMCP have a departmental home, and while there are subtle differences between the departments, they all have a peer-review system wherein assigned faculty or a faculty committee review the annual performance criteria of each faculty member and assign a merit ranking. These criteria, from a research perspective are evaluated, in general, on grantsmanship, publications, the quality of the journal (based on a citation index) and invited and/or contributed scientific talks and seminars. These are also the same criteria that are used to evaluate promotion and tenure decisions. The peer committee recommendations are reported to the respective department chair who provides his/her input and then provides a final ranking and conducts the annual review. This process is followed for tenured, tenure-track, and research faculty appointments.

Faculty at UMES through the School of Agricultural and Natural Sciences (SANS) are being evaluated on a yearly basis using an Annual Evaluation document. Same criteria as mentioned above (grantsmanship, publications, the quality of the journal (based on a citation index) and invited and/or contributed scientific talks and seminars are being used.

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey of selected individuals from the general public
- Other (Community-based listening sessions)

Brief explanation.

Stakeholder participation is encouraged through local Extension Advisory Councils, 4-H Club leaders (volunteers), and various surveys (including needs assessments) targeted to UME clients. On an annual basis, approximately 50-75 surveys are conducted with UME clientele to solicit feedback and encourage participation in UME programs. Surveys are deployed either via paper or electronically, depending on the best strategy to reach the particular clientele. Social media strategies (Facebook, web sites, blogs, Twitter, Instagram) are also now being used to solicit feedback. Text messages are also being used to reach stakeholders.

Inclusive and diverse mailing lists are maintained by all Extension units. These lists include a variety of ways to reach stakeholders, either via mail, telephone, email, or a web site. Traditional methods (outside of using technologies) are still important strategies for soliciting stakeholder feedback. Extension Educators and Area Extension Directors are visible and accessible in local communities through face-to-face engagement.
Facilities where Extension programs are held are accessible and comfortable for a variety of stakeholders. Extension Educators use a variety of methods to accommodate Limited English Proficiency (LEP), physical disabilities, or other barriers to participation. Examples of these methods include using larger type for senior clientele; modifying recipes to accommodate dietary restrictions; and, modifying equipment.

The administrative officers of the MAES, AES, and UME sit on and attend a wide array of committees with the State's agricultural leaders. Such continuous contact with the agricultural leadership, including the Maryland Secretaries of Agriculture, Natural Resources and Environment, provides additional contact to keep current the research and education issues examined by research and extension in the State's two land-grant universities. The groups include the Maryland Agricultural Commission, the Maryland Grain Producers Association, the Delmarva Poultry Industry, the Southern Maryland Agriculture Commission, the Maryland Association of Soil Conservation Districts, Department of Housing and Community Development, Maryland Department of the Environment, and many other similar groups. Both research and extension faculty also seek stakeholder inputs through their participation and presentation of their projects to stakeholder audiences in state, regional, and national workshops and conferences.

In addition, UME administrative leaders connect with many other stakeholder groups outside of agriculture, such as with local departments of health and many nonprofit organizations that provide direct service to stakeholders, including public schools, and civic and community groups.

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 (Focus Groups)

Brief explanation.

End-of-class surveys are used to gather input from individuals attending UME workshops and other events. In addition, follow-up surveys are conducted with stakeholders across all of the major program areas who have attended programs. In 2017, a comprehensive agricultural needs assessment was conducted in the Western and Northern regions of Maryland and a statewide nutrition literacy survey was implemented to drive nutrition programming in the coming years. A needs assessment of participants in the UMES Small Farms program was conducted in 2013-14, and data are obtained each year during the annual Small Farms Conference. Other examples of collecting input from stakeholders are: key informant interviews with parents of 4-H'ers; surveys of beef producers in Maryland; survey of adults involved in school gardens and greenhouses; survey of farmers who attend farm food safety trainings; and 4-H youth and adults across Maryland involved in building social capital in communities.

Extension educators were trained in 2017 in various research/evaluation-based methods on how to solicit data from clientele, such as surveys (multiple formats, including paper-based, on-line, and via text messages) and focus groups--both face-to-face and on-line. Extension Educators are trained in and adhere to all University of Maryland Institutional Review Board (IRB) regulations regarding human subjects research. In addition, Extension Educators have received multiple training sessions on inclusion and diversity and how to reach out to ALL of Maryland's residents.
The UME Facebook page is used as a method to solicit feedback from our stakeholders, as well as feedback from the UME and UMES web sites. Other social media are used--including Twitter and Instagram to reach diverse audiences and hear their comments.

The administrative officers of the MAES, AES, and UME sit on and attend a wide array of committees with the State's agricultural leaders. Such continuous contact with the agricultural leadership including the Maryland Secretaries of Agriculture and Natural Resources and Environment provides additional contact to keep research and education issues examined by the research and extension in the State's two land grant universities. The groups include the Maryland Agricultural Commission, the Maryland Grain Producers Association, the Delmarva Poultry Industry, the Southern Maryland Agriculture Commission, the Maryland Association of Soil Conservation Districts, Rural Maryland Council, MARBIDCO, and many other similar groups.

A College-wide Advisory Council has been established by the Dean of AGNR that represents Research, Teaching, and Extension. Representatives of stakeholder groups were identified to serve

on this Council on a rotating basis. This Advisory Council has started meeting and is highly engaged in the College's strategic visioning process.

The Dean of the School of Agriculture and Natural Sciences at UMES works with clientele and stakeholders representing a diverse group of audiences varying from limited and under-served communities to competitive private companies in to address new challenges and opportunities for community growth and resiliency through research, teaching and Extension as well.

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
- 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)

Brief explanation.

Input from stakeholders was used to create the priorities for the UME strategic plan 2014-2019; determine statewide staffing plans for UME; develop new job descriptions for county and regional extension positions; develop new initiatives for the College and UME; allocate financial resources, primarily operating expenses for program and curriculum development; and, to assist in revamping strategic initiatives as needed to deal with current budgetary shortfalls and staffing challenges. MAES and AES used the information obtained from the stakeholders to focus on research issues that are important to the state with respect to production, marketing, economics, public-economic-environmental policies, biotechnology, ecosystem services, animal and human health, energy issues, etc. This information, combined with the national priorities set by USDA-NIFA was used to set the research priorities and monitor progress.
Brief Explanation of what you learned from your Stakeholders
During the process of gathering input from Maryland residents for the 2014-2019 strategic plan, stakeholders helped to shape four strategic goals for UME:

1. Identity: Solidify UME's identity as the provider of excellent research-based educational programs in defined priority areas that meet the needs of Maryland's diverse population and are consistent with organizational capacity.
2. Innovation: Create and foster a culture of innovation that anticipates and responds to current and emerging needs of the organization and Maryland residents.
3. Infrastructure: Invest in human capital and organizational systems that foster a culture of inclusion, excellence, and engagement among faculty, staff, volunteers, and stakeholders.
4. Marketing and Visibility: Effectively communicate who we are; what we do; and the social, environmental, and economic importance of our work to clientele, volunteers, and stakeholders.

As seen in many other states, Maryland's residents are concerned about the quality of their food,

health, environment, families, and youth.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans
- To Set Priorities
- Other (Strategic Plan Development)

Brief explanation.

Input from stakeholders was used to create the priorities for the UME strategic plan 2014-2019; determine statewide staffing plans for UME; develop new job descriptions for county and regional extension positions; develop new initiatives for the College and UME; allocate financial resources, primarily operating expenses for program and curriculum development; and, to assist in revamping strategic initiatives as needed to deal with current budgetary shortfalls and staffing challenges. MAES and AES used the information obtained from the stakeholders to focus on research issues that are important to the state with respect to production, marketing, economics, public-economic-environmental policies, biotechnology, ecosystem services, animal and human health, energy issues, etc. This information, combined with the national priorities set by USDA-NIFA was used to set the research priorities and monitor progress.
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As seen in many other states, Maryland's residents are concerned about the quality of their food, health, environment, families, and youth.

Brief Explanation of what you learned from your Stakeholders

During the process of gathering input from Maryland residents for the AGNR strategic visioning process, stakeholders identified the five major initiatives they wanted the College as a whole to address. These data are the latest findings from Maryland residents and will help inform the new program strategic plan for UME.

1) Ensure a clean and healthy Chesapeake Bay

- Design land use management strategies to minimize negative environmental impacts.
- Develop storm water management technologies to improve water quality.
- Safely apply fertilizer, manure and other nutrients to protect soil health and water quality.

- Evolve in the face of climate change to address sea level rise and extreme weather.
- Create environmentally aware communities and promote increased interest and participation.

2) Establish a healthy food system and ensure global food and nutritional security

- Encourage entrepreneurship in food production, accessibility, availability and processing.
- Improve the health and well-being of populations through sharing knowledge of food production, processing, access and consumption.
- Inform policy based on sound research.

3) Advance innovative, profitable, and sustainable agricultural production systems

- Increase plant and animal productivity.
- Improve and conserve soil and water quality.
- Contribute to the success of agricultural businesses.
- Prepare the next generation for careers in agriculture.

4) Optimize urban environments through design, green technology, and community engagement

- Refine and improve the process and perception of urban expansion into rural areas.
- Improve understanding of agriculture and environmental awareness in urban areas.
- Improve the performance of built environments.

5) Improve human, animal, and environmental health

- Create sustainable energy solutions.
- Decrease chronic diseases and diseases transmitted from animals to humans.
- Promote and support healthy and livable communities through education.
- Manage and adapt to climate change.
- Investigate links between human, animal and environmental health.
- Analyze environmental and agricultural policy and inform decision makers.

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	3432749	1371434	3084434	1567145
Actual Matching	3432749	1371434	3084434	938822
Actual All Other	7109223	0	0	1222170
Total Actual Expended	13974721	2742868	6168868	3728137

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	0	1545461

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	10%	10%	15%	14%
112	Watershed Protection and Management	0%	0%	0%	5%
205	Plant Management Systems	10%	25%	10%	27%
211	Insects, Mites, and Other Arthropods Affecting Plants	0%	0%	0%	15%
212	Diseases and Nematodes Affecting Plants	0%	0%	0%	14%
215	Biological Control of Pests Affecting Plants	0%	0%	0%	4%
216	Integrated Pest Management Systems	15%	1%	10%	0%
301	Reproductive Performance of Animals	0%	3%	10%	0%
302	Nutrient Utilization in Animals	10%	0%	10%	0%
307	Animal Management Systems	0%	15%	0%	0%
311	Animal Diseases	10%	15%	10%	0%
403	Waste Disposal, Recycling, and Reuse	10%	0%	10%	0%
601	Economics of Agricultural Production and Farm Management	10%	15%	10%	0%
602	Business Management, Finance, and Taxation	5%	1%	10%	0%
608	Community Resource Planning and Development	0%	15%	0%	0%
704	Nutrition and Hunger in the Population	10%	0%	5%	7%
723	Hazards to Human Health and Safety	10%	0%	0%	14%
	Total	100%	100%	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	28.0	4.0	16.0	10.3
Actual Paid	36.0	4.0	26.0	9.3

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**
1029825	411430	1542217	1177563
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1029825	411430	1542217	458585
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
418813	0	0	739449

V(D). Planned Program (Activity)

1. Brief description of the Activity

• AES, MAES, and UME will have a combined focus to ensure that Maryland agriculture and food production will be sustainable and profitable and produce a safe, abundant, affordable, and accessible food supply.
• Research coordinated through MAES and AES on crop and animal breeding, specialty crops, market analysis, economic sustainability, and policy analysis will be performed, while UME will be involved in local and regional efforts to assist agricultural and natural resource entrepreneurs.
• Research conducted through MAES, AES, and UME will generate vital information to increase productivity using genomics, breeding, and adaptation of alternate crops with economic and environmental sustainability.
• Through UME's Action Teams and MAES and AES research projects, the following planned program activities will be emphasized: IPM; Value Added & Specialty Crops; Grow It-Eat It; Annie's Project; Best Management Practices in Crop and Animal Agriculture; Technologies for the Genetic Improvement of Crops and Animals; Agronomic Fruit & Vegetable Production; Dairy Analysis; and Small/Beginning Farmers Program.
• On-line educational programs, field trials, twilight tours, seminars, workshops, on-farm research & demonstrations and individual farm consultations will be used to educate Maryland farmers, Agriculture industry professionals, Soil Conservation District personnel, USDA-NRCS conservationists and extension faculty.
• New research and technologies developed by the MAES and AES will be transferred via UME on-farm demonstrations and twilight tours.
• Training programs will be developed to improve nutrient management practices, IPM, diagnostic skills, identification and control of invasive species, water management practice improvements and reductions, biosecurity and animal health and the use of sheep and goats to manage unwanted vegetation.

2. Brief description of the target audience

• Farmers, including new and beginning farmers, and U.S. veteran farmers
• Female farmers
• Producers

- Retailers
- Plan growers and breeders

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	38497	3723174	23567	901

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	10	14	24

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational programs offered

Year	Actual
2018	164

Output #2

Output Measure

- Number of applied research projects

Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Acres of land exposed to educational programming efforts

Year	Actual
2018	232188

Output #4

Output Measure

- Number of newsletters distributed

Year	Actual
2018	79

Output #5

Output Measure

- Number of agronomic and fruit and vegetable winter meetings

Year	Actual
2018	18

Output #6

Output Measure

- Number of nutrient management plans written

Year	Actual
2018	375

Output #7

Output Measure

- Number of individuals reached through Extension programs

Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of information pieces developed

Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

18	Identification and Characterization of Viruses Infecting Soybeans and Lima Beans
19	Demonstration of Successful Apple Orchard Establishment on the Eastern Shore of Maryland
20	Potential of Day Neutral Strawberries Using Nanotechnology on the Delmarva Peninsula
21	Small Farm Outreach Initiative

Outcome #1

1. Outcome Measures

Increase in agricultural profitability attributable to extension and research efforts.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The U.S. Department of Agriculture (USDA) defines a beginning farmer as one who has been farming for less than 10 years. In Frederick County, 275 principal operators have been farming for 9 years or less on their current farm, while 207 principal operators have been farming for 9 years or less on any farm. As beginning farmers start their business, they are faced with selecting an enterprise, marketing their products, managing finances, and production challenges, such as weather and pests. Land acquisition and being unaware of available resources can also be a challenge for beginning farmers.

What has been done
A Beginning Farmer Course was offered in March of 2018. Over the course of 4 weeks, participants learned about setting goals and picking an enterprise; soils, nutrient management, and conservation planning; integrated pest management; business planning; and risk

management.

Results
Seventeen beginning farmers attended the Beginning Farmer Course. Eight participants elected to take the end of class survey. Out of the eight responses, seven stated they were very likely to use integrated pest management on the farm as well as use best management practices for conservation. Six respondents said this course provided them answers to their questions and ideas they could try immediately. All eight respondents stated this course gave them resources materials they can use. From this course, beginning farmers gained knowledge and resources needed to help produce safe and healthy food for their communities while using best management practices to promote a healthy environment.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Increase in small, part-time, female, veteran, and limited resource farmers

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Women in Agriculture (WIA) Wednesday Webinars were created as a way to stay connected with past participants in WIA programs or to connect to potential participants of the MidAtlantic Women in Agriculture Programs. Topics covered the five areas of USDA Risk Management.

What has been done
Wednesday webinars began in April of 2014 on the second and fourth Wednesday of the month. There have been 105 webinars (2014?2018) on a variety of topics in farm and risk management

with 7,967 registrations, of that 2,040 are unique registrants. All webinars are recorded and have received 10,303 YouTube views and 79,520 minutes (1,325 hours) of viewing time.

Results

In 2015 this program was funded by Rural Maryland Council Grant (MAERDAF) and was evaluated in early 2016 and again in 2017 and 2018 for annual results. The survey was sent to 972 registrants (324 responses 33% response rate). Of the participants: 66% were interested in the topic, 37% will use the information to help their clients, 29% will improve their farm business management, 74% are interested in marketing, 70% social media, 61% business planning, 53% in finance, 43% on legal issues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
608	Community Resource Planning and Development

Outcome #3

1. Outcome Measures

Increase in the amount of agricultural land under best-management practices due to Extension programming efforts

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Regardless of land use, improperly or excessively applied nutrients can leach into the groundwater or exit landscapes via runoff from precipitation and then migrate into Maryland's waterways. Once in the water, excess nutrients upset the Bay's ecological balance by causing algal blooms and contributing to eutrophication and degradation of wildlife habitat.

What has been done

The Agricultural Nutrient Management Program provides support to the nutrient management planning community through educational opportunities, technical support and software development. It also provides support to agricultural producers through the development of nutrient management plans.

Results

Nutrient management advisors updated 5,028 existing nutrient management plans (NMPs), covering 222,373 acres, and 96 no-land plans; developed 375 new plans that covered 9,815 and 38 no-land plans; conducted the Phosphorus Site Index and Phosphorus Management Tool on 832 fields for 184 clients; developed NMPs for 14 manure transport clients, allowing transportation and application of manure on 2,607 acres; developed new and updated NMPs for 149 CAFO or MAFO clients; and, developed plans for 321 clients participating in Maryland Agricultural Water Quality Cost-share (MACS) cover-crop program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Increase in the number of people growing food for health and economic reasons

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Suburban and urban population growth in Maryland increases the potential for degraded soils and contaminated water and air. Many residents lack the knowledge and experience to manage land sustainably. Many web-based gardening sources are not science-based and can lead residents to

make decisions with negative environmental and human health consequences. Public funding for Extension nationwide has been in decline for the past two decades, making it difficult for Extension to address new environmental issues and rising demand for services.

