2018 University of Wisconsin Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

Operating Philosophy/ Program Overview:
The Wisconsin Agricultural Experiment Station (WAES) and University of Wisconsin-Madison Division of Extension* are partners who work together to generate new research-based knowledge and apply that knowledge to help Wisconsin's citizens and communities address challenges and take advantage of new opportunities.

These priorities inform decisions about what research to conduct, and about the development of educational initiatives conducted by Extension in partnership with local, state, tribal and regional organizations, farmers, consumers, business owners and entrepreneurs, support services, coalitions, decision makers, and public and tribal government agencies.

*Extension is now formally part of the University of Wisconsin-Madison rather than a separate institution.

How we allocate capacity funds
The success of our statewide educational efforts is founded on new, relevant knowledge through peer-reviewed, investigator-driven research supported by capacity grant funding. We seek to allocate these funds in a manner that best addresses the needs of our stakeholders.

The WAES's general approach is to allocate capacity funds to support specific, peer-reviewed projects rather than to distribute block grants to departments. We use capacity funds to support approximately 130 projects each year, covering the cost of personnel (mainly graduate students), supplies, student hourly help and travel. We use a different approach to distribute funds for capital equipment. In this case, departments set the priorities and where practical, several projects may share capital equipment. We cover the costs of travel to multistate research meetings (for two representatives per project) out of a central pool of funds.

We continually re-examine our research portfolio in order to address short-term, intermediate term and long-term issues. We may fund a small number of new projects at mid-year as new faculty members are hired or to address emerging problems that require immediate attention. These mid-year projects are funded at the discretion of the associate dean for research and chief financial officer of WAES in the College of Agricultural and Life Sciences (CALS), of which WAES is a part. This ongoing portfolio review ensures that we invest in projects that are relevant to the REE and NIFA national goals and emphasis areas and focus on current state research needs.

Extension's interdisciplinary and cross-program area statewide teams are often co-chaired by campus-based specialists and community-based educators. Structuring team leadership in this manner is intentional, building relationships and linkages among communities of research interest, communities of practice, and communities of locale. Teams develop plans focused on interests that cut across these communities. They do so from the point of issue identification and priority-setting, to resource commitment, plan implementation and evaluation. This same approach applies to multi-state and joint research and

extension activities.

How we measure success
WAES uses several indicators to assess the impact and outcomes of a research project. We consider peer-reviewed publications, efforts to share results with client groups, patent disclosures and graduate students trained. The list may be expanded in the future to include other criteria that will enable us not only to assess the effectiveness of current programs, but also to help us set future capacity grant funding priorities. CALS published research has been ranked first among peer institutions in terms of the Scientific Impact Factor. Formula funding plays a major role in this achievement, not just because of the success of our capacity-funded projects, but also because formula grants help our researchers attract significant funding from other sources. CALS also ranks very high in extramural funding awarded to land-grant universities and public institutions, as well as private universities.

Extension's approach to measuring success is grounded in an overarching program development framework. This framework begins with understanding the need and context for a particular program and its intended change. Program plans, which includes measuring program outcomes and impact, are developed by statewide teams. As teams implement and evaluate their efforts, they can determine overall impact and make changes to address emerging trends.

Publications in refereed journals, books and extension bulletins have been reported on projects using the annual reports in the REEport system.

What follows are a few brief summaries which describe impact across our research and extension portfolio.

Investigator: Brian Luck
Project: In-field determination of corn kernel particle size distribution for whole plant corn silage using image processing technique

Issue:

A dairy cow can eat over 100 pounds of feed each day, and much of that ration is whole plant corn, a crop of vital importance to the dairy industry. For cows to be able to fully digest it, the hard kernels must be processed. Rollers on the harvesting machinery crush the kernels into small fragments just millimeters in diameter. Efficiency and accuracy are serious challenges and moving targets. If the rollers are set too wide, particles are too large for the cow's digestive system to fully extract the nutrients and starches. If the rollers are set too narrow, much more fuel is used by the equipment to produce particles that may be smaller than necessary for the cow. Raw kernel size can vary based on the corn variety and field growing conditions, while processed particle size can vary by the model of machinery and its state of repair. It can take days to receive results of laboratory analysis, the only precise way to determine if the ideal particle size is being achieved. By then, the harvest has been completed and roller adjustments can no longer be made. A more instantaneous, accurate method is needed to improve feed quality and maximize fuel- and time-efficiency of the harvest process.

What has been done:

Researchers at UW-Madison processed corn at each of its various crop states (fresh, dried, and ensiled) through three different harvester models at their various roller settings in one millimeter increments. Photographs were taken of the processed corn from every possible combination, creating an image database to serve as a reference for an algorithm. The algorithm was incorporated into a smartphone application that would allow for instant analysis of kernel particle sizes in the field. Researchers also

studied the feasibility of adapting the algorithm and imaging sensors onto harvesting machinery to allow for automated, real-time adjustments to roller settings. Interested in determining the maximum particle size a dairy cow can fully digest, researchers placed samples of various kernel particle sizes into the rumens of cannulated Holstein dairy cows to study "dry matter disappearance" -- a measure of digestion.

Impacts:

The kernel particle measurement algorithm was successfully incorporated into a smartphone application -- SilageSnap -- which was released in September 2018 and allows users to get an instant, laboratory accuracy "kernel processing score" by taking a photograph of a processed sample with their smartphone. Researchers deemed it feasible to adapt the technology to harvesting machinery, and at least one manufacturer has expressed interest. The algorithm and associated technologies could increase the quality of dairy cow feed processing domestically and around the world. The digestion study, performed with a collaborator in the Department of Dairy Science, has been completed and the data are undergoing analysis. One peer-reviewed journal article has been submitted and is under review. A second paper, and an extension publication are expected in 2019. The investigator and collaborator both have extension appointments. One postdoctoral fellow and several undergraduate students were supported by this grant.

Investigator: Mark W. Stephenson, Director of the UW-Madison, Center for Dairy Profitability; Tina Kohlman, Professor, Dairy & Livestock Agent and Katie Wantoch, Associate Professor - Division of Extension - University of Wisconsin - Madison

Project: Ag viability - Farming in Challenging Times

Issue:

Wisconsin farmers have experienced low commodity prices for a number of years. With tight margins farmers and everyone they do business with feel the effects of stress radiating through their work and home lives. During these tough financial and emotional times there is undue stress on the farm family, strained relationships with agriculture suppliers and financial institutions, stress-related health concerns, and data reporting of increased suicide in the farm communities.

What has been done:

County agents and campus specialists developed and led workshops and discussions to help farmers, family members and agricultural professionals understand the events, biological and neurological mechanisms that lead to chronic stress as well as the outcomes related to health, injury risk, impact on financial decision making and personal relationships. Instead of focusing on financial resources, the goal of the workshops was to help deal with and recognize the signs and symptoms of stress, and assist those in crisis. Workshops and support publications cover positive behaviors and practices connected to health, nutrition, and mindfulness.

To assist agricultural professionals and agency staff when working with farmers in distress, the Dealing with Farmers in Distress Seminar provided additional knowledge and tools to help them feel more comfortable and confident when working with their farm clientele. Ten specific actions are recommended around goal-setting, planning, and engaging the appropriate helping professionals/experts http://nasdonline.org/static_content/documents/7400/farmstress-a-ash-103-top10listpdf.pdf.

Mark Stephenson, Director of the Center for Dairy Profitability, presented at workshops and produced monthly podcasts to keep dairy farmers and agriculture professionals apprised of dairy market trends, including reviewing factors causing the strain. The podcasts have 2000 unique IP hits per month.

Stephenson's podcast also included a three-part discussion with John Shutske, professor and Extension specialist regarding reducing the burden of occupational illness and injury in farming https://dairymarkets.org/PubPod/Podcast/Misc/Stress/Stress1.html.

Impacts:

Pre- and post- surveys conducted to assess behavioral change as a result of participation in workshops showed positive results. In addition, some farmers were also able to make personal contacts with organizations attending the workshops to assist them on their operations to make informed decisions for 2018. More than 225 people attended meetings targeted specifically to agriculture professionals and agency staff; after these meetings, attendees indicated they had a better understand of the decision-making process for farmers during challenging times, and are better prepared to initiate important conversations with a farmer in distress. The agricultural professionals also indicated they will share meeting information with more than 4,000 colleagues and farm clientele.
Additional programs have been planned to help assist farmers in distress and those who work with them.

Meeting NIFA Priorities
The 2018 combined Research and Extension federal annual report describes how statewide interdisciplinary campus and county faculty, staff and colleagues provide research-based education and assistance to sustain and grow the state's vital agricultural economy across NIFA priorities:

1. Global Food Security Food Availability: Crops and Agronomic Plants
The WAES and Extension collaboration among campus, county and regional colleagues, partners and trained volunteers, provides research-based education and assistance to improve food security by strengthening local food markets and systems, responding to growing consumer demand for sustainably produced local foods, building community capacity to increase access to healthy foods for vulnerable populations, increasing household access to healthy foods for those in need, and providing education to assist with the succession of farm businesses and retaining on-farm jobs.

2. Global Food Security Food Availability: Livestock and Poultry
The WAES research and Extension colleagues, partners, and trained volunteers provide timely research-based education and assistance to producers to develop food production systems that enhance animal health, while increasing the production capacity, efficiency and nutritional value of food. Research and professional education of such topics as grass-fed beef, pasture-raised poultry, and managing pastures for water quality continue to be just a few areas of focus.

3. Global Food Security and Hunger: Food Accessibility
WAES and Extension colleagues collaborate among campus, county and regional colleagues, partners and trained volunteers, providing research-based education and assistance to improve food security by strengthening local food markets and systems, responding to growing consumer demand for sustainably produced local foods, building community capacity to increase access to healthy foods for vulnerable populations, and increasing household access to healthy foods for those in need.

4. Climate Change and Energy Needs
Climate change and energy needs have a variety of impacts on communities, agriculture, natural resources, local economies and human health. In addition, the WAES and Extension educators in both agriculture and community development program areas are being called upon to respond to questions about bioenergy and sustainable renewable energy. Professionals and community leaders need locally relevant, science-based climate change and energy needs information and methods to incorporate into economic development and resource management planning processes.

5. Sustainable Use of Natural Resources
Communities are interested in developing renewable energy industries for energy independence, job creation, and economic development. The WAES incorporates research to benefit forest production, weed management, surface water quality, and promote new farm based practices. Extension campus and county faculty and staff are conducting integrated research and extension programs, and building capacity for scalable, sustainable energy among extension colleagues and communities.

6. Nutrition
The WAES and Extension research projects explore basic human nutrition, and identify effective measures that guide individuals and families to make informed, science-based decisions to promote health and reduce malnutrition in high-risk populations. Effective research-based interventions that are practical to implement and sustain are needed to support parents and others to help young children develop healthy behaviors

7. Food Safety
As the U.S. becomes more urban, youth and adults are becoming disconnected from a basic understanding of the science behind agricultural production and the technology it takes to make sure their food supply is safe and readily available. The WAES and Extension plan collaborations among campus and county faculty and staff, colleagues, partners and trained volunteers to provide research-based training and support to reduce the incidence of food-borne illnesses and to improve the safety of the food supply by educating consumers and food safety professionals, and developing food processing technologies to improve food safety.

8. Education and Science Literacy
Education and science literacy reach beyond local communities to impact regional, national and global communities. The WAES and Extension campus and county faculty and staff, colleagues, partners and trained volunteers work with Wisconsin youth in educational events using curriculum such as STEM and the Master Gardener and Master Naturalist programs.

9. Rural Prosperity
Rural Prosperity not only depends on attracting, retaining and informing young people through community development efforts that build upon a community's assets, while improving agricultural development and marketing, rural prosperity also means supporting established and possibly aging rural property owners through education and outreach. Extension campus and county faculty and staff, colleagues, partners and trained volunteers work with rural property owners across the state to help them stay current regarding ownership and leasing decision-making. In addition, while half of Wisconsin farmers are nearing retirement, most do not discuss farm succession plans with anyone. Extension county agriculture agents and campus specialists will continue to deliver comprehensive regional farm succession trainings.

