2016 Washington State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The primary goals of the Washington State University (WSU) Agricultural Research Center (ARC - the Agricultural Experiment Station of the State of Washington) and of Washington State University Extension are to conduct research beneficial to the citizens of Washington State and to extend relevant research results generated here and elsewhere to stakeholders within the state and beyond. We strive to create outcomes that improve the economic viability, environmental sustainability, community resilience, and quality of life for our people. We recognize that we have unique land grant research and outreach missions to serve the people of Washington in order to enhance their quality of life and to evaluate both short and long term consequences of potential actions. The ARC provides leadership in discovering and accessing knowledge by carrying out high quality research that contributes to a safe and abundant food supply; promotes the well-being of individuals, families, and communities; encourages sustainability of agricultural and economic systems; promotes energy innovation; and encourages careful stewardship of natural resources and ecological systems. WSU Extension creates programs with measurable deliverables and outcomes that leverage the research base of the University and the world to address primary and timely issues in ways that lead to economic development as well as personal, family, and environmental well-being. The synergy provided by connecting the problem-solving skills of the research community with the Extension experience gained from working with individuals who sometimes represent different perspectives can be quite powerful and can support valuable contributions to our citizens and society. The WSU ARC and WSU Extension have many natural and structural links. All Washington State University faculty members have responsibilities that include both research and outreach, with many having formal joint appointments. The focus of our joint efforts is to provide for the primary needs of the people of Washington State. As part of this core mission, the ARC has made significant commitments to focus on fourteen high priority research areas that advance our land-grant mission in discovery and development research. These research areas are (1) animal biology and biomedicine, (2) integrated crop and weed management systems, (3) energy-biofuels, (4) food processing, food quality, food safety, and food supply, (5) health and wellness, (6) integrated pest management, (7) plant breeding and physiology, (8) livestock, (9) natural resources, (10) water, (11) molecular plant sciences, (12) sustainable agriculture and organic farming, (13) precision agriculture, and (14) soils. And, while significant components of our Extension programs are aligned with the ARC research base, Extension also delivers significant outreach related to natural resource stewardship; food safety; health and wellness; youth and family development; governance and community & economic development. The efforts of ARC and Extension are not the only parts of WSU that work to reach these goals, but they are a committed element of a broader set of programs that reside in the many WSU colleges and interdisciplinary centers, including the College of Agricultural, Human and Natural Resource Sciences (CAHNRS); the Voiland College of Engineering and Architecture; the College of Arts and Sciences; the College of Pharmacy; the College of Veterinary Medicine; the Center for Environmental Research, Education and Outreach; and the three outreach centers of the Community and Economic Development program unit: the William D. Ruckelshaus Center (a joint program with the University of Washington), the Division of Governmental Studies and Services, and the new Metropolitan Center for Applied Research and Extension. Additionally, through close partnerships and collaborative agreements, our Extension faculty also extends the research conducted by faculty at other regional centers of expertise, including the University of Washington, Oregon State

University, and the University of Idaho. For these and other reasons, we believe the Combined Research and Extension Annual Report is fundamental to understanding how we make our contributions.

The state of Washington is beautiful, rich in natural resources, and has a highly diverse topography and climate. This diversity is also reflected in our people, communities, industries, and our significant natural resources. For a number of reasons, our agricultural systems are among the most diverse in the nation and the state produces over 300 different crops that are sold domestically or exported, largely to countries in the Pacific Rim. Washington is especially known for its apples, pears, sweet cherries, wheat, potatoes, beef, milk and milk products, and it produces a major share of many specialty crops, like small fruits (e.g. grapes, berries), seeds (e.g., vegetables, alfalfa), pulse legumes, hops, and mint. Most of the state's farm and ranch lands are in Central and Eastern Washington but most of the state's population is located in a coastal zone on the west side of the Cascade Mountains in a corridor that stretches from the Canadian border south to Vancouver, Washington and the Oregon border. Western Washington is characterized by an expanding urban population, which values environmental quality and supports local food systems. As a consequence of the dense population in an area with good agricultural conditions, including a moderate climate, rich alluvial soils, and abundant rainfall, this region of Washington is home to a small but extraordinarily diverse agriculture that focuses on high value production. Eastern Washington is characterized by larger farming operations, especially in the cultivation of wheat, potatoes, legumes, and orchard crops. Our forested lands are in coastal regions, the Cascade Range, and in northwestern and southwestern Washington and they contribute significantly to the state's economy and overall quality of life through economic and recreational opportunities. Washington is also home to two great rivers, the Columbia and the Snake, which provide transportation, electrical power, irrigation, and important fish and wildlife habitat. Other river systems, coastal regions, and the Puget Sound support abundant yet fragile aquatic and marine ecosystems and provide a rich mosaic unique to the Pacific Northwest.

The diversity of Washington doesn't end with its physical features as the state also has continually evolving demographic dynamics, which influence the cultural and political milieu. The state has a significant Native American population with 29 Federally-recognized tribes. There has been almost a tripling of the Hispanic population in the last twenty years, especially in the central and south-central counties, and a virtual doubling of Asian populations in Western Washington during the same period of time. Adding to this overall cultural diversity are the large refugee populations that now call Washington State home; Washington State is the 8th most popular resettlement area for refugees nationally. Washington now ranks second in the nation for bilingual and migrant education programs at the K-12 level. While this diversity is enriching the tapestry of the state by bringing a multitude of new cultures, foods, and arts, these demographic shifts also strain social services and challenge educational delivery systems. The health and wellness of our youth are also at risk with over 26% of our adult population categorized as obese and almost 30% of our youth categorized as overweight or obese. Our rural communities are struggling with increased poverty and with differential access to technology, health services, and educational opportunities. In such a diverse cultural and environmental landscape, research, technology transfer, and outreach are challenging but essential.

The agricultural industry is a constantly shifting tableau. Weather variability and climate change have had significant impacts on water availability and facilitate migration of new plant and animal diseases and pests into the state. New varieties of crops, both domestically and internationally developed, compete for market share but also provide our growers with new opportunities; constant changes in disease and pest pressure, input costs, and per bushel prices affect how we grow our crops and what we incorporate into our crop rotations; agriculture labor supplies affect the timing and cost of our fruit harvests; and, as importantly, changes in consumer demand and governmental policy shape, and may even dictate, direction. The dynamics of our communities change as the result of changing demographics, changes in transportation, communication, educational and health care opportunities, and the availability and stability of employment locally. As we examine how to adapt to these changes and challenges, we provide the expertise that allow us to take advantage of all potential opportunities. Examples of relatively newly created opportunities include the possibility of growing and processing industrial hemp for oil and fiber, a burgeoning Washington State viticulture and enology enterprise, and the increasing importance of niche legumes in crop rotations. Washington has the second largest wine industry in the United States but there

are issues related to local climate, soil, and pest management that need to be resolved in order to exploit the potential of this crop. The partnership that has developed between the research, Extension, and industry components of the viticulture and enology business are truly outstanding and a model for future endeavors. In addition, our commercial tree fruit industry has funded several endowed faculty positions as well as infrastructure support that will continue to keep us at the cutting edge of research. We also continue to explore avenues where we have traditionally been a world leader. We have many researchers involved in breeding programs to adapt crops such as wheat and tree fruits to drought and high temperature conditions.

There are also many other challenges to Washington State that impact our citizens. Our natural resources are at risk from land conversion, wildfires, and pollution. Last year Washington State saw a lower incidence of wildfires than in 2015, but still witnessed significant impacts. Our faculty in research and extension were mobilized to provide information and support in this critical time. Counties across the state experienced severe and emergency drought conditions. This had severe negative impacts on all aspects of life for our citizens but was especially impactful for agriculture. Another issue that is rising to the forefront are pollutants in our environment that are serious concerns for the safety and health of our water systems. Our Washington Stormwater Center was created in 2009 by House Bill 2222 and it is a technical resource center in partnership with the University of Washington and the Washington Department of Ecology to provide tools for storm water management. We are also partners in the State of Washington Water Research Center (it is directed by our faculty) which conducts research on water, fosters education of future water professionals, and serves as a nexus for the academic community, water resource managers, and water stakeholders. As a result of studies on water management for multiple uses, our economists are critically examining current and future water use for urban development, crop production, fisheries, and recreation. Now more than ever it is necessary to develop new ways to meet the demands of climate change and an increasing population.

Our role in dealing with these issues continues to be in both basic discovery research and highly translational applied research that provides information and assistance to our constituents. We use cutting edge technology to develop new processes and solutions and provide this information to our stakeholders. We have strategically prioritized hiring and strengthening research programs in the areas of plant biotechnology and genomics and are leading the nation in several efforts to apply these areas of expertise to issues like cropping systems research and cultivar development for specialty markets. Our biological systems engineers are working on precision systems for delivering water and fertilizer at appropriate times for efficient crop yield and resource management and on remote monitoring to close the loop and measure local effects on a large scale. Our integrated pest management programs are developing genomics as well as management techniques to minimize traditional chemical pesticide use while effectively managing pests across a broad variety of agricultural crops and urban environments. And our energy extension programs are pioneers in areas like building technology and plant operations efficiency.

WSU researchers have garnered millions of dollars in extramural support to leverage their capacity grant funds into discovery and development research important to the citizens of Washington State. External funding awards to Research and Extension has been uneven over the past several years were $91 million in 2012; $80 million in 2013; and $85 million in 2014, $81 million in 2015, and $83 million in 2016. For the last four out of five years, the College of Agriculture, Human and Natural Resources at Washington State University has been among the top six universities in the nation for total dollars awarded from USDA National Institute of Food and Agriculture competitive grant funding. The recently-completed Northwest Advanced Renewables Alliance is an important example of a partnership led by WSU with 15 partners ranging from private companies to public research institutions with over 50 principal investigators. This WSU-led consortium was a $40 million dollar award. This grant is providing transformational research to make a sustainable aviation biofuels industry a reality. The largest gift to Washington State University overall is still the Washington Tree Fruit Commission, which approved check-off increases worth an estimated $32 million over the 8 years of the increased assessment for support of apple, cherry and pear research and extension. Other support is available from organizations like the Washington Grain Alliance (which donated over $5 million dollars to build a new grains greenhouse), the Washington Potato Commission, the Washington Hops Commission and the Washington Wine Commission (which donated

funding for the new Ste. Michelle Wine Estates WSU Wine Science Center). There is a very vibrant relationship between WSU Research and Extension and numerous commodity-based entities in the state and region and we view this as a validation of the value placed on our efforts by our constituents and stakeholders.