What has been done
The UME Master Gardener (MG) program uses a train-the-trainer model of education. MG Volunteers learn science-based information and then make recommendations and teach best practices to the public. In particular, Master Gardeners help reduce unnecessary pesticide use by teaching residents the principles and practices of Integrated Pest Management.

Results
The MG program extends UME?s reach, raises UME visibility, and provides excellent value to COAGNR and Maryland residents. In 2018, 1804 certified MGs and 264 interns volunteered 110,485 hours (53 FTEs). The work was valued at $3.04 million (based on a $27.50/hr. figure from IndependentSector.org). Master Gardeners had 107,398 educational contacts in 2018- 69,982 adult contacts and 37,416 youth contacts.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
205	Plant Management Systems
216	Integrated Pest Management Systems
608	Community Resource Planning and Development
704	Nutrition and Hunger in the Population

Outcome #5

1. Outcome Measures

Increase in research findings that help to ensure global food security.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Mechanisms Affecting Post-hatch Growth and Metabolism Following Embryonic Growth Hormone Induction in Broiler Chickens

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Increasing the amount and efficiency of chicken meat production is important to the poultry industry and to the growing world population. Growth in chickens is controlled in part by the chicken's production of its own hormones, including growth hormone which is secreted from the chicken's pituitary gland. A better understanding of the mechanisms regulating growth hormone secretion is essential to develop new strategies aimed at improving growth through increasing naturally occurring growth hormone production.

What has been done

A preliminary trial was conducted to determine the optimum age for egg injection to maximize growth hormone (GH) mRNA induction. Eggs were left uninjected or injected with saline or corticosterone (200 ng/egg) on embryonic day (e) 10 or e11, and pituitary glands were collected 6h and 12h post-injection on each age. While CORT injection increased pituitary GH mRNA on both ages, the response was greater and more consistent on e11 and this was the age chosen to use for the trial to evaluate growth performance. The experiment required to evaluate growth performance and physiological effects of early GH for Specific Aims 1 and 2 has been completed.

Results

This research evaluated growth parameters (body weight, body weight gain, average daily gain, feed intake, and feed conversion ratio) and determined that CORT injection did not appear to influence performance in this trial. At the conclusion of the study, on post-hatch day 43, birds were processed and carcass yields were determined. Injection with CORT increased collective meat yield breast (Pectoralis major and minor, wing, thigh, and drumstick) by 1.2% in males and 0.7% in females. All samples have been collected to evaluate effect of in ovo CORT injection on metabolic indicators, hormone levels, and gene expression in neuroendocrine and somatic tissues.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems

Outcome #7

1. Outcome Measures

Using Leguminous Cover Crops In Vegetables To Provide Several Ecosystem Services

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural intensification is a major contributor to natural enemy and pollinator decline as well as environmental pollutants in specialty crops. This project proposes to evaluate and disseminate more ecofriendly practices such as using reduced-risk and organic products, conservation tillage and biological control, and cover cropping to enhance populations of beneficial organisms above and below the soil while subsequently lowering arthropod pests and GHG emissions and improving environmental health. The project goal is to develop and disseminate effective production practices that will help producers alleviate weed problems in vegetable fields without compromising soil health. Weed management is a major economic hindrance to the organic vegetable industry; and for years, organic growers have identified weed management as a top production constraint. Mechanical tilling isthe most commonly used method to control weeds in organic vegetables. However, excessive tillage and cultivation encourages new weed flushes, are deleterious to soil health and requires excess fossil fuel usage. Some of these issues can be overcome by adopting reduced tillage (RT) practices in company with an integrated weed management program.

What has been done
Four integrated tactics (cover cropping, strip-tillage, stale seedbed and banded herbicide spray) are being evaluated for their weed suppression potential in vegetable system. The main research goal is to examine the use of RT practices (no-till, strip-till) for managing weeds. To support this agenda, different RT and a conventional tillage practice will be investigated for their impact on: 1) seasonal weed density and biomass, and time weeding; 2) weed seed predation; 3) soil health and 4) crop growth, productivity and marketable yield. Further, the economic cost of using these practices will be estimated.

Results
Results from the weed seed predation trials indicate that there is no significant difference in weed

seed removal by seed predators between treatments. Data and samples were also collected to assess the soil health and crop growth under different treatments, as well as economic benefits of applying each management strategy. Soil health is being assessed by analyzing the community of free-living soil nematodes from samples collected throughout the growing season. Free-living soil nematodes occupy many different trophic positions within the soil food web, and are excellent indicators of the complexity, stability, and secondary productivity of the community of soil microorganisms. Crop growth parameters were measured at multiple times through the growing season to assess how the different treatments affected plant size and rates of reproductive development. Finally, inputs for each of the different treatments, including cover crop seed, tractor-driven operations, and labor from hand-weeding,and other operations were recorded to calculate the operating costs associated with each treatment. These values will be compared against the market value of the pepper yields to determine the overall financial benefits of each treatment. Sample and data analyses for each of these project components are on-going.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

Ecology and Management of Arthropods in Corn

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Surveys of Maryland grain producers conducted during extension meetings indicate that multiple arthropod pests are problematic for corn growers in this region. Seed corn maggot, grubs, and wireworms were considered to be the most problematic arthropod pests by 24% of respondents (107 total), with slugs (16%), corn borer (12%), cutworms (11%), and rootworms (6%) also

considered to be the most problematic by some respondents.

What has been done

Applied and demonstration research was conducted to encourage the adoption of best management practices by corn producers, including evaluating Maryland field corn insect pest pressure as well as non-target effects and economic benefits of pyrethroid insecticides and neonicotinoid seed treatments. Training opportunities were provided to undergraduate and graduate students.

Results

A peer-reviewed paper examining the impact of clothianidin treated seed on the arthropod communities in mid-Atlantic no-till corn agroecosystems, and another examining the impact of riparian buffers on biological control of arthropods in grain crops including corn, were published. An additional peer-reviewed paper that examined the effect of brown marmorated stink bug on fumonisin contamination of field corn was also published during this project period.Results were disseminated to other scientists and extension professionals through in-person international and regional scientific presentations and through peer-reviewed publications. Results were disseminated to stakeholders via in-person extension talks at field days and winter meetings as well as through publications in University of Maryland Extension's Agronomy Newsletter and interviews with news media targeting producers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems

Outcome #9

1. Outcome Measures

Implementation of Honey Bee Best Management Practices To Improve Colony Health

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Managed honey bee colonies have been dying at high rates in the US for the last 10 years. These high rates of losses are a concern for both beekeepers and the farmers who rely on a healthy honey bee population to pollinate their crops. In the US over $16 billion of produce rely on managed honey bees for pollination. This project aims to reduce the high rate of losses experienced by beekeepers by testing and promoting the adoption of data derived best management practices. There is growing consensus that multiple factors are contributing to poor bee health. Some of these are in the direct control of beekeepers while others are not. This project focuses on practices in control of beekeepers.

What has been done

Over the last 5 years the Bee Informed Partnership has conducted surveys of beekeepers' management practices and operational losses. The team had now identified practices that seem to work better than others. These practices were validated in the field and, and using various efforts encouraged best management practice adoption by beekeepers by showing the economic advantages of Best Management Practices (BMP) adoption. Beekeepers were encouraged to regularly have colonies tested for parasite and disease loads so they are more aware of the threats to their operations. In this study, the team will attempt to better understand why some beekeepers are willing to adopt new practices while others are not, and will quantify factors, like the presence or absence of bee viruses, that may complicate BMP success.

Results

Several students have been trained in sample processing, workflow coordination, and molecular techniques. They assist with field work in sampling BMP apiaries and Sentinel apiaries. They gain knowledge of honey bee health issues, life cycle, and beekeeping practices. Seven undergraduates, 4 graduates and 1 post doc worked directly under this project. For both BMP testing and Sentinel Apiary participants, results from monthly sampling are given to them directly in the form of a Disease Load Report. These reports summarize Varroa and Nosema loads from each colony and compare them to monthly national averages from the USDA-APHIS National Honey Bee Disease Survey. At the end of the year, as in the past 2 years, participants in each project receive a yearly report summarizing data collected from all beekeepers throughout the season. This includes average Varroa and Nosema levels for all participants, trends in timing and use of chemical Varroa control products, timing and use of supplemental feed products, and colony mortality. Results from the Sentinel Apiary Program have also been presented at beekeeper club meetings and beekeeping research conferences. The final reports are also posted on our website (https://beeinformed.org/programs/sentinel/) for all beekeepers to benefit from the data and results.

4. Associated Knowledge Areas

KA Code	Knowledge Area
211	Insects, Mites, and Other Arthropods Affecting Plants
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #10

1. Outcome Measures

Preventing Outbreaks of Avian Influenza Through Timely Dissemination of Practical Science-Based Information

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Avian influenza (AI) affects various species of poultry and outbreaks caused by the H5 and H7 strains have resulted in severe economic losses to the poultry industry worldwide. In 1983, an outbreak of highly pathogenic H5N2 in the Mid-Atlantic region of the U.S. cost the federal government over 62 million dollars to eradicate and producers lost nearly 200 million dollars. Thirty-two years later, the U.S. is facing its worst outbreak of AI with 223 infected poultry premises in 15 states as of June 17, 2015. More than 48 million birds have been lost due to infection caused mainly by a deadly mixed-origin H5N2 strain of highly pathogenic avian influenza (HPAI). While cases have not been reported on the East Coast, poultry growers and workers in major poultry production areas in the U.S. need to know how HPAI is transmitted so they can take the necessary measures to prevent it. To address these needs, this project will develop, enhance, and disseminate practical, credible, science-based information on avian influenza prevention, preparedness, and response.

What has been done
A six-minute avian influenza (AI) biosecurity videos developed in this project have reached wide national and international audience through presentations at scientific/professional meetings as well as through online (YouTube) access. Updated the eXtension Avian Influenza biosecurity Moodle courses for emergency responders, backyard flock owners, and 4-H/youth groups as well as the EDEN Avian Influenza and eXtension Avian Influenza CoP content pages and Avian Influenza Facebook page to reflect current trends and knowledge on AI epidemiology and modes of transmission.

Results
Through these efforts, ordinary citizens and Extension specialists are able to access current objective information on the transmission and spread of AI virus, thereby increasing awareness

which would encourage them to practice strict biosecurity. Poultry industry and emergency response personnel are also able to update their AI emergency preparedness plans based on latest information on epidemiology (sources and modes of spread) of AI virus. Poultry industry and animal health agencies have been using the biosecurity videos to train their personnel and other target audiences on practical biosecurity to prevent avian influenza outbreaks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management
723	Hazards to Human Health and Safety

Outcome #11

1. Outcome Measures

Honey Beekeeping in Somerset County.

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pollinators and honeybee colonies are declining in drastic numbers worldwide at an alarming rate. Their decline poses a threat to global agriculture and human food supply and security. USDA data shows that the domestic number of managed honey bee colonies dropped from 6 million in 1947, to 2.63 million in 2018. The phenomenon known as ?Colony Collapse Disorder?, parasites (Varroa mites), genetics, poor nutrition and other environmental factors are considered major causes of the population decrease.

What has been done
The University of Maryland Extension-1890 program continues to sponsor the UMES Honey Bee Club for those individuals who want to learn how to promote honey bees and other pollinators on the Maryland Eastern Shore. Up to 15 interested beekeepers participated in the installation of 11 new honey bee colonies. Mr. Dean Burroughs facilitated the training and participants practiced

the use of the apiary veils, gloves, smokers, and other equipment available at the UMES apiary at the UMES farm at Stewart Neck Rd. in Princess Anne. A workshop was held to teach beekeepers how to check and mark the queen bees and verify that the colonies were functioning as expected. Subsequently, checking and feeding of the colonies was scheduled on a weekly basis.

Results
Participants in the UMES Honey Bee Club had the opportunity to learn, by doing, the installation and care of new bee colonies. When using the equipment available at the UMES Apiary, honey bee keepers had learned how to establish new colonies and how to care and monitor hive populations.

4. Associated Knowledge Areas

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

Outcome #12

1. Outcome Measures

Raising Sheep and Goats for Quality Meat Production

2. Associated Institution Types

- 1862 Extension
- 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)
Changes in the Unites States? demographics have increased lamb and chèvon (goat meat) demand. In 2013, more than 80,000 t (metric tons) of lamb were imported to the United States. Also, USDA/NASS reported annual chèvon imports above $129 million. Combined value of imported lamb and chèvon exceeds $800 million.

What has been done
The Southern Maryland Meats program of the Southern Maryland Agricultural Development Commission (SMADC) partnered with the University of Maryland Extension (UME) to offer the

second in a series of workshops for farmers raising sheep and goats for quality meat production in Southern Maryland.

Results
Sheep and goat producers, youth, 4-H members and the general public benefit from participating in workshops where UME Small Ruminant Specialists contribute by providing technical advice on multiple topics of sheep and goat production. Up to 300 sheep and goat producers learned practices to enhance productivity in their farms and ranches in Maryland just by participating in workshops sponsored by UME Small Ruminant Specialists in Southern Maryland and Delmarva.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
307	Animal Management Systems
311	Animal Diseases
601	Economics of Agricultural Production and Farm Management
704	Nutrition and Hunger in the Population

Outcome #13

1. Outcome Measures

Increase in Research Findings and Standards Development that Promote Pesticide Operator Health and Safety.

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Workers applying pesticides and similar chemicals need to protected by wearing Personal Protective Equipment (PPE). The need exists to investigate factors that impact selection, use, care, and maintenance of PPE products and protective clothing. This project is part of NC-170 multistate research.

What has been done

Decontamination/laundering studies were conducted in collaboration with international partners. Preliminary tests to contaminate the test specimens by spraying and to simulate transfer from washed fabric as a result of rubbing were carried out. Protocols were developed for studies to be conducted next year.

Results

A new standard (ISO 27065:2017) was developed and published in in the Official Journal of the European Union. Standard EN/ISO 18889 (performance standard for chemical resistant gloves) was updated and submitted for a vote. Revision of ISO 17491-4, Protective clothing -- Test methods for clothing providing protection against chemicals -- Part 4 is being worked on in close collaboration with the two laboratories in Japan and Brazil that are testing certified garments to compare penetration through the garments with the existing nozzle and proposed flat fan nozzle. The proposed change in nozzle is to obtain a more uniform spray pattern for whole garment testing. This international collaboration involving universities, regulatory agencies and industry partners will result in better protection of workers applying pesticides and similar chemicals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety

Outcome #14

1. Outcome Measures

Developing Management Strategies of Kudzu Bug

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The invasive kudzu bug (Megacopta cribraria) has emerged as the top yield-limiting pest of soybean in the U.S. and has been reported in eight Maryland counties. Kudzu bugs may have the potential to expand throughout Maryland, but no effective control strategies other than chemical insecticides are currently available to manage this pest. Preparing economically-viable, socially-acceptable and environmentally-friendly kudzu bug management strategies is needed.

What has been done
Field-collected entomopathogenic fungi, that has a potential for control of kudzu bugs, have been isolated from cadavers of kudzu bugs and identified. Due to issues with seasonal availability of kudzu bugs, field collected pathogenic fungi were tested on Green Stink Bug and the Brown Marmorated Stink Bug.

Results
Field-collected entomopathogenic fungal strains were identified as Alabama, pink and white strains. The mortality of bugs infected with the Alabama strains were higher than white strain infected bugs. There was no statistically significant difference between the Alabama and pink strain. This is indication that the pathogen is a real candidate as a biological control agent of bug pests in soybeans.

4. Associated Knowledge Areas

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

Outcome #15

1. Outcome Measures

Increase in Research Findings in the Production of Ethnic Specialty Crops in Sandy Soils with Added Biofertilizers

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increasing immigrant population on the Delmarva Peninsula has created the demand for ethnic/specialty crops in the region. Growing specialty crops in the Delmarva region could provide opportunities for farmers, especially new and beginning farmers, including youth and immigrant farmers, to diversify and provide healthy diets desired by growing ethnic populations. Cropping on the Delmarva is constrained by sandy soils that are mainly acidic and low in plant nutrients. Biofertilizers have been identified as an alternative to chemical fertilizers to enhance soil fertility and crop production in sustainable agriculture.

What has been done
Two preliminary greenhouse and three field studies have been conducted to evaluate the performance of biofertilizers on the growth and development of three ethnic crops, bok choi, amaranth, and hibiscus.
The biofertilizers used in this study include Vermicompost Tea, Fish Emulsion, Poultry Litter Leachate and Green Manure, as well as a chemical fertilizer (20:20:20) as control.

Results
There was no significant difference between the control and treatments for the three field studies, which indicates that either treatment can be used to produce a quality yield.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #16

1. Outcome Measures

Increase in Research Findings in the Production Organic Crop Management

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nationally, organic food use and demand by consumers has steadily increased in recent years and the Delmarva Peninsula, like other regions, continue to follow this trend. Environmental concerns about phosphorus and nitrogen runoff into the Chesapeake Bay watershed have triggered regulatory changes in Maryland related to the use of poultry manure on farmland. Organic nutrient sources, such as poultry litter, must be incorporated or injected in the soil within 48 hours of application. Also, potential microbial contaminations pose food safety risks to humans from produce grown in soil amended with infected animal waste.