10. Wisconsin Competitive Program
Capacity funds are being used to address a number of state priority research activities that cannot be classified in the nine priority areas. We have grouped these ongoing projects under the rubric of the "Wisconsin Competitive Research Program," but funds supporting these projects will be redirected to the new national priorities in the future. These projects do contribute to a variety of important state needs and are focused in several areas, including water resource issues, applied statistics in support of agricultural research, policy analysis for use in land use planning and commodity programs, management of invasive exotic organisms, and bio-waste management.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	102.0	{No Data Entered}	133.0	{No Data Entered}
Actual	94.0	0.0	118.0	0.0

II. Merit Review Process

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

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

2. Brief Explanation

A 10--person faculty Research Advisory Committee (RAC), appointed by the CALS Associate Director of the Agricultural Experiment Station, reviews proposals for capacity grant funding on the UW-Madison campus. Each proposal is reviewed by two RAC members (designated primary and secondary reviewers) and by two, non-committee members--drawn from the Madison campus, other UW campuses, state agencies, non-governmental organizations and other states--who are established experts in the field. The reviewers are asked to consider a proposal's merit in terms of its relevance to program guidelines and to national goals and emphases areas, pertinence to state problems and priorities, relationship to multistate projects and inclusion of integrated activity. Some Wisconsin faculty members are cooperators in multistate committees in the North Central, North East, Southern, and Western Region as well as a few National (NRSP) projects. Each region has a review process with slight modifications.

Extension activities undergo review during annual and mid-year performance reviews. Extension faculty undergo faculty review within their Academic Department. Colleagues write annual plans of work that describe the specific needs they will address, target audiences, intended outcomes, action plan for how to achieve outcomes, and evaluation plan. These are reviewed by program leadership and by Area Extension Directors. In some cases, colleagues organize into teams to complete planned programs and those teams also write a plan of work with oversight from program leadership. Reviewer recommendations serve to improve program quality and relevance for the intended audience.

Extension curricula and publications are peer reviewed by research and extension faculty, government or industry colleagues and professionals as appropriate to the content, purpose and intended audience. Translations and interpretations are managed by our nationally recognized Language Access team to ensure cultural appropriateness and effectiveness. Scholarly peer review and cultural review assure the

quality and relevance of educational materials and outreach scholarship.

III. Stakeholder Input

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

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

Brief explanation.

Methods of collecting stakeholder input vary greatly and are comprehensive overall. Most generally, this involves personal contact with someone from the UW-Madison WAES/CALS and Extension administrative leadership group meeting with a traditional or non-traditional stakeholder group or individual, or meetings that are open to the general public or selected individuals. Extension educators routinely conduct local needs assessments that identify critical issues. This is done through interviews, focus groups, surveys, evaluation, and stakeholder conversations. These issues inform local educational programs and are communicated to campus-based staff to inform research priorities.

In 2018, Extension undertook a major statewide needs assessment effort, called the Developmental Situational Analysis. All 22 Areas of the state formed work groups representative of different types of educators and led by their Area Extension Director. These work groups collectively reviewed over 500 sources of local data and consistently engaged county funding partners through interviews, surveys, and Nominal Group Technique facilitated process.

UW-Madison hosted 14 field days at 12 agricultural research stations around the state of Wisconsin. Field days, which included many opportunities for researchers to gather input from attendees, covered a wide range of topics from best practices for production methods related to crops, soils and livestock to specific advances in no-till for all soil types, organic cover crops and tips for home gardeners. All events are free and open to the public, and are well publicized through the agricultural media and by collaborating partner organizations (e.g., Commercial Flower Growers, the Midwest Organic and Sustainable Education Service, the Wisconsin Alumni Association).

This year college craftsmen built two accessible, low-profile wagons with slip-resistant running boards that can accommodate wheelchairs and are shared by all stations. The wagons make it easy for all attendees to safely enjoy field tours offered at field days. Read a story about the wagon's success at the annual Farm Tech Days event: https://ecals.cals.wisc.edu/2018/07/30/marshfield-ag-research-station-improving-accessibility-with-new-tour-wagons/

Agricultural Station field days link: https://ecals.cals.wisc.edu/2018/05/21/schedule-of-2018-agricultural-research-station-field-days/

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

Brief explanation.

The CALS and Extension leadership maintains close relationship with leaders of the industry and advocacy groups that have an interest in disciplines we study.

The college's Board of Visitors meets twice per year and formally provides input to the dean and other college leaders on our research, instructional and outreach missions. Several academic departments also have their own advisory groups, whose feedback is shared with the dean through department chairs. Beyond advisory groups convened by the college and its departments, CALS and Extension leaders frequently meet with Wisconsin commodity groups at their invitation (e.g., Cranberry Growers, Wisconsin Potato and Vegetable Growers, GrassWorks, Apple Growers). The CALS and Extension deans are also invited to attend a joint meeting of the Wisconsin Agricultural Coalition at least twice annually; this group is made up of executive directors of each of the Wisconsin commodity groups.

CALS offers trainings for those interested in getting started in agriculture. Those programs include: The Farm and Industry Short Course, the School for Beginning Dairy Farmers, the School for Beginning Market Growers, Cut Flowers Growers School and the School for Beginning Apple Growers.

In addition to established producer groups, we also intentionally reach out to groups organized around new and expanding Wisconsin agricultural sectors. This year college and Extension leaders participated in a number of discussions with those interested in growing hemp in the state.

Extension also has a Board of Visitors made up of diverse partners and stakeholders that meets regularly with the Dean's Leadership Team. Members were identified via leadership seeking out multiple perspectives and by asking Extension colleagues to make membership recommendations.

In the 2018 Developmental Situational Analysis (Extension's statewide needs assessment), diverse county funding partners, including Administrators, Executives, Administrative Coordinators, and County Board Chairs, were identified because they were determined to be the local **funding** partners that know Extension best and could provide the most relevant input. Twenty-two Area Work Groups engaged those partners and made hard decisions of which local data resources to review, based on recommendations from program leadership but mainly based on their own local knowledge of which information was up-to-date, most relevant, most comprehensive and representative of the diversity of needs and perspectives in their communities.

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

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Survey of traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey of the general public
- Meeting specifically with non-traditional groups
- Survey specifically with non-traditional groups
- Meeting specifically with non-traditional individuals
- Survey specifically with non-traditional individuals
- Meeting with invited selected individuals from the general public
- Survey of selected individuals from the general public

Brief explanation.

Membership on the college's Board of Visitors is thoughtfully balanced to represent all of our disciplines, geographies and mission areas. We solicit nominations from our academic departments, our commodity partners, the non-profit alumni association dedicated to supporting CALS and from current and past board members. We strive for gender balance and representation from all ethnic groups, and believe this will become easier as our recent graduates, who represent greater gender and ethnic diversity, continue to progress in their careers.

We collect as much input as possible through in-person meetings and other discussions. Examples of meetings with a variety of stakeholders in 2018 include:

• Meetings with FFA student leaders and staff to commemorate the 100th anniversary of the FFA creed, which was written by a UW faculty member and graduate.
• A Harvest of Ideas hosted symposium hosted by the college invited all parties interested in organic agriculture in Wisconsin to share their priorities for organic research and outreach.
• A celebration of the groundbreaking for construction of a new dairy processing facility on campus, which included representatives of more than two dozen dairy production and processors from across the state.

In order to best meet the needs of our audiences, this year we also conducted an online survey of the more than 30,000 readers of our publication, Grow magazine, to gauge their interest in learning more about specific topics, as well as their preferred method for receiving educational communications. Results from the survey will inform changes to our future publications.

Input has been gathered from diverse and under-represented audiences statewide through focus groups, interviews, listening sessions and case studies. Statewide team efforts accord with the local context, where all 72 Wisconsin county extension offices have civil rights plans designed to increase access to educational programs among traditionally under-served audiences.

The 2018-2019 Developmental Situational Analysis process led by Extension includes a statewide look at the needs and opportunities across the state that our programming could address. This

involves review of 500+ existing data sources, collecting new data from partners, and in-depth analysis and synthesis of information by Extension colleagues.

3. A statement of how the input will be considered

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

Brief explanation.

Results from stakeholder input identify priority issues. Planning is ongoing and continues to set direction for research and extension to address priority issues, for incorporation into budget and staffing decisions through statewide self-directed teams, and shape team implementation and evaluation plans as well as statewide federal plans of work.

Brief Explanation of what you learned from your Stakeholders

In meeting with stakeholders, we continue to learn of their interests in many areas related to agriculture, natural resources and environment, food, energy, rural life and health issues, youth and families, and rural economic development. The consistent theme being presented to us is the growing demands for food and new food markets, community food systems and health issues.

Extension categorized what we learned from stakeholders in the 2018 Developmental Situational Analysis section into themes: Workforce and Workplace Development, Population Health, Infrastructure, Environment & Stewardship, and Social Infrastructure & Systems.

Overall results from our situational analysis were generated by analyzing local reports from all 22 administrative geographical areas of Wisconsin. The prevalence of each issue varied and more detail can be found in the full results here: https://drive.google.com/file/d/164Vy8u1FZac2LYD8R3GMfmy5RwsODxIr/view?usp=sharing

Workplace & Workforce Development: Work and working are not viable enough.

- There are not enough people to fill jobs.
- Jobs do not pay enough to make them financially feasible.
- Tight profit margins and a changing operational environment limit farms' fiscal viability.

Population Health: Our residents experience significant mental and physical health challenges related to access, trauma, behaviors, and exposures.

- Residents have limited access to health necessities.
- Many residents do not have appropriate resources to prevent, manage, and heal chronic and ongoing health issues.
- Many residents suffer from the effects of traumatic experiences.
- Residents suffer from high rates of alcohol and drug use/abuse and mental health conditions.
- Residents are exposed to dangerous environmental toxins via homes, water, and air.

Infrastructure: Our infrastructure does not serve Wisconsin residents enough.

- Transportation is too expensive, failing or unavailable.
- The housing market does not serve all of the population enough.
- Access to high-speed internet is limited in some areas.

Environment & Stewardship: Our environment needs protective management balanced with economic productivity.

- Communities primarily supported with natural resource economies need to protect resources while providing for sustainable livelihoods.
- Water quality is causing various health, environmental and economic problems.
- Private forested lands lack management and farm land requires conservation practices.

Social Infrastructure & Systems: Our current social systems are not equitable to all residents, which can disadvantage individuals' and groups' abilities to lead full, productive lives.

- Residents that have not had full access to education need the skills and content that help them navigate through social systems.
- Violence and the threat of violence sometimes causes and sometimes stems from distress in communities; this distress has or can become intergenerational and/or historical trauma.
- Organizations that provide public services lack the resources needed to provide adequate and equitable services to communities.
- People must individually navigate, interact with, cope with, and/or adapt to inequitable or otherwise difficult social systems and situations, and many require support in doing so.
- Misperceptions and misunderstandings between groups can hinder efforts to collectively solve shared problems.