There are some difficulties in reporting the information about our combined Research and Extension activities through the rubric that is imposed by the reporting structure. One obvious concern is in assigning "credit" to one area when an activity fits partially in more than one area. The two benchmark numbers that are especially affected by this are publications and graduate students. For publications, we have assigned equal "credit" to two Planned Programs when this seemed appropriate. Thus the number of refereed journal article publications reported in a Planned Program might be lower than the number of actual publications making a significant contribution to the area of the planned program. Under state-defined outcomes, we have separately counted refereed Extension publications. For the graduate students, we asked their major department to indicate whether individual students had a significant part of their studies focused on the Planned Program and, when appropriate, allowed them to assign effort to multiple programs to the nearest tenth. The number associated with a Planned Program represents graduate student Full Time Equivalency and a larger number of students may have had partial effort in this Planned Program. For the expenditures in a Planned Program, we asked the administrator with responsibility for each Hatch project to classify the project to Planned Program, and then proportionately allocated total expenditures in this project to the Programs. Individual administrators were given the option of assigning some of the project to "other," to represent an effort that did not fit into the classification scheme, but the dollar amount associated with this choice was small.

There are numerous societal challenges that can be addressed by cutting-edge research and through the application of that research to the practical issues that drive production. Every year we assess and evaluate our research portfolio in order to strategically prioritize our efforts to ensure the greatest impact is derived from both our research and extension programs. As a result, we are able to continue to deliver important outcomes including economic benefits to agricultural and natural resource-based industries, communities, and individuals. Additionally, our research and outreach help ensure that the people of Washington State maintain a high quality of life by limiting the negative impacts of chronic disease, food insecurity, and obesity. Finally, our programs help ensure that the beauty of the state and its natural resources are sustained for future generations. This annual report endeavors to summarize the inputs, outputs, and impacts of our work conducted during the year.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	520.0	0.0	440.0	0.0
Actual	494.0	0.0	656.0	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

Merit evaluation takes place at several levels. Prioritization for specific programs is manifested by allocations of effort and limited funds. Support for research projects generally begins with discussions between stakeholders, administrators, and researchers. Agricultural Research Center (ARC) project proposals that address these high priority areas are then written by individual faculty members or by faculty teams. These proposals are submitted to the chair of an appropriate academic department, who reviews the proposal, and ascertains that the topic of the research is consistent with the previous discussions. If so, the project proposal is circulated for peer review to internal and/or external reviewers. These reviewers are asked whether the research represents solid science, is directed to topics of current need, will advance the field of study, and whether the research plan is appropriate. Reviewers are asked to offer written suggestions for improvement and to identify the strongest and weakest points of the proposal. After comments are received from the reviewers, the chair assembles the commentary and discusses it with the faculty member who proposed the project. If necessary, the faculty member then revises the project proposal. After examining these changes, the chair submits the project proposal to the ARC where it is proposal is sent to USDA and reviewed by the appropriate National Program Leader. When approval is final, the approved project is entered into our database and into the REEPort system. We also use this system by entering our state projects as a way of tracking most projects that are funded by external funds to track the majority of our research activity in one database. In addition to review of individual projects prior to their establishment, the programs are evaluated on a yearly basis and are reviewed in the context of university and college planning and evaluation priorities. In parallel, proposals for funding that may overlap these projects may be submitted to federal or state agencies or to commodity commissions. As appropriate, we also use the NIFA system that arranges for expert external review teams to examine specific departments or activities.
Individual WSU Extension faculty program plans are developed through statewide planning processes informed by the (now aging) NIFA Plan of Work, the College of Agricultural, Human and Natural Resource Sciences Strategic Plan, and the WSU Strategic Plan. Extension faculty members are reviewed annually on a set of performance expectations related to the grand challenges recently articulated in the University and College strategic plans. These include: effective program planning, implementation, and evaluation of impact; scholarly work and creative outreach materials; success with grants and extramural funding; leadership and teamwork; professional development; and service to the public and the institution. Annual merit ratings are assigned based on accomplishment within these categories, which are also the performance expectations considered for tenure and promotion of Extension Faculty. All faculty report at the end of the calendar year into our electronic database called WORQS (WSU Online Reporting and Query System), which can be accessed quickly at any time during the year that the information is needed. The progress of Extension faculty member's work is reviewed by Program Directors, Department Chairs, Associate Deans and the Dean as an integral part of the annual performance review process. WSU Extension faculty receive over 60% of their total funding from extramural sources, including USDA grants, grants from other agencies, foundation grants, and commodity commission grants. These funding agencies subject our proposals to expert peer review by scientific panels and by industry professionals and growers. All WSU Extension publications undergo a double blind peer review. Reviewers include faculty at WSU or other Land Grant Universities, state and federal agencies, or research faculty at non-Land Grant universities.

III. Stakeholder Input

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

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

Brief explanation.

- Use of media to announce public meetings and listening sessions
- Targeted invitations to traditional stakeholder groups
- Targeted invitations to non-traditional stakeholder groups
- Targeted invitations to traditional stakeholder individuals
- Targeted invitations to non-traditional stakeholder individuals
- Targeted invitations to selected individuals from the general public
- Surveys of traditional stakeholder groups
- Surveys of traditional stakeholder individuals
- Surveys of the general public
- Surveys specifically with non-traditional groups
- Surveys specifically with non-traditional individuals
- Surveys of selected individuals from the general public

Brief explanation:

Washington State University has a long and close relationship with its many stakeholders. Not only do we maintain relationships with the local stakeholders through our WSU Extension network of county offices, but we also have established large Research and Extension Centers (R&E Centers) at several locations throughout the state, which are not just farms or research sites but have significant permanently based Research and Extension faculty and staff. They are also centers for graduate student training. Thus, we are able to interact with our primary stakeholders on a daily basis and they develop both personal and professional relationships between those stakeholders and WSU personnel. Major R&E Centers are located in Pullman, Prosser, Wenatchee, Mt. Vernon, and Puyallup. Additionally, many stakeholder groups have research and administrative personnel that have interacted with WSU for a number of years.
In many instances, commodity commissioners or commodity research directors have been appointed as adjunct faculty in appropriate academic units. The agricultural community of Washington is heavily populated with former WSU students who are proud to claim that experience as part of their identity. Stakeholders in Washington have long recognized WSU as a major asset for their industries and activities and are often very forthcoming with suggestions and critiques. Our

stakeholders are familiar with our web pages and our phone numbers and are not reluctant to give both formal and informal input to the administrators and scientists in the ARC and WSU Extension and even to contact public officials in their areas to offer suggestions. We make use of all information avenues to connect with the broadest array of stakeholders.

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.

● Use Advisory Committees
● Use Internal Focus Groups
● Use External Focus Groups
● Open Listening Sessions
● Needs Assessments
● Use Surveys
Brief Explanation:
Many Departments within the College of Agricultural, Human, and Natural Resource Sciences have an advisory board, and there are similar groups that advise the CAHNRS, ARC and Extension administrations. These advisory councils and committees are kept abreast of activities within their respective units through newsletters, telephone calls, emails, social media, blogs, and directmeetings. These advisory groups meet at regular intervals both as a unit and with their primary departments. During these meetings, they are briefed about new initiatives, on-going work, and issues related to Research and Extension.
There is a College level advisory committee as well as a smaller college-level food and agricultural council. Both of these interact with the Dean, the ARC Director, the Director of Extension, and other Associate Deans in helping to define priorities, identify emerging research issues, and provide feedback on the quality and relevance of our research and extension activities. Individuals who serve on these advisory panels represent specific knowledge about target audience needs or about specific subject matter that will help advance program design, delivery, and impacts. These individuals are contacted directly by an appropriate person (County Director, Program Director, Associate Dean, Dean, etc.) to invite their participation, often after previous peer contact. Finally, web content delivery and web conferencing is being increasingly used to both communicate

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.

- Meetings with traditional Stakeholder groups
- Surveys of traditional Stakeholder groups
- Meetings with traditional Stakeholder individuals
- Surveys of traditional Stakeholder individuals
- Meetings with the general public (open meeting advertised to all)
- Surveys of the general public
- Meetings specifically with non-traditional groups
- Surveys specifically with non-traditional groups
- Meetings specifically with non-traditional individuals
- Surveys specifically of non-traditional individuals and populations
- Meetings with invited selected individuals from the general public
- Surveys of selected individuals from the general public

Brief Explanation:

We prepare and distribute WSU project-related information through our Communications, Marketing and Information personnel. While electronic media (email, websites, social media and blogs) are used to solicit information we also recognize that some individuals do not have access to these media, so more traditional approaches are also used. These latter methods include the use of radio, direct mail,
telephone contacts, and personal visits, including Spanish language radio (especially in Hispanic communities), local access television, newspapers (English and other languages), newsletters, posted announcements in high volume areas (often in multiple languages), group meetings, and targeted direct mail. As indicated by the target audience or solicitation, we develop materials that are both culturally sensitive and are designed to engage a variety of stakeholder groups and populations. For example, multiple language materials are produced for the nutrition education program. Electronic surveys are increasingly used to capture rapid feedback from program participants, advisors, and the general public. These are generally conducted via media such as Qualtrics.
The use of survey tools allow for rapid assessment which are often critical in the development of projects with short timelines as is often the case when responding to federal, state, and foundation calls for grant proposals or contributing to the analysis of initiatives. WSU Extension continues to adapt its web capabilities to enabled greater ease of use and access to information. Web conferencing is generally delivered via Zoom, Skype for Business, Adobe Connect or similar platforms. This allows ARC scientists and Extension educators to communicate broadly with dispersed groups and simultaneously collect feedback from these audiences through online chats and polls.

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.

Feedback from stakeholders is extremely important and is especially important in developing new initiatives and outreach programs. One major mechanism of interaction is through various State commodity commissions, which support research and extension at WSU through competitive processes that tend to be biased toward projects that address relatively immediate problems. In addition to researchers, the ARC Director and the Director of Extension or their representative is often present at these sessions to help the groups understand the context of the WSU activity and to get their input into the strategic planning done at WSU related to their industry.