What has been done

Field studies were conducted on conventional and organic sites at the university Experiment Station using two heirloom tomato cultivars. Different fertilizers and combinations, including poultry litter, nature safe, blood meal and 20-0-12 fertilizer were used. Ginger development and yield in high tunnel and field conditions using three different nutrient treatments, including Cotton Seed/Azomite, Nature Safe and Phytamin Fish Emulsion were measured. Organic carrot field trials were conducted to evaluate two different nutrient regimes, Blessings compost and Nature Safe. Crops were tested for food pathogens.

Results

There was a difference in numbers of marketable tomatoes between tomato cultivars for both, organic and conventional management, but there was no difference between organic and conventional management when comparing the same cultivar.

The yield of organic kale grown with, Blessings compost or Nature Safe at 80 lb. /acre N did not differ among the two cultivars tested, nor between the two fertilizer sources.

High tunnel ginger grown from multi shoot seedlings produced more rhizomes than those grown from single shoot seedlings; nutrient treatments did not significantly affect yield.

Organic carrots grown with Blessings compost or Nature Safe at 90 lb. /acre N and 160 lb. /acre K, showed no differences in marketable yield between the fertilizers used.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #17

1. Outcome Measures

Increase in Research Findings in the Development of Aronia Mitchurinii as a Specialty Crop

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Aronia mitchurinii is a specialty horticultural fruit crop that is presently grown on over 1000 hectares (2470 acres) in the United States and the area increasing yearly. The fruit contains the highest known hydrophilic antioxidant content, 15 times greater than the popular tropical fruit,

Açai. With an increased interest in locally grown foods and especially those with a high nutritional value, markets for specialty crops are expanding. There is a need to study the effects of cultural management including fertility, pests and weed management and breeding on phytochemical and nutritional content.

What has been done
Aronia was processed and analyzed for yield of juice from berries, brix, pH, and the contend of anthocyanins, flavonoids and polyphenol in juice, as a function of fertilization (nitrogen rate), organic vs. traditional growing and application of mineral bursts.

Results
Aronia content of antioxidants is much higher than any other fresh fruit; 40x higher than tomatoes and 15x higher than acai berry. Cultural management such as nutrient application, mineral amendments, age of plants during the growing season may influence the quality and quantity of phytochemicals in the fruit. Preliminary results reveal that nitrogen rate of 3g/bush/year is an optimal rate in order to achieve the highest antioxidant content; there is no significant difference between phytochemical quality of fruits grown organic vs. regular protocol; mineral burst helps to slightly increase the antioxidant content of aronia.

4. Associated Knowledge Areas

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

Outcome #18

1. Outcome Measures

Identification and Characterization of Viruses Infecting Soybeans and Lima Beans

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Increasing globalization has led to increased travel and trade, introducing new diseases and pests, deleteriously affecting U.S. agriculture. The ability to develop successful plant protection strategies depends first on identifying new/emerging diseases. The emergence of fast and

affordable next-generation sequencing (NGS) has been widely used to identify novel pathogens, which promote plant health or preventing disease. A comprehensive survey of viruses infecting two important legume crops relevant to the Delmarva Peninsula is needed.

What has been done
We collected samples from different fields located in Maryland, Delaware and Virginia. We have started to extract total RNA from the infected samples. The quality and quantity of RNA samples will be evaluated and will be sent for RNA-Seq analysis.

Results
Ninety-eight soybean and lima bean samples showed virus like symptoms. We contributed to regional outreach activity to improve soybean diseases management through collaborative efforts with other faculty members, consultants, agricultural business field personnel, producers and other appropriate clientele.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Diseases and Nematodes Affecting Plants

Outcome #19

1. Outcome Measures

Demonstration of Successful Apple Orchard Establishment on the Eastern Shore of Maryland

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In spite of growing demand for local produce and higher economic potential of apple cultivation no work has been done on the establishment of apple orchards on the Eastern Shore. There is an urgent need of diversification of fruit crop cultivation and extension of the fruit growing season. Returning apple orchards to the eastern Shore is one promising option for accomplishing this diversification.

What has been done
UMES created a 25 member SARE-Apple team to help and guide the future apple growers on the Delmarva Peninsula. This team is continuously educated on the multiple aspects of orchard management. Team members will also provide individual consultation and advice to interested growers. In addition, team members can also facilitate farmer's visits to UMES apple orchard for live demonstrations. Team members can also provide online study material to targeted audience.

Results
This project will enhance farm income, promote local produce, reduce the carbon footprint, and concomitantly rejuvenate the lost apple legacy on the Eastern Shore to boost agro-tourism and encourage the agricultural economy

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #20

1. Outcome Measures

Potential of Day Neutral Strawberries Using Nanotechnology on the Delmarva Peninsula

2. Associated Institution Types

- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The strawberry industry is chiefly dominated by June-bearer, short day cultivars, which restrict the peak production to spring or early summer seasons in the mid-Atlantic. In spite of growing demand for local produce and higher economic potential of the strawberries no work has been done on the production potential of the DNS on the Delmarva Peninsula. There is no comprehensive study about what is the business as of late & site dating evaluating the potential of multiple day DNS in open bed and low tunnel regimes to accelerate the local production and extend the season beyond early spring and summer.

What has been done
UMES will evaluate the production potential of the DNS cultivation on the Delmarva Peninsula. Field and greenhouse presentations have been made to growers, as well as email and face-to-face consultations, and demonstrations at public events.

Results
This program is still in its early phase and has already showed promising response from local growers and plant sellers. Berlin organic farm (Worcester County), Assateague Farm & Nursery (Worcester County), and Somos Inc, (Somerset county) NGO in Crisfield submitted a collaborative grant (North American Strawberry Growers Association) with UMES to grow DNS using different cultivation regimes (vertical, open bed, and low tunnel). Local homeowners inquired about the addresses of nurseries to purchase the bare root strawberry plants. Berlin organics, Berlin, MD, also submitted a SARE-farmer grant to cultivate DNS using high tunnels. During workshops at UMES local growers showed interest in using low tunnels to grow day neutral strawberries for season extension.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems

Outcome #21

1. Outcome Measures

Small Farm Outreach Initiative

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)
The primary purpose of the Small Farm Program is to deliver educational programs, training, and outreach that help limited-resource and socially disadvantaged farmers own and operate farms successfully and assure equitable participation in USDA agriculture programs.

What has been done

The Small Farm Outreach Initiative provides a variety of outreach and educational activities that address the issues and needs as identified among target audiences to include but not limited to: alternative enterprise selection, direct marketing, improved and inexpensive agriculture production practices, farm business management, conservation awareness, and participation in USDA farm programs.

Results

UMES IFARMS team coordinated an on-farm field tour to introduce participants and educate them on the various farm field demonstration projects at UMES new research and demonstration farm located just a few miles off campus. Tour sites featured included: aronia production, high tunnel systems, specialty crop vegetable production, small farm equipment, mobile solar energy, and much more. A two-day farm bus tour was conducted to introduce farmers to new alternative enterprises, as well as, educated them on exploring new markets for their own products. As part of the educational tour, a total of 52 small-scale producers and aspiring farmers traveled by bus to the New Jersey and Northern Delaware to visit diverse farm operations utilizing various marketing strategies (value-added products, community supported agriculture, internet and email marketing, roadside stands, agri-tourism activities, etc..) to increase farm profits.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Women in Agriculture Wednesday webinars began in April of 2014 on the second and fourth Wednesday of the month. There have been 105 webinars (2014-2018) on a variety of topics in farm and risk management with 7,967 registrations, of that 2,040 are unique registrants. All webinars are recorded and have received 10,303 YouTube views and 79,520 minutes (1,325 hours) of viewing time. The audience for webinars include 26% service providers, 25% beginning farmers, 21% established farmers, 35% are from Maryland the

other 65% are from 18 other countries, 49 states and District of Columbia. There were 94% female, 84% white, 8% African American, 65% are over the age of 45, and 83% have a college degree or higher.

The program was evaluated in early 2016 and again in 2017 and 2018 for annual results. The survey was sent to 972 registrants (324 responses with 33% response rate). Of the participants: 66% stated they were interested in the topic presented; 37% will use the information to help their clients; 29% will improve their farm business management; and 74% are interested in marketing; 70% in social media, 61% in business planning, 53% in finance, 43% in legal issues. Results concluded a statistically significant increase in knowledge after attending the Webinars. Participants report increasing knowledge by 48%. Those that reported no knowledge or slight knowledge increased by 64%.

- 56% plan to make a change as a result of the webinars
- 93% visited the website, 56% visited Facebook, 55% visited eXtension.org
- 32% are beginning farmers, 28% are service providers, 24% are exploring farming options
- 44% are from Maryland, 10% from Delaware, 43% outside of the MidAtlantic (16 states represented)
- 92% were female, 82% white, 11% African American, 30% were age 45-54, 22% were 55-64, 36% were college graduates, 33% have Master's degrees.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	35%	0%	0%
111	Conservation and Efficient Use of Water	0%	10%	0%	0%
112	Watershed Protection and Management	0%	10%	0%	0%
123	Management and Sustainability of Forest Resources	20%	0%	0%	0%
302	Nutrient Utilization in Animals	0%	20%	0%	0%
403	Waste Disposal, Recycling, and Reuse	40%	25%	50%	0%
511	New and Improved Non-Food Products and Processes	0%	0%	40%	0%
601	Economics of Agricultural Production and Farm Management	40%	0%	0%	0%
801	Individual and Family Resource Management	0%	0%	10%	0%
	Total	100%	100%	100%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	6.0	1.0	4.0	4.5
Actual Paid	6.0	1.0	4.0	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**
171637	68572	246755	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
171637	68572	246755	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
39531	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Short course and training seminars for industry personnel and growers.
- Conduct basic and applied research in alternative fuel sources, energy saving techniques, recycling of green waste products, and precision agriculture.
- Contribute to trade and peer reviewed journal publications.

2. Brief description of the target audience

- Nursery, greenhouse, dairy farmers, poultry growers and managers
- In-state bioenergy industry.
- Research community at large.
- Farmers and producers.

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	184	0	122	0

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	1	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of Extension educational programs offered

Year	Actual
2018	13

Output #2

Output Measure

- Number of applied research projects

Year	Actual
2018	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase in the number of educational programs offered to consumers.
2	Increase in the number of research projects on alternative energy sources and precision agriculture.
3	On-Farm Energy Policy & Technology
4	Residential Energy Conservation & Technology
5	Residential Energy Use
6	Research on Ecology of Wetlands to Improve Water Quality, Biofuel Production, Sustainable System Design, & Ecosystem Restoration
7	Research on Biomass Degradation by Enzymes of Saccharophagus Degradans
8	Research on Uses of Byproducts of Biofuels
9	Spatial Economic Modeling of Land Use and Watershed Management
10	Determinants of Residential Energy Demand and Energy Efficiency

Outcome #1

1. Outcome Measures

Increase in the number of educational programs offered to consumers.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Energy efficiency has become a high priority for farms and greenhouses within the state, considering that 15% of agricultural production costs are related to energy use according to the USDA. However, many Maryland farmers have trouble financing improvements as rising energy costs claim increasing portions of their farm budget.

What has been done
An educational energy program is currently being developed to help target clientele (e.g., ag service providers, farmers, greenhouse operators) reduce their energy bills and operate their facilities more efficiently. Energy assessments through UME may help producers in obtaining funding for energy efficiency upgrades while providing information that encourages others to make energy investments on their own.

Results
A needs assessment survey of UME faculty and staff indicated that farmers and ranchers account for 26.85% of those clientele in the state that are currently seeking energy-related information with priority given to economics, heating and energy assessments. Various academic, research, private enterprise, and government stakeholders in Maryland have also expressed a priority in on-farm renewable energy such as grid-tied solar PV to meet the state's RPS. A quantifiable number of energy assessments may be performed through this UME Program while the outcome indicators may be reported in terms of the number of participants (#) adopting appropriate energy practices, the total cost ($) of energy efficiency renovations in grant applications, the annual financial ($) and energy (BTU) savings, and the reduction in carbon emissions (g-CO2).

4. Associated Knowledge Areas

KA Code	Knowledge Area

511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
801	Individual and Family Resource Management

Outcome #2

1. Outcome Measures

Increase in the number of research projects on alternative energy sources and precision agriculture.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

On-Farm Energy Policy & Technology

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Maryland is one of the fastest-growing solar energy producers in the country with a total installed solar capacity of 967 MW (13% growth last year). However, many communities within the state lack the technical expertise and experience necessary to facilitate project development with many counties having no definition of renewable energy terms (i.e., solar array, solar facility, solar power).

What has been done
An educational energy program is currently being developed to help target clientele (e.g., ag service providers, attorneys, community members, landowners, solar developers, state officials) address the economic, legal, and community issues associated with solar energy leasing on farmland, as well as, the resources available to promote solar-related economic development across the state.

Results
A needs assessment survey of UME faculty and staff indicated that wind turbines (13.98%), grid-tied solar PV (12.90%), and land leasing (11.83%) were top priorities for those clientele currently seeking information about clean energy technology in the state. Various academic, research, private enterprise, and government stakeholders in Maryland have also expressed a priority in on-farm renewable energy such as grid-tied solar PV to help meet the state's RPS. Outcome indicators of this Program may be reported in terms of the monetary value ($) of successful grants and financed projects, the annual financial ($) and energy (BTU) savings, and the reduction in carbon emissions (g-CO2).

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
801	Individual and Family Resource Management

Outcome #4

1. Outcome Measures

Residential Energy Conservation & Technology

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Maryland's ambitious energy goals include the state's Renewable Portfolio Standard (RPS) which requires 25% of the state's electricity to be generated from renewable energy sources by 2020 (including 2.5% from solar energy), as well as, the Greenhouse Gas Reduction Act which calls for a 25% reduction in GHG emissions by 2020 (relative to 2006 levels). While the extension of Maryland's EmPOWER efficiency program requires a 2% annual reduction in electricity usage through 2023, over 500,000 Maryland households still face an unaffordable home energy burden.

What has been done

An educational energy program is currently being developed to help target clientele (e.g., homeowners, renters) learn sustainable strategies and develop innovative energy solutions for their homes to help reduce energy use, lower energy costs, and adopt clean energy technology. This new area of programming, however, will require an assessment of the educational needs within the state, as well as, the constitution of teams which will engage in this newly identified area of education.

Results

A needs assessment survey of UME faculty and staff indicated that rural and urban residents currently account for 25.93 and 15.74% of those clientele seeking energy-related information in Maryland, respectively. The survey results further indicate a priority in economics, heating, and landscaping issues associated with residential settings. Various academic, research, private enterprise, and government stakeholders in Maryland have also expressed a priority in renewable energy including solar PV for residential markets to meet the state's RPS. Outcome indicators of this Program may be reported in terms of the number of participants adopting relevant energy practices (#), the monetary value ($) of successful grants and financed projects, the annual financial ($) and energy (BTU) savings, and the reduction in carbon emissions (g-CO2).

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management

Outcome #5

1. Outcome Measures

Residential Energy Use

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Residential energy use is responsible for a number of environmental externalities, including greenhouse gas emissions. Energy consumption in buildings accounts for some 20-30% of the carbon dioxide emissions in developed countries (IPCC 2007, McKinsey, 2009), and in the US

the average household living in a single family home generates about 12 tons of CO2 each year (EIA, 2012). As a result, there has been significant legislative and programmatic activity to encourage the adoption of microgeneration technology based on renewables, improve the energy efficiency of homes, and tightening energy efficiency standards

What has been done
A study has been conducted in four counties of Maryland where the climate and the absence of piped natural gas make air-source heat pumps a popular choice for heating the home in the water and cooling in the summer.

Results
A survey paper has been written describing the state of knowledge about residential energy behavior; also a paper on response to residential energy tariff changes based on data collected in Ukraine has been written. Currently working on showing the short-run elasticity and long-run effect of energy efficiency upgrades using data from Ukraine.

4. Associated Knowledge Areas

KA Code	Knowledge Area
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes
801	Individual and Family Resource Management

Outcome #6

1. Outcome Measures

Research on Ecology of Wetlands to Improve Water Quality, Biofuel Production, Sustainable System Design, & Ecosystem Restoration

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wetlands have long protected human societies from floodwater. Modern societies also use wetlands to clean waste- and storm-water. Wetlands are increasingly being used to receive waste from anaerobic digesters that use microorganisms to break down biodegradable material and

produce energy. Developing coupled wetland-biodigestor systems are crucial to help the US to meet its increasing energy demands in a more sustainable way.

What has been done

The overall goal of this research was to better understand complex ecological processes of waste- and storm-water wetland systems to improve their ecological functioning and ability to provide important ecosystem services. This project specifically addressed the services of pollutant removal, infectious disease regulation, and biofuel production. Example project methods included vegetation studies, environmental data collection, mosquito studies, testing of coupled wetland-anaerobic digester systems, and modeling.

Results

The main activity during this final project year was writing the remaining manuscripts for publication, presenting findings at scientific conferences, and incorporating the findings from this project, from all project years, into university courses. A total of 35 students advanced their knowledge of the ecological processes related to wetlands in classes on Wetland Ecology and Wetland Restoration. Investigators mentored a total of two PhD and four MS students.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
511	New and Improved Non-Food Products and Processes

Outcome #7

1. Outcome Measures

Research on Biomass Degradation by Enzymes of Saccharophagus Degradans

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is an acute need to develop efficient enzyme mixtures to improve the digestion of lignocellulosic biomass to aid in the release of sugars. Current systems require uneconomical pretreatments or the retained hemicellulose and lignin blocks access of the cellulases to their substrate, thus limiting hydrolysis. Complicating this issue is the crystallinity of cellulose.