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	4775955	0	7723232	0
Actual Matching	4775955	0	7723232	0
Actual All Other	0	0	0	0
Total Actual Expended	9551910	0	15446464	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	4775955	0	1364872	0

V. Planned Program Table of Content

S. No.	PROGRAM NAME
1	Global Food Security Food Availability: Crops and Agronomic Plants
2	Global Food Security Food Availability: Livestock and Poultry
3	Global Food Security and Hunger: Food Accessibility
4	Climate Change and Energy Needs
5	Sustainable Use of Natural Resources
6	Nutrition
7	Food Safety
8	Education and Science Literacy
9	Rural Prosperity
10	Wisconsin Competitive Research Program

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Global Food Security Food Availability: Crops and Agronomic Plants

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%		4%	
133	Pollution Prevention and Mitigation	15%		0%	
135	Aquatic and Terrestrial Wildlife	0%		1%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		13%	
202	Plant Genetic Resources	5%		7%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%		10%	
204	Plant Product Quality and Utility (Preharvest)	0%		4%	
205	Plant Management Systems	10%		3%	
206	Basic Plant Biology	0%		4%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		13%	
212	Pathogens and Nematodes Affecting Plants	0%		16%	
215	Biological Control of Pests Affecting Plants	0%		6%	
216	Integrated Pest Management Systems	20%		4%	
302	Nutrient Utilization in Animals	0%		10%	
402	Engineering Systems and Equipment	0%		4%	
601	Economics of Agricultural Production and Farm Management	10%		0%	
608	Community Resource Planning and Development	10%		0%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	28.0	0.0	21.7	0.0
Actual Paid	21.0	0.0	44.6	0.0
Actual Volunteer	168.0	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**
1172896	0	1954577	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1172896	0	1954577	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Faculty working on food availability issues transcend discipline lines and use a variety of biological, physical and social science approaches in working on these issues. The majority of our work involves improvements in the management of important crop food sources in the upper Midwestern U.S. However, many projects have broad national and international applications, including herbicide resistance, late blight management, identification and application of genes of economic significance, practices for maintaining soil fertility, conservation and management of crop genetic resources, and management of a variety of globally important microorganisms.

In 2017, educators with the Extension Program for Crops and Soils primarily delivered educational events and resources, such as seminars, workshops, and summits. For example, educators participated or led efforts as varied as chairing the 2017 Midwest Manure Summit; preparing farmers for marketing their goods to consumers and industry buyers; providing information on techniques for managing crop growth inputs; forming community-based coalitions to interpret and educate about new safety regulations; and others. Major programs focused on general production, environmental sustainability, and social sustainability. This Extension Program also houses the Plant Disease Diagnostics Clinic. This clinic, hosted on the UW-Madison campus, serves audiences from indoor gardeners and commercial growers to plant health professionals and governmental agencies. The clinic provides not only a diagnosis but also information on managing the disease, including additional, collaborative assistance with managing diseases with widespread environmental health implications. Educators whose work fits this Extension Program also often led or contributed to research efforts. These educators have been involved primarily with researching the benefits of cover crops, particularly the effects of certain varieties/strains of potential cover crops, as well as how to balance nutrient (especially nitrogen) management to maximize the health of both crop-growing soil, surface water, and groundwater. A few educators aided audiences in strategic planning and/or in bringing about systemic change in an organization or business to help modernize farm equipment and buildings or involve growers with water conservation conversations.

2. Brief description of the target audience

Integrated activity for our capacity grant programs targets three broad groups of stakeholder audiences in agricultural, natural resources, and the public. The audience includes North Central Region colleagues, agricultural professionals and other educational partners, grains, commercial vegetable, fruit and specialty crop growers and workers, 4-H and FFA youth, grower associations, food processors and entrepreneurs, food coalitions and cooperatives, agricultural service providers, agronomic retail and wholesale suppliers, local and regional economic development initiatives, local and tribal officials, planning commissions, state and federal rural development and regulatory agencies, and others.

The vast majority of the audience for programming in the Crops & Soils Extension Program towards Global Food Security, Food Availability, Crops/Agronomic Plants were businesses and professionals, particularly farms and farmers. Educators working in this area identified the following as their top three audiences:
1. all types of farmers (crop, fruit & vegetable, grazers, forage, home gardeners, dairy and livestock),
2. agricultural professionals (e.g. crop consultants, fertilizer dealers), and
3. agricultural service providers (e.g. lenders, buyers, and food processors).
Other audiences were community residents; nonprofits; and government agents/officials at the county, state, and federal levels. Other researchers and Extension professionals also benefited from research work, presentations, and trainings described in our data.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	46382	0	5351	0

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

Patent Applications Submitted

Year:	2018
Actual:	1

Patents listed

Title: Four Open Pollinated Table Beet Populations with Defined Geosmin Levels and Unique Color Patterning
Investigator: Irwin Goldman
Patent Application: P180259

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	37	70	107

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	146

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Manage and minimize the loss due to plant pests and/or diseases.
2	Enhance the economic and environmental sustainability of agribusiness.
3	Build the capacity of the agriculture service and support industry.
4	Innovations and increased efficiencies in production.

Outcome #1

1. Outcome Measures

Manage and minimize the loss due to plant pests and/or diseases.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dave Stoltenberg, Professor, WAES

Project: Resistance of Wisconsin Giant Ragweed (Ambrosia trifida) to Acetolactate Synthase Inhibiting Herbicides

Issue:

Herbicide-resistant weeds have become a worldwide crop management problem. In the U.S. alone, at least 144 weed species have evolved resistance to one or more herbicides due to over-reliance on their use. This represents a significant threat to farm productivity, sustainability and the environment. Giant ragweed, which can be found throughout the eastern two-thirds of the U.S., is one of the most difficult weed species to manage. This can be attributed to its long germination period, rapid and expansive growth, ability to adapt to a wide range of soil environments, and resistance to commonly used acetolactate synthase (ALS)-inhibiting herbicides such as cloransulam (FirstRate) and the enolpyruvyl-shikimate-phosphate (EPSPS)-inhibiting herbicide glyphosate (Roundup). The weed is found in abundance in Midwestern corn and soybean fields and can cause substantial yield losses.

What has been done
Researchers from UW-Madison set out to determine 1) the genetic mutation that gives giant ragweed resistance to cloransulam, 2) how the plant transfers the resistance trait to its offspring, and 3) whether resistance is associated with a reduced ability to produce viable offspring. Seeds were collected from a giant ragweed population with reputed cloransulam resistance in Wisconsin and grown in greenhouses for subsequent experiments. Further study confirmed high levels of cloransulam resistance in the plants, the first verified case of giant ragweed resistance to ALS-

inhibiting herbicides in Wisconsin. Using DNA extraction and gene sequencing, scientists found an altered enzyme to be the likely factor leading to cloransulam resistance. Experiments analyzing the ability of plants to competitively grow and produce viable seeds and offspring found no difference between resistant and sensitive phenotypes.

Results

The results indicate that cloransulam resistance may persist and spread in the giant ragweed field populations over time even in the absence of the herbicide's use and the resulting selection for the resistance trait. Consequently, crop producers should adopt a long-term, integrated weed management plan that does not involve ALS-inhibiting herbicides. To promote this message, the researchers have shared their findings with crop producers and agricultural professionals through "field day" events, conferences and newsletters, and with scientists through multiple seminars, three academic papers, and several presentations at society meetings and conferences. This project also provided mentoring and professional development for two graduate students and several undergraduate students.

4. Associated Knowledge Areas

KA Code	Knowledge Area
212	Pathogens and Nematodes Affecting Plants

Outcome #2

1. Outcome Measures

Enhance the economic and environmental sustainability of agribusiness.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Build the capacity of the agriculture service and support industry.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Innovations and increased efficiencies in production.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Training graduate students is a priority of our program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The success of a program is measured by several factors (outreach, new tools released to the public, graduate degrees, patents, publications, etc.). A huge success in 2018 for Crops and Agronomic Plants is described in the In-field Determination of Corn Kernel Size Distribution project highlighted in the Executive Summary. The project produced several press articles, journal articles, outreach events, as well as a smartphone application that gives an instant, laboratory accuracy "kernel processing score'.

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Global Food Security Food Availability: Livestock and Poultry

☑ 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
111	Conservation and Efficient Use of Water	0%		2%	
125	Agroforestry	0%		2%	
133	Pollution Prevention and Mitigation	0%		2%	
135	Aquatic and Terrestrial Wildlife	0%		2%	
204	Plant Product Quality and Utility (Preharvest)	0%		2%	
205	Plant Management Systems	0%		2%	
301	Reproductive Performance of Animals	10%		10%	
302	Nutrient Utilization in Animals	0%		23%	
303	Genetic Improvement of Animals	0%		4%	
304	Animal Genome	0%		13%	
305	Animal Physiological Processes	0%		12%	
306	Environmental Stress in Animals	0%		4%	
307	Animal Management Systems	15%		8%	
308	Improved Animal Products (Before Harvest)	10%		2%	
311	Animal Diseases	5%		8%	
315	Animal Welfare/Well-Being and Protection	5%		4%	
601	Economics of Agricultural Production and Farm Management	20%		0%	
602	Business Management, Finance, and Taxation	15%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	10%		0%	
806	Youth Development	10%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	35.0	0.0	21.0	0.0
Actual Paid	18.0	0.0	19.4	0.0
Actual Volunteer	2555.0	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**
878811	0	1579560	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
878811	0	1579560	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The WAES and Extension provide timely research-based education and assistance to producers to develop food production systems that enhance animal health, while increasing the production capacity, efficiency and nutritional value of food. In 2017, Extension colleagues identified economies and efficiencies of livestock production, animal health - biosecurity, and manure management as the top three animal agriculture programs. Research and Extension faculty projects have broad national and international applications, including technologies to improve fertility in livestock and management of a variety of globally important microorganisms. Research and professional education of such topics as dairy profitability, milk quality, livestock production systems (including grass-fed beef and pasture-raised poultry), animal care and well-being, farm safety, farm management, sustainable production and managing pastures for water quality continue to be just a few areas of focus.

In preparation for today's specialized careers in agriculture, youth must understand their many options for gaining experience and obtaining the education needed to attain their chosen career. Extension 4-H Youth Development outreach staff coordinates the annual National 4-H Dairy Conference in collaboration with a national committee of dairy specialists, industry leaders, recent alumni youth, and 4-H dairy project volunteers. All youth delegates explore careers while attending seminars on the UW-Madison College of Agricultural and Life Sciences campus, sparking an interest in attending this or another college to pursue a specialized educational degree for a career in agriculture.

2. Brief description of the target audience

Integrated activity for our livestock and poultry capacity grant programs targets a broad group of stakeholder audiences in agriculture, natural resources, and the public. The audience includes: scientists, health professionals, animal nutritionists, livestock producers including producer associations, veterinarians, dairy herd management, dairy farmers and consumers. In 2017, Extension colleagues identified farmers/producers, agribusiness/agricultural service providers, and farm employees as the top

three audiences for animal agriculture outreach. These audiences include rural farmers, women, youth, and Spanish-speaking farm workers.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	13604	0	26430	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	21	76	97

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	127

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Manage and minimize the loss due to animal disease.
2	Enhance the economic and environmental sustainability of agribusinesses.
3	Build the capacity of the agriculture service and support industry.
4	Innovations and increased efficiencies in production.

Outcome #1

1. Outcome Measures

Manage and minimize the loss due to animal disease.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Christopher Choi, Professor, WAES

Project: Assessment of innovative cooling methods of lactating dairy cows using computational fluid dynamics

Dairy cows are highly metabolically active, which produces body heat and makes them prone to heat stress. Compared to humans, they also have less ability to perspire to shed heat. Their core body temperatures will rise in hot and humid summer weather, and when they crowd together in holding pens. When a cow is under heat stress, her milk supply can decrease and health problems, such as infertility, can occur. Dairy farmers have vested economic and welfare interests in keeping their cows comfortable and their core body temperatures within a normal range. Climate change is expected to exacerbate the issue with more extreme weather patterns. In some dairy producing regions, conventional design and outfitting of barns may be insufficient for the task, and innovative cooling methods may be needed.

What has been done
Researchers at UW-Madison have used computational fluid dynamics (CFD)- the same technology used to design aerodynamic airplanes and race cars - to study how air flows and heat transfers within barns and around cows. With computerized CFD, researchers can relatively quickly study an existing space, object, or system, or even prototypes not yet built. Accurate visualizations can show areas of high or low airflow and regions of high or low temperature. Two innovative cooling methods were tested with CFD: (1) a tube ventilation system with a powerful fan, plastic tube and directional vent holes (intended for suspension over cows in a holding pen, for example), and (2) a bedding stall mattress supplied with circulating cold groundwater to

promote conductive cooling. Prototypes of the cooling mattresses were constructed and evaluated with a group of eight lactating Holstein dairy cows at Arlington Agricultural Research Station in high temperature-humidity index conditions that typically correlate with moderate-to-severe heat stress for dairy cows.