Brief Explanation of what you learned from your Stakeholders

In 2016, the ARC and Extension initiated a new Food and Agricultural Advisory Council. This group is composed of key stakeholders in our agricultural industries and will advise our ARC Director and Director of Extension on areas of focus for research and development and extension. An important partnership to point out is that in 2015 we had the grand opening of our Grains Greenhouse Complex. This facility was built with funding from our stakeholder partners, the first phase in 1997 and the second phase completed in 2016. Our partners on this long-term project are the USDA-ARS, the USA Pea and Lentil Council, the Washington Grain Commission, and royalties from WSU grain varieties. Another important advancement for our research and extension is the new St. Michelle WSU Wine Science Center at the WSU Tri-Cities campus which has been open for one year and has already hosted many important events while providing training for graduate and undergraduate students. This state of the art facility was built in partnership with the Washington Wine Advisory Committee, leaders of the Washington State wine and viticulture industry, the Washington Association of Grape Growers, and the Washington State Wine Commission. Finally, we interact very closely with our partners in commercialization activities. Key examples include our work with the Tree Fruit Licensing committee who advise us on commercialization of tree fruit varieties produced by the WSU breeding program. We also work closely with the Cultivar Release committee which works with us on the release of WSU grain varieties produced by the WSU grains breeding programs.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
4417690	0	4708652	0

Institution Name: Washington State University

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	4621341	0	4401176	0
Actual Matching	4621341	0	4401176	0
Actual All Other	51462724	0	47128786	0
Total Actual Expended	60705406	0	55931138	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Natural Resources Stewardship

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
111	Conservation and Efficient Use of Water	12%		6%	
112	Watershed Protection and Management	12%		6%	
121	Management of Range Resources	7%		5%	
122	Management and Control of Forest and Range Fires	10%		9%	
123	Management and Sustainability of Forest Resources	10%		10%	
124	Urban Forestry	4%		4%	
125	Agroforestry	3%		4%	
133	Pollution Prevention and Mitigation	10%		5%	
135	Aquatic and Terrestrial Wildlife	9%		14%	
136	Conservation of Biological Diversity	0%		5%	
213	Weeds Affecting Plants	5%		5%	
214	Vertebrates, Mollusks, and Other Pests Affecting Plants	2%		2%	
215	Biological Control of Pests Affecting Plants	5%		11%	
302	Nutrient Utilization in Animals	0%		3%	
403	Waste Disposal, Recycling, and Reuse	5%		5%	
605	Natural Resource and Environmental Economics	2%		5%	
610	Domestic Policy Analysis	4%		1%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	79.0	0.0	25.0	0.0
Actual Paid	76.0	0.0	47.0	0.0

Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
992564	0	308736	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
992564	0	308736	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
8083606	0	3584972	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

WSU scientists will conduct research leading to a better understanding of the interaction between human development and terrestrial, aquatic, and atmospheric conditions; genetically improve poplar, alder, black cottonwood and other species to more effectively sequester carbon, restore riparian areas, and provide wood and fuel using sustainable production practices; develop innovative mechanisms for revegetating mining sites, watersheds, and native prairies; and understand habitat requirements of key and endemic species. Extension educators will work with researchers and local communities to develop customized, science-based solutions to local problems and to educate target audiences about new tools to more effectively manage natural resources. This education will in turn lead to behavior change and ultimately to an improved condition of the natural resource base in Washington State.

2. Brief description of the target audience

The target audiences include landowners and managers; state, federal, and local natural resource agency personnel; K-12 educators, local and state governments; and the general public, including the scientific disciplines that relate to these issues.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	132950	284133	22483	31622

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	28	18	46

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of extension workshops, demonstrations, field days, and conferences that focus on stewardship of natural resources and environmental protection.

Year	Actual
2016	1198

Output #2

Output Measure

- Number of peer-reviewed (official) WSU Extension publications produced on natural resource stewardship topics.

Year	Actual
2016	28

Output #3

Output Measure

- Number of graduate students with a significant professional orientation in the area of Natural Resources stewardship.

Not reporting on this Output for this Annual Report

Output #4

Output Measure

- The number of WSU Master Gardeners trained during the year to address environmental concerns and natural resource stewardship.

Year	Actual
2016	3515

Output #5

Output Measure

- The number of individuals trained in the safe and proper use of pesticides.

Year	Actual
2016	8231

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of program participants who enhanced their knowledge of natural resource management, environmental protection, water quality, and efficient water use
2	Percentage of participants evaluated who applied their newly acquired information to conserve and use water more efficiently.
3	Number of acres of rangelands and forests receiving application of sustainable management practices as a result of WSU programs or program partnerships.
4	Percentage of pesticide training participants who applied the training received in pesticide safety and proper use.
5	Percentage of participants who applied recommended practices and strategies to protect water quality.

Outcome #1

1. Outcome Measures

Percentage of program participants who enhanced their knowledge of natural resource management, environmental protection, water quality, and efficient water use

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	95

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Washington?s rivers, lakes and groundwater sources provide water for agricultural, residential and recreational use in addition to providing wildlife habitat. Puget Sound has been rated as unhealthy. Multiple species of salmon are listed as endangered. Runoff from roads, parking lots and rooftops contribute to the decline in water quality in streams, lakes, Puget Sound, and potentially aquifers. Improper pesticide and fertilizer applications; inefficient irrigation systems and water use; and the selection of poorly adapted plants to local climates are major issues. Conversion of private forestlands for urban development continued with little regard for wildlife, water quality and climate change.

What has been done
Water quality education, including proper pesticide use, proper fertilizer use, and integrated pest management are core components of the Master Gardener program. Newer volunteer-based programs, included Rain Gardener Mentors, Stream Stewards, Native Plant Advisors, and Extension Livestock Advisors, taught residents how to improve water quality through workshops focused on changing their behaviors to improve water quality, install rain gardens, and maintain a buffer in riparian areas. Workshops were held to assist landowners on rain garden installation, fencing to improve grazing management and livestock exclusion, integrated pest management to reduce the use of pesticides, and proper fertilizer applications to reduce nutrient contamination in water. Low impact development certification workshops were held to present the newest methods of green infrastructure to planners, engineers, and agency personnel.

Results
Volunteers, home gardeners, ranchers, crop producers and agency personnel gained a greater understanding of natural resources, stewardship of resources, and water quality protection and improvement. Green infrastructure research and outreach developed new approaches to green

infrastructure and new stormwater standards for the state. The City of Puyallup, a local project partner, installed additional pervious concrete for streets and sidewalks, including the renovation of a major five-lane road. WSU implemented a new riparian grazing tool for ranchers as a best management practice. Agency personnel have been trained to use this tool for use with clientele for grazing planning. Ranchers are able to use economic, workable solutions to maintain water quality that improves habitat for fish. Removal of culverts and diversion dams continued to open more spawning areas for fish. Additional releases for biocontrol agents for invasive species expanded to all 39 counties.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
124	Urban Forestry
125	Agroforestry
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants
215	Biological Control of Pests Affecting Plants
302	Nutrient Utilization in Animals
403	Waste Disposal, Recycling, and Reuse
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

Outcome #2

1. Outcome Measures

Percentage of participants evaluated who applied their newly acquired information to conserve and use water more efficiently.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	86

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The demand for water increased as the population and industry expands. Changing weather patterns, increased drought, and modified stream flows to accommodate migrating fish have compound this problem. 2016 was one of the hottest and driest years on record. To provide adequate water for lawns, gardens, agriculture and natural resource uses, residents must learn about and implement water saving strategies.

What has been done
Fields days, workshops, demonstration gardens, applied research, fact sheets and web sites were used to teach and demonstrate water conservation methods. 791 outreach events were conducted across the state. 161 Master Gardeners in the Puget Sound region were trained as Rain Garden mentors. These educational opportunities demonstrated water conserving garden practices to reduce the demand for water. Rain Garden mentors and demonstration sites demonstrated proper stormwater handling, rain barrel collection, and use of gray water in landscapes. The statewide Water Resources Team developed new outreach materials and planned a 2017 conference on Climate Change and Water.

Results
3,515 Master Gardeners taught 10,524 residents, groundskeepers, and landscape maintenance personnel how to conserve water and protect water quality. One county held a third micro-irrigation workshop that included irrigation demonstrations and installation. 98% of program participants learned new information about water use and management. Selective follow-up evaluations showed that 78% of program participants used: one or more water conserving methods; highly efficient irrigation methods, especially drip hoses; adjusted watering times to reduce evapotranspiration; or rain gardens.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation

Outcome #3

1. Outcome Measures

Number of acres of rangelands and forests receiving application of sustainable management practices as a result of WSU programs or program partnerships.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	143554

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Washington has 215,000 people that control 5.8 million acres of forestland, making this the largest rural land use group in the state. The majority of landowners lack the knowledge and skill to properly manage their forest nor do they have a written management plan to provide the biological and physical information necessary to make sound decisions to execute best management practices. Much of this land is at risk due to land-use conversion, landscape fragmentation, poor health, degraded habitat, invasive species, and wildfire.

What has been done
63 forestry outreach events were held, including eight eight-week (one taught online) Coach Forest Stewardship workshop series (153 families) and two major regional field days attended by 1,254 people. Five social media sites and three comprehensive websites were maintained. Forestry specialists collaborated with personnel from other natural resource agencies to address the recovery from record wildfires in Eastern Washington in previous years. Six public meetings were held to help landowners and communities understand how to protect and improve the land.

Results
Evaluations showed that 91% of program participants have implemented at least two new management practices. In terms of fire risk reduction cost savings alone, this translates to a minimum of $51 million saved by public and private entities, were this land to burn in a wildfire. As a result of the Coached Forest Stewardship classes, 104 Forest Stewardship Plans were prepared. There were 104,500 indirect contacts made with clients via e-newsletters, three regional email list serves, and direct mailings. 71,344 web clients actively sought information from our statewide website http://forestry.wsu.edu, which contains downloadable publications, streaming videos, resource directories, online newsletters, and a calendar of events. Forestry faculty were instrumental in helping landowners recover from wildfire, including determining salvageable timber, selecting a knowledgeable consulting forester, selecting a proper grass seeding mix, and determining when to plant. Plans were coordinated with other agencies on management of noxious weeds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water

112	Watershed Protection and Management
121	Management of Range Resources
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
124	Urban Forestry
125	Agroforestry
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants
215	Biological Control of Pests Affecting Plants
302	Nutrient Utilization in Animals
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

Outcome #4

1. Outcome Measures

Percentage of pesticide training participants who applied the training received in pesticide safety and proper use.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	96

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pesticide use in commercial agriculture, the home garden and around the home is controversial. Improper pesticide use can result in crop and ornamental plant damage, illegal pesticide residues, contamination of water, human and animal poisonings, and unintentional death to pollinators. The spread of invasive species, including Asian Gypsy Moth, Spotted Wing Drosophila and Brown Marmorated Stink Bug, have resulted in increased monitoring of insects, outreach, and strategies for control. Although neonicotinoid insecticides have been very effective in the control of a wide

range of insects, controversy remains on their direct effects on honeybee health.