What has been done

The first steps in the research were to understand the biochemical activities of S. degradans contributing digestion of specific substrates and to elucidate the regulation of the source genes. With this knowledge, more effective enzyme mixtures were assembled and their expression engineered. In collaboration with researchers in the Department of Material Science and Engineering, methods were developed to enhance the enzymatic conversion of biomass into sugars and reduce the crystallinity of cellulose, a second barrier to digestion.

Results

Researchers accomplished: Production of enzymes for degrading biomass and clarification of the role of critical enzymes; identification of the first new family of cellulases found in over 10 years; a solvent system for preventing the recrystallization of cellulose biomass; detailed metabolic flux analysis of the movement of carbon during the metabolism of glucose and the enzymes involved; and, novel transporters for the import of hydrolytic products.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
403	Waste Disposal, Recycling, and Reuse
511	New and Improved Non-Food Products and Processes

Outcome #8

1. Outcome Measures

Research on Uses of Byproducts of Biofuels

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The rapid expansion of fuel ethanol production has led to an increase in both the cost of corn and the production of corn byproducts. The livestock and poultry industries have a great interest in utilizing distiller's dried grains with solubles (DDGS) and we distiller's grains (WDG) to lower the cost and increase the health of meat.

What has been done
Testing alkali hydrolysis of corn distillers grains to convert most of the matrix-bound, unabsorbable phenolics into absorbable phenolics in animal GI tracts.

Results
Results indicated that phenolic compounds, especially phenolic acids and carotenoids and antioxidant capacities in corn are well concentrated into DDGS during the fuel ethanol production processing. Because the health benefits of phenolic acids and carotenoids have been well recognized, corn distillers grains co-products, especially DDGS, can be a good source to improve health and wellness of farm animals and their profitability.

4. Associated Knowledge Areas

KA Code	Knowledge Area
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management

Outcome #9

1. Outcome Measures

Spatial Economic Modeling of Land Use and Watershed Management

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Land-use change is a primary driver of the losses in biodiversity and ecosystem services at local to global scales. Developing spatially explicit projections of land-use change and their consequences has thus emerged as one of the eight grand challenges in environmental science.

Yet our ability to forecast land-use change has been limited by the availability of spatial data and our understanding of nonlinear threshold responses in economic and ecological systems.

What has been done

Managing urban sprawl is critical to maintaining the integrity of agricultural and resource areas, particularly due to low-density exurban development. This project created data on the residential subdivision history in the Baltimore metro region from 1960 to 2007 to understand the economic factors affecting spatial land-use patterns and forecast land-use change. The study evaluated the effect of a major downzoning policy to preserve agricultural and forested land in the region. It was found that the down-zoning policy did not affect the likelihood of development, but it did decrease the density of development. Also analyzed is the effect of the forest conservation regulations on residential development and forest cover change in the region.

Results

Results indicated that, after the FCA regulation, forest cover increased by 21% within subdivisions relative to the amount without the regulation. Parcels with the highest levels of forest cover continue to have significant forest losses, despite the FCA regulations. Because regions with the most intact forest cover are those least protected by the FCA regulations, land-use planners must conserve high priority forested areas using other approaches (e.g., purchase of development rights or conservation easements). The land-use change models were also integrated with the Chesapeake Bay watershed model to analyze the economic efficiency of regulatory and incentive-based policies on the fluxes of nutrient and sediment loads in urban areas of the Chesapeake Bay watershed. These results provided novel approaches to analyze the effect of land-use policies and their associated effects on water quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
601	Economics of Agricultural Production and Farm Management

Outcome #10

1. Outcome Measures

Determinants of Residential Energy Demand and Energy Efficiency

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Residential energy use is responsible for a number of environmental externalities, including greenhouse gas emissions. Energy consumption in buildings accounts for some 20-30% of the carbon dioxide emissions in developed countries, and in the US the average household living in a single family home generates about 12 tons of CO2 each year. As a result, there has been significant legislative and programmatic activity to encourage the adoption of microgeneration technology based on renewables, improve the energy efficiency of homes, and tightening energy efficiency standards.

What has been done
Since 2005, the state of Maryland has been issuing grants for the installation of photovoltaics and other renewables, and the Empower Maryland required that electricity consumption in the state to be reduced by 15% by 2015. Other approaches rely on improved information and real-time feedback about energy usage, normative approaches, whereas real-time pricing has been primarily applied to reduce infraday variation and contain demand at times when it is especially high.

Results
This research study has been conducted in four counties in Maryland where the climate and the absence of piped natural gas make air-source heat pumps a popular choice for heating the home in the winter and cooling in the summer. A paper has been written describing the state of knowledge about residential energy behavior; also, a paper on the response to residential energy tariff changes based on data collected in Ukraine has been written. Current work includes showing the short-run elasticity and long-run effect of energy efficiency upgrades using data from the Ukraine.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
801	Individual and Family Resource Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

As in previous years, there is limited capacity across Extension and Research to address this planned program. However, it has been an area where some capacity has been built over the past years. For example, UME hired an energy specialist in 2018 and is working to create a team devoted to this topic with this Specialist's leadership. The poultry, dairy, and green industry are very interested in alternative sources of energy and more energy savings techniques that make their operations more efficient and profitable. Research on the conversion of biomass to bioenergy has matured, but it is envisioned that with more research funding Maryland scientists will move forward in developing economically and environmentally sound methods to convert biomass and waste into biofuels.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

A needs assessment survey of UME faculty and staff indicated that farmers and ranchers account for 26.85% of those clientele in the state that are currently seeking energy-related information with priority given to economics, heating and energy assessments. Various academic, research, private enterprise, and government stakeholders in Maryland have also expressed a priority in on-farm renewable energy such as grid-tied solar PV to meet the state's RPS. A quantifiable number of energy assessments may be performed through this UME Program while the outcome indicators may be reported in terms of the number of participants (#) adopting appropriate energy practices, the total cost ($) of energy efficiency renovations in grant applications, the annual financial ($) and energy (BTU) savings, and the reduction in carbon emissions (g-CO2).
A needs assessment survey of UME faculty and staff indicated that wind turbines (13.98%), grid-tied solar PV (12.90%), and land leasing (11.83%) were top priorities for those clientele currently seeking information about clean energy technology in the state. Various academic, research, private enterprise, and government stakeholders in Maryland have also expressed a priority in on-farm renewable energy such as grid-tied solar PV to help meet the state's RPS.
A needs assessment survey of UME faculty and staff indicated that rural and urban residents currently account for 25.93 and 15.74% of those clientele seeking energy-related information in Maryland, respectively. The survey results further indicate a priority in economics, heating, and landscaping issues associated with residential settings. Various academic, research, private enterprise, and government stakeholders in Maryland have also expressed a priority in renewable energy including solar PV for residential markets to meet the state's RPS.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Climate Change

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	10%	0%	15%	13%
104	Protect Soil from Harmful Effects of Natural Elements	0%	0%	0%	10%
111	Conservation and Efficient Use of Water	10%	10%	5%	0%
112	Watershed Protection and Management	15%	25%	10%	34%
123	Management and Sustainability of Forest Resources	5%	0%	5%	0%
131	Alternative Uses of Land	10%	10%	5%	0%
132	Weather and Climate	0%	20%	0%	10%
133	Pollution Prevention and Mitigation	10%	15%	25%	13%
205	Plant Management Systems	15%	0%	10%	0%
216	Integrated Pest Management Systems	10%	0%	10%	0%
307	Animal Management Systems	0%	0%	0%	10%
403	Waste Disposal, Recycling, and Reuse	5%	20%	15%	0%
601	Economics of Agricultural Production and Farm Management	0%	0%	0%	10%
608	Community Resource Planning and Development	10%	0%	0%	0%
	Total	100%	100%	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	16.0	3.0	11.0	3.5
Actual Paid	29.0	3.0	11.0	1.6
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**
686550	274287	370132	176173
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
686550	274287	370132	130827
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
796538	0	0	183586

V(D). Planned Program (Activity)

1. Brief description of the Activity

• UME, MAES, and AES will have a combined focus to help producers plan and make decisions in adapting to changing environments, sustaining economic vitality, and taking advantage of emerging economic opportunities offered by climate change mitigation technologies.
• UME, MAES, and AES will also develop research and education programs that generate knowledge to develop agriculture systems that maintain high productivity in the face of climate changes and reduce greenhouse gas emissions.
• In an effort to meet these objectives, UME, MAES, and AES will develop research and action teams that will focus on: Alternative energy and biofuels; Aquatic resources; Biodiversity/ecosystem services; Energy conservation; Forest resources; Integrated Pest Management; Invasive and exotic species; Land use; Nutrient management; Recreational resources; Waste management; Waste utilization and resource recovery; Watershed restoration; and Wildlife resources.
• UME, MAES, and AES will conduct workshops, demonstrations, symposia, twilight tours, forums and research to educate producers, farmers and citizens about adapting management practices to benefit the environment and minimize climate change impacts.
• MAES, AES, and UME will develop and expand collaborative research and education programs with partners and stakeholder and develop new web based and media educational materials.

2. Brief description of the target audience

- Maryland citizens;
- Master Gardeners and Naturalists;
- Urbanites
- Land developer and owners;
- UME, MAES, and AES faculty;
- USDA-NRCS conservationists;
- Soil Conservation District personnel;
- EPA-Chesapeake Bay
- MDA program staff;
- MDE program staff;
- Producers;
- Farmers;
- Nursery and Greenhouse industry personnel;

- Forest landowners;
- 4-H youth;
- County planning and zoning program staff;
- AGNR industry;
- Nonprofits;
- Appropriate state and municipal government officials;
- Primary and Secondary Science Teachers;
- Media; and
- Maryland homeowners.

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	25702	6222	20932	22

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

Patent Applications Submitted

Year: 2018

Actual: 1

Patents listed

Dual System Process for Ammonia Vapor Recovery

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	3	8	11

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational programs (workshops, twilight tours, field days, courses) offered

Year	Actual
2018	825

Output #2

Output Measure

- Number of applied research projects

Year	Actual
2018	7

Output #3

Output Measure

- Number of Master Gardeners, Naturalists, Bay-wise, Watershed stewards, and other trained volunteers to deliver educational programs

Year	Actual
2018	7500

Output #4

Output Measure

- Number of newsletters (electronic and paper) to the public

Year	Actual
2018	17

Output #5

Output Measure

- Number of individuals reach through Extension programs
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of information pieces developed

Year	Actual
2018	17

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased number of citizens and communities adopting practices of landscape ecology and understanding the relationship among pesticides, poor septic systems and environmental health.
2	Number of new crop varieties, animal breed, and genotypes with climate adaptive traits.
3	Increase in management and sustainability of forest and wildlife resources.
4	Increase in nutrient management planning, waste management systems, and use of composting technology.
5	Increase in research regarding agricultural waste management, composting, water quality, and environmental health.
6	Increased number of acres of best management practices (storm water, nutrient management) implemented
7	Watershed Diagnostics for Improved Adoption of Management Practices: Integrating Biophysical and Social Factors
8	Waste Management and Cover Cropping System to Enhance Soil Health, Nutrient Cycling, Waste to Energy, Water Quality, and Climite Adaptation
9	Implementing Disease Forecasting in Mid-Atlantic Strawberry Production to Promote Industry Sustainability
10	Mitigation of Heat Stress in Broiler Chickens through Early-Life Thermal Conditioning
11	Economic Modeling of the Design and Effects of Environmental Regulation
12	Coastal Community Climate Resilience
13	Meadow Making Program
14	Developing a Cost Effective Method to Reduce Ammonia Emission
15	An Agro-ecosystem Model to Achieve Agricultural Sustainability
16	Impact of Climate Changes on Water Quality of Chesapeake Bay

Outcome #1

1. Outcome Measures

Increased number of citizens and communities adopting practices of landscape ecology and understanding the relationship among pesticides, poor septic systems and environmental health.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Maryland's diverse natural resources and ecosystems are experiencing increasing pressure and negative impacts due to expanding population and development. Master Naturalist (MN) programs, found nationwide in 39 states, are conservation-based collaborative ventures between state and local groups formed for the purpose of producing an educated corps of volunteer environmental stewards.

What has been done
Based on a need expressed by Maryland's natural resource agencies and organizations, the Maryland Master Naturalist Program was developed and piloted in 2010. Unlike many other UME volunteer training programs, the volunteers trained through this program are managed directly by staff at the site where they were trained instead of by Extension faculty. Another difference is that the program is totally self-supported by funds raised through class registration fees and donations. These two differences enabled a needed volunteer training program in the critical realm of natural resources education and conservation to exist without being a financial burden to the University.

Results
In the past eight years, a cumulative total of 1,264 Maryland Master Naturalists, taught using UME curriculum in one of 69 trainings, have volunteered a total of 97,912 hours. According to the Governor's Office on Service & Volunteerism, this time is valued at $2,586,372.23. Volunteer service provided by Certified Master Naturalists and Interns in 2017-18 totaled 23,529.70 hours, valued at $647,066.75.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
216	Integrated Pest Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #2

1. Outcome Measures

Number of new crop varieties, animal breed, and genotypes with climate adaptive traits.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Increase in management and sustainability of forest and wildlife resources.

2. Associated Institution Types

- 1862 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Deep row entrenchment using biosolids and hybrid poplar trees (DRE) solves a major problem with how to beneficially use biosolids. P regulations make agricultural applications more problematic. There are thousands of acres of coal and gravel mine spoils around major urban areas that were mined prior to the mine reclamation act of 1973. DRE provides a viable business

model that will help to restore these sites so they can grow trees while provide a beneficial use for biosolids.

What has been done

UME faculty have received many calls from out of state engineering firms and wastewater treatment authorities about DRE application on coal mine spoils. The application to coal mine sites requires different approaches compared to the gravel spoils using in the UM research. Visits to various sites in OH and PA in 2017 made it clear that a best practices guide was needed and this is being finalized by UME faculty. This will be shared with wastewater treatment organizations and private firms via webinar and publications in the coming year.

Results

The developing of a best practices guide and documentation of DRE in other states will be used by UME faculty in work with the Maryland Department of Environment to reconsider the use DRE in Maryland. Using biosolids to restore old gravel and mine spoils will create in-state jobs and environmental restoration, compared to the present practice of exporting biosolids to other states.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
132	Weather and Climate
133	Pollution Prevention and Mitigation
608	Community Resource Planning and Development

Outcome #4

1. Outcome Measures

Increase in nutrient management planning, waste management systems, and use of composting technology.

2. Associated Institution Types

- 1862 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Regardless of land use, improperly or excessively applied nutrients can leach into the groundwater or exit landscapes via runoff from precipitation and then migrate into Maryland's waterways. Once in the water, excess nutrients upset the Bay's ecological balance by causing algal blooms and contributing to eutrophication and degradation of wildlife habitat.

What has been done
The Agricultural Nutrient Management Program provides support to the nutrient management planning community through educational opportunities, technical support and software development. It also provides support to agricultural producers through the development of nutrient management plans.

Results
Nutrient management advisors updated 5,028 existing nutrient management plans (NMPs), covering 222,373 acres, and 96 no-land plans; developed 375 new plans that covered 9,815 and 38 no-land plans; conducted the Phosphorus Site Index and Phosphorus Management Tool on 832 fields for 184 clients; developed NMPs for 14 manure transport clients, allowing transportation and application of manure on 2,607 acres; developed new and updated NMPs for 149 CAFO or MAFO clients; and, developed plans for 321 clients participating in Maryland Agricultural Water Quality Cost-share (MACS) cover-crop program.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #5

1. Outcome Measures

Increase in research regarding agricultural waste management, composting, water quality, and environmental health.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Increased number of acres of best management practices (storm water, nutrient management) implemented

2. Associated Institution Types

- 1862 Extension
- 1890 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
As population in the Chesapeake Bay watershed continues to increase, natural areas are converted to more impervious surfaces to accommodate the needs of residents, businesses, and industry, thereby increasing storm water runoff and the transport of sediment and nutrients. The Chesapeake Bay Program (CBP) estimates state that increased development across the watershed has made storm water runoff (also called polluted runoff) the fastest growing source of pollution to the Chesapeake Bay.

What has been done
The Watershed Stewards Academy trains and supports a diverse group of volunteers (stewards) conversant in storm-water issues who then use their training to educate communities and design, implement, maintain, and promote restoration projects focused on storm-water management and improving local water quality.

Results
Through education, oversight, or support from the Sea Grant Extension Specialists throughout 2018, Watershed Stewards Academies graduated 66 new Master Watershed Stewards as well as provided assistance to previous program graduates with their community outreach and restoration activities. Their combined efforts of class, capstone, and community projects resulted in the completion of 34 new projects totaling 4,092 square feet of best management practices (BMP) treating 8,531 square feet of impervious surfaces. In all, they planted 1,291 native plants, held 39 educational events, educated 2,577 individuals, and engaged 575 volunteers to complete 3 rain gardens, 87 rain barrels, individual and community site assessments, conservation landscapes, storm drain stenciling, pet waste stations, BMP maintenance, and an Earth Day educational video.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

Outcome #7

1. Outcome Measures

Watershed Diagnostics for Improved Adoption of Management Practices: Integrating Biophysical and Social Factors

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Chesapeake Bay is the most important estuarine ecosystem in Maryland. For the past three decades research and extension efforts have focused in alleviating degradation of the Bay by reducing point-source pollution loadings of sediments and nutrients entering the bay, but nonpoint-source pollution has been a challenge due to the source of pollution and the size and spatial heterogeneity of the Bay's drainage basin. NPS pollution is best tackled by applying best management practices (BMPs) over the landscape. However, land area, time, and monetary resources are limited. For local, county, and state governments to make efficient and effective resource allocations, they need to know where especially vulnerable watershed areas are so that they can focus their BMP adoption and implementation efforts there.