Results
Researchers found that CFD accurately predicted the performance of the tube ventilation system and the cooling mattresses, and they deemed both potentially effective cooling methods for cows. Using the prototypes, researchers found that the conductive cooling mattresses helped keep the cows within a normal core body temperature range, and 0.31Cº cooler than eight other cows without access to the mattresses. These cooling methods could help dairy producers maintain their dairy cow herds' health, welfare, and milk production in the face of intensifying environmental stressors. Findings have been taught in the investigator's collegiate-level CFD courses, and five peer-reviewed journal articles have been published to date. One graduate student was supported by this grant. The investigator is collaborating with colleagues in the School of Veterinary Medicine to optimize the performance of these systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals

Outcome #2

1. Outcome Measures

Enhance the economic and environmental sustainability of agribusinesses.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Build the capacity of the agriculture service and support industry.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

Innovations and increased efficiencies in production.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Training graduate students is a priority of our program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The success of a program is measured by several factors (outreach, new tools released to the public, graduate degrees, patents, publications, etc.). WAES project's under this program produced 76 publications and trained 30 students. A project that demonstrates success is described under outcome number one. This cooling method project discovered a cooling method for cows that will help dairy producers and the milk production.

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger: Food Accessibility

☑ 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	5%		0%	
202	Plant Genetic Resources	0%		100%	
205	Plant Management Systems	10%		0%	
601	Economics of Agricultural Production and Farm Management	5%		0%	
602	Business Management, Finance, and Taxation	15%		0%	
604	Marketing and Distribution Practices	10%		0%	
607	Consumer Economics	25%		0%	
608	Community Resource Planning and Development	15%		0%	
703	Nutrition Education and Behavior	15%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	12.0	0.0	0.0	0.0
Actual Paid	7.5	0.0	0.6	0.0
Actual Volunteer	1745.0	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**
305328	0	53101	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
305328	0	53101	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Extension and WAES colleagues collaborate among campus, county and regional colleagues, partners and trained volunteers, providing research-based education and assistance to improve food security by strengthening local food markets and systems, responding to growing consumer demand for sustainably produced local foods, building community capacity to increase access to healthy foods for vulnerable populations, and increasing household access to healthy foods for those in need.

Related horticulture work includes community programs (such as Seed to Kitchen and Master Gardener Volunteer community garden programming) and commercial programs (such as building farmer market vendor capacity, as well as diagnostic services at both the consumer and commercial levels.

2. Brief description of the target audience

The audience includes farmers' market managers, vendors and customers, small-scale producers, producer associations, food processors and entrepreneurs, gardeners and Master Gardener volunteers, food coalitions and cooperatives, hunger coalitions and task forces, food pantries and other community service providers, local and regional economic development initiatives, local and tribal governments, school boards, school food service directors, teachers and parents of school-age children, low-income women with infants and young children, Hmong and Spanish-speaking central city residents, state and federal agency personnel, and others.

Horticultural audiences also included county and state Extension colleagues, Seed to Kitchen and Master Gardener volunteers, urban farmers, the incarcerated, Wisconsin public radio, Wisconsin Public Television, social media, youth, younger adults, the elderly, community garden users, special needs clientele, veterans, homeowners, beekeepers, homeowners, hospitals and health care providers.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4698	0	2435	0

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	5	0	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	6

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Strengthen local food markets and systems.
2	Increase household access to healthy foods for vulnerable populations

Outcome #1

1. Outcome Measures

Strengthen local food markets and systems.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Increase household access to healthy foods for vulnerable populations

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)
Mike Maddox, Master Gardener Program Director, Division of Extension - University of Wisconsin-Madison

Project: Growing Together WI

Low-income families tend to have poorer quality diets and less knowledge about nutrition recommendations than families who are more financially secure. Ten percent of Wisconsin households are food insecure, meaning they lack assured access to nutritionally adequate and safe foods. Access to fresh fruits and vegetables through community gardens and food pantries, along with nutrition and gardening education, can improve the health and well-being of individuals with limited incomes.

What has been done
Growing Together WI is a collaboration between Wisconsin Master Gardener Volunteers (MGV) and Extension FoodWIse education staff to promote healthy food access and availability through garden spaces. This collaborative effort can include the development and maintenance of community garden spaces for limited income audiences, garden produce donations to food

pantries, and teaching limited income audiences how to grow their own food.

In 2017, the first year of the program, mini-grants were awarded to implement the nine projects around the state. The success of the 2017 programs and multi-state program growth led to availability of grants in 2018. In the second year of the program, mini-grants were awarded to 10 projects. Individual projects were developed in response to the needs of a specific community.

Each Growing Together WI project uses a combination of three primary strategies: Grow, Educate, and Connect. These strategies are employed in a variety of ways, including the development and maintenance of community gardens for limited income audiences, garden produce donations to food pantries and other sites, and teaching participants how to grow their own food and adopt healthy eating habits.

Results

Gardens were established at a variety of locations, including food pantries, youth centers, schools, community organizations, and places of worship. Adults and children learned how to plant seeds, care for plants and ultimately how to harvest and enjoy fresh fruits and vegetables. Many individuals also participated in garden-based nutrition education led by FoodWIse educators.

Evaluation results indicate that Growing Together WI is improving access and availability of fresh produce in food pantries, leading to improved food security and health for limited income audiences in Wisconsin.

The Growing Together WI collaboration resulted in new community garden spaces, increased fresh produce in food pantries, and new community partnerships. During the two years of the program, nearly 4,500 pounds of fresh produce was donated to food pantries, meal sites, low income housing, after school programs and youth centers, reaching more than 10,000 people. Recipes and point of purchase prompts in food pantries also encouraged the selection and consumption of nutritious local produce.

Fifty-eight MGVs were engaged and contributed more than 1,100 volunteer hours. Ninety-nine community partners beyond MGVs were involved and more than $15,000 in non-SNAP-Ed funds were leveraged.

Growing Together WI is part of a multi-state effort, Growing Together. Other participating universities include Illinois, Iowa State, Purdue, and Nebraska. Collectively in 2017 and 2018, Growing Together served more than 195,000 individuals with limited income and donated 244,523 pounds of fruits and vegetables to 358 food pantries.

States: IA, IL, IN, NE, WI

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

604	Marketing and Distribution Practices
607	Consumer Economics
608	Community Resource Planning and Development
703	Nutrition Education and Behavior

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

Brief Explanation

Training graduate students is a priority of our program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

One example of how well this program is working is the College of Agricultural and Life Science-Department of Horticulture, the Seed to Kitchen Collaborative. This is an active collaboration among chefs, farmers and breeders which presents an unique opportunity to focus on vegetable variety characteristics important to local food systems. These include flavor, fresh-market quality, and agronomic performance on smaller-scale diversified farms. Participatory on-farm trials are completely managed by growers who provide input during planning and priority-setting phases, conduct collaborative research on farms, engage in data collection and evaluation, and share results. More recently, the project director, Julie Dawson, hosted a public event, to help plant breeders and farmers understand what vegetables (mainly beets) chefs prefer. This initiative helped plant breeders make better recommendations to farmers as to which crops to harvest. See news article: Building the Perfect Beet: Seed to Kitchen brings chefs , farmers, and plant breeders to the table: https://madison.com/ct/entertainment/dining/building-the-perfect-beet-seed-to-kitchen-brings-chefs-farmers/article_c9a275aa-1ad7-57d0-a25a-26f1341c4245.html

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please

reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Climate Change and Energy Needs

☑ 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%		6%	
104	Protect Soil from Harmful Effects of Natural Elements	0%		6%	
123	Management and Sustainability of Forest Resources	0%		6%	
133	Pollution Prevention and Mitigation	15%		20%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	5%		6%	
205	Plant Management Systems	10%		0%	
206	Basic Plant Biology	0%		13%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
302	Nutrient Utilization in Animals	0%		6%	
303	Genetic Improvement of Animals	0%		6%	
305	Animal Physiological Processes	0%		6%	
403	Waste Disposal, Recycling, and Reuse	5%		1%	
511	New and Improved Non-Food Products and Processes	0%		13%	
601	Economics of Agricultural Production and Farm Management	10%		0%	
605	Natural Resource and Environmental Economics	20%		0%	
608	Community Resource Planning and Development	25%		0%	
903	Communication, Education, and Information Delivery	0%		6%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	17.0	0.0	30.0	0.0
Actual Paid	3.1	0.0	7.1	0.0
Actual Volunteer	65.0	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**
156108	0	535562	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
156108	0	535562	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Collaboration among campus, county faculty and staff, tribal, regional and national colleagues, partners and trained volunteers provide timely, science-based education and assistance for climate change adaptation and mitigation. WAES and Extension 2018 efforts focused on developing, implementing, and evaluating outreach programs to reduce carbon, nitrogen, and energy and water footprints in local communities. Other projects looked at bioenergy and fiber production with aspen trees and agriculture feedstocks, greenhouse gas emissions, and crop resilience.

The Extension Climate Change Task Force is made up of several educators and specialists with expertise including community development, natural resources, land use, energy, sustainability, placed-based & culturally-responsive environmental education, communication and evaluation. In 2017, the task force wrote a proposal asking for funds to train internal Extension colleagues to deliver appropriate and needed climate change programming across the state. This capacity building effort is the top priority for the task force in the near future, as determined by an internal cross-program area survey of colleagues followed by brainstorming and voting on options by the task force.

2. Brief description of the target audience

Integrated research-extension activity for our capacity grant programs targets a broad group of stakeholder audiences in agricultural, natural resources, and the public. The audience includes colleagues and other professionals, growers and grower associations, certified crop advisors, agricultural service providers, coalitions and cooperatives, community leaders, business owners, local elected officials, town, city, county and tribal governments, state and federal agencies, local planning departments and regional planning commissions, utilities, school districts, economic development practitioners, the news media, and families.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	743	0	2808	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	23	24

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	34

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Work to reduce atmospheric greenhouse gas emissions.
2	Develop biomass use for biofuels
3	Build capacity to create, refine and implement scalable conversion technologies

Outcome #1

1. Outcome Measures

Work to reduce atmospheric greenhouse gas emissions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Investigator: Kevin Erb, Director, Conservation Professional Training Program, Division of Extension - University of Wisconsin-Madison

Project: North American Manure Expo

Because much of the equipment for hauling and applying manure is specialized and only used for a short time each year, livestock producers often find it more cost-effective and efficient to hire custom operators to handle their manure rather than handling it themselves. As a result, the custom application industry has grown significantly in Wisconsin and other livestock-producing states, creating an expanding need for continuing education, professional development, and innovation. Custom haulers and applicators must keep up with evolving nutrient management regulations, for example, as well as guidelines for protecting personal safety and water quality. Manure management is also becoming more challenging as weather becomes increasingly variable and severe, and interest grows in reducing fuel consumption on farms and greenhouse gas emissions from livestock. Further complicating matters for the industry is the need to address environmental concerns while also delivering economic benefits to customers. Since the 1990s, Wisconsin's custom manure application industry has sought help from UW-Extension to improve its practices, and provide educational and certification programs for its members.

What has been done
In 2001, a new professional association of custom applicators asked UW-Extension to organize a field event, so they could see demos of manure management equipment in action. (Existing farm shows wouldn't allow manure equipment to operate during their events because of odor concerns.) To meet this need, an Extension team created the Upper Midwest Manure Handling

Expo that year and then repeated the event in 2003. After the 2003 expo drew more than 700 attendees, other states began asking to host it. It subsequently rotated through Minnesota, Michigan, Wisconsin, Ohio, Iowa, Pennsylvania, and Nebraska, with Extension in each state handling all the logistics and educational programming each year.