What has been done
Safe pesticide use, integrated pest management concepts, and biological weed control have been Incorporated into core Master Gardener training. Major revisions to PestSense: (http://pestsense.cahnrs.wsu.edu/Home/PestsenseHome.aspx) and HortSense (http://hortsense.cahnrs.wsu.edu/Home/HortsenseHome.aspxprograms) websites continues. Pesticide pre-training and pesticide recertification classes; online pesticide recertification modules; classes on the safe use of pesticides in demonstration gardens taught 7,145 residents about integrated pest management as a proven system for managing pests in a way that keeps pest damage tolerable and minimizes threats to non-target animal and plant species, as well as the environment. A new video: Pollination and Protecting Pollinators (https://vimeo.com/146957716) is an outstanding resource for everyone. It has been accessed

Results
Pesticide use was significantly reduced on rangeland and noncropland through the use of biocontrol insects. Land managers released over 193,000 biocontrol agents (valued at $270,000) were released on 2,790 acres. This saved over $111,000 in herbicide applications. 32% of respondents noted that the use of biocontrol resulted in decreased use of pesticides. Participants in the pre-license pesticide training have a 99% test passing rate on their pesticide applicator exams. Over 98% of participants in the pesticide recertification training obtained new knowledge and applied this information to their job, business, or consulting practice. Gardeners reported the implementation of simple practices as a way of controlling weeds or insects, including; over 65% used mulches to reduce weed germination; 86% pulled weeds instead of using an herbicide; 92% reported using at least one integrated pest management technique instead of using a pesticide.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
213	Weeds Affecting Plants
214	Vertebrates, Mollusks, and Other Pests Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #5

1. Outcome Measures

Percentage of participants who applied recommended practices and strategies to protect water quality.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	94

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rivers, lakes and groundwater sources provide water for agricultural, residential and recreational uses and wildlife habitat. Safe, reliable sources of water must be maintained to meet the needs of our growing population. Water-conserving garden practices, such as mulching, efficient irrigation, planting drought tolerant plants and xeriscaping are the most cost effective and environmentally sound ways to reduce the demand for our limited water supplies. Stormwater has been linked to pollution of drinking water supplies and declining health of fish and has been identified as the number one cause of pollution in the Puget Sound region.

What has been done
New Master Gardener training; Rain Garden Mentor training; Stream Steward training; Beach Watcher training; Master Gardener continuing education classes; e-newsletters; websites; demonstration gardens; plant clinics; online forums; webinars; fact sheets; online modules; Rain Garden installation clinics; Natural Yard Care workshops; sustainable gardening workshops; integrated pest management workshops; and livestock riparian grazing research and workshops. A new LID Stormwater Management specialist provides statewide leadership for green infrastructure. A full-time director and new grant opportunities for the Washington Stormwater Center provides additional outreach and research for Western Washington.

Results
New Master Gardener trainees passed core competencies tests on integrated pest management, safe pesticide use, and efficient water use in the home garden. Rain Garden Mentors were trained and extended outreach to homeowners. They collaborated with research and extension specialists to rebuild demonstration rain gardens. 3,814 rain gardens have been installed in homeowner?s yards to collect roof and sidewalk runoff and officially registered. Nearly 100% of program participants enhanced their knowledge of water quality protection and over 90% planned to implement at least one yard or garden practice that would protect water quality. Riparian cattle grazing field research and presentations to Washington policy makers and enforces have resulted in enforcement changes in relation to rangeland grazing.
External Factors

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management

133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Economic - Home gardening remains popular for economic reasons. Families are interested in growing their own fresh fruits and vegetables with the satisfaction that they know where they came from and how they were raised; and increased interest in obesity reduction initiatives. Federal, state and local budget reductions have slowed hiring following retirements and resignations, resulting in coverage gaps in critical areas of the state.
Government regulations - New rules restrict the use of conventional fertilizers and pesticides in urban and riparian areas. Alternatives are recommended to improve water quality. More emphasis has been placed on stormwater management, including keeping stormwater from entering rivers and Puget Sound; retaining rainfall on the property to replenish groundwater; and pervious pavements.
Natural disasters - Time was redirected to address post-wildfire areas in Eastern Washington, including timber salvage, soil erosion prevention, grass planting, and tree planting. This effort will continue as landowners rebuild buildings, fences, and livestock herds.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Program participants have an increased awareness, knowledge, and application of knowledge to manage their yards, forestlands and ranches. The target audiences are utilizing multiple methods for pest control and better choices are being made regarding alternative options. Growers are increasingly interested in soil health and water quality in Washington State. This interest crosses commodities and locations. Home gardeners are using more efficient irrigation methods and are using less water. Forest owners implemented practices to improve forest health, reduce wildfire potential, and secure the future of their forest for future generations.

Key Items of Evaluation

The planned programs focused on protection and good stewardship of natural resources. Our assessments indicated that over 95% of program participants increased their knowledge relative to the program initiatives. The aggregate outcomes showed more productive forestlands, safer pesticide use, and conservation and protection of our water

resources.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Agricultural Productivity and Food Security

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	5%		8%	
104	Protect Soil from Harmful Effects of Natural Elements	5%		3%	
111	Conservation and Efficient Use of Water	5%		7%	
112	Watershed Protection and Management	5%		3%	
121	Management of Range Resources	2%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		14%	
202	Plant Genetic Resources	5%		8%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		9%	
205	Plant Management Systems	5%		6%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		8%	
212	Pathogens and Nematodes Affecting Plants	12%		9%	
213	Weeds Affecting Plants	10%		3%	
215	Biological Control of Pests Affecting Plants	8%		5%	
216	Integrated Pest Management Systems	10%		4%	
301	Reproductive Performance of Animals	5%		3%	
302	Nutrient Utilization in Animals	5%		3%	
303	Genetic Improvement of Animals	3%		2%	
304	Animal Genome	0%		2%	
307	Animal Management Systems	10%		0%	
604	Marketing and Distribution Practices	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	150.0	0.0	290.0	0.0
Actual Paid	0.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1377021	0	2830878	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1377021	0	2830878	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
10606183	0	30305775	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Fundamental, translational and applied research will be conducted in laboratories, at research and extension centers, and in collaboration with farmers and ranchers. Extension programs will operate to hasten the application of new and existing science within the agricultural industries of Washington State using a variety of educational events including farm visits, workshops, seminars, field days, tours, and mass media resources including the internet and social media.

2. Brief description of the target audience

Target audiences include farmers and ranchers, agricultural consultants, scientists, commodity commissions, educators, state and federal agency professionals, elected officials, food processors, transporters, agricultural chemical producers and applicators, and the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	159031	476536	19932	515477

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	173	225	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of seminars, workshops, demonstrations, field days, and educational events conducted annually

Year	Actual
2016	1666

Output #2

Output Measure

- Number of peer reviewed (official) WSU Extension publications published

Year	Actual
2016	37

Output #3

Output Measure

- Number of graduate students with a significant professional orientation in the area of agricultural productivity and food security.

Year	Actual
2016	157

Output #4

Output Measure

- Farm Bill Outreach Education Training Workshops

Year	Actual
2016	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of evaluated participants who demonstrated increased knowledge and skills relative to one or more key learning objectives for enhancing productivity, efficiency, risk management, or sustainability of crop and livestock production systems.
2	Percentage of evaluated program participants who applied knowledge gained from the program to enhance productivity, efficiency, risk management, or sustainability of crop and livestock systems.
3	Number of acres impacted by WSU research and extension programs that enhanced productivity, efficiency, or sustainability of crop production enterprises.
4	Number of food production animals impacted by WSU research and extension programs that enhanced productivity, efficiency, or sustainability of livestock and dairy production enterprises.
5	Number of food processing facilities or direct marketing enterprises that enhanced processing, marketing, or overall efficiency of food distribution.

Outcome #1

1. Outcome Measures

Percentage of evaluated participants who demonstrated increased knowledge and skills relative to one or more key learning objectives for enhancing productivity, efficiency, risk management, or sustainability of crop and livestock production systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	88

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Washington State's diverse microclimates produce over 300 crops, including small grains, vegetables, fruits, legumes, and livestock. Washington State University (WSU) conducts research and extension programs focused on increasing the productivity and efficiency of our farms and ranches by reducing plant and animal pests and diseases, developing new genetic resources, and optimizing overall food production practices and strategies.

What has been done
Program implementation utilized local, regional, state-wide, and multistate efforts in a coordinated effort that involved workshops, clinics, seminars, field days, field demonstrations, print and electronic publications, mass media, social networks, and other methods, such as mobile app development, to disseminate research- based knowledge and other relevant information to targeted, diverse audiences.

Results
This outcome documents that 87.5% of program participants increased their knowledge and skill through participation in one or more of over 1,600 educational events focused on enhancing agricultural productivity and food security for the benefit of producers and consumers alike. Participants represented diverse agricultural enterprises, including very large commercial operations, midsize family farms, small farms, and community supported agriculture. Program participants also represented the diverse range of Washington State stakeholders.

4. Associated Knowledge Areas

KA Code	Knowledge Area

102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome
307	Animal Management Systems
604	Marketing and Distribution Practices

Outcome #2

1. Outcome Measures

Percentage of evaluated program participants who applied knowledge gained from the program to enhance productivity, efficiency, risk management, or sustainability of crop and livestock systems.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	73

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Washington State's diverse microclimates produce over 300 crops, including small grains, vegetables, fruits, legumes, and livestock. Washington State University (WSU) conducts research and extension programs focused on increasing the productivity and efficiency of our farms and ranches by reducing plant and animal pests and diseases, developing new genetic resources, and optimizing overall food production practices and strategies.

What has been done
Program implementation utilized local, regional, state-wide, and multistate efforts in a coordinated effort that involved workshops, clinics, seminars, field days, field demonstrations, print and electronic publications, mass media, social networks, and other methods, such as mobile apps, to disseminate research-based knowledge and other relevant information to targeted audiences.

Results
This outcome documents that 72.7% of program participants utilized the research-based information and training provided through this planned program to enhance productivity, efficiency, risk management, or sustainability of crop and livestock systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
121	Management of Range Resources
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome
307	Animal Management Systems
604	Marketing and Distribution Practices

Outcome #3

1. Outcome Measures

Number of acres impacted by WSU research and extension programs that enhanced productivity, efficiency, or sustainability of crop production enterprises.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	6731492

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Washington State's diverse microclimates produce over 300 crops, including small grains, vegetables, fruits, legumes, and livestock. Washington State University (WSU) conducts research and extension programs focused on increasing the productivity and efficiency of our farms and ranches by reducing plant and animal pests and diseases, developing new genetic resources, and optimizing overall food production practices and strategies.

What has been done
Program implementation utilized local, regional, state-wide, and multistate efforts in a coordinated effort that involved workshops, clinics, seminars, field days, field demonstrations, print and electronic publications, mass media, social networks, and other methods to disseminate research-based knowledge and other relevant information to targeted audiences.

Results
WSU research and extension programs enhanced productivity, efficiency, and sustainability of food production on almost 7 million acres of the 15 million acres of agricultural land in the state.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
104	Protect Soil from Harmful Effects of Natural Elements
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

121	Management of Range Resources
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
215	Biological Control of Pests Affecting Plants
216	Integrated Pest Management Systems
307	Animal Management Systems

Outcome #4

1. Outcome Measures

Number of food production animals impacted by WSU research and extension programs that enhanced productivity, efficiency, or sustainability of livestock and dairy production enterprises.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	6534633

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Washington State's livestock industry includes a diverse mix of dairy, beef, swine, sheep, goat, and poultry enterprises. These enterprises range from small farms to very large cooperate farms with thousands of animals under management. Washington State University?s research and extension programs continue to provide reliable information and training beneficial to the sustainability of these farms and food animal production.