What has been done

A team of researchers from AGNR collaborated with colleagues from ENGR to study the potential effects of climate change on nutrient pollution and effectiveness of management practices. The research focused on an agricultural watershed of the Chesapeake Bay drainage basin to help watershed managers mitigate the effects of run-off, sediments, nitrogen, and phosphorous from farming. The work used hydrological models to identify areas in the watershed that produced the

most pollution ("hotspots") under current climate conditions. It then developed a decision support tool allocate the most appropriate management practices to "hotspots" given the local environmental conditions (land use, soils, topography). Models were subjected to weather from different climate scenarios that were downscaled from global climate models.

Results

The research indicated that areas that produced highest amounts of pollutants will grow substantially with climate change and that the allocation of management practices under current climate conditions would be in insufficient to mitigate pollution and meet Chesapeake Bay TMDLs. The allocation of management practices needs to take into account the expected effects of weather under future climate change scenarios. As part of the project's 4-H Youth Development educational outreach efforts, a series of Chesapeake Bay and water quality-themed lessons have been developed for a target audience of middle school students. In order to make water quality education accessible to all students, most of the activities are designed to be adaptable for use with younger and older students.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management

Outcome #8

1. Outcome Measures

Waste Management and Cover Cropping System to Enhance Soil Health, Nutrient Cycling, Waste to Energy, Water Quality, and Climite Adaptation

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This project features a team of five faculty labs that focus on optimizing the cycling and management of nitrogen (N),phosphorus (P) and other essential nutrients. Improved nutrient management by understanding the fate, transformations, and transport of N and P from land to

water is needed to improve water quality in the Chesapeake Bay. Cover crops represent a major nutrient management tool that is increasingly being used in agriculture to improve soil health and minimize negative environmental impacts. waste-to-energy systems are needed to make effective use of organic by-products from agriculture and other industries.

What has been done

In 2018, progress was made in developing extended season cover cropping systems. The team focused on a 3-way cover crop mix that included a Brassica, a cereal, and a legume. Extended growth by planting green in spring quadrupled the biomass and N accumulated, and reduced moisture stress to corn during summer drought and eventually resulted in increased corn yields. They also compared standard drilling after harvest 2 Aerial overseeding three to four weeks before harvest for the early planting alternative. In another experiment, several early overseeding dates were imposed as subplots within several early-maturing corn hybrids to create the diversity of cover crop planting windows. The over-seeding in July and August produced excellent cover crops using a 12 species mix. They will then examine the individual species for adaptation to over-seeding conditions.

Results

The most significant impact of the project was a direct influence on the design of a new pilot cover program by the Maryland Department of Agriculture. This pilot program will be a performance-based program that allows later cover crop planting in fall but requires the cover crop to be kept alive until May 1st, four to five weeks longer than is typical. This program will be aimed at soil health benefits (carbon, roots, water conservation) rather than the nitrogen capture benefits that are the focus of existing Maryland Department of Agriculture cover crop programs. Our research on extending the cover crop season and planting green directly impacted the design of this program through discussions with the Assistant Secretary of Agriculture. The program was implemented as a pilot in the fall of 2018. Three research articles were published in high-impact factor journals that provided insights on the fate and transport of nutrients in the environment. Several presentations were made to the target audience to increase their understanding of behavior of nutrients in the landscape throughout the counties in Maryland. Several grants were secured to better understand the availability, behavior, and transport of nutrients from land to water bodies. Six undergrads and two graduate students were trained and advised under this project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
205	Plant Management Systems
403	Waste Disposal, Recycling, and Reuse

Outcome #9

1. Outcome Measures

Implementing Disease Forecasting in Mid-Atlantic Strawberry Production to Promote Industry Sustainability

2. Associated Institution Types

- 1862 Extension
- 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)
Strawberries are the top grossing fruit crop in the mid-Atlantic, valued at $250 to $500/hundredweight in 2015. Over 1600 farmers in the region depend on this crop as their only source of spring income, and a way to kick off the agrotourism season. Fruit rot diseases are one of the major stakeholder-identified factors limiting strawberry production in the Mid-Atlantic and the single most significant obstacle to profitable production.

What has been done
Fruit rot disease management is essential for profitable production and currently relies on calendar-based fungicide applications. Facing critical losses associated with fungicide failures, growers have requested solutions that preserve effective chemistries. The southeast has developed the Strawberry Advisory System (SAS), a risk-based disease forecasting tool which has reduced fungicide applications by up to 50%. Growers in the mid-Atlantic are interested in using risk-based management; however, the southeast system does not presently include the mid-Atlantic, and regional validation trials are requisite to grower adoption.

Results
The research team has conducted the 2nd year validation trial at Western Maryland Research & Education Center (WMREC); initiated and conducted year 1 efficacy trials at four sites in Virginia; initiated the validation trial to include matted-row strawberry system at commercial farms in Maryland; and, installed the 2nd weather station in VA and MD respectively, and successfully integrated into the SAS disease forecasting website, APP, and SMS alert system. The two weather stations in Maryland were installed at UMD off-campus research facilities (WMREC and WREC), allowing for a good exposure to extension agents and educators. In addition, the access to the real-time weather data were granted to extension agents and specialists, so that they can learn how to retrieve historical weather data, set environmental variables alerts, and monitor

weather conditions. County extension agents and educators attended meetings and conferences when forecasting tool and trial data were presented. Results were disseminated at local meetings, field days, and strawberry schools in the Mid-Atlantic region.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
132	Weather and Climate
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #10

1. Outcome Measures

Mitigation of Heat Stress in Broiler Chickens through Early-Life Thermal Conditioning

2. Associated Institution Types

- 1862 Extension
- 1862 Research
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Heat stress in chickens can occur in the summer, when temperatures often exceed 95°F in the regions of the United States where most broiler chickens are raised. Notable effects of heat stress on broiler production include increased death of chickens in the flock and reduced feed intake and growth by the birds that survive. In addition to the financial costs, heat stress in commercial poultry operations represents a serious issue of animal well-being.

What has been done
A series of experiments is being conducted in which broiler chickens are exposed to heat stress with and without prior thermal conditioning. Broiler chickens are housed in temperature-controlled rooms for collection of blood and tissue samples. Analyses include measurement of circulating hormone, gas, and electrolyte levels, and quantification of mRNA levels for key regulatory genes

within multiple tissues. Circulating hormone and electrolyte levels will be assessed to complement the gene expression studies proposed. Stress-related behavior are also being assessed as an indication of overall well-being of the animals. Finally, effects of prior thermal conditioning and high ambient temperatures on carcass and performance parameters will be evaluated in a production setting. The specific objectives of the project are: (1) Define the minimal duration of thermal conditioning required for reducing heat stress and morbidity; (2) characterize mechanisms involved in alleviation of heat stress by thermal conditioning; and (3) evaluate effects of thermal conditioning on performance under production conditions.

Results
Broiler chickens were raised in temperature controlled rooms to 32 days of age, with and without thermal conditioning on day 3. An 8-hour heat stress at 95 degrees was applied on day 32. Tissue samples were collected, and RNA was extracted. Analysis of gene expression in the hypothalamus of the brain and the anterior pituitary gland indicates that heat stress alters expression of genes involved in controlling metabolic rate and stress responses.
One postdoc and one technician worked on this project in the previous year. Knowledge was gained in procedures for extracting RNA and analyzing gene expression.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate

Outcome #11

1. Outcome Measures

Economic Modeling of the Design and Effects of Environmental Regulation

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is increasing recognition of the need to reduce greenhouse gas emissions that lead to global climate change, and to further reduce emissions of local air and water pollutants. At the same time, there are worries about the costs of environmental regulation, both to society as a

whole and to particular groups (such as low-income households, or geographic regions that rely on jobs in polluting industries). Better understanding of those potential costs can help inform decisions about whether to regulate a particular pollutant, how stringent to make those regulations, and how to design regulations to better protect the environment while also limiting costs.

What has been done

This project aims to use economic modeling to advance understanding of the effects of environmental regulations, especially those designed to mitigate climate change. Specifically, research is being conducted to address five key questions: How does environmental regulation affect jobs? Who bears the cost of carbon pricing? How does linking cap & trade programs across nations or regions affect the efficiency of those programs? Under what circumstances can narrow-based carbon pricing be more efficient than broad-based carbon pricing? And how can carbon pricing be adapted better to work with price-regulated industries? This research will utilize a variety of modeling techniques to address the different questions.

Results

A combination of models will be used together with a simple empirical micro-simulation model to look at the incidence of carbon pricing (i.e., who bears the cost of the policy), how that incidence changes over time as the economy adjusts to the policy, and how the use of revenue generated by the policy affects incidence. Progress is being made on linking these models to look at who bears the cost of carbon pricing. A manuscript has been revised and submitted to the Journal of Public Economics about environmental regulation and jobs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
608	Community Resource Planning and Development

Outcome #12

1. Outcome Measures

Coastal Community Climate Resilience

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Approximately 70% of Maryland's population (over 4 million people) resides in a coastal county. However, Maryland's coastal communities are facing a variety of challenges due to a changing climate, including warmer air and ocean temperatures, more frequent storm events, and flooding from rising sea levels and increased precipitation. In particular, relative sea level in Maryland is rising at a rate that exceeds the global average with a projected increase of 1.2 feet by 2050. As a result, Maryland residents in low-lying coastal areas are exceptionally vulnerable to flooding, and this problem will continue to be compounded by precipitation changes in the mid-Atlantic region.

What has been done

Educational programs and technical assistance for coastal community residents and decision-makers are needed to improve the ability of Maryland's coastal communities to respond to changing climate conditions. UME Educators have established working relationships with local government officials on the Eastern Shore, researchers and Extension Educators within the University of Maryland System, and state, federal, and non-profit partners working on coastal climate issues in the state of Maryland and the mid-Atlantic region; contributed to state work groups developing plans to address nuisance flooding and saltwater intrusion; have begun organizing a Climate Forum for UMD researchers; developing outreach materials to communicate the state's new sea level rise projections; and are establishing new partnerships within the Chesapeake Bay Region.

Results

Over the next year, based on what has been accomplished to date, the knowledge of coastal residents and decision-makers about changing coastal conditions and adaptation strategies will be increased though public presentations, printed outreach materials, and online educational content. The ability of Maryland's coastal communities to respond to the effects of climate change will also be improved through technical assistance to local governments facilitating grant applications, plan development, and project implementation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
608	Community Resource Planning and Development

Outcome #13

1. Outcome Measures

Meadow Making Program

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Development, invasive species, and climate change are reducing the extent and quality of Maryland's natural areas. One direct consequence is a loss of biodiversity. The total number of vascular plant species growing outside of cultivation (in the wild) in Maryland is estimated at 3,069. Of these, 777 species (25%) are exotic. Of the 2,292 natives, 451 (20%) are listed by the state as rare, threatened, endangered, or extirpated. In many cases, the remaining native plant communities are so fragmented that cross-pollination is limited, and species dwindle simply from lack of access to diverse genetic partners.

What has been done
New Extension programs are needed that will teach landowners and green industry professionals how to include native plants in residential and commercial landscapes. One way to do that is by converting the vast acreage of unused lawns into native meadows. Making Meadows is a seven-part Master Gardener course that is also well-attended by MNs and landscape professionals. The education provided in this class dramatically increases the chances of a successful meadow project.

Results
Long-term outcomes of the Meadow Making program include: a professional community within the Mid-Atlantic region that shares knowledge of effective techniques through tours, demonstrations, workshops and an annual conference; training opportunities, fact sheets, newsletter, social media for professionals and the public; a higher success rate for landscape managers and professionals establishing native meadows; public awareness of the profession of establishing and maintaining meadows; higher public opinion of native meadows resulting in more jobs for landscape professionals; reduced landscape maintenance costs for landowners and tax payers; policies and regulations that encourage, rather than discourage, native meadow establishment; increased biodiversity, pollinator habitat, beneficial insect populations, carbon sequestration; and, reduced air pollution, noise and fossil fuel consumption.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
132	Weather and Climate

205	Plant Management Systems
608	Community Resource Planning and Development

Outcome #14

1. Outcome Measures

Developing a Cost Effective Method to Reduce Ammonia Emission

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Ammonia emission from poultry houses creates problems for people as well as animals. Adding gypsum to poultry litter can reduce the amount of ammonia emission. Poultry litter amended with gypsum will improve soil health, change chemical and physical qualities, increase water and air infiltration rates when used as fertilizer. Gypsum also Improves water quality by reducing the transport of dissolved phosphorous, pathogens and other contaminates in surface and subsurface waters.

What has been done
Two-gallon jars containing fresh poultry litter were treated with either a commercial ammonia-reducing product, or gypsum. Pen trials were conducted as a Randomized Complete Block design of four treatments, two concentrations of each, a commercial ammonia-reducing product and gypsum. Besides ammonia emission, poultry production data were collected.

Results
Both treatments in jars reduced ammonia volatilization significantly (40-60%) compared to the control and continued reductions for nearly two weeks. In the pen trials, there were no significant differences for any of the measurements. The lack of difference between ammonia volatilization and reduction were likely due to a very low moisture content of the initial poultry litter bedding during placement of the chicks.

4. Associated Knowledge Areas

KA Code	Knowledge Area

102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
133	Pollution Prevention and Mitigation

Outcome #15

1. Outcome Measures

An Agro-ecosystem Model to Achieve Agricultural Sustainability

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Delmarva Peninsula, home to some of the most productive agriculture in the nation, faces numerous environmental challenges that may jeopardize both its productivity and its economic viability. Climate change has the potential to impact food system productivity via a wide variety of mechanisms including direct effects on plants as a result of temperature, water, or CO2 changes, and indirect effects by changing weed, insect, and pathogen pressure. Adaptation and mitigation strategies must be developed to feed the growing global population while coping with climate change and land availability.

What has been done
Field monitoring data has been collected and long-term data from research and commercial farms compiled and organized to help improve modeling parameterization in the difficult terrain (very flat) of the Manokin water shed. We are developing monitoring datasets that include groundwater, ditch and stream monitoring, soil characteristics, field management, and subsurface imaging.

Results
A farm economic model was developed using linear programming to evaluate crop and poultry opportunities for Delmarva. Total farm net returns to land, risk, and management are an average of $3,058/ha ($1,238/ac). Included enterprises are broilers, unirrigated corn grain, wheat, soybean, alfalfa, and tomato. Major factors behind the high return are broiler and tomato production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
132	Weather and Climate
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #16

1. Outcome Measures

Impact of Climate Changes on Water Quality of Chesapeake Bay

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
With the increasing CO2 concentration in the atmosphere, the circulation pattern, water-column chemistry and material transport in the Chesapeake Bay will be impacted. Precipitation over the Chesapeake Bay is projected to increase in winter and spring by multiple climate models, and the winter and spring streamflow will increase correspondingly. How these changes in the physical environment (salinity, vertical mixing, etc.) will affect the biogeochemical cycles in the relatively large estuary has not been widely discussed.

What has been done
A biophysical model for Chesapeake Bay was developed and improved based on our high-resolution coupled hydrodynamics-eutrophication model, to increase the stability and robustness of simulating several biophysical factors. Water quality model calibration was completed. The scenarios of year 2020, 2030, 2040,2050, 2060, 2070, 2080, 2090 were run for the water quality variation.

Results
Analysis of data generated by the model is ongoing, as well as further model development.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

In the past eight years, a cumulative total of 1027 Maryland Master Naturalists, taught using UME curriculum in one of 56 trainings, have volunteered a total of 74,266.80 hours. According to the Governor's Office on Service & Volunteerism, this time is valued at $1,936,211.24. In the words of a 2014 trainee, "As a nature lover, I learned so much that I have been able to share with my family, friends, and scouts. In addition, it also gave me knowledge of people to call for more information. Incredibly valuable class."

In 2018, 21 Master Gardeners learned Bay-Wise best management practices (BMPs) in 1 Bay-Wise advanced training class. This brings the total of trained Bay-Wise-trained Master Gardeners to 1,386, with 400 of them currently active on their local Bay-Wise Committees. In a 2015 post-class survey, Master Gardeners indicated that 96% (n=29) of them would frequently or almost always use information they learned during training in their Bay-Wise outreach efforts. Only seven percent had their home landscapes certified as ecologically sound demonstration sites in their own neighborhoods. As a result of the training, 80% pledged to do so. Since 1997, Bay-Wise Master Gardeners created and maintained 645 residential demonstration sites throughout Maryland. They have also certified 2,154 residential and 241 non-residential sites around the state. In 2018, Master Gardeners volunteered 6,754 hours in Bay-Wise and environmental horticulture projects. This time is valued at $185,730.00 by independentsector.org. The program generated $3,925.55 in fees in 2018. This income is used to support the program's operating expenses.