At the same time, Extension and university budgets were experiencing deep cuts, and by 2012 it was clear that Extension could no longer finance and manage both the educational and non-educational aspects of the expo. In response, a multi-state Extension committee convened to examine ways to run the expo more sustainably. With funding from the Great Lakes Regional Water Quality Leadership Team, acquired by Kevin Erb, and strong interest and support from industry, the group spent nine months developing a feasibility study that outlined several new management options. The committee ultimately decided to create an independent board for the expo; importantly, this board would be able to hire a third-party commercial vendor to manage the event, freeing Extension to focus on the educational component. Third-party management of the 2013 event (as a pilot) proved successful and the North American Manure Expo has continued under this structure ever since. The structure provides the expo with a solid financial foundation and stable long-term management, while also allowing Extension to produce a stronger educational program each year.

Since third-party management was implemented, the North American Manure Expo has rotated through new states and areas, including South Dakota (in 2018) and Ontario, Canada. Indiana will host it for the first time in 2019. States have also begun collaborating on the expo. In 2018, for example, five states partnered to deliver the educational program, an arrangement that allows for greater depth and breadth of programming. Attendance at the event also rises when states share responsibility for promoting it. The expo today attracts 750 to 1,200 participants and 80 to 90 equipment companies each year, including many from outside North America. In 2018, 13 to 14 countries outside the U.S. were represented, for instance, including approximately 20 international businesses. Even as the expo matures, however, Wisconsin continues to play a strong role. Kevin Erb was chair of the expo's board for six years before rotating off in 2018. And in 2017, when Wisconsin last hosted the expo, approximately 15 Extension educators, UW researchers, and other Wisconsin scientists and ag professionals presented in the educational program, while a team of UW-Extension evaluators performed a robust assessment of the event's impact.

Results

The North American Manure Expo is the only rotating education and field-training event focused strictly on manure management and related nutrient management issues. Evaluation data consistently show that the event plays a unique and important role in fostering nutrient management planning on livestock farms. Survey data from the 2017 Manure Expo, which was held in Wisconsin, revealed that more than 80% of attendees agreed or strongly agreed that "attending the expo made me more aware of current research in manure solutions." Similarly, participants cited exposure to new techniques and technology as a top reason for attending. Most survey respondents agreed with the statement, "I used what I learned to do my job better" (80% at both 3 months and 10 months after the expo). Nearly all respondents also indicated that they shared their newfound knowledge with others (more than 85% at both three months and 10 months). On average, survey respondents reported they were responsible for managing manure on 5,000 acres, with numbers ranging from 100 to 7,500 acres.

The 2017 survey also asked attendees about protecting the environment and the safety of people and livestock. One-third of respondents reported 10 months after the expo that they had made changes or planned to make changes to reduce manure's environmental impact. One-quarter said they were making changes or planned to make changes in how they use manure as a

fertilizer, while another 25% stated they were making changes to manage manure gases more safely. In addition, one notable innovation that delivers both environmental and economic benefits has been demonstrated at the expo since 2013: a "manure agitation boat" for keeping manure solids from settling out in stored manure slurry. The agitation process can consume significant amounts of fuel. But using a remote-controlled agitation boat instead of several tractor-based agitators cuts fuel usage by 70 to 75%, drastically reducing both greenhouse gas emissions and the cost of agitating manure.

States and provinces: IA, IN, MI, MN, NE, OH, PA, SD, WI, and Ontario, Canada

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
133	Pollution Prevention and Mitigation
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
206	Basic Plant Biology
302	Nutrient Utilization in Animals
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development

Outcome #2

1. Outcome Measures

Develop biomass use for biofuels

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Build capacity to create, refine and implement scalable conversion technologies

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Training graduate students is a priority of our program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Program success is measured by several factors (outreach, new tools released to the public, graduate degrees, patents, publications, etc.). A 2018 highlight for WAES is a "Cultivars to Cropping Systems" project. This new project looks to provide tools to study the stability and resilience of agricultural systems, in order to identify cultivars, species mixtures, and cropping systems that can withstand climate change. So far, using historical data from 12 states, over the past 20 years, the project was able to identify quantitative measures for resilience and stability for each cultivar at each location. Several outside sources and industry are very interested in this project and hope to help expand this line of research.

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Sustainable Use of Natural Resources

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	0%		5%	
102	Soil, Plant, Water, Nutrient Relationships	0%		8%	
103	Management of Saline and Sodic Soils and Salinity	0%		3%	
111	Conservation and Efficient Use of Water	0%		5%	
112	Watershed Protection and Management	0%		8%	
123	Management and Sustainability of Forest Resources	0%		10%	
131	Alternative Uses of Land	0%		3%	
132	Weather and Climate	0%		5%	
133	Pollution Prevention and Mitigation	0%		10%	
135	Aquatic and Terrestrial Wildlife	0%		10%	
136	Conservation of Biological Diversity	0%		8%	
141	Air Resource Protection and Management	0%		3%	
213	Weeds Affecting Plants	0%		3%	
216	Integrated Pest Management Systems	0%		5%	
307	Animal Management Systems	0%		2%	
403	Waste Disposal, Recycling, and Reuse	0%		2%	
511	New and Improved Non-Food Products and Processes	0%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		5%	
806	Youth Development	60%		0%	
903	Communication, Education, and Information Delivery	40%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	22.0	0.0
Actual Paid	11.2	0.0	14.9	0.0
Actual Volunteer	1235.0	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**
541334	0	1170505	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
541334	0	1170505	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The WAES encourages research to benefit forest production, weed management, surface water quality, and promoting new farm based practices. An on-going project looked at how to increase crop water use efficiency in the Wisconsin Central Sands. This is needed to help manage consumptive groundwater use in this region.

Extension primarily does its natural resources work via the Environmental Resources Center (erc.cals.wisc.edu) and a number of campus-based integrated specialists (e.g. UW-Stevens Point Center for Land Use Education, Center for Watershed Science and Education, and Extension Lakes). Outreach and applied research programs span citizen monitoring (e.g. Water Action Volunteers - volunteer stream monitoring), agricultural stewardship (e.g. Conservation Professional Training Program), sustainable forestry (e.g. Natural Resource Education Program), water resource management (e.g. North Central Region Water Network), community and climate resilience (e.g. G-WOW "Guiding for Tomorrow" approach - g-wow.org), drinking and groundwater management, lakeshore management, and wildlife management.

Extension land, forestry and water programming features a) applied research and b) citizen engagement for positive behavior change. Facilitating sustainable management decisions is key for land and forestry programs. Extension water programs utilize multidisciplinary problem-solving approaches to address complex water resource challenges at multiple scales. Upham Woods Outdoor Learning Center builds curriculum continuity between onsite programming and programming at partner organizations, conducts offsite programming and engages with community partners to reach new audiences, and provides informal science education.

2. Brief description of the target audience

Rural and private landowners are a major target audience for forestry, land and water Extension programs. Other audiences include resource professionals, industry and commercial entities, local governments,Wisconsin Department of Natural Resources, agricultural producers, lake & watershed associations, college students, and the general public including diverse ethnicities.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	23015	0	8996	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	20	49	69

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	88

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Build capacity to create, refine and implement scalable conversion technologies
2	Improve and encourage the use of and growth in the ThinkWater curricula
3	Implement and improve forest production, weed management, water quality, and promote new farming practices.

Outcome #1

1. **Outcome Measures**

Build capacity to create, refine and implement scalable conversion technologies

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

Improve and encourage the use of and growth in the ThinkWater curricula

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Implement and improve forest production, weed management, water quality, and promote new farming 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)
Investigator: Ken Schroeder, Associate Professor and Agricultural Agent, Division of Extension - University of Wisconsin-Madison

Project: Farmer-led Watershed Protection

Efforts to reduce nitrogen and phosphorus loading from nonpoint sources into streams, rivers, and groundwater have a better chance of succeeding when several farmers in a watershed implement conservation practices together rather than just on their own farms. This is why the

state of Wisconsin has offered funding since 2016 to farmer-led watershed groups interested in working cooperatively to improve water quality and soil health. In addition to the benefit of having many farms working at once to reduce nutrient losses, voluntary farmer-led efforts often adhere to stricter environmental standards than those required by Wisconsin law. Farmer participation increases because farmers take the lead in choosing the conservation practices best suited for the unique soil and water quality needs of their local landscapes, and that fit their individual management and profitability goals. Farmers also determine the financial incentives, such as cost-share funds, that the council offers to those who participate in watershed protection. And they host events to share knowledge and help each other adopt better practices.

What has been done

Since 2016, the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) has awarded Producer-Led Watershed Protection Grants to projects that focus on preventing runoff from farm fields and that work to increase farm participation. From 2016-2018, the agency awarded nearly $1 million in these watershed protection grants to 44 producer-led projects. To qualify for funding, watershed councils must include at least five farmers in the same watershed, and partner with an agency such as DATCP, their local land conservation department, a nonprofit conservation organization, or Extension. Since the program's inception, several grantees have chosen to collaborate with UW-Extension personnel on educational events such as field days; demonstration projects and on-farm research; and other activities.

One example of these collaborations is the partnership between Extension associate professor and agricultural agent, Ken Schroeder, and the Farmers of Mill Creek Watershed Council in Portage County, WI. Since 2015, Schroeder and the council have been cooperating to reduce phosphorus loading from nonpoint sources (farm fields and barnyards) into Mill Creek, a waterway listed by the U.S. EPA as "degraded" due to lack of dissolved oxygen for extended periods. To assist the group, Schroeder has been coordinating and developing the educational programs for at least three field days each year, drawing 60 to 70 people each time. Featured demonstrations have included different methods for no-till planting soybeans into rye; a rainfall simulator which shows how conservation practices can reduce surface runoff and improve water infiltration; a low-disturbance tool for injecting manure into cover crops and hay fields without destroying the crops; and techniques for inter-seeding cover crops into growing corn and soybeans.

Results

Between 2016 and 2018, 30 farmers in the Mill Creek watershed worked with Schroeder and the council to install conservation practices on more than 4,000 acres, including 1,900 acres of cover crops and 2,300 new acres of no-till planting. To expand the educational reach of these projects, Schroeder published the first edition of the Farmers of Mill Creek Watershed Council newsletter in 2017 increasing the reach to 424 farmers, agribusiness professionals, and interested citizens.

The Farmers of Mill Creek Watershed Council is starting to reach audiences beyond the Mill Creek Area. Council members have been invited, for example, to participate in several panel discussions, give presentations on their accomplishments, and share lessons learned through their producer-led process of watershed protection. The Farmers of Mill Creek have also hosted groups to inform them about soil and water conservation practices in the watershed. These groups include the Professional Dairy Producers of Wisconsin and UW Discovery Farms "Water Tour: Every drop counts. Let's work together to keep it safe, sustainable, and accessible," and the Wood County Conservation, Education, and Economic Development Committee.

Yet another outcome of Schroeder's work with the Farmers of Mill Creek was the launch of a new

project in 2017, located in the Tomorrow/Waupaca River watershed in eastern Portage County. In February 2017, Schroeder received an email from a concerned farmer in the Tomorrow River watershed. With all the recent talk about water quality, the farmer wrote, he thought it might be time for Portage County farmers to become more proactive in addressing water quality issues. He knew about the Mill Creek farmer-led project in western Portage County and adjacent Wood County. But projects weren't yet happening on the county's eastside, he explained, where concerns were rising about increasing nitrate levels in groundwater. In fact, 95% of the watershed is highly susceptible to groundwater contamination due to highly permeable soils, geology, and other physical resources. After several planning meetings between Schroeder, a small group of farmers, and Portage County Land and Water Conservation, the team applied for and received a 2018 DATCP Producer-Led Watershed Protection grant of $37,120. The goal of the project is to educate farmers on conservation practices that can potentially reduce groundwater nitrate levels in the Tomorrow/Waupaca River watershed.