What has been done
Program implementation utilized local, regional, state-wide, and multistate efforts in a coordinated effort that involved workshops, clinics, seminars, field days, field demonstrations, print and electronic publications, mass media, social networks, and other methods to disseminate research-

based knowledge and other relevant information to targeted audiences.

Results
This planned program directly impacted the management of almost 7 million food production animals, thought dissemination of research information and training for producers to enhance risk management strategies, animal health, reproductive efficiency, meat quality, feeding management, grazing management, and a variety of other management and animal husbandry practices important for sustainable animal agriculture enterprises.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
121	Management of Range Resources
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
304	Animal Genome
307	Animal Management Systems
604	Marketing and Distribution Practices

Outcome #5

1. Outcome Measures

Number of food processing facilities or direct marketing enterprises that enhanced processing, marketing, or overall efficiency of food distribution.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	2074

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food processing and marketing are essential components of a food system and insuring food security. In addition to the importance of large scale food processing operations; on-farm

processing and direct marketing of locally grown food is increasingly in high demand.

What has been done
This work included a series of outreach and training methods that included workshops, clinics, seminars, print and electronic publications, and other methods to disseminate research-based knowledge and other relevant information to targeted audiences. Program offerings were customized for each audience, ranging from midsize, commercial processing plants to farmers market associations and direct farm marketers.

Results
Just over 2,000 small to mid-size enterprises were provided training and assistance resulting in improvements to processing efficiency and improved distribution of locally grown foods.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenge

Although many factors impact the sustainability of agricultural enterprises and food production, our primary goals of providing training and research-based information to target audiences continue to be impacted by reduced or uncertain funding from federal, state, and local sources. This uncertainty directly impacts our decisions on hiring and deployment of human and financial resources. Our work in research and extension is increasingly dependent on securing competitive grants to support our system and drive our programs forward. Ultimately, competing priorities for limited funds and financial resources continue to be our most limiting factor.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This program encompassed a wide array agricultural enterprises including irrigated and dryland agronomic crops, high value horticultural crops, fruit orchards, vine crops, grazing lands, livestock and poultry operations, and dairy farms. The overall program evaluation for all events and projects under this program theme was evaluated in terms of "knowledge gained by participants" and "application of this knowledge" to address agricultural productivity and food security. Additionally, we collected data on the acreage of agricultural land and livestock numbers that directly benefited from our work. We also reported the number food processing facilities, direct marketing enterprises, and food banks that enhanced efficiency of food processing and distribution. Collectively, the results indicate positive impacts to agricultural productivity through the dissemination of research-based information and the application of this knowledge for sustaining agricultural enterprises and food production. Results were collected through a variety of methods including pre and post event evaluations, surveys, agricultural statistics, feedback from stakeholder groups, and other assessments of program participants. The analysis provided the aggregate results indicated below under key items of evaluation.

Key Items of Evaluation

Our scientists were near the top ten for extramural competitive funding from the USDA by congressional district in 2016. This is a trend that we have continued. We are 26th for capacity funds awarded. It is clear that we are leveraging our funds wisely to help fight global hunger and keep our food supply safe and secure. This planned program focused on increasing agricultural productivity, food processing efficiency, and food distribution as a means of enhancing food security though a sustainable system. Our assessments indicated that 87.5% of program participants increased their knowledge relative to the knowledge areas covered, and 72.7% indicated application of one or more principles or practices learned from their participation. The aggregate outcomes of this work impacted close to 7 million acres for farm land, and almost 7 million food animals. This work also supported enhancements to over 2,000 enterprises associated with food processing, direct marketing, and food distribution.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Sustainable Energy

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		5%	
123	Management and Sustainability of Forest Resources	20%		5%	
131	Alternative Uses of Land	10%		5%	
133	Pollution Prevention and Mitigation	10%		2%	
141	Air Resource Protection and Management	5%		3%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		15%	
204	Plant Product Quality and Utility (Preharvest)	0%		15%	
205	Plant Management Systems	0%		5%	
206	Basic Plant Biology	0%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	0%		5%	
402	Engineering Systems and Equipment	25%		5%	
403	Waste Disposal, Recycling, and Reuse	15%		10%	
511	New and Improved Non-Food Products and Processes	0%		5%	
601	Economics of Agricultural Production and Farm Management	0%		5%	
603	Market Economics	10%		2%	
605	Natural Resource and Environmental Economics	5%		3%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890

Plan	48.0	0.0	45.0	0.0
Actual Paid	0.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
185297	0	438042	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
185297	0	438042	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
8470435	0	3791829	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research will be conducted on energy-related yield and production and processing efficiency of using agricultural and woody biomass, algae and oil seeds. Economic analyses will be conducted on these various energy systems to assess thresholds for local and regional application of these technologies. Extension programs will be developed to teach and demonstrate alternative energy systems such as anaerobic digestion, biomass production, oil seed production, increasing energy efficiency, and utilization of wind and solar energy systems.

2. Brief description of the target audience

The target audiences will include farmers, business owners, homeowners, industry technology providers, project developers, and public agencies and utilities.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	2681	26116	64	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	6	112	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops, demonstrations, and symposia conducted related to alternative energy and energy efficiency.

Year	Actual
2016	12

Output #2

Output Measure

- Number of peer reviewed (official) WSU Extension publications related to sustainable energy that are published annually.

Year	Actual
2016	6

Output #3

Output Measure

- Number of graduate students with a significant professional orientation in the area of Sustainable Energy.

Year	Actual
2016	15

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of evaluated participants who demonstrated increased knowledge and skills relative to biofuels, energy efficiency, and alternative energy sources.
2	The number of farmers that applied information provided by this program to produce biofuel crops.
3	The number of forest and woodland owners who applied information from this program in the production of wood for biofuels.
4	The acres of forestland and cropland impacted by our programs to advance the production of biofuel feedstocks.

Outcome #1

1. Outcome Measures

Percentage of evaluated participants who demonstrated increased knowledge and skills relative to biofuels, energy efficiency, and alternative energy sources.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	94

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Regional systems for renewable, biomass-based, liquid transportation fuels (i.e. gasoline, diesel, and jet fuel) are needed to support energy independence, reduce net carbon emissions, stabilize fuel prices for consumers, provide new economic opportunities for landowners, and bring jobs and economic development to rural communities. Renewable bio-based chemicals are a stepping stone to biofuels and can provide similar benefits to communities. The Advanced Hardwood Biofuels Northwest (AHB) Northwest Advanced Renewables Alliance (NARA) USDA-NIFA funded research projects are examples of successful projects.

What has been done
Outcomes include increased awareness of the AHB project and a greater energy literacy on biomass and biofuels. Extension personnel in our target four-state region were more aware of the potential of hybrid poplar as a feedstock for biofuels, and we have been specifically targeting them in our outreach efforts. In addition, poplar growers are interested in poplar for both environmental benefits and bioenergy. Based on past event evaluations, an average of 94% of surveyed field tour participants reported a better understanding of hardwood biofuels.

Results
Washington-based Alaska Airlines made history in November 2016 flying the first commercial flight using the world?s first renewable, alternative jet fuel made from forest residuals, the limbs and branches that remain after the harvesting of managed forests. The alternative jet fuel was produced through the efforts of the WSU-led NARA. The demonstration flight departed Seattle-Tacoma International Airport for Reagan National Airport in Washington, D.C. The flight was fueled with a 20 percent blend of sustainable aviation biofuel, which is chemically

indistinguishable from regular jet A fuel. The flight, the first commercial passenger flight of its kind, continues to advance viable alternatives to conventional fossil fuels for aviation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
603	Market Economics
605	Natural Resource and Environmental Economics

Outcome #2

1. Outcome Measures

The number of farmers that applied information provided by this program to produce biofuel crops.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area

102	Soil, Plant, Water, Nutrient Relationships
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
133	Pollution Prevention and Mitigation
141	Air Resource Protection and Management
201	Plant Genome, Genetics, and Genetic Mechanisms
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management
603	Market Economics
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

The number of forest and woodland owners who applied information from this program in the production of wood for biofuels.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
603	Market Economics
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

The acres of forestland and cropland impacted by our programs to advance the production of biofuel feedstocks.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

What has been done

Results

4. Associated Knowledge Areas

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

123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land
141	Air Resource Protection and Management
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Although many factors impact sustainable energy, our primary goals of providing training and research-based information to target audiences continued to be impacted by reduced or uncertain funding from federal, state, and local sources. Our work in research and extension is increasingly dependent on securing competitive grants to support our system and drive our programs forward. The continued low price of oil from nearly $120 per barrel in 2011 to $49 per barrel in April 2017, continues to significantly slow the interest in biofuels. Although we demonstrated a successful pilot plant using plantation- produced feedstock and biomass recovered for biofuel production, the variable costs cannot be currently covered in the market.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This program focused on applied research and outreach regarding conversion of woody biomass into biofuels and co-products. The overall program evaluation for all events and projects under this program theme was evaluated in terms of "knowledge gained by participants" and "application of this knowledge". Collectively, the results indicate positive impacts to understanding poplar production and energy conversion through the dissemination of research-based information and the application of this knowledge. Results were collected through a variety of methods including pre and post event evaluations, surveys, website statistics, feedback from stakeholder groups, and other assessments of program participants.

Key Items of Evaluation

The planned programs focused on increasing sustainable energy as a means of providing alternative renewable energy sources and reducing the reliance on fossil fuels. Our assessments indicated that 94% of program participants increased their knowledge relative to the knowledge areas covered. The aggregate outcomes of this work demonstrated that on a pilot basis, aviation fuel can be produced from renewable sources and be successfully used in commercial jets.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Climate Change

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%		5%	
111	Conservation and Efficient Use of Water	5%		5%	
112	Watershed Protection and Management	5%		5%	
122	Management and Control of Forest and Range Fires	5%		5%	
123	Management and Sustainability of Forest Resources	0%		5%	
132	Weather and Climate	5%		5%	
133	Pollution Prevention and Mitigation	5%		5%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		10%	
202	Plant Genetic Resources	5%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	10%		10%	
205	Plant Management Systems	10%		5%	
211	Insects, Mites, and Other Arthropods Affecting Plants	10%		10%	
212	Pathogens and Nematodes Affecting Plants	10%		10%	
213	Weeds Affecting Plants	5%		3%	
216	Integrated Pest Management Systems	10%		5%	
404	Instrumentation and Control Systems	5%		2%	
605	Natural Resource and Environmental Economics	5%		5%	
610	Domestic Policy Analysis	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	20.0	0.0	65.0	0.0
Actual Paid	0.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
211636	0	482851	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
211636	0	482851	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
3374719	0	7281332	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and outreach will be conducted to facilitate conversion of agricultural, forestry, and industrial waste streams into clean energy and stable construction grade materials. This includes development of new products and transfer of associated technology to the private sector. Delivery of information to the general public will continue to be a high priority.