The book, The Woods In Your Backyard: Learning to Create and Enhance Natural Areas Around Your Home, was revised in 2016 for the 2nd edition. A downloadable workbook was provided. The book content was put into ELMS as an online course with additional videos

and other resources. A BETA test was done in spring 2016 and improvements and changes made to the course. The course was first offered in Fall 2016 and every spring and fall semester thereafter for a maximum of 25 participants. A followup survey was done in March 2018 for 69 total enrollees (65% response rate) from Fall 2016, and spring and fall 2017. Some key results include:
* the biggest barrier to not completing the course was personal and family circumstances.
* 52% of respondents over 60 years old and 32% under 50.
* 42% contacted service provider. 31% were arborist, 23% landscapers and only 15% foresters
* Top 5 unpaid labor projects were: planting tree and shrubs, creating wildlife brush piles, reducing/eliminating mowing, using herbicides to control invasive/exotic plants, and pruning trees.
* Top 3 paid labor projects were: planting trees and shrubs, using herbicides to control invasive/exotic plants, and planting or enhancing mast trees.
* 70% had converted some lawn to natural areas with 56% converting up to one acre and 9% converting 5-15 acres.
* 660 Total acres owned or managed
* 96% had undertaken some type of land care practice

The Carroll County Extension office partnered together to deliver and evaluate AgVenture. The program is divided into 4, 30 minute hands-on lessons. The stations are: dairy, soil, watershed, and grains. Students are given a 15-20 minute talk coupled with a hands-on activity to reinforce concepts. Pre-post data is collected to determine is the program is effective. To date, approximately 3400 adults and youth have been through the AgVenture program. Paired sample t-tests show a statistically significant increase in agriculture knowledge. Feedback from teachers, students and parents show that enthusiasm for the program and that it creates a healthy interest in STEM. This has led to increased partnership within the community and the number of donations for community businesses, farmers, and ag-based organizations has grown. Further, the program has no fee so that all students can attend and benefit without having the barrier of payment. This means that for Marylanders, they become exposed to the Extension, get quality education for their children and interest in agriculture and STEM grows.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Childhood Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
703	Nutrition Education and Behavior	50%	34%	0%	0%
704	Nutrition and Hunger in the Population	5%	33%	0%	0%
724	Healthy Lifestyle	35%	33%	0%	0%
801	Individual and Family Resource Management	10%	0%	0%	0%
	Total	100%	100%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	1.5	5.0	0.5
Actual Paid	15.0	1.5	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**
343275	137143	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
343275	137143	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
5489356	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Develop/implement training for cafeteria/food service workers using Walk the Line curriculum.
- Workshops and professional development for Growing Healthy Habits, Farm-2-School, and Walk the Line.
- Develop and implement training for School Wellness Champions in pilot test sites focusing on sustainable wellness policies that support healthy lifestyles.
- Create effective materials and programs that meet standards of health literacy.
- Investigate taste preference and trying new fruits and vegetable measures for statewide evaluation.
- Educational programs for cafeteria and food service workers and school administrators.
- Educational programs targeting pre-schoolers and their parents through train-the-trainer approach for child care and pre-school teachers.
- Up For the Challenge curriculum implemented for school-age youth in 3 sites targeted to geographically dispersed military families/youth.
- Contribute articles and expertise to eXtension.org Community of Practice for Food, Fun, and Fitness
- Develop Social Marketing and Social networking strategies to engage target audiences in Healthy Living dialogue
- Conduct applied research to inform educational program interventions.

2. Brief description of the target audience

- School-age youth
- Parents of school-age youth
- Teachers
- Cafeteria/Food service workers
- School administration
- Providers of before and aftercare
- Limited Income Mothers and Children
- Food Stamp recipients
- Geographically dispersed military families
- Childcare providers

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	42500	0	22000	0

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	1	0	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational programs offered

Year	Actual
2018	1445

Output #2

Output Measure

- Number of applied research projects

Year	Actual
2018	2

Output #3

Output Measure

- Number of schools and child-care partnerships in childhood obesity prevention programs

Year	Actual
2018	138

Output #4

Output Measure

- Number of school gardens developed
  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	Increase in fruit and vegetable consumption among preschoolers and youth
2	Increase in school cafeteria workers' awareness, knowledge, and skills regarding healthy eating practices
3	Increase in preschoolers and youth who include physical activity in daily routine
4	Increase in preschoolers and youth who report eating more healthy foods

Outcome #1

1. Outcome Measures

Increase in fruit and vegetable consumption among preschoolers and youth

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food insecurity is gaining national attention in recent years. Major contributing factors include lack of access to nutritious foods and lack of knowledge about the importance of making healthy food choices. There is a strong need within Maryland for educational interventions that can help to address the problem. Food insecurity is widely prevalent in Talbot County, but the public is largely unaware. In reality, the majority of the county's ten schools have more than 50% of students who qualify for free and reduced meals. There is a need to draw attention to the problem and offer educational interventions to empower residents.

What has been done
During fiscal years 2017, 2018, and 2019 Talbot 4-H received grants from the Talbot Family Network to fund the Community Nutrition and Gardening Education Program. One of the program objectives is to help food-insecure youth and adults learn to make healthy food choices, and Help youth and adults understand gardening's role in growing vegetables and fruit and reducing the amount of money spent at the grocery store.

Results
569 youth and adults participated in nutrition and gardening lessons offered by Talbot 4-H. 12 raised garden beds were installed, and partners and participants learned to plant, maintain, harvest, and prepare produce at sites that serve populations experiencing food insecurity.100% of Talbot County Hunger Coalition partners surveyed stated that they value the importance of the nutrition and gardening programs offered by Talbot 4-H. 80% of 160 youth surveyed reported increased knowledge about making healthy food choices after as little as one lesson; and 85% of 140 youth surveyed reported increased knowledge about gardening's role in growing fruits and vegetables and reducing the amount of money spent at the grocery store. Data support the

effectiveness of this program in empowering youth to grow, obtain, and prepare nutritious produce items and reduce their struggle with food insecurity.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

Increase in school cafeteria workers' awareness, knowledge, and skills regarding healthy eating practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Smarter Lunchrooms is an evidence-based approach guiding students to select and eat healthy foods in the school cafeteria. Grounded in research from the Cornell Center for Behavioral Economics in Child Nutrition Programs, Maryland SNAP-Ed (FSNE) Smarter Lunchrooms supports schools and childcare centers in making simple no- to low-cost changes that ?nudge? students toward selecting healthy foods. Smarter Lunchrooms strategies make nutritious foods the easy and attractive choice for students, supporting healthy decision-making in their day-to-day lives.

What has been done
In FY18, 31 schools across 13 Maryland counties and Baltimore City engaged in Smarter Lunchrooms programming. FSNE staff also completed Cafeteria and Nutrition Environment Scans for participating Smarter Lunchrooms sites.

Results

The Smarter Lunchrooms Scorecard is a checklist of evidence-based best practices that have been shown to increase healthy eating behaviors through environmental changes in the school cafeteria. The environmental scan prompted nutrition educators to look at 241 different facets of the school lunchroom environment. The End of Year Reports were completed by FSNE educators at the end of the program year and assessed the extent to which school community settings adopted or utilized policy, systems, and environmental efforts to promote healthy eating and physical activity at their sites.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Increase in preschoolers and youth who include physical activity in daily routine

2. Associated Institution Types

- 1862 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity is a health crisis in the US. According to the CDC National Center for Health Statistics, 15.7% of Maryland youth between the ages of 10-17 years are obese. Approximately, one third of people living in the Upper Shore Cluster are obese. Results of the 2018 Maryland Upper Shore Needs Assessment indicated that people were concerned about their overall health and most interested in attending programs that focused on nutrition and healthy eating classes.

What has been done
Eating a healthy, balanced diet and making healthy lifestyle changes plays an essential role in maintaining a healthy weight. Educating people about the benefits of making healthy food choices will help them manage their weight and lower their risk for certain diseases. In response to the

results of the Upper Shore needs assessment, partnerships were formed and sites were recruited to host nutrition and healthy eating programs throughout the cluster. Program curriculum and resources used were from reliable sources including the USDA, Maryland's FSNE program, Iowa Department of Public Health's Snap-Ed program, and University of Maryland Extension program.

Results

In 2018, eight partnerships in Cecil, Kent and Queen Anne's Counties were formed. As a result of these partnerships, 13 nutrition and healthy eating programs were presented to 151 youth, adults and older adults in the cluster. As a result of attending these programs, knowledge about nutrition and physical activity improved. People correctly identified sources of lean proteins and unhealthy oils and the recommended physical activity guideline (150 minutes/week). Program participants also reported an increased intention to change behavior after attending these programs. They reported they were more likely to write a healthy goal and commit to it for a minimum of one week.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #4

1. Outcome Measures

Increase in preschoolers and youth who report eating more healthy foods

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A 2015 article by the Baltimore Sun states that ?the lack of proper nutrition, food deserts, a lack of physical activity, poor school nutrition and limited education contribute to the problem of childhood obesity. These can lead to youth suffering from social and psychological problems such as low self-esteem which includes bullying, a feeling of sadness, hopeless and stigmatization.

What has been done
In order to mitigate this youth are engaged in healthy living and healthy behaviors curriculum. The aim is to engage youth in a safe and engaging environment and to also increase their knowledge about health and nutrition.

Results
17 adult volunteers, 7 youth volunteers and 9 program directors in Baltimore City were trained in 2018 in Nutrition lessons. Surveys collected from the program directors and volunteers showed that over 80% believe that they learned a lot from the lessons and can be successful in implementing age-appropriate lessons to their youth. 628 youth completed the nutrition and healthy lifestyles lessons. Approximately, 20% of youth completed surveys which showed improved attitude, towards eating healthy. 80% of teens who filled out a survey to gauge their attitudes towards nutrition education agreed that they learned a lot from the lessons taught.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	10%	0%	100%	0%
205	Plant Management Systems	10%	0%	0%	0%
404	Instrumentation and Control Systems	10%	0%	0%	0%
501	New and Improved Food Processing Technologies	20%	0%	0%	26%
502	New and Improved Food Products	20%	0%	0%	7%
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	10%	0%	0%	17%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	20%	100%	0%	42%
723	Hazards to Human Health and Safety	0%	0%	0%	8%
	Total	100%	100%	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	10.0	1.5	5.0	5.8
Actual Paid	15.0	1.5	5.0	1.3
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**
343275	137143	925330	213409
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
343275	137143	925330	349410
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
79062	0	0	299135

V(D). Planned Program (Activity)

1. Brief description of the Activity

- Develop technical assistance programs for UME
- Develop and/or adapt food safety materials and resources for UME Educators
- Collaborate with local, regional, and national partners
- Develop safe food educational materials/ resources and disseminate USDA food safety materials to consumers and producers
- Develop food preservation educational materials/resources and disseminate to consumers via workshops and media
- Conduct trainings and workshops, including train-the-trainer workshops
- Conduct evaluations
- Promote and support Maryland Farm to School and other agricultural literacy programs
- Conduct data analysis, needs assessments, environmental scans, and asset mapping
- Network internally and externally with collaborators, partners, and affiliates
- Raise community and stakeholder awareness of local food issues
- Contribute to relevant eXtension Communities of Practice
- Develop online food safety modules
- Conduct social marketing awareness education focusing on food safety
- Conduct basic and applied research to inform program development regarding food borne illnesses and beneficial and safe compounds in the food.
- Protect fresh produce from pathogens during production
- Control Salmonella in poultry products
- Control Vibrio in shell fish
- Establish baseline data for the presence of certain pathogens in retail beef and veal in our region

2. Brief description of the target audience

- Consumers: Youth, adults, older adults
- Commercial: Fruit and vegetable producers and food processors
- Commercial: Seafood and meat producers and processors
- Food service workers, childcare workers, community-based organizations
- Service agencies related to food production, promotion, consumption, protection, education

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13494	5274	6429	100

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	4	8	12

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational programs offered

Year	Actual
2018	764

Output #2

Output Measure

- Number of applied research projects

Year	Actual
2018	6

Output #3

Output Measure

- Number of fruit and vegetable growers using good agricultural practices
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- Number of food processing operations using good manufacturing and sanitary practices
  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	Increase in people who gain basic food safety knowledge and skills
2	Increase in fruit and vegetable farmers adopting good agricultural practices
3	Increase in applied research projects
4	Increase in processors using good practices
5	Reducing On-farm Enteric Pathogens through Cropping Methods and Improved Food Safety Trainings
6	Investigation and Validation of Chlorine-Based Fresh Produce Washing Procedures Using Novel Experimental Platforms
7	Risk Identification for Toxoplasma Transmission in Pasture-Raised Animals
8	Sonochemical Processes for inactivation of spoilage microorganisms on surface of fresh produce and food-contact surfaces
9	Investigation of pathogens in domestic and imported frozen seafood
10	Utilization of Agricultural and Food Processing Byproducts

Outcome #1

1. Outcome Measures

Increase in people who gain basic food safety knowledge and skills

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Annually, foodborne illnesses affect an estimated 48 million American, which roughly translates into an economic burden of $55.5 billion dollars. Specifically in Maryland, it is estimated that the per-resident annual cost per case of food-borne illness is between $133 to $391 (2nd highest behind Washington DC), where cases are often preventable. Those most susceptible to food-borne illness are: children age birth to five years of age; pregnant women; immunosuppressed (e.g. cancer patients); and adults 50+ years of age.

What has been done
FCS agents teach food preservation as part of the states Grow It Eat It campaign that encourages Marylanders to grow and eat their own food gardens. Understanding safe and evidence-based food preservation techniques and having an appreciation of the food science behind the process can prevent unnecessary food-borne illnesses (especially Clostridium botulinum, or botulism) from occurring. Workshops are both lecture and hands-on processing in a 3-four-hour workshop.

Results
The results from the food preservation workshops show it is an effective means to assist the community to safely preserve food and prevent botulism. The operating cost (excluding utilities) to the potential annual cost per case of food-borne illness in Maryland was $1,062.34:$103,224, were potentially saved if one case of food-borne illness was prevented per food handler completing the course (264 participants X $391). To date, no food-borne botulism related to home canned food in Maryland has been reported.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Increase in fruit and vegetable farmers adopting good agricultural practices

2. Associated Institution Types

- 1862 Extension
- 1890 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Vegetables and fruits grown in Maryland represent over 1,132 farms and 33,107 acres of cropland with a market value over $90 million and over $4.5 million in Baltimore County (NASS 2012). In order to provide the most current education and research University of Maryland Extension provides winter meetings and other programming for Maryland farmers, crop advisors and agriculture professionals.

What has been done
Farmers from the Eastern Shore to Western Maryland participate in annual winter vegetable meetings to increase crop production knowledge, meet regulatory requirements and improve production practices. These regional meetings draw an average of approximately 800 farmers, crop consultants and agriculture professionals from across the state.

Results
A survey of farmers who attend these meetings indicate over 87% of the participants report that the sessions benefit their farming operation and 82% increased knowledge or skills. Participants report information and production practices that will be implemented following the program. These include: improved pest management practices (58%), improved fertility management (47%), improved crop production practices (48%), use of risk management tools (13%), regulatory information (25%), and adoption of a new product or practice (37%).

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
205	Plant Management Systems
502	New and Improved Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

Increase in applied research projects

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Increase in processors using good practices

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cattle and calves raised for beef production in Maryland exceed $69 million in sales annually. This market is largely dominated by farmers raising small herds. There is a need for beef programming, and producers are seeking education and information to optimize their beef operations. With this opportunity, UME developed a new workshop, "Maryland Beef Producer's Short-Course."

What has been done
A two-day short course was developed in the fall of 2017 and implemented in 2018. The course is a combination of classroom and hands-on learning in several topics about beef production. A formal needs assessment was administered in the summer of 2017 to gauge the interest and of the course and help refine the course format and topics.

Results
The initial needs assessment confirmed that producers want more programming in the area of beef production. Post-class evaluations indicate that 100% of attendees improved their knowledge in beef cattle production, animal health, body condition scoring, reproduction, genetics, facilities, and hay and pasture management. All surveyed intended to monitor production and operating costs as a result of this course. 93% believe that they will be able to make their operation more profitable as a result of attending this course, with 63% estimating a greater than $1000 profit, per farmer.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

Outcome #5

1. Outcome Measures

Reducing On-farm Enteric Pathogens through Cropping Methods and Improved Food Safety Trainings

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Produce can be a vehicle for food-borne illness. However, conditions which facilitate pre-harvest crop contamination are not fully understood. Of particular concern is the lack of data on the influence of different soil management and cropping methods on pathogen survival in soil and transmission onto crops. This knowledge gap hampers efforts to adequately educate farmers.

What has been done

The goal of the research is to assess the fate and transport of Salmonella, shigatoxin-producing Escherichia coli, Listeria monocytogenes and bacterial indicators in an integrated animal/crop-producing environment. Microbiological prevalence and concentration data will be used to develop a predictive modeling tool to predict pathogen fate under different management conditions. Trainings will be evaluated for their effectiveness in spurring food safety-motivated shifts in practices, by measuring grower/marketer knowledge, attitude, and practices changes pre- and post-training, through process and outcome indicators. The predictive tool will be included in this assessment.

Results

The results of this research is being used to reduce the food safety risks attributed to cropping methods employed during in-field production of fruit and vegetables. Industry and retail also benefits from risk reduction cropping methods. Additional benefits have been gained for government and regulatory agencies. Knowledge of risk reducing cropping methods can be used to make scientifically based guidelines for fruit and vegetable production. This work generated important information for researchers and Extension educators involved in food safety training on specific cropping methods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
205	Plant Management Systems

Outcome #6

1. Outcome Measures

Investigation and Validation of Chlorine-Based Fresh Produce Washing Procedures Using Novel Experimental Platforms

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Sanitizer wash is crucial for mitigating pathogenic contamination and prevent cross-contamination for fresh produce. Chlorine is the predominant sanitizer for fresh produce industry, but its efficacy is compromised by its physical/chemical interactions with organic materials generated from produce and debris during washing. The knowledge gap on the nature and effect of those interactions impedes the development and validation of sanitizing procedures.