Fourteen farmers in the Tomorrow/Waupaca River watershed installed conservation practices in 2018, such as no-till planting, cover crop variety demonstration plots, cover crop planting; or they hosted an on-farm research project looking at inter-seeding alfalfa into corn silage, or at the relationship between nitrogen rates and corn grain yields. These conservation practices covered more than 1,770 acres. One winter kickoff meeting and two field days during the year also attracted approximately 140 area farmers and local residents.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
103	Management of Saline and Sodic Soils and Salinity
112	Watershed Protection and Management
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
806	Youth Development
903	Communication, Education, and Information Delivery

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

Brief Explanation

Training graduate students is a priority of this program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Sustainable use of Natural Resources is a large program that explores ways to improve agricultural and forest production on working lands. Extension and WAES have had great success in this area in 2018. A few examples are:

-Efforts were detected in invasive plants to enhance the ability for land managers to minimize the adverse effects of species in Wisconsin. Over a three-year period, over 110,000 invasive species reports were shared to the public by stakeholders and volunteers.

-Work is being done to predict how eutrophic lakes will respond to changes in the nutrient loading. This work provides the fundamental science to help water quality managers make decisions about nutrient loading and enable public health officials to issue warnings when toxin-producing cyanobacteria are present. 100 samples were collected, which yielded an estimate of 90 draft genomes of common and abundant freshwater lake bacteria. The final conclusion was made that microbe-microbe interactions are important to study, instead of just environmental parameters in aerobic regions of lake water columns. This will lead to future work to explore which interaction is most important. The work was presented at several local groups, lake associations, and farmers to help promote lake management as well as shared with an ad-hoc committee for Dane County, which helped create a reference manual for beach closures.

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please

reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Nutrition

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		8%	
206	Basic Plant Biology	0%		4%	
302	Nutrient Utilization in Animals	0%		16%	
305	Animal Physiological Processes	0%		4%	
311	Animal Diseases	0%		4%	
501	New and Improved Food Processing Technologies	0%		4%	
502	New and Improved Food Products	0%		12%	
511	New and Improved Non-Food Products and Processes	0%		4%	
607	Consumer Economics	0%		4%	
701	Nutrient Composition of Food	0%		4%	
702	Requirements and Function of Nutrients and Other Food Components	0%		24%	
703	Nutrition Education and Behavior	75%		4%	
704	Nutrition and Hunger in the Population	10%		0%	
724	Healthy Lifestyle	15%		8%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	2.0	0.0	7.0	0.0
Actual Paid	1.4	0.0	9.0	0.0
Actual Volunteer	46.0	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**
71879	0	662578	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
71879	0	662578	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Faculty in WAES/CALS and specialists in Extension have assessed the causes and consequences of childhood obesity and poor nutrition for families based on Nutritional Sciences, Bacteriology, Biochemistry, Food Science and Genetics aspects. Educational projects this year include introducing and emphasizing the importance of nutrition for children, promoting healthful eating campaigns, dietary markers of human health and nutrition, general obesity prevention and research on nutritional perspectives of diabetes.

2. Brief description of the target audience

The targeted audience for research and extension are children and youth, caregivers, parents and family members, local and tribal officials, public and private collaborating and community agencies, child care providers, teachers, school districts, administrators, tribal, state and federal agencies and others in a variety of educational settings to reach under-represented audiences including low-income Latino/a, African American, American Indian and Hmong parents, families and youth, translating and interpreting as needed.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4314	0	1255	0

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

Patent Applications Submitted

Year:	2018
Actual:	1

Patents listed
Title: Diffusion Transfer Functionalized Membrane
Investigator: Mark Etzel
Patent Application: P180369

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	3	25	28

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	42

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Develop and implement behavioral interventions that improve nutrition and increase physical activity
2	Build capacity among community partners and schools to address issues related to nutrition and childhood obesity

Outcome #1

1. Outcome Measures

Develop and implement behavioral interventions that improve nutrition and increase physical activity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Federico Rey, Assistant Professor, WAES

Project: Interpersonal differences in gut microbial metabolism of choline and cardiovascular disease

Choline is an essential nutrient abundant in protein-rich foods such as eggs, soy beans and red meat. It is required for a number of functions including neurotransmission, maintaining cell membrane structure and regulating epigenetics, which are chemical tags on DNA that can change the expression of genes. Long-term choline deficiencies can cause epigenetic changes associated with cancer, atherosclerosis, cognitive disabilities and more. Only 10% of the U.S. population meets the recommended daily intake of choline, and women who are pregnant or breastfeeding need increased amounts of choline. After ingestion, some choline is transformed into trimethylamine-N-oxide, or TMAO, which has been associated with heart disease. Microbes in the gut, the amounts of which differ from person to person, play a role in this conversion and can limit the amount of choline available for the body to use. Researchers at UW-Madison want to better understand how microbes are competing for choline and how the conversion of choline to TMAO affects the body.

What has been done
Scientists first identified the genes required for choline metabolism in a bacterium. They then developed a model using germ-free mice with a simplified gut microbiome incapable of metabolizing choline. To the mice they added either bacteria able to consume choline (CC+) or bacteria unable to consume choline due to the absence of a single gene (CC-). They found that the plasma of the CC+ mice contained altered levels of metabolites, indicating that these mice

had less choline available to use. CC+ mice also had increased fat storage and decreased levels of epigenetic tags in several organs. Scientists also wanted to study the effects of choline metabolism on fetal development. Female CC+ and CC- mice were bred, and pups were collected by C-section. Researchers found that TMAO levels were higher in CC+ mothers and pups, and there was a reduction in epigenetic tags in the brains and livers of pups born from CC+ mothers. In another mouse model of cognitive skills, the researchers saw more anxious behaviors in pups born from CC+ mothers compared to pups from CC- mothers.

Results
Researchers found that gut microbes that can metabolize choline compete with the body for the essential nutrient. This can cause increased fat storage and epigenetic changes that may increase an animal's likelihood of developing metabolic disorders. These microbes are likely not only affecting health through the accumulation of TMAO, but also by competing for choline. Finally, epigenetic changes caused by decreased choline levels in pregnant mice can lead to epigenetic and behavioral changes in offspring. Overall, these findings suggest that personalized diets that take into account interactions between nutrients and gut microbes are needed to improve health. Also, those sensitive to choline shortages, such as pregnant women, would benefit from understanding their microbial communities and following diet recommendations based on their personal metabolism.

Three peer-reviewed journal articles have been published describing this work, and the authors have presented their findings at several conferences including the American Heart Association General Meeting. The investigators also shared the work with the public at a Fermentation Fest and other community events as well as on radio shows. A graduate student was supported by this grant.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior

Outcome #2

1. Outcome Measures

Build capacity among community partners and schools to address issues related to nutrition and childhood obesity

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Training graduate students is a priority of our program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The success of this program explores various ways to improve all aspects of the quality of human life. A 2018 highlight is:

-Research under this program focused on identifying and measuring how an individual's health status, particular to obesity status, interacts with consumption of environmental services and exposure to environmental pollution. One project studying population health status showed that the use of medical services related to respiratory conditions, such as asthma, is responsive to local ambient concentrations of air pollution. It was found that a one standard deviation reduction in particulate matter reduces aggregate spending by as much as 5 percent-which translates into over $4 billion annually in economic benefit from a pollution reduction, operating through the medical expenditures mechanism.

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment

Report.

V(A). Planned Program (Summary)

Program # 7

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
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		4%	
311	Animal Diseases	0%		11%	
501	New and Improved Food Processing Technologies	0%		11%	
502	New and Improved Food Products	0%		11%	
701	Nutrient Composition of Food	0%		4%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	50%		4%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	50%		37%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		7%	
723	Hazards to Human Health and Safety	0%		11%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	17.0	0.0
Actual Paid	2.2	0.0	10.3	0.0
Actual Volunteer	127.0	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**
137792	0	758682	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
137792	0	758682	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The collaboration between the WAES and Extension has focused on developing and evaluating the improved technologies in food processing and several on-farm food safety practices. Current research has been done in several important aspects of food safety, including food toxins and their causal organisms, development of thermal food preservation technologies, residual pesticides in foods and several other areas.

The WAES and Extension plan collaboration among interdisciplinary campus and county faculty and staff, colleagues, partners and trained volunteers providing research-based training and support to improve the safety of the food supply by helping youth and adult agricultural producers, meat, dairy and acidified canned food processors and entrepreneurs adopt best practices and comply with government regulations. Twenty county Extension educators and state specialists are Beef Quality Assurance trainers, two Swine Team members are certified Transport Quality Assurance trainers, and all four are Pork Quality Assurance Plus Advisors. This group also helps train certified 4-H youth and volunteer leaders in Meat Animal Quality Assurance required for participation in county and state fair swine, beef and sheep projects and auctions.

2. Brief description of the target audience

Integrated activity for our capacity grant program targets a broad group of stakeholder audiences in agricultural, natural resources, and the public. The audience includes colleagues, veterinarians and other professionals, individuals, families, 4-H and FFA youth, school-age children and preschoolers, fresh market vegetable and fruit growers and sellers, small food processors and entrepreneurs, crop, dairy and livestock producers, producer associations, dairy food processors and artisan cheesemakers, natural, organic and conventional meat processors, local and regional economic development initiatives, local and tribal governments, state and federal regulatory agencies, and others preserving food safely and keeping the food supply safe and wholesome.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme

weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1881	0	2010	0

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

Patent Applications Submitted

Year: 2018
Actual: 1

Patents listed
Title:Tannin-Chitosan Nanofibers with and without Nano-Reservoirs
Investigator: Jess Reed
Patent Application: P180313

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	1	29	30

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research

program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	46

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Improve the safety of the food supply.
2	Develop and implement behavioral interventions that improve consumer food safety practices.

Outcome #1

1. Outcome Measures

Improve the safety of the food supply.

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)
Jan Peter Van Pijkeren, Assistant Professor, WAES

Project: Development of a probiotic delivery platform of enzybiotics: An alternative approach to antibiotics

Since the dawn of the antibiotics era, when people or animals get sick with a bacterial infection, we have been able to turn to antibiotics to combat the illness. Antibiotics have also been widely used in agriculture to promote animal growth. Unfortunately, over time, bacteria-including pathogens-have developed resistance to the antibiotic drugs that we currently have in our arsenal, and there aren't a lot of new antibiotics in the drug development pipeline. There is an urgent need to develop alternative methods to eliminate bacterial pathogens, especially approaches that are 1) effective against "superbugs" that have already developed resistance to multiple, commonly-used antibiotics and 2) don't contribute to the problem of antibiotic resistance development.

What has been done
A team of researchers at UW-Madison is pursuing a new strategy to fight bacterial infections. The strategy involves taking a probiotic bacterium and turning it into an "antimicrobial delivery system" that can kill specific pathogenic bacteria as it passes through the digestive system. More specifically, researchers want to insert a set of lysin genes into the genome of the probiotic Lactobacillus reuteri. As it passes through the digestive tract, this modified L. reuteri will produce and release its various lysins, which are antimicrobial proteins capable of lysing-or rupturing-the cell wall of specific target pathogens. In this Hatch project, researchers took a critical first step toward creating this potential powerful pathogen-killing probiotic: They developed the genetic tool needed to efficiently insert large segments of DNA - large enough to contain multiple lysin genes -

into the genome of L. reuteri. Now that this new genetic tool has been made, they are moving to the next step: Turning L. reuteri into an antimicrobial delivery system by adding lysin genes.