Our plant breeding and molecular biology programs will continue to develop new crop varieties that are able to withstand emerging disease and pest threats associated with climate change. Our integrated pest management programs will continue to develop new techniques to mitigate the effects of introduced pests and range expansions of pests already in the region. We will investigate the possibilities that changed climatic conditions might present opportunities for growing new crops or growing traditional crops in new ways or new areas. These represent a form of mitigation to try to stabilize farm based economies in the face of climate-driven pressures to change.

We will assess climate change related policies and develop research and outreach programs to position Washington's agriculture and forestry industries effectively to increase sequestration of carbon and to benefit from future carbon trading protocols or other greenhouse gas mitigation policy mechanisms.

2. Brief description of the target audience

Owners and managers of crop and range lands, forest resources, and wood products industries; community leaders; and public agencies and organizations.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1731	44585	0	0

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	6	15	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops and other educational events delivered on mitigation and adaptation to climate change.

Year	Actual
2016	38

Output #2

Output Measure

- Number of peer reviewed (official) WSU Extension publications referencing climate change mitigation and adaptation published per year.

Year	Actual
2016	0

Output #3

Output Measure

- Number of graduate students with a significant professional orientation in the area of Climate Change.

Year	Actual
2016	26

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives on mitigating or adapting to climate change.
2	Percentage of evaluated program participants who applied knowledge or technology gained from WSU on mitigating or adapting to climate change.
3	Number of farms utilizing WSU-developed crop varieties and/or other technologies to adapt to evolving environmental conditions or newly emerging plant pests and diseases.
4	Number of farms employing anaerobic digestion or other methods to reduce GHG emissions or to sequester carbon.

Outcome #1

1. Outcome Measures

Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives on mitigating or adapting to climate change.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	46

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The impacts of climate change on Washington State could be significant, with potential changes in irrigation water availability as well as growing conditions for crops statewide. The impacts of climate change on Washington State could be significant, with potential changes in irrigation water availability and seasonal growing conditions for crops statewide. New plant and animal pests and diseases are likely to emerge over time as well. These and other factors will impact communities, agriculture and natural resource management, navigation, and electrical generation in the state.

What has been done
Program implementation utilized local, regional, and statewide efforts that involved anaerobic digester research; 38 outreach educational programs; print and electronic publications; and other methods to disseminate research-based knowledge and other relevant information to target audiences. A team of researchers also investigated how water resources can be better managed in response to climate change induced scarcity and variability of water supply for agriculture.

Results
Program evaluations revealed that an average of 46% of program participants increased their knowledge and awareness of climate change mitigation and/or adaptation practices. This knowledge included basic understanding of climate change and steps to adapt to future changes and mitigate trends that are predicted.

4. Associated Knowledge Areas

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

111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
404	Instrumentation and Control Systems
610	Domestic Policy Analysis

Outcome #2

1. Outcome Measures

Percentage of evaluated program participants who applied knowledge or technology gained from WSU on mitigating or adapting to climate change.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	32

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The impacts of climate change on Washington State could be significant, with potential changes in irrigation water availability and seasonal growing conditions for crops statewide. New plant and animal pests and diseases are likely to emerge over time as well. These and other factors will impact communities, agriculture and natural resource management, navigation, and electrical generation in the state.

What has been done
Program implementation utilized local, regional, and statewide efforts that involved anaerobic digester research; 38 outreach educational programs; print and electronic publications; and other methods to disseminate research-based knowledge and other relevant information to target audiences. A team of researchers also investigated how water resources can be better managed in response to climate change induced scarcity and variability of water supply for agriculture.

Results
Thirty-two percent of program participants indicated and intent to apply the knowledge gained from one or more of the 38 educational events delivered in this program area.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
213	Weeds Affecting Plants
216	Integrated Pest Management Systems
404	Instrumentation and Control Systems
610	Domestic Policy Analysis

Outcome #3

1. Outcome Measures

Number of farms utilizing WSU-developed crop varieties and/or other technologies to adapt to evolving environmental conditions or newly emerging plant pests and diseases.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	87

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The impacts of climate change on Washington State could be significant, with potential changes in irrigation water availability and seasonal growing conditions for crops statewide. New plant and animal pests and diseases are likely to emerge over time as well. These and other factors will impact communities, agriculture and natural resource management, navigation, and electrical generation in the state. Researching and communicating strategies for mitigating human contributions to greenhouse gases as well as strategies for adapting to such shifts are key roles for us to take.

What has been done
Program implementation utilized local, regional, and statewide efforts that involved anaerobic digester research; outreach educational programs; print and electronic publications; and other methods to disseminate research-based knowledge and other relevant information to target audiences. A team of researchers also investigated how water resources can be better managed in response to climate change induced scarcity and variability of water supply for agriculture.

Results
Eighty-seven farms reported to adopt WSU- technologies to adapt to evolving environmental conditions or newly emerging plant pests and diseases.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
132	Weather and Climate
133	Pollution Prevention and Mitigation
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources

203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants
216	Integrated Pest Management Systems
404	Instrumentation and Control Systems
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

Outcome #4

1. Outcome Measures

Number of farms employing anaerobic digestion or other methods to reduce GHG emissions or to sequester carbon.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	109

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farm and processor waste estimated to be 17 million tons annually can lead to major unproductive releases of fixed carbon as carbon dioxide and methane. By using anaerobic digestion (AD) to recover some of the energy content of this waste, less fossil fuel is needed and the energy associated with waste disposal is reduced. The economics of AD operations in animal production in Washington is best when tipping fees for disposal of other waste products are also available.

What has been done
WSU scientists have conducted extensive research on anaerobic digestion (AD) as a technology to recover methane (energy), stable carbon, and nutrients from organic wastes such as manure, food processing wastes and the organic fraction of municipal solid wastes. We have evaluated the technical and economic performance of commercially available systems, developed improved AD reactors, and commercialized WSU patented nutrient recovery technology.

Results

One hundred and nine farms are employing methods to reduce GHG emissions, and 23 commercial farm-based AD projects are now operating in the PNW (WA, OR, ID), processing over 7800+ tons of organic waste daily. Four commercial scale nutrient recovery facilities have been installed nationally based on WSU patented technology. Data was collected from survey of project developers and estimates based on existing research.

4. Associated Knowledge Areas

KA Code	Knowledge Area
132	Weather and Climate
133	Pollution Prevention and Mitigation
205	Plant Management Systems
404	Instrumentation and Control Systems
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Increased knowledge and adoption of improved agricultural systems that support carbon sequestration is a primary focus of our work in climate change. Audiences were receptive to procedures and materials that will allow them to adapt to changing conditions, even as some reject the concept that some of the practice changes are motivated by an evolving climate. Self-reported knowledge increase by 46% of program participants and the intent to apply that knowledge by 32% of participants were the metrics selected to evaluate outcomes achieved through 38 educational events in this planned program. Deployment of anaerobic digesters and other GHG mitigation strategies on 109 farms was another measure of evaluation utilized.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Increased knowledge and adoption of improved agricultural systems that support carbon sequestration is a primary focus of our work in climate change. Audiences were receptive to procedures and materials that will allow them to adapt to changing conditions, even as

some reject the concept that some of the practice changes are motivated by an evolving climate. Self-reported knowledge increase to 46% of program participants and the intent to apply that knowledge by 32% of participants were the metrics selected to evaluate outcomes achieved through 38 educational events in this planned program. Deployment of anaerobic digesters and other GHG mitigation strategies on 109 farms was another measure of evaluation utilized.

Key Items of Evaluation

Approximately 46% of program participants indicated they acquired increased knowledge and skills relative to key learning objectives of this program. This measure is a calculated average of evaluations across program events where participants reported increased knowledge or skill through their participation. Thirty-two percent of program participants indicated an intention to use or apply one or more principles gained from 38 educational events delivered in this program area. One hundred and nine farms employed anaerobic digestion or other methods to reduce GHG emissions or to sequester carbon.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Childhood Obesity

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
134	Outdoor Recreation	5%		0%	
601	Economics of Agricultural Production and Farm Management	5%		0%	
604	Marketing and Distribution Practices	5%		0%	
607	Consumer Economics	0%		70%	
701	Nutrient Composition of Food	10%		25%	
703	Nutrition Education and Behavior	20%		5%	
704	Nutrition and Hunger in the Population	15%		0%	
724	Healthy Lifestyle	20%		0%	
806	Youth Development	20%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	83.0	0.0	2.0	0.0
Actual Paid	81.0	0.0	0.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
280025	0	20683	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
280025	0	20683	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
8136367	0	16149	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Educational programming will be delivered to limited resource families through our nutrition education programs, which are funded by SNAP-Ed and EFNEP (Smith-Lever 3-D) programs. Additionally, youth development programs will expand emphasis on physical activity in a number of programs and project areas. Finally, technical assistance will be provided to farmers in the urban fringe to help them produce and effectively market produce to urban residents.

2. Brief description of the target audience

Limited resource adults and families, youth,community agencies,senior citizens, partner organizations, food banks, County and State Departments and agricultural producers (generally small producers) operating in the urban fringe.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	53146	44374	142863	12339

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	45	6	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of educational programs delivered focused on increasing local food supplies, improving dietary quality, and increasing physical activity.

Year	Actual
2016	18376

Output #2

Output Measure

- Number of peer reviewed (official) WSU Extension publications published per year.

Year	Actual
2016	23

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives.
2	Percentage of participants evaluated who applied acquired knowledge to improve their diet quality, level of physical activity, or production of locally-grown produce.
3	Percentage of participants reporting increased physical activity.
4	Number of communities cooperating with WSU program with farmers' markets and community gardens producing and/or selling locally grown fruits and vegetables.

Outcome #1

1. Outcome Measures

Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	66

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In FY 2016, 13% (952,693) of the population receives Basic Food (SNAP/FAP) assistance. This represents 47.3% of those eligible for benefits. In FY2016, people receiving basic food dropped by 4% of those eligible. The impact of limited income puts these families at risk for consuming foods of low nutritional quality and getting less physical activity. In addition low-income settings are at higher risk for geographically living in ?food deserts? and live in higher-risk neighborhoods where families are concerned for their safety in accessing public venues which they can use to increase physical activity opportunities. Consequently, they are at increased risk for nutrition-related health issues, including obesity and chronic disease. Compared to other groups, low-income families consume fewer fruits, vegetables, and low fat milk and more high fat foods, sweetened beverages and other non-nutritive foods. Many lack the skills to select and prepare healthful diets within their income.