What has been done
The fabrication of a chlorine sensing chip to mimic fresh-cut and cracks of produce and investigation on the sanitization process using the sensing chip under simulated washing conditions have been developed.

Results
A novel 3-D printed base chip was developed and fabricated with separable artificial cracks. Coating a DPD-zein layer with surface roughness of 79.3m and average thickness of 60m onto the base chip generated a chlorine-sensing functionality. The layer surface showed an affinity of chlorine aqueous solution with contact angle of 39.7°. The chlorine-sensing chip is a useful platform to study the sanitizer efficacy in hard-to-reach locations during the washing process. A post-doctoral research scientist was trained to advance his knowledge and experience in the polymer chemistry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #7

1. Outcome Measures

Risk Identification for Toxoplasma Transmission in Pasture-Raised Animals

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Toxoplasma gondii is responsible for 24% of all deaths attributed to foodborne pathogens in the U.S. with an estimated 327 deaths per year. Of the major meat animal species, pigs and lambs are shown to frequently harbor T. gondii. Pigs and lambs that are reared with complete or partial pasture access have substantially greater opportunities for exposure to T. gondii as compared to animals managed in confinement systems that use stringent biosecurity practices.

What has been done

A nationwide survey of retail organic, free-range pork and lamb samples using the serological and bioassay in mice to detect the presence of Toxoplasma gondii in these meat products has been conducted. Organic pork and lamb meat samples from retail stores of 25 Metropolitan Statistical Areas (MSAs) around the country were collected and processed from 10 randomly selected supermarkets, grocery outlets, or wholesale club stores (60 samples from one MSA) and tested for sero- and tissue prevalence of T. gondii using ELISA and bioassay in mice, respectively). A total of 1,500 pork and lamb samples were collected and tested.

Results

Using dose-response models developed by the team, two Quantitative Microbial Risk Assessment (QMRA) studies were performed: (1) A farm-to-table QMRA model was developed to address the public health burden, to quantify the effects of meat processing, and to compare the infection risk of various fresh pork cuts, and (2) A farm-to-table risk model was developed to predict the public health burden in the United States associated with consumption of U.S. domestically-produced lamb.

Project information and results have been shared at different annual meetings and conferences of professional societies and at federal agencies. Graduate students and postdoctoral scholar working on this project were trained in advanced laboratory techniques and quantitative risk assessment techniques.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #8

1. Outcome Measures

Sonochemical Processes for inactivation of spoilage microorganisms on surface of fresh produce and food-contact surfaces

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Post-harvest spoilage of fresh whole and cut produce is a significant challenge that impacts sustainability, economics and nutritional aspects of fresh produce. Despite significant advances in hurdle technologies including combinations of produce washing and cooling, chemical sanitation and fumigation, refrigerated storage and modified atmospheric packaging, currently over 30% of the fresh produce in North America is wasted and microbial spoilage is one of the leading factors influencing the shelf-life of fresh produce.

What has been done
To address this critical challenge, this project evaluated a synergistic interaction of ultrasound (US) with (a) sonocatalytic materials to develop novel food-contact surfaces that can minimize or eliminate the risk of cross-contamination and biofilm formation, and (b) microbubbles combined with sonocatalytic food-grade materials to improve inactivation of spoilage microorganisms on fresh produce and wash water while maintaining the quality of fresh produce by avoiding mechanical damage.

Results
This project measured the influence of ultrasound for enhancing removal of both human and plant pathogens from fresh produce surface, and assessed the combination of ultrasound and chlorine for improving sanitation of fresh produce. Three graduate students and two postdoctoral students worked on this project in 2018 collaboratively. Experiments were performed jointly between UMD, Drexel and UC Davis. Students also had an opportunity to present their findings at a scientific meeting.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #9

1. Outcome Measures

Investigation of pathogens in domestic and imported frozen seafood

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The United States (U.S.) is the third leading seafood consuming nation in the world and its average seafood consumption grew from 12.5 pounds per capita in 1980 to 15.8 pounds in 2009. Seafood imports increased significantly from below 50% of the gross seafood consumption in 1980 to more than 80% in recent years to meet the deficit of the domestic production. Catfish, crab, ground fish, salmon, shrimp, squid and tuna were the favored imported species. The U.S. Centers for Disease Control and Prevention (CDC) (2012) stated that seafood has been a major group incriminated in foodborne outbreaks in the U.S. caused by bacterial, viral, and parasitic agents.

What has been done
A total of 468 imported and domestic frozen catfish, shrimp, and tilapia samples were collected from retail stores on the Eastern Shore of Maryland and analyzed for aerobic plate count (APC), total coliforms, Escherichia coli and three foodborne pathogens of concern (Campylobacter jejuni, Salmonella, and Vibrio) using standard methods. All seafood samples were analyzed for the presence of fourteen antimicrobials

Results
All samples were positive for APC and the average log CFU per gram for APC ranged from 3.9 to 4.1 in the three types of seafood. Approximately 3 percent, 27 percent and 8 percent of the samples
were positive for C. jejuni, Salmonella, and Vibrio, respectively. Salmonella prevalence was 33.3 percent in imported tilapia and 19.4 percent in domestic tilapia. Other differences were not statistically significant. While some seafood samples were positive for the presence of antimicrobials, no correlation between antimicrobial resistance of the pathogens isolated from the

same seafood samples existed.

4. Associated Knowledge Areas

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

Outcome #10

1. Outcome Measures

Utilization of Agricultural and Food Processing Byproducts

2. Associated Institution Types

- 1890 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is need for continued research on ways to expand the utilization of byproducts of agricultural and aquacultural operations, including use of fish skin and bones, crustacean shells, oilseed meals, fruit peels and pomace, and other such low value biomaterials. Those materials may be suitable for development of biobased films that may be incorporated with antimicrobials to improve food safety and extend shelf life. The technical information needed to demonstrate the suitability of those materials for commercial applications in food, feed, nutraceutical, pharmaceutical and other areas is still lacking.

What has been done
One graduate student has been recruited to develop biopolymer packaging films that would be suitable for use with compatible foods to enhance safety and extend shelf life. The PD has started assembling relevant instruments needed to test moisture barrier properties (water vapor permeability tester - Permatran-W Model 1/50 G+), water activity (Aqualab 4TE), and a rheometer to investigate properties of films and film-forming solutions to address.

Results

Packaging films were created and being analyzed for mechanical properties and barrier characteristics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The initial needs assessment for the Maryland Beef Producers Short Course confirmed that producers want more programming in the area of beef production. Post-class evaluations indicate that 100% of attendees improved their knowledge in beef cattle production, animal health, body condition scoring, reproduction, genetics, facilities, and hay and pasture management. All surveyed intended to monitor production and operating costs as a result of this course. 93% believe that they will be able to make their operation more profitable as a result of attending this course, with 63% estimating a greater than $1000 profit, per farmer.

In 2018, over 200 individuals from seafood handling, processing, packing, storing, transportation and distribution, and shellfish growers and shippers attended Seafood HACCP and SCP Courses (37), HACCP for Shellfish Shippers (33), Oyster Rapid Cooling by Using Ice Slurries during Harvest (130, estimated) and Crabmeat Pasteurization Demonstration Workshops (13).
By completing the HACCP for Shellfish Shippers course, all trainees (33) received their certificates of course completion from the MDH that meet the state's training requirement for shellfish handling. For Seafood HACCP and SCP courses, 92% attendees (34/37) received certificates from the AFDO/SHA that satisfy the US FDA Seafood HACCP Regulation training requirements (21 CFR 123.10).
Through a UME online survey tool Qualtrics, approximately 80 participants were surveyed with a total of 21 responses being received. Results generated from the follow-up evaluation (n=21) elucidated practices improved, behaviors changed or benefits gained as outcomes of this program.

- Two business received their state operational license as a result of the training.
- 44% percent of respondents observed an average of a 30% reduction in contamination incidence. Further, 24% improved employee hygiene and sanitation practices. In addition:
- 86% of respondents noted a significant increase in their understanding of seafood safety and HACCP system.
- 5% of respondents either developed a HACCP plan or improved their seafood HACCP implementation (correction, verification, and record-keeping practices).

As a result of the training, 15% of respondents estimated an economic impact of $1,000 - 10,000; and another 15% estimated the economic value of $25,000 - 100,000; and a mean annual economic gain of $7,250.

A follow-up survey to Grow It/Eat It/Preserve It workshop participants in 2018 (n=69) found that the majority of participants were female(75.4%), identified as White, Caucasian, Non-Hispanic (97.1%), and had a college degree or higher (78.2%). Age range and income were evenly distributed.
The majority of the participants did not preserve any produce in the past year(59%), and this was their first food preservation workshop in the past 12 months(81.2%).

Short-term impacts include:

- Confidence to operate a water bath canner significantly increased ($p<0.001$).
- The intent to use current laboratory-tested recipes significantly increased($p<0.001$).
- The intent to use UME as a community resource for food preservation significantly increased ($p<0.001$).
- The intent to use check pressure-canner lids annual significantly increased ($p=0.002$)

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Family & Consumer Sciences

☑ 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
504	Home and Commercial Food Service	10%	0%	0%	0%
607	Consumer Economics	30%	0%	0%	0%
723	Hazards to Human Health and Safety	10%	0%	0%	0%
724	Healthy Lifestyle	30%	50%	0%	0%
801	Individual and Family Resource Management	20%	20%	0%	0%
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures	0%	30%	0%	0%
	Total	100%	100%	0%	0%

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	3.5	13.0	0.0
Actual Paid	18.0	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**
411930	164572	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
411930	164572	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
94874	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Full development and implementation of Smart Choices Curriculum for Consumers focusing on making 'smart choices' related to health insurance; continue training Extension educators across the country to be certified to teach "Smart Choices."
• Develop, pre-test, pilot-test, and implement Smart Use Curriculum focusing on maximizing the use and understanding of health insurance.
• Conduct "Smart Choice" train the trainer and consumer workshops for targeted consumer groups (farm families, etc).
• Create and publish scholarly work in support of Smart Choice curriculum and associated health insurance literacy efforts.
• Conceptualize and initiate small working forum to explore the idea of developing a "Health Extension" program in collaboration with the UMD medical community.
• Piloting, testing, and implementation of Financial Nuggets Curriculum for parents and youth.
• Plan, organize, and conduct Personal Finance Seminar for Professionals (professional development for personal finance specialists, educators, and practitioners from across the country).
• Develop, pilot, and test adapted Small Steps to Health and Wealth in the Workplace; partner with Shore Health to implement SSHW on the Shore and beyond.
• Develop, review, test, and finalize on-line modules to support MD State Retirement Program participant education.
• Train Community Health Workers in MD and DC
• Promote green cleaning as a component of healthy homes
• Conduct healthy living programming at Senior Centers focusing on healthy eating and increased physical activity.
• Develop and implement educational programs focusing on safety on the farm and at home.
• Development of FCS Volunteer Program to support key programming outreach and education.

2. Brief description of the target audience

• Extension Educators
• People who need to purchase health insurance
• Professionals/Practitioners
• Childcare providers
• Youth/4-H
• Families with specific health hazards

- Older adults
- Military families
- General audiences
- Athletes, coaches, medical professionals
- University-wide faculty
- Community Partners
- Federal/State Partners
- Professionals/Practitioners

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13494	277566	6429	2317

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	5	0	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational workshops offered

Year	Actual
2018	764

Output #2

Output Measure

- Number of adults and youth with increased financial literacy

Year	Actual
2018	3300

Output #3

Output Measure

- Number of adults and youth with increased health literacy

Year	Actual
2018	6933

Output #4

Output Measure

- Number of youth with increased safety awareness

Year	Actual
2018	167

Output #5

Output Measure

- Number of adults and youth with increased understanding of healthy and safe home environments
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

- Number of youth and adults with increased nutrition/healthy eating understanding

Year	Actual
2018	5800

Output #7

Output Measure

- Number of applied research projects

Year	Actual
2018	15

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase in children and youth who report eating more of healthy foods.
2	Individuals who report increased ability to set financial goals, make savings plans, establish emergency funds, and decrease debt
3	Increase in individuals who report the adoption of healthy eating practices (including eating more fruits and vegetables, choosing high fiber foods, choosing more whole grains)
4	Increase in people reporting the adoption of healthy home practices
5	Increase in reported confidence and capability to make smart health insurance decisions
6	Increased research findings that contribute to individuals and families well-being and quality of life.

Outcome #1

1. Outcome Measures

Increase in children and youth who report eating more of healthy foods.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity is a health crisis in the US. According to the CDC National Center for Health Statistics, 71.6% of adults over 20 years of age are overweight, including 93.3 million or 39.8% who are obese. In Maryland the adult obesity rate is currently 31.3%; the 26th highest obesity rank in the nation. Obesity is also a health concern for older adults and youth. According to the Centers for Disease Control and Prevention Healthy Aging Data, 29.2% of older adults (65+) are obese and 15.7% of Maryland youth between the ages of 10-17 years are obese.

What has been done
Eating a healthy, balanced diet and making healthy lifestyle changes plays an essential role in maintaining a healthy weight. Educating people about the benefits of making healthy food choices will help them manage their weight and lower their risk for certain diseases. In response to the results of the Upper Shore needs assessment, partnerships were formed and sites were recruited to host nutrition and healthy eating programs throughout the cluster. Program curriculum and resources used were from reliable sources including the USDA, Maryland's FSNE program, Iowa Department of Public Health's Snap-Ed program, and University of Maryland Extension program. As a Registered Dietitian with experience in program development, the educator created one nutrition curriculum that focused on improving eating habits.

Results
In 2018, eight partnerships in Cecil, Kent and Queen Anne's Counties were formed. As a result of these partnerships, 13 nutrition and healthy eating programs were presented to 151 youth, adults and older adults in the cluster. Topics included Eating for Better Health, Family Meals, Herbalicious, Brain Health, The Mediterranean Diet for adults and older adults, and Teen Cuisine for youth.
As a result of attending these programs, knowledge about nutrition and physical activity

improved. People correctly identified sources of lean proteins and unhealthy oils and the recommended physical activity guideline (150 minutes/week). Program participants also reported an increased intention to change behavior after attending these programs. They reported they were more likely to write a healthy goal and commit to it for a minimum of one week.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Individuals who report increased ability to set financial goals, make savings plans, establish emergency funds, and decrease debt

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to a 2017 published report from Prosperity Now (formerly CFED), 17.4% of households in Frederick County are asset poor and 24.2% are liquid asset poor. Taken together, these indicators show that a significant portion of Frederick County is struggling with living paycheck to paycheck, being unable to handle unexpected expenses, and living with limited resources.

What has been done
The All My Money program from Illinois was selected because it was designed with limited resource adults in mind. All My Money was used as the curricula for 17 programs across Frederick County. This includes a series that was developed in partnership with United Way, Religious Coalition, and the Housing Authority of Frederick. The series that was established also linked participants to community resources so that they could use what they had learned to access more personalized community support.

Results
Overall, 93% of attendees indicated they learned a good amount from the programs. Additionally, 98% of attendees said that the activities used were useful to them. After Lesson 1, 83% of

participants said after the lesson they would ?Ask myself whether a purchase is a need or a want before I buy?. After Lesson 2, 100% of participants said they would commit to tracking spending for a month and create a SMART goal. After Lesson 3, 83% planned to try a savings challenge. After Lesson 6, 100% planned to weight the costs and advantages before using credit and compare APR before borrowing money. After Lesson 7, 100% said they planned to contact creditors if unable to make a payment and think about their credit before applying for more. Finally, after lesson 8, 100% planned to get their free credit report and 80% planned to improve their credit history.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
724	Healthy Lifestyle
801	Individual and Family Resource Management

Outcome #3

1. Outcome Measures

Increase in individuals who report the adoption of healthy eating practices (including eating more fruits and vegetables, choosing high fiber foods, choosing more whole grains)

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
According to the Centers for Disease Control and Prevention Healthy Aging Data, only 20% of older adults (65+) eat three or more vegetables daily, 29.2% are obese, and 31.5% do not participate in leisurely physically active.The Maryland Department of Aging set objective 3.4 in their 2017-2020 State Plan on Aging to increase the availability of promising and evidence-based programs and practices that empower individuals to improve the quality of their health, independence, and well-being.

What has been done

To address this national issue at a local level, Maryland Extension's Family and Consumer Sciences (FCS) Educators piloted the Fresh Conversations program in rural counties across the state in collaboration with local senior living communities/activity centers.

Results

The majority of participants in the Southern Maryland pilot effort said they learned something (100%), reported they would us the information provided in the lesson (96%), were interested in attending future sessions (93%) and learning more about the lesson?s topic (82%), and would recommend the workshop to their friends (89%). Upon receiving resounding interest in extending this program, Southern Maryland?s FCS educator decided to facilitate a full eight month series beginning in spring and concluding in winter of 2019. The educator will recruit participants in three senior activity centers or living communities within Maryland's Southern Cluster (Calvert, Charles, and St. Mary's Counties). Educators will also recruit volunteers this next year with the intent of implementing a train-the-trainer model to increase the number of sites and participants reached.

4. Associated Knowledge Areas

KA Code	Knowledge Area
724	Healthy Lifestyle

Outcome #4

1. Outcome Measures

Increase in people reporting the adoption of healthy home practices

2. Associated Institution Types

- 1862 Extension
- 1890 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In the US, foodborne illness is estimated to cause 48 million domestically acquired episodes of foodborne illnesses, 128,000 hospitalizations, and 3,000 deaths each year. An individual case of foodborne illness in Maryland averages $1,476-2,591 per case. Botulism is one of the major and severe foodborne illnesses that affect the nervous system. As stated by CDC, the incidence of botulism through home canned foods are very evident (38%).