Results
The scientific community has a powerful new tool capable of modifying the genome of Lactobacillus reuteri, a probiotic that is of importance to human and animal medicine. A major benefit of the new tool is that it is broadly applicable across the large, diverse Lactobacillus genus; it is anticipated to work in around 85 percent of Lactobacillus species, and has already been proven to work in five species. Compared to other genome editing tools for Lactobacillus, this new "plug and play" tool is easier, faster, more efficient and more broadly applicable. The tool was described in a peer-reviewed paper in the Journal of Bacteriology, and findings from this project have been shared at three scientific conferences. Scientists from around the globe have started using the tool for a range of research applications. The Wisconsin Alumni Research Foundation accepted the tool as a "biomaterial," and one company has already expressed interest in licensing it. UW-Madison researchers are now using the tool to modify L. reuteri and turn it into a pathogen-killing organism.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

Develop and implement behavioral interventions that improve consumer food safety practices.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Training graduate students is a priority of this program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The success of a program is measured by several factors (outreach, new tools released to the public, graduate degrees, patents, publications, etc.). One example of this is the summary under outcome number 1. The Food Safety project had two publications and a counterselection marker accepted by Wisconsin Alumni Research Foundation as a biological material. The project created a powerful pathogen-killing probiotic and a tool needed to insert large segments of DNA. The tool is being used by other UW-Madison researchers potentially other companies. This remarkable project provided novel opportunities for safer farm-to-fork foods.

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Education and Science Literacy

☑ 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
603	Market Economics	0%		17%	
703	Nutrition Education and Behavior	0%		15%	
704	Nutrition and Hunger in the Population	0%		17%	
802	Human Development and Family Well-Being	0%		17%	
806	Youth Development	100%		17%	
903	Communication, Education, and Information Delivery	0%		17%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	2.0	0.0
Actual Paid	11.5	0.0	2.0	0.0
Actual Volunteer	561.0	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**
486118	0	136900	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
486118	0	136900	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The WAES incorporates research projects to address the needs of communities, farmers, landowners, and policy makers to educate them to improve education about community issues and needs, policies, behaviors, agricultural, the land, and use of natural resources. Current research projects look at ways to improve motivated reasoning, educate low income communities about nutrition, Extension 4-H STEM specialists building capacity in 4-H educators and volunteers providing LEGO® Mindstorms® Robotics programs across Wisconsin.

2. Brief description of the target audience

The audience includes communities, policy makers, farmers, landowners, 4-H youth, parents, staff, teachers, community leaders, business owners, school districts, economic development practitioners, the news media, and families.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	4938	0	36121	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	27	4	31

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	34

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	To increase the knowledge and implement decision-making tools for farmers and landowners.
2	To increase the knowledge of youth and teachers in the 4-H STEM program.

Outcome #1

1. Outcome Measures

To increase the knowledge and implement decision-making tools for farmers and landowners.

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

To increase the knowledge of youth and teachers in the 4-H STEM program.

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)
Investigator: Joanna Skluzacek, 4-H STEM Specialist, Division of Extension - University of Wisconsin-Madison

Project: Wisconsin 4-H Tech Changemakers

In 2017, Wisconsin 4-H began partnering with Microsoft Corporation on the 4-H Tech Changemakers project: an effort to empower teens across the country to be "Tech Changemakers" who bring people together and solve problems in their communities through technology. Two places targeted by Microsoft to participate in the initiative were Brown and Outagamie counties, which include the city of Green Bay, Wisconsin, and neighboring communities. After Microsoft contacted the National 4-H Council about working in Wisconsin, UW-Extension personnel in these counties were asked to develop project proposals. In Outagamie County, UW-Extension reached out to the Oneida Nation to see if the tribe wanted to collaborate on a project. When the Oneida agreed, a needs assessment was done to determine how best to use the Microsoft funding to address an issue in the community.

The assessment revealed a divide within the Oneida Nation centered on digital technology. Elders in the community were alarmed by what they perceived as Oneida youth's total immersion in the digital world of smart phones, video games, and social media. As a result, the elders contended, youth had completely lost interest in "real world" Oneida culture and agricultural traditions. Youth, on the other hand, said that they were indeed interested in tribal history, culture, and farming. However, they wanted to engage with these traditions in modern ways, such as through social media.

What has been done

Working with the Oneida Nation, UW-Extension 4-H project coordinators designed a Tech Changemakers program aimed at using technology to engage Oneida youth in indigenous knowledge and agriculture; teach youth new digital skills; and foster a more positive attitude in Oneida adults and youth toward technology and innovation. To this end, the project leaders recruited their team of Tech Changemakers: three high schoolers who were all experts in Minecraft, a popular video game that lets users build their own virtual worlds. The teen Tech Changemakers were then paired with the Oneida Falling Leaves 4-H Club, composed of ten youth and two adults.

During meetings between January and June 2018, the teens taught the 4-H members computer and programming skills, especially how to use Minecraft's "icon programming" - also used in many robotics platforms. The youth then worked together within Minecraft to build their virtual community. The community they created was based in part on information the 4-H members gained from interviews with tribal elders about indigenous agriculture and other Oneida traditions. In particular, the 4-H members and their high school mentors recreated in Minecraft a parcel of farmland owned by the Falling Leaves 4-H Club. Their work in Minecraft was followed by an event during the Oneida's Growing Our Future Agricultural Expo, held in June 2018. The 4-H club members and other youth (32 in all), along with some parents, first interacted with the virtual farmland in Minecraft. The group then visited the actual farmland, where Oneida elders spoke about indigenous agriculture, especially the "three sisters" story about cultivating squash, potatoes, and beans together. At the site, participants also heard about planting and harvesting Native American crops such as elderberries and raspberries, and raising horses.

Results

The Tech Changemakers initiative had several impacts on Oneida youth. Membership in the Oneida Falling Leaves 4-H Club increased 300% as a result of the Minecraft project. Moreover, in a survey performed in June 2018, more than 85% of the Falling Leaves 4-H members indicated that they liked technology after participating in the project; another 75% said they'd like to get a job that uses technology. In addition, nearly all the youth who attended the Growing Our Future Agricultural Expo agreed in a survey that they learned new technology skills during the Minecraft activity and wanted to learn more. More than 90% also said the activity showed them how technology cannot only help them as individuals but also change their community for the better. Meanwhile, parents who played Minecraft with their children at the expo reported a more positive attitude toward video games afterward. That is, rather than viewing technology simply as an "electronic babysitter," they saw it as a fun way to connect with their children.

The Minecraft project also sparked the Oneida youth's interest in indigenous farming, gardening, and the land. For example, more than half of the youth participants in the Growing Our Future expo said in a survey that lessons about gardening and planting corn, beans, and squash

together were the most important things they learned that day. In addition, the Falling Leaves 4-H Club has chosen in 2019 to focus on improving the actual parcel of farmland that they built in 2018 in Minecraft. They hope to turn it into a community garden or farm, as well as to develop facilities where groups can host educational events and activities.

Another outcome of the successful 4-H Tech Changemakers project is that UW-Extension 4-H leaders are now collaborating with Microsoft on a second digital literacy initiative in 12 Wisconsin counties. Called 4-H Digital Ambassadors, the initiative is just beginning. But, eventually, teams of four to six teens and two adults in each county (the Digital Ambassadors) will be teaching adults about broadband internet service and how it can help the local community. The Digital Ambassadors will also be doing various projects in their counties, depending on each county's needs and interests. For example, one project may help seniors stay connected with friends and family via email and social media, while also educating them about online security and how to protect themselves from internet scams. Another team of ambassadors is interested in teaching job-seeking adults how to post their resumes, search for jobs, and apply for jobs online.

States (and tribes): Oneida Nation of Wisconsin, WI

4. Associated Knowledge Areas

KA Code	Knowledge Area
806	Youth Development
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Training graduate students is a priority of this program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The success of a program is measured by several factors (outreach, new tools released to the public, graduate degrees, patents, publications, etc.) A 2018 highlight for this program demonstrating success is:

-A research project is examining the involvement of agricultural and life science faculty at US land grant universities in two types of university-industry relations (academic engagement, academic commercialization) and conventional academic scholarship. After data analysis (a 2016 survey and 35 years of data from land grant scientists), they found that academic engagement (sponsored research and industry collaboration) generates 15-20 times the research funds that academic commercialization (patents, licensing and start-ups) does. Two publications have already been submitted, as well as content for a book.

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Rural Prosperity

☑ 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
131	Alternative Uses of Land	0%		10%	
134	Outdoor Recreation	0%		5%	
135	Aquatic and Terrestrial Wildlife	0%		5%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	0%		5%	
315	Animal Welfare/Well-Being and Protection	0%		5%	
601	Economics of Agricultural Production and Farm Management	60%		20%	
604	Marketing and Distribution Practices	0%		10%	
605	Natural Resource and Environmental Economics	0%		5%	
609	Economic Theory and Methods	0%		5%	
610	Domestic Policy Analysis	0%		5%	
724	Healthy Lifestyle	0%		5%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	40%		20%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	3.0	0.0
Actual Paid	18.4	0.0	7.0	0.0
Actual Volunteer	269.0	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**
1025689	0	651540	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1025689	0	651540	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

WAES is providing education to communities about development, land improvements, and how to attract, retain, and inform young people, as well as elderly, through community development efforts. Examples of our 2018 efforts include research about industry shifts and impact of unemployment, retaining elderly in communities, benefit of wind energy development while addressing zoning laws, and promotion of active living in rural towns.

Much of Extension work falls under Rural Prosperity, ranging from community economic development to farm management to human development and relationships. The Wisconsin 4-H program and positive youth development contribute to both rural and urban prosperity.

- Community economic development includes providing data and research, building capacity, and planning around local government, community infrastructure, and businesses. Major topics include basics of local government, energy, facilitation, placemaking, racial literacy, food systems, and broadband.
- Farm management mainly includes strategic planning; mission, vision and goal setting; and business planning.
- Financial capability programming covers basic money management and housing (rental and ownership). Strategies include coaching, online programs, video games, and curating current literature. This year, financial capability programming is featured below as a Qualitative Outcome/Impact Statement.
- Human development and relationship work covers mindfulness, protective factors, early childhood development, and more--coalition development is a strategy used.
- Youth programming uses core competencies and authentic, hands-on engagement around topics such as leadership development, life skill development and post-high school pathways.

Educators in this programmatic area support rural community leaders and organizations in strategic planning, place-making, and strengthening rural community leaders. Main programming efforts connected to Rural Prosperity consist of planning and providing educational events, and the facilitation of organizational change in rural community or government organizations.

For example, a tribal Land and Natural Resource Division Administrator asked our educator to develop strategic plans for each of the division's ten departments. Over the course of one year, our educator led each department through a process of identifying goals and barriers, and creating plans. As a result of each department's strategic plan, the division was able to better align its long term strategy with funding opportunities. Main programming audiences of these efforts are rural local residents and non-profit boards, as well as rural government (municipal, county, tribal nations).

As the example above illustrates, a core outcome of this work is the identification of next steps for community organizations and individuals. One characteristic of our work in rural areas is our ability to respond flexibly. This illustrates how Extension serves as a responsive resource for rural residents and organizations, helping them build and retain vibrant rural communities.

This Extension Program's work is not limited to strategic planning support in service of Rural Prosperity. Our educators help developing strong community leaders, for example through the Leadership Wisconsin program, which is designed to fill the leadership gap in rural areas. Through supporting rural communities in coming together to address local issues, we are playing a core role in mobilizing and connecting community resources. For example, our educators facilitated several multi-day workshops in rural communities focusing on place-making. The events allowed the community members to build a common vision for the community's future and they are currently developing implementation teams to put ideas from the program into action.

2. Brief description of the target audience

Integrated activity for our capacity grant program targets a broad group of stakeholder audiences in agricultural, natural resources, and the public. The audience includes colleagues and other professionals, growers and grower associations, land owners, policy makers, Certified Crop Advisors, agricultural service providers, coalitions and cooperatives, community leaders, business owners, local elected officials, town, city, county and tribal governments, state and federal agencies, local planning departments and regional planning commissions, utilities, school districts, economic development practitioners, the news media, and families.

We serve two core audiences in the Extension Program of Organizational and Leadership Development: local government entities (municipal, county, tribal) and rural residents. One-third or more of our programming in this area reached those audiences. Non-profit boards are another key audience, in about a fifth of our programming. In addition, we serve professional communities (such as chambers of commerce) and businesses (such as small rural farms and food producers) with this programming.