What has been done
During FY2016, 446 agencies across 32 counties & 4 Tribes in WA. State partnered with WSU SNAP-Ed to provide nutrition education to 103,210 individuals. Of the 103,210 participants enrolled in direct education, 96% are reported as actual, unduplicated counts with 37% self-identifying as persons-of-color. Sixty-four percent (64%) of those receiving direct education were SNAP recipients. In addition, another 416,219 participants received indirect nutrition education through newspaper articles & other educational and community events.
Kids & Food in a Media-Driven World is the curriculum developed as the project intervention. It is comprised of six content sessions that include a parent lesson, a youth lesson and a combined parent/youth session.

Results

Of those adults enrolled in series classes and completing pre/post surveys (820), 44% and 49%, respectively, increased the variety and quantity of vegetables consumed, 42% and 49%, respectively, increased the variety and quantity of fruits consumed; 39% increased frequency of eating fruits and vegetables as snacks; 28% reduced the frequency of consuming high consuming high-sugar beverages; 51% use MyPlate to plan meals more often, 48% use the label when food shopping, and 41% shop with a list more often, 29% run out of food less often before the end of the month, 35% increased the number of days each week they are physically active. Youth evaluations indicated that 28% of the youth ate more fruits and vegetables every day, 21% increased physical activity to 60 minutes most days of the week, and 28% improved skill using food labels to compare nutrition content of foods, and 29% report eating breakfast that includes 3 food groups and use MyPlate to select healthful snacks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
134	Outdoor Recreation
607	Consumer Economics
701	Nutrient Composition of Food
724	Healthy Lifestyle
806	Youth Development

Outcome #2

1. Outcome Measures

Percentage of participants evaluated who applied acquired knowledge to improve their diet quality, level of physical activity, or production of locally-grown produce.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	89

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It is well established that childhood overweight and obesity have increased significantly in the past three decades and that child obesity rates are particularly high in low-income, minority populations. Although researchers are beginning to target preschool children in their obesity

prevention efforts, no comprehensive, scientifically validated, family-focused obesity prevention program currently exists for parents of children in this age range. Moreover, none of the current programs addresses the needs of low-income, minority parents, nor do any of these programs apply the results of recent research on the impact of food parenting practices on children?s obesity. The purpose of this multi-site, integrated research-extension project was to develop, evaluate, and disseminate a scientifically validated, family-focused, obesity prevention program.

What has been done
In 2016, faculty and staff in eight WSU Extension counties offered the Diabetes Prevention Education program. The program is either a self-pay flat-rate program or some insurance companies reimburse on a fee for performance basis. Performance fees are based on participant enrollment, attendance, and weight loss achievement. The project focuses on the role of parents in affecting young children?s eating patterns, influencing change within the family environment to promote sustainable effects. The major focus is on improving children's self-regulation of energy intake and on increasing their willingness to try new foods (especially fruits and vegetables).

Results
In 2016, Diabetes Prevetion Education participants reduced their cholesterol and blood pressure resulting in a elimination for medication. Participants lost between 5 to 10% of their body weight and reported becoming more physically active. The Diabetes Prevention Program recommends 150 minutes of moderate physical activity per week. Sixty-four percent (9) of those completing four or more sessions significantly increased their time engaged in physical activity while participating in the program. Food and activity journal entries and self-reports during sessions revealed that individuals increased their physical activity minutes per week, as well as choosing more active lifestyle activities, like hiking, walking to or between errands, coaching softball, walking to stores, libraries and fitness facilities from home. Regarding lifestyle changes, participants comment: "I can wear clothes that my adult daughter has gained too much to wear."

4. Associated Knowledge Areas

KA Code	Knowledge Area
134	Outdoor Recreation
604	Marketing and Distribution Practices
607	Consumer Economics
701	Nutrient Composition of Food
724	Healthy Lifestyle
806	Youth Development

Outcome #3

1. Outcome Measures

Percentage of participants reporting increased physical activity.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	18

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It is well established that childhood overweight and obesity have increased significantly in the past three decades and that child obesity rates are particularly high in low-income, minority populations. Recently, we developed a family-focused, childhood obesity prevention program for use with low-income parents and their children (i.e., the SEEDS program). The goal of the current project is to add a parental feeding component to the award winning, Eating Smart-Being Active EFNEP curriculum using videos and video footage created for the SEEDS program. Moreover, the effectiveness of two delivery strategies for adding the video-based content will be examined (in-class videos and activities versus online lessons).

What has been done
Researchers at Washington State University, the Children's Nutrition Research Center in Houston, and Colorado State University Extension are collaborating with WSU Extension faculty (both statewide specialists and county level faculty) on this project. After piloting, the program will be implemented in four counties in Washington and two counties in Colorado. The evaluation design will involve comparing three groups of mothers (randomly assigned to conditions): Eating Smart-Being Active (ESBA) alone, ESBA plus in-class videos and activities, and ESBA plus online videos and activities. Pre- and post-assessments will be conducted on maternal feeding practices, meal structure, maternal knowledge, child eating behaviors, and child dietary intake. Follow-up assessments of these constructs will also be conducted at 6- and 12-months after program completion

Results
During the reporting year, we completed modifying the videos and developing activities (online and in-person). We plan on piloting the program in both Washington and Colorado In January of 2017.

4. Associated Knowledge Areas

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

806 Youth Development

Outcome #4

1. Outcome Measures

Number of communities cooperating with WSU program with farmers' markets and community gardens producing and/or selling locally grown fruits and vegetables.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	448

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Fruit and vegetable consumption by families and especially low income families is affected by factors such as access, availability, cost, taste, convenience and spoilage. One of the main risk factors for obesity is a poor diet, which could be related to a low consumption of produce. In 2010, only 26% of the adults and 25% of the youth in Clark County reported eating five daily servings of fruits and vegetables. One reason people may not eat many fruits and a vegetable is due to cost. In southwestern Clark County, only 9% of dollars spent on food are spent for food produced locally. Increasing the amount of dollars spent for locally produce foods will assure improvements in access to healthy food while strengthening the local economy and help preserve farms. Multiple barriers, such as cost, availability, access, taste, convenience and spoilage, can affect daily fruit and vegetable consumption by low income families

What has been done
Over the past 4 years received funding to work with Farmers Markets to increase participation of limited income families at the markets. In 2015 WSU Clark County Extension received a FINI grant to do this work. The purpose is to reduce barriers that may prevent family?s accessibility and affordability of local produce. The project has 3 projects: work with Farmers Markets to provide extra funding for families to purchase produce at the markets; provide information on selecting and using fresh produce on a budget; and hire a regional coordinator to expand the work in the SW area.

Results
More than twelve events were held in Clark County during the summer of 2016. Four hundred and forty-eight market shoppers filled out surveys at the Healthy Families booth, which distributed

372 bags of produce to families receiving public assistance in some form. Of those completing the survey, 82 percent said they would try making the demonstrated recipe at home. Farmers Market directors feel that the presence of the WSU Extension display and educational efforts increased the knowledge of the people and encouraged them to purchase new kinds of produce and return on following weeks. Vendors also indicted they saw an increase in purchases from limited resource families using EBT tokens and fresh match tokens.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
607	Consumer Economics
701	Nutrient Composition of Food
704	Nutrition and Hunger in the Population

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

WSU Extension Youth and Families have been able to increase our outreach and delivery in the Childhood Obesity program due to the acquisition of numerous competitive grants and contracts. Continued sustainability of these programs will be challenging especially in our rural communities. Washington wildfires impacted communities across Washington. Unhealthy air quality reduced outdoor activities. The treats of evacuation and coordination of support to neighboring communities severely impacted the delivery of educational programs.
Lastly, the access to Snap-Ed finances continues to cause stress throughout the system. The recent switch to an RFP has negatively impacted our program outputs, relationships with partners, and upcoming loss of high quality, talented staff.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The Childhood Obesity prevention program measures the percentage of participants who demonstrated increased knowledge and skills relative to key learning objectives; percentage of participants who applied acquired knowledge to improve their diet quality, level of physical activity, or production of locally-grown produce; percentage of participants

reporting increased physical activity; and the number of communities cooperating with WSU program with farmers' markets and community gardens producing and/or selling locally grown fruits and vegetables.

Key Items of Evaluation

Our evaluation methodologies were designed to assess the amount of acquired learning, degree of application of learning and the social, environmental and economic value of this application. We used post-program, retrospective and before and after assessments to document changes in knowledge. We used survey methods after an appropriate time lag to assess how much of the new knowledge was actually applied.
For the work with Childhood Obesity and overall health and wellness programs, the Socio-Ecological Model (SEM) provides the overall program and evaluation framework. Educators address individual's attitudes, beliefs, behaviors and choices in addition the environmental conditions in which our participants live.
Through the vast offering of WSU Extension foods and nutrition programs, Washington school age youth gain life skills in selecting healthy foods and learn to increase physical activity. Behavior changes that youth and their families are implementing will improve their health now and into the future.

V(A). Planned Program (Summary)

Program # 6

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
307	Animal Management Systems	0%		20%	
315	Animal Welfare/Well-Being and Protection	0%		5%	
504	Home and Commercial Food Service	25%		5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	15%		10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	25%		50%	
723	Hazards to Human Health and Safety	35%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	25.0	0.0	13.0	0.0
Actual Paid	5.0	0.0	20.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
247678	0	254724	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
247678	0	254724	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2571058	0	2138994	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research is ongoing in the scientific discovery areas of food safety that will benefit the industry and citizens of Washington State and focuses on dairy, fruit, wine, grain, legumes, and livestock. Research into epidemiology of foodborne diseases, especially in animal herds, and in mechanisms whereby pathogenic organisms reach the consumer.
Educational conferences, workshops, and onsite visits were conducted across the state. In a majority of the counties, Master Food Preserver and Food Safety Assistant volunteers engaged with the general public to provide training on consumer food preparation and preservation.
Publications, facebook, twitter and websites will also be maintained as outreach instruments to the food industry and to consumers..
A major continuing effort involves the transfer of microwave sterilization and pasteurization technology, which has achieved FDA approval at two levels, into commercial applications. The research is conducted in a new NIFA Center of Excellence at Washington State University to accelerate technology transfer with these methods.

2. Brief description of the target audience

Food processors, food purveyors, food producers, 4-H leaders, supervised and trained volunteers, staff and the general public.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	15444	16014	30025	404

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	15	150	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of conferences, workshops or other training sessions conducted by WSU Extension educators related to food safety.

Year	Actual
2016	310

Output #2

Output Measure

- Number of peer reviewed (official) WSU Extension publications published per year

Year	Actual
2016	8

Output #3

Output Measure

- Number of graduate students with a significant professional orientation in the area of Food Safety.

Year	Actual
2016	45

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives.
2	Percentage of evaluated participants who applied at least one practice learned from WSU Extension workshops, conferences, or training sessions.
3	Percentage of participants who will institute a HACCP or GAP plan as a result of attending WSU workshops.