What has been done
The Grow It, Eat It, Preserve It program teaches Marylanders how to follow safe home food preservation recipes and techniques, including the use of pressure canners. Twenty Extension professionals are trained to teach the program throughout Maryland.

Results
Pre-post survey results indicate there was a statistically significant change observed in the following components of the program: 74% of respondents increased their confidence in operating a water-bath canner; 51% increased their confidence in operating a pressure canner; and, 89% increased their use of trusted recipes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Increase in reported confidence and capability to make smart health insurance decisions

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Consumers are confused about health insurance, including how to select the best plan, how to use it and budgeting to pay for the insurance. The goal of the Health Literacy Initiative (HILI) Team is to reduce confusion, increase capability and increase confidence of consumers in choosing health insurance plans and making the best use of their health insurance plans.

What has been done
Certified Extension Educators taught 16 workshops in four states and two national webinars reaching 186 consumers between May 2017 and June 2018. In 2018, HILI team members presented, both in-person and via webinar, six Smart Choice-Basics workshops reaching 47

consumers; three Smart Use-Your Health Insurance Benefits workshops reaching 25 consumers; and 11 Smart Use-Smart Actions for Using Your Health Insurance workshops reaching 55 consumers.

Results
Using evaluation questions, tested for validity and reliability, all workshop participants (n=127) reported an increase in confidence to be smarter users of their health insurance.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
724	Healthy Lifestyle
801	Individual and Family Resource Management

Outcome #6

1. Outcome Measures

Increased research findings that contribute to individuals and families well-being and quality of life.

2. Associated Institution Types

- 1862 Extension
- 1890 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the U.S., health insurance is a means of access to preventive, acute and chronic care. Recent research, funded by the USDA, found approximately three out of four (73%) farmers or ranchers rated health insurance as an important or very important risk management strategy for their farm or ranch. A large majority (72%) had an off-farm job, primarily for health insurance and additional income. Among young farmers, 41% received some form of government-related insurance.

What has been done

A research study has been funded from the Northeast Center for Rural Development out of Penn State to address the problem in Maryland, Delaware and Virginia. The grant had two main activities. The first activity was to hold a Forum between health, farming, and community stakeholders on how health insurance and farm vitality intersect. The second was to host an informational webinar to provide those working with farmers tools they can use to address these issues. The MD/DE Forums were held in September, with the webinar occurring in October.

Results

Bonnie Braun, Professor Emeritus, and Shannon Dill UME Agriculture Educator, were invited to be on Maryland's public radio station program, "On the Record," for a program entitled The Stresses of Farming. The Mental Health First Aid kit training will be held in four locations around Maryland in 2019 to reach organizations that work with farmers. Increased awareness about social isolation, stress management and the lives of farm audiences is being shared in a publication geared for Family and Consumer Science professionals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
723	Hazards to Human Health and Safety
724	Healthy Lifestyle
801	Individual and Family Resource Management
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

4-H Youth Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

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

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	17.0	0.0	0.0	0.0
Actual Paid	34.0	4.0	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**
446257	178287	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
446257	178287	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
191049	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

1. 4-H community clubs will be conducted focusing on activities that support youth learning science and technology, healthy living, and citizenship

2. 4-H school enrichment programs
3. 4-H Operation Military Kids programs
4. Camping programs
5. State and county fairs
6. Demonstrations
7. Adventures in Science programs
8. Other special interest clubs and activities, such as Health Rocks!

2. Brief description of the target audience

- All youth in the State of Maryland
- All youth who are children of military parents
- All adults with an interest in becoming 4-H volunteers
- Businesses who would be interested in financially supporting 4-H programs
- Community partners

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	31263	112546	67387	67377

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	1	0	1

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of community club programs offered

Year	Actual
2018	0

Output #2

Output Measure

- Number of members enrolled in school-based clubs, community clubs, 4-H military programs, and camps

Year	Actual
2018	74441

Output #3

Output Measure

- Number of youth engaged in Science, Engineering, and Technology

Year	Actual
2018	54842

Output #4

Output Measure

- Number of youth engaged in building citizenship skills

Year	Actual
2018	14329

Output #5

Output Measure

- Number of youth involved in healthy lifestyles

Year	Actual
2018	31289

Output #6

Output Measure

- Number of adult 4-H leaders

Year	Actual

2018	4206

Output #7

Output Measure

- Number of youth enrolled through the Health Rocks program
  Not reporting on this Output for this Annual Report

Output #8

Output Measure

- Number of Youth Enrolled in 4-H Adventure in Science program

Year	Actual
2018	1688

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increase in youth reporting adoption of healthy eating behaviors
2	Increase in youth who intend to engage in community projects and community leadership positions
3	Increase in the number of youth and adults adopting animal science practices that demonstrate increased knowledge of raising animals in a responsible, ethical, and ecologically viable manner
4	Increase in the number of youth who report aspirations to pursue science-related fields in college
5	Increase in youth who intend to pursue science-related careers
6	Increase in youth who practice environmentally responsible behaviors
7	Increase in youth and families who report becoming more literate in concerns surrounding global hunger and its relationship with agriculture, understanding of food systems, and the relationship of agriculture, food, nutrition, and the economy.
8	Education About Careers in Agriculture for High, Middle and Elementary School Students

Outcome #1

1. Outcome Measures

Increase in youth reporting adoption of healthy eating behaviors

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A 2015 article by the Baltimore Sun states that the lack of proper nutrition, food deserts, a lack of physical activity, poor school nutrition and limited education contribute to the problem of childhood obesity. These can lead to youth suffering from social and psychological problems such as low self-esteem which includes bullying, a feeling of sadness, hopeless and stigmatization.

What has been done
In order to mitigate this youth are engaged in healthy living and healthy behaviors curriculum. The aim is to engage youth in a safe and engaging environment and to also increase their knowledge about health and nutrition.

Results
17 adult volunteers, 7 youth volunteers and 9 program directors in Baltimore City were trained in 2018 in Nutrition lessons. Surveys collected from the program directors and volunteers showed that over 80% believe that they learned a lot from the lessons and can be successful in implementing age-appropriate lessons to their youth. 628 youth completed the nutrition and healthy lifestyles lessons. Approximately, 20% of youth completed surveys which showed improved attitude, towards eating healthy. 80% of teens who filled out a survey to gauge their attitudes towards nutrition education agreed that they learned a lot from the lessons taught.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #2

1. Outcome Measures

Increase in youth who intend to engage in community projects and community leadership positions

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A 2016 4-H National Youth Survey on Leadership indicated most youth (88%) believe they can make a difference, they see themselves as leaders (74%) and they feel a responsibility to lead (73%). Peer Mentor Leadership training will give Tech Wizard veterans an opportunity to build leadership skills. Structured training for the peer mentors is essential in the success of the 4-H Tech Wizards programs in Garrett County. Developing strong leaders by providing guidance to achieve, commit and understand their responsibilities has been a goal since the program began in 2011.

What has been done
A series of Peer Mentor Trainings were held for the 5th grade peer mentor group for each Tech Wizards site. The training began with a visit to the 5th grade classroom with an invitation to apply. Using the 4-H Life Skill Wheel as a reference, the peer mentors were asked to complete an application and participate in an informal interview at the school.

Results
Results have been tracked using evaluations from peer mentors and their parents for 2017. Performance measures show success:
citizenship survey results indicate that youth strongly agree that they can make a difference in their communities through community service; 94% agree that they treat everyone fairly and equally when in charge of a group; 100% gained skills through serving their communities; 94% gained skills in communication; 100% gained self-esteem; 94% increased confidence in themselves; 80% learned to work with others to solve problems; 87% plan to work on projects to better their communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #3

1. Outcome Measures

Increase in the number of youth and adults adopting animal science practices that demonstrate increased knowledge of raising animals in a responsible, ethical, and ecologically viable manner

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Allegany County is currently the only county in Maryland that does not have an in-school agriculture education program. It is important that 4-H continue to highlight agriculture and animal sciences among the community through education, exhibits, and outreach. Youth development in the area of agriculture is imperative to ensure our nation will remain economically viable in the future. With fewer youth going into agriculture, the long-term future of the agricultural industry is in jeopardy. There is a visible need to conduct agriculture education in both formal and non-formal settings to improve the knowledge and perceptions of agriculture.

What has been done
A large portion of agriculture education conducted in Allegany County is 4-H Club based. 4-H Club members are able to receive an extended more in depth education on the specific animal science project of their choice, with yearlong hands-on experience and application of their knowledge learned. The Educator provides year-round guidance, support, and educational programs to leaders, volunteers, and youth in groups and one-on-one settings to assist in the learning process and making it a rewarding experience.

Results
Allegany County 4-H youth enrolled in animal science projects have earned over $100,000 annually through sale of their project animals. When polled, youth most often re-invest earned money into future 4-H projects, vehicles, and higher education (college or vocational schools). In addition, the youth livestock sale program appears to encourage dedicated annual community participation as 79% of bidders are returning bidders, while only 21% were first time bidders.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #4

1. Outcome Measures

Increase in the number of youth who report aspirations to pursue science-related fields in college

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Maryland's number one industry is agriculture even in a rapidly urbanizing state whose population is farther and farther removed from their food sources. A survey conducted by U.S. Farmers & Ranchers Alliance (USFRA) found that 72 percent of consumers know nothing or very little about farming and ranching. Another study conducted by the Innovation Center for US Dairy found that 48% of people didn?t know where chocolate milk comes from. For agriculture to remain a viable occupation and industry in Maryland residents need to be educated about its importance in their everyday lives.

What has been done
The University of Maryland Extension AGsploration program uses hands on experiential learning lessons to teach participants about science and agriculture in the hopes of increasing their awareness and appreciation of MD agriculture. It also strives to increase the amount of youth pursuing post-secondary degrees and careers in agriculture and science related fields. The program is offered through integration in classroom teaching, outreach programs and supported with a website and YouTube channel.

Results
In 2018 one hundred and thirty-two individuals accessed the AGsploration curriculum in 25 states. In Maryland 38 AGsploration lessons were taught to 3,290 program participants and 3 trainings were held to certify 81 new curriculum teachers. The curriculum was also highlighted at the National 4-H Agri-science Summit where 180 participants were trained as teachers.85% of trained teen teachers indicated that their participation in AGsploration developed their teaching ability,

and confidence in teaching agriculture. 77% also indicated the program helped develop planning and organization skills. An additional 62% reported developing agriculture content knowledge and leadership skills. Of the group 62% major in agriculture and 73% now have a job in the agriculture industry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #5

1. Outcome Measures

Increase in youth who intend to pursue science-related careers

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The majority of youth do not have access to quality STEM program and few see such disciplines as a facilitator for their future. Currently only 81 percent of Asian-American and 71 percent of Caucasian high school students attend a high school with a full range of math and science courses. Access for American Indian, Native-Alaskan, African American, and Hispanic is lagging far behind. Only 16 percent of American high school seniors have been found to be proficient in math and interested in pursuing a STEM related career. (U.S. Department of Education)

What has been done
Partnerships (with schools and camps) and special events (fairs, workshops, and festivals) were developed throughout Wicomico County and nearby counties. These partnerships and special events focused on aspects of STEM education including agriculture, environmental science, marine science, climate science, and physics.

Results
Approximately 500 youth took part in UMES Extension STEM school enrichment programming. Of these youth many have learned the value of STEM careers and decided to pursue higher education to achieve those careers. Therefore, the UMES Extension STEM school enrichment

programming has contributed to the increased knowledge and interest of STEM subject matter in the state of Maryland.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #6

1. Outcome Measures

Increase in youth who practice environmentally responsible behaviors

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Recent 4-H camping evaluations show that youth gain multiple benefits from 4-H camp experiences in the areas of leadership, character development, self-esteem, decision-making skills, independent living skills, and citizenship. In order to be able to provide camping experiences to youth the 4-H program must have safe and available facilities. The Maryland 4-H Environmental Education Center is a valuable asset owned by the University of Maryland. The 1,100 acre facility provides a unique and scenic location for outdoor education, camping, and recreation for youth and families.

What has been done
The educator serves as the local administrator of the Maryland 4-H Environmental Education Center. This role includes hiring and supervision of 8 summer employees, fiscal management, scheduling, marketing, and completion of American Camp Association accreditation standards. The educator collaborates with an advisory board and other UME staff to meet the goals outlined in the strategic plan for the center.
Goals for the Center:
Remain financially sound through the collection of user fees and grant acquisition.
Maintain a safe environment by providing on-going maintenance and improvements of the facility
Develop innovative environmental education lessons

Results
The revenue generated from user fees at the center has averaged over $280,000 annually over the past three years. Revenue supports staff salaries, supports on-going maintenance, and funds a plant reserve account for emergencies.
Grants have been received totaling $43,560 over the past 3 years. Grantors include; the Maryland 4-H Foundation, Maryland Friends of the NRA, National 4-H Council with support from Microsoft and the Cargill Foundation.
Facility improvements completed include, electrical upgrade to buildings, roof replacements, water system improvements, food service equipment purchases, landscaping, extermination plan, and upgrades for compliance with Americans with Disabilities Act. The camp received accreditation with the American Camp Association, meeting all inspection standards with 100% compliance.
Over 2,500 individuals receive an array of contemporary environmental education topics. Recent lessons included invasive plants and insects, biodiversity, wilderness survival, owl banding, monarch butterfly gardens, underwater robotics, and native plants.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #7

1. Outcome Measures

Increase in youth and families who report becoming more literate in concerns surrounding global hunger and its relationship with agriculture, understanding of food systems, and the relationship of agriculture, food, nutrition, and the economy.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food insecurity is gaining national attention in recent years. Major contributing factors include lack of access to nutritious foods and lack of knowledge about the importance of making healthy food choices. There is a strong need within Maryland for educational interventions that can help

to address the problem. Food insecurity is widely prevalent in Talbot County, but the public is largely unaware. The extremely high incomes of a small percentage of county residents greatly skew the average per capita income. In reality, the majority of the county's ten schools have more than 50% of students who qualify for free and reduced meals. There is a need to draw attention to the problem and offer educational interventions to empower residents.

What has been done

During fiscal years 2017, 2018, and 2019 Talbot 4-H received grants from the Talbot Family Network to fund the Community Nutrition and Gardening Education Program. Working with Hunger Coalition partners, the program offered educational lessons and outreach in the areas of nutrition and gardening. Primarily during the growing season, raised garden beds were installed at a variety of locations including schools, churches, homeless shelters, and community centers. Youth and adult staff/clientele learned to prepare garden beds, plant vegetables and fruits, care for plants, harvest produce, and properly prepare produce. Participants also learned techniques for selecting and preparing low-cost, nutritious foods. Families who visited food pantries participated in demonstrations showing how to prepare healthy meals using produce they received at the pantries. In addition, nutrition and gardening lessons were taught at a variety of community outreach events including the new Talbot County Community Resource Day and the Multiculural Festival.

Results

569 youth and adults participated in nutrition and gardening lessons offered by Talbot 4-H. Twelve raised garden beds were installed, and partners and participants learned to plant, maintain, harvest, and prepare produce at sites that serve populations experiencing food insecurity. One hundred percent of Talbot County Hunger Coalition partners surveyed stated that they value the importance of the nutrition and gardening programs offered by Talbot 4-H. Eighty percent of 160 youth surveyed and 96% of 55 adults surveyed reported increased knowledge about making healthy food choices after as little as one lesson. Eighty-five percent of 140 youth surveyed and 93% of 55 adults surveyed reported increased knowledge about gardening's role in growing fruits and vegetables and reducing the amount of money spent at the grocery store. Data support the effectiveness of this program in empowering adults and youth to grow, obtain, and prepare nutritious produce items and reduce their struggle with food insecurity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

Outcome #8

1. Outcome Measures

Education About Careers in Agriculture for High, Middle and Elementary School Students

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)
Multiple studies have indicated that students and parents lack exposure to trending careers in science, technology, engineering, agriculture and mathematics (STEAM). Additionally, a recent study funded by USDA and conducted by Purdue University, documented that between 2015 and 2020, it is expected to see 57,900 average annual openings for graduates with bachelor's or higher degrees in STEAM areas. However, US graduates will fill only 61% of those new jobs (35,400). In particular, many residents in neighboring counties to the University of Maryland Eastern Shore (UMES) ignore that UMES has robust academic programs in agriculture, biological science, and liberal arts. Students in elementary, middle and high school need to know that their academic needs will be served at UMES, an 1890 Land-grant University.

What has been done
Between January and June 2018, approximately, 115 students, parents and teachers visited the UMES Small Ruminant Farm to participate in a number of bus tours, goat Yoga, and special events (Rams, Lambs, and Ewe Program). The visits and tours are focused in exposing students, parents and teachers to the educational values that UMES have to offer. The tours and visit included a unique component: the hands-on activities like handling goat kids and lambs, hand-feeding goats, touching and listening to the particular sheep and goat feelings and sounds. The tours and visits were arranged in collaboration with 4-H and the UMES Office of Admissions.

Results
Approximately 60 students from Wicomico Middle School, 25 students from Parkside High School (Goat Yoga), and 35 students and parents from neighboring schools (Rams, Lambs, and Ewe Program) visited the UMES Small Ruminant Fam where there were multiple hands-on activities offered by STEAM programs. Participants in University of Maryland Extension 4-H STEM gain introduction to numerous STEM animal science concepts and activities focused in careers in agriculture, thus increasing their STEAM awareness and preparation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

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.