3. How was eXtension used?

Extension campus and county faculty and staff participate in various communities of practice, engaging with colleagues around the country to improve the educational content of research-based programs and assistance delivered to residents across the state and region. 289 Extension colleagues have created accounts with eXtension. They are connected by email and online newsletters, and shared resources such as teleconferences and webinars, eXtension Communities of Practice, and the national Extension Disaster Education Network (EDEN) to quickly address critical and emerging issues such as responding to extreme weather.

In 2018, Wisconsin teams representing food systems, opioids, nutrition and educational technology attended a Designathon in Madison, WI around innovation in Extension. This event was hosted by eXtension and by Wisconsin facilitators that were trained by eXtension in 2017. The event notably helped our new opioid team begin their work in a strategic way.

Interdisciplinary colleagues and other professionals in this network include University of Wisconsin researchers on the Madison, Platteville, River Falls and Stevens Point campuses, working with 3 tribes, and at 12 agricultural research stations.

V(E). Planned Program (Outputs)

1. Standard output measures

2018	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	24572	0	4115	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	30	25	55

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension self-directed teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	67

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	To develop and implement programs to improve succession planning, grazing strategies and land management.

Outcome #1

1. Outcome Measures

To develop and implement programs to improve succession planning, grazing strategies and land management.

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)
Investigators: Bill Ryan, Community Business Development Specialist; Victoria Solomon, Associate Professor and Community Development Extension Educator Division of Extension - University of Wisconsin-Madison

Title: Community Place-making

Smaller rural communities located in larger regions often find themselves in unspoken, friendly competition for attention and investment from stakeholders. A strong community brand identity helps a community differentiate itself from other, similar communities in a positive manner that helps achieve community and economic development goals.

The primary objective of this brand strategy is to help stakeholders within a community deliver a consistent message about the community that is grounded in statistics, examples, and testimony. Communities want objective local research to inform their economic development work and help in discovering their shared vision for the future economic and community growth that will benefit those that work or live there.

In the fall of 2017, the Village of Belleville, Wisconsin, contracted with Extension for a market analysis to assist them in strategically strengthening their downtown area.

What has been done
Extension offers research, education, and technical assistance to Wisconsin's downtowns to create and sustain business vitality. One example is the Market Analysis program which has evolved over the past 25 years. This program helps communities conduct market research specific to their trade area. It directly informs recruitment, retention, and expansion for existing

and future business in the community and provides local leaders with much-needed consumer data on which to base economic development decisions. Bill Ryan, Community Business Development Specialist, works with county-based Extension colleagues to assist communities. He also maintains the Downtown and Business District Market Analysis toolbox, a widely used web resource https://fyi.extension.wisc.edu/resilientdowntowns/resource/downtown-and-business-district-market-analysis-toolbox/.

Extension is well equipped to conduct local research as we have access to faculty, staff, and students who work in the tradition of the Wisconsin Idea. Colleagues facilitate meetings with local community study groups, help them analyze data, and guide them in the development of recommendations. One recurring theme among market studies is the preference of residents to repurpose downtown as a place to gather for social, cultural, and recreational events.

Results

Village of Belleville study group participants learned about the lifestyles of local residents and their purchasing behaviors. They learned that many of their community residents already had specific ideas in mind for the development of downtown. They also became more aware of community assets upon which certain business sectors could leverage to their benefit.

Using the results of a 2017 survey of community stakeholders, in combination with market data and information about comparable communities in the region, Extension identified a target market for future residents.

In addition to data on consumer markets, a second report analyzing stakeholder perceptions of Belleville, citizen civic engagement patterns, socialization patterns and variables related to their decision to live in Belleville (i.e., school quality, housing cost, commute distance) has been used in developing a brand identity for the community.

A series of research-based messages, images, and strategies have been outlined for the purpose of aiding community leaders and articulated in the form of a 'brand book' which provides specific guidance in communicating about Belleville.

The report was instrumental in a new coffee shop opening in downtown Belleville in a two-story brick building with a rehabilitated storefront. The coffee shop owner was appreciative of the report and shared it with his lender. He thought that the study presented Belleville as a place where downtown is being repurposed to serve the community better.

The work with Belleville is just one example of Extension's community development work in partnership with others. Design Wisconsin is a community design program offered by Extension's Community Vitality & Placemaking Team. Design Wisconsin assists local communities in working to identify and visualize their short-, medium-, and long-range visions. In Ellsworth, Wisconsin, The Ellsworth Design Team worked with 17 planning and design professionals from Minnesota. A shared vision and development plan focused on the priorities of the Ellsworth community members including Resident Experience, Social Life in Ellsworth, Recreation, Downtown & Business Districts, and Community Amenities & Housing. A total of 402 adult residents, 200 youth, and 130 local business stakeholders were involved in the visioning sessions. https://blogs.extension.wisc.edu/community/community-placemaking-community-design-charrette/community-design-team/

States: MN, WI

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
609	Economic Theory and Methods
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

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

Brief Explanation

Training graduate students is a priority of this program. Since these funds do not allow tuition remissions, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

A variety of factors could affect the outputs and outcomes of this planned program including those listed above. However, the breadth of the program ensures that there is still a sustainable base of work being done that can grow and evolve in 2018 and beyond.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The success of a program is measured by several factors (outreach, new tools released to the public, graduate degrees, patents, publications, etc.). A 2018 highlight for this program is:

-A current research project under this program is examining key responses to grazing regimes with livestock and in turn will produce decision tools that will be important for livestock producers and land managers. Thus far, this project had several outputs highlight the success of this program:
-outreach connections at 14 stakeholder meetings

-produced a site evaluation tool which is used to describe and assess sites for potential

grazing management. This is currently being used by the Wisconsin Department of Natural Resources.

-produced two draft spreadsheet calculators to assess the costs of grazing infrastructure

-authored three manuscripts, two reports and 11 poster presentations

In 2018, Extension hired three Evaluation and Program Development Specialists, to help with evaluation of high priority planned programs and to build colleague capacity, which will increase our ability to provide concise summaries in the years to come. For now, please reference the Results section of the Qualitative Outcome or Impact Statement sections above.

Key Items of Evaluation

In 2019, Extension started collecting indirect contacts again in our internal reporting system. We plan to begin reporting these to NIFA in the 2019 Annual Accomplishment Report.

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Wisconsin Competitive Research Program

☑ 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
123	Management and Sustainability of Forest Resources	0%		12%	
132	Weather and Climate	0%		8%	
134	Outdoor Recreation	0%		8%	
135	Aquatic and Terrestrial Wildlife	0%		8%	
136	Conservation of Biological Diversity	0%		8%	
301	Reproductive Performance of Animals	0%		8%	
305	Animal Physiological Processes	0%		8%	
312	External Parasites and Pests of Animals	0%		8%	
501	New and Improved Food Processing Technologies	0%		8%	
502	New and Improved Food Products	0%		8%	
721	Insects and Other Pests Affecting Humans	0%		8%	
722	Zoonotic Diseases and Parasites Affecting Humans	0%		8%	
	Total	0%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2018	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	7.3	0.0
Actual Paid	0.0	0.0	2.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	220227	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	220227	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Capacity grants are being used to address a number of state priority research activities that cannot be classified in the nine priorities. We have grouped these ongoing projects under the rubric of the "Wisconsin Competitive Research Program", but funds supporting these projects will be redirected to the new national priorities in the future. Our 2018 highlights include projects that contribute to a variety of important state and global needs and are focused in several areas, including tick management, mammary gland development, and animal survival.

2. Brief description of the target audience

Integrated activity for our capacity grant program targets a broad group of stakeholder audiences. Examples are: Wisconsin Department of Natural Resources, research community and the public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

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

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

Patent Applications Submitted

Year:	2018
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2018	Extension	Research	Total
Actual	0	8	8

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW-Extension teams on the relevance, importance and impact of our research program. The output measures listed will also serve as outcome measures in that patents, graduate degrees and publications all include an element of critical review and assessment of uniqueness, originality, contribution to the science and knowledge base, or other performance criteria.

Year	Actual
2018	12

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW Extension teams on the relevance, importance and impact of our research program.

Outcome #1

1. Outcome Measures

Outcome measures for this work are both qualitative and quantitative. We will rely on feedback from stakeholder groups, advisory boards, and individual constituents, as well as from UW Extension teams on the relevance, importance and impact of our research program.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2018	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Susan Paskewitz, Professor, WAES

Project: Integrated tick management and host ecology

Diseases transmitted by ticks are a significant health problem for humans and animals in Wisconsin. The state has become a hot spot for tick-borne diseases as, over the past 25 years, deer ticks have moved from the northern parts of the state to the south and east. They are now found nearly everywhere, from the backcountry to wooded areas of neighborhoods to even well-manicured lawns. Tick-borne diseases include Lyme disease, ehrlichiosis and anaplasmosis, which can cause flu-like symptoms, neurological problems, nerve pain and more. Tick pathogens can also affect the health of domestic, farm and wild animals. To address the many complications associated with ticks, researchers at UW-Madison want to develop methods that target their small mammal hosts and reduce the abundance of both ticks and their pathogens. They aim to improve living and working conditions and enhance recreation for those throughout Wisconsin and beyond.

What has been done
Seventeen research plots were established at the UW Arboretum in Madison, WI. Five of the plots served as negative control and were not treated, and four plots received only a vegetation removal treatment, while researchers placed tick tubes in four plots and combined tick tubes with vegetation removal in four additional plots. Tick tubes are short stretches of pipe stuffed with cotton balls coated with an insecticide called permethrin. The tubes are placed near logs where small animals regularly travel. When the animals find the tubes, they take the cotton balls for their nests, and the permethrin transfers to their coats, where it repels and kills ticks. The effects of the

tick tubes were monitored in various ways. Ticks were caught and counted by dragging cloth through vegetation at the study sites. Small mammals were live trapped, and the attached ticks were collected and counted. Samples from the ticks and mammals were tested for common tick pathogens.

Results
Researchers found that tick tubes did reduce the number of ticks at the study sites, though the amount of reduction varied between the years of the study from 25 to 50% of the control. Further, the prevalence of the Lyme disease pathogen carried by ticks and small mammals decreased. The use of tick tubes as a possible tick control measure was shared through presentations at meetings of the Midwestern Pest Control Operators and the Illinois Mosquito and Vector Control Association. The data were also presented to scientific colleagues at the Centers for Disease Control and the national meeting of the Entomological Society of America. The public was informed of the work through discussions with homeowners groups in two Wisconsin communities. Results were also reported to the staff of the UW Arboretum, Dane County Public Health and the State Department of Public Health Services. One graduate student and several undergraduate students worked on the project, and two journal articles were published. Residential communities were approached to explore the potential of tick-tube trials on their properties to further this research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
135	Aquatic and Terrestrial Wildlife
312	External Parasites and Pests of Animals
721	Insects and Other Pests Affecting Humans

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

Brief Explanation

A variety of factors could affect the outcomes of this project including those listed above. However, the breadth of the program makes it unlikely that the outcomes would be completely disrupted unless there was some major natural, economic, or public policy disruption.

Training graduate students is a priority of our program. Since these funds do not allow tuition remission, we continue to discuss alternatives to meeting our capacity grant mission, while continuing to train graduate students for the next generation of agricultural science.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

WAES measures success of a program based on outreach, tools, publications, patents, graduate degrees, and contributing to science. This program is our smallest, however, our 2018 projects produced eight publications, trained four graduate students, and produced several noticeable contributions to the research world.

One Example:
Tick transmitted disease agents are a problem for both human and animal health in Wisconsin. One project looked at the success of using tick tubes which contained nest materials that were treated with tick killing chemicals. These tick tubes showed 20-40% fewer ticks in the sample plots (17 half acre plots).

Key Items of Evaluation

N/A

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.