Outcome #1

1. Outcome Measures

Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	70

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Whether handling food at home or in a commercial establishment of all sizes and types, knowledge of current food safety standards are critical to maintain the safety of the food supply. WSU Extension faculty and staff are concerned with individuals who process food at home, whether by canning, freezing, or dying. Faculty conduct extensive food safety trainings for food workers, owners and managers of food establishments, focusing on safety knowledge beyond that required to get a food handlers card. WSU Extension Specialists are also concerned about all food processing companies (of all types and sizes) in the Pacific Northwest region. Strong informational needs were recognized for faster development of the new food products, consistent production of the existing products, new ways to differentiate the food products in addition to developing products with extrusion processing.

What has been done
WSU Extension?s food safety outreach for 2016 continued to be extensive and varied. Extension faculty, staff and volunteers conducted face-to-face trainings, workshops at Extension offices, Food Systems conferences and in-school classrooms focused on food safety, food preservation and storage. Informal educational demonstrations were scheduled at weekly farmers, markets, fairs and other community events. Newspaper articles, and electronic media such as blogs, Facebook, list-serves and e-communities were methods used to expand the educational reach. In addition, an online course was adapted from Iowa State University to further outreach. Working with the Washington State Dept. of Health, WSU Extension faculty developed a curriculum and training program called Person In Charge.
The Preserve the Taste of Summer Online food preservation course allows anyone in the state of Washington to enroll and take the 8 lesson course and receive a completion certificate. To date 357 people have registered and taken portions of the course, and 198 (46 in 2016) have received

completion certificates.

Results
Extension specialists, faculty, staff, and volunteers delivered 310 workshops, conferences, and teaching activities across Washington State.

On the Colville Reservation, 22 people participated in the Preserving Fish workshops. Participants reported a 118% increase in being able to explain the safety reasons behind fish needing to be pressure canned. In Clark County, all consumer food safety class participants say they now have the knowledge and skills to provide food that won?t make anyone sick. Of 200+ callers, 187 said they would be changing their practices. The gauges that did not test accurate were replaced. This prevented people from getting ill potentially saving thousands of dollars per person in medical costs and/or loss from food spoiling and being thrown away. 100% of the consumers that MFP interacts with at community events walk away with new information or skills that will produce a quality and safe product.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

Percentage of evaluated participants who applied at least one practice learned from WSU Extension workshops, conferences, or training sessions.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	63

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food Safety Modernization Act (FSMA) ? Preventive Controls for Human Food Rule (PCHF) (Food Safety Training Course) Objective: The major objective of this course is to provide the training for the standardized curriculum that is approved by the FDA, to meet the requirements of the new FSMA-PCHF regulation. Target Audience and Need: This workshop reaches out to food companies of all types and sizes. Anybody who processed any type of food for human consumption benefit from this training. The audience also include the employees from the regulating agencies such as the FDA and the WSDA.

What has been done
Preventive Controls for Human Food Rule (PCHF) (Food Safety Training Course) reaches out to food companies of all types and sizes. Anybody who processed any type of food for human consumption benefits from this training. The audience also include the employees from the regulating agencies such as the FDA and the WSDA. . A total of 267 people were trained in 2016. Dr. Ganjyal has been officially recognized as ?Trainer of Trainers? by the FSPCA (Food Safety Preventive Controls Alliance). There are only 35 of such ToT?s in the United States.

Results
Written evaluations documented short term impacts of the program. Long term evaluations of for this program will be conducted in 2018-19. ? Among 267 participants, increases in high to very high knowledge and potential impacts to their business were observed for the following categories: o 98% increase for FSMA-PCHF rule and food safety plan development. o 95% increase for understanding of the requirements under the new FSMA-PCHF rule. o 95% increase for basic food safety. Total funds generated for this training in 2016: $322,483 Registration Fees Collected: $57,750 Special WSDA/FDA Contract Received for offering subsidized trainings: $35,000 WSDA-SCBG Received: $229,733

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Percentage of participants who will institute a HACCP or GAP plan as a result of attending WSU workshops.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	434

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Food borne pathogens cause an estimated 9.4 million illnesses, 55,962 hospitalizations and 1,351 deaths yearly in the U.S. Maintaining a safe food supply requires vigilance from farm to table. Produce foodborne outbreaks decreased consumer confidence and increased buyer demand for third-party certification. The Food Safety modernization Act will impact produce growers as well as food packers and processors.

The major objective of this workshop is to advance the knowledge of the food processing line workers and management about the food safety and sanitation. This workshop addresses basic food safety and sanitation issues, as well as cutting edge issues related to food sanitation and food safety. Topics having broad interest are covered in the general sessions. There are more specific subjects are discussed in small breakout sessions, with basic and advanced tracks.

What has been done
The Northwest Food Safety and Sanitation workshop reached many food companies of all types and sizes. Many of the attendees included the line employees of these companies, who are the majority of the people coming in contact with the food that is processed and packaged. The workshop helps to train these employees about the basics of food safety, food handling, hand washing, basic microbiology, equipment designing for food safety, process safety and other related topics. This year, topics related to FSMA (Food Safety Modernization Act) were also covered by many speakers at the workshop.

During 2016, this workshop was held in Portland, OR with 434 registered attendees with a total of over 475 attendees including the speakers and other invited attendees.

Results
This is a tremendous undertaking with the impacts reaching the whole pacific North West region (WA, OR, ID, MT, AL, UT, CA) and other parts of the United States as well with attendees coming from the Midwest and the Eastern US. Along with the lectures, an exhibitor?s hall was also arranged with 37 industry exhibitors (another record with full capacity). In 2016, the first ?Line Worker Award? was given away. This was to help elevate the role of the line workers in the food industry and also help enhance the food safety culture in the industry. Importance of the Program:

This program is very important as it brings together, the food industry (small, medium and big companies), government agencies (State Ag Departments of OR, WA, ID and the Food and Drug Administration - FDA) and the non-profit groups into one place and help them interact.

4. Associated Knowledge Areas

KA Code	Knowledge Area
307	Animal Management Systems
315	Animal Welfare/Well-Being and Protection
504	Home and Commercial Food Service
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Numerous external factors can impact the success of our extension and research programs. During 2016, educational programming continues to be severely affected by the continual budget reductions. As county educators retire or resign, positions are either not filled or left open for an extended time.
A resignation of an Extension Specialist and the continual delay in has impacted the extent of the program delivery.
Lastly, the pool of eligible and trained food scientist with an interest in consumer food safety or working with non-formal education is limited. As you can see by the reduced number of graduate students interested in this career, candidate pools are limited.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Our Biological Systems Engineering Faculty member Juming Tang was awarded a USDA $4M Center of Excellence grant for his work on microwave sterilization/pasteurization. His work, and the work of others in this area have allowed WSU to showcase its' research accomplishments in this area.
WSU Extension continued to increase it's capacity to meet the ever growing and important

need for home, consumer and commercial food safety education through face-to-face, social and print media and an online education program.
During 2016, WSU Extension faculty, specialists, volunteers and staff reached 123,817 adults and 227,569 youth through 394 workshops, demonstrations, fairs, farmers' markets or conferences. Participants increased their knowledge of safe food handling and preservation or processing practices to minimize the risk of food borne illnesses.
Our Extension Food Safety Specialist developed a self-sustained program on "Value-added processing of the agricultural outputs to create safe and high quality food products". He started two new national level workshops, the Food Ingredient Technology Conference and a Food Extrusion Processing Conference. He led the Annual NW Food Safety and Sanitation Workshop and assisted over 600 small-scale food processors with their product and process development. Lastly, he assisted the WA State Ag Commissions in increasing the markets for their agricultural outputs.

Key Items of Evaluation

WSU Extension specialists, faculty, staff and volunteers continue to utilize evaluation methodologies that are designed to assess the level of acquired learning, degree of application of learning and the social, environmental and economic value of this application. We used post-program, retrospective and before and after assessments to document changes in knowledge. We used survey methods after an appropriate time lag to assess how much of the new knowledge was actually applied.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Youth and Family Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	5%		0%	
802	Human Development and Family Well-Being	25%		10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	15%		30%	
805	Community Institutions, Health, and Social Services	5%		50%	
806	Youth Development	50%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	71.0	0.0	1.0	0.0
Actual Paid	71.0	0.0	0.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
808653	0	65262	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
808653	0	65262	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
6229073	0	9735	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The Washington State University Extension Youth and Family Unit faculty, staff and supervised volunteers plan, deliver and evaluate research-based programs across 39 counties and one tribal extension office. These programs include 4-H youth development programs through a variety of delivery methods and family-based programs, such as Strengthening Families, that focus on enhancing individual and family protective factors.

2. Brief description of the target audience

Youth (K-12) throughout the state; military and minority families; urban and rural communities; current and future community and organization leaders; families; and volunteers, teachers and other educators.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	34899	16841	75968	24930

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	45	10	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Number of workshops, demonstrations, and projects developed to foster positive youth, family and community development.

Year	Actual
2016	3231

Output #2

Output Measure

- Number of peer reviewed (official) WSU Extension publications published annually.

Year	Actual
2016	23

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives.
2	Percentage of participants evaluated who applied knowledge or skills from WSU programs.
3	Difference in grade point average between former 4-H members and peer students at WSU when they enter as university freshman.
4	High School graduation rates for 4-H members compared to their Peers.
5	Number of participants that reported an increase in family protective factors as a result of WSU programs.

Outcome #1

1. Outcome Measures

Percentage of evaluated participants who demonstrated increased knowledge and skills relative to key learning objectives.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	85

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Our 4-H youth development programs focus on enhancing the capacity of youth in grades K-12. Interventions that these young people receive develop their life skills and prepare youth to be productive contributing adults to their communities and the world. 4-H Youth Development Programs are planned, intentional educational outreach efforts of sufficient intensity, frequency, duration, and interval to ensure that measureable outcomes are obtained. These intentional educational efforts built not only the life skills of youth but also built the life skills of the adult volunteers who mentor them. Extensive effort is invested in the volunteer mentors, over 5200 of them, to best prepare them to build the capacity of youth for growth and development.

What has been done
In 2016, 4-H youth development programs were conducted in all of Washington?s 39 counties and one tribal Extension program. There were 3231 distinct life skill events/activities/programs reaching over 75,968 youth with educational outreach efforts in our three mission mandate areas: mentoring and STEM, citizenship, leadership and healthy living. The life skill events/activities/ programs included but were not limited to: YA4-H!, State 4-H Teen Leadership and 4-H Know Your Government Conferences, Tech Wizards, club and project work, school enrichment, environmental education and camping programs.

Results
For many of the statewide events and activities, a pre-post retrospective survey was implemented. Participants identified increases in life skills such as decision making, self-responsibility, understand and see positive path for their future and healthy living choices.

Nationally, the Common Measures tool is helping 4-H continually improve programs so that we can reach even more young people with a life-changing 4-H experience. It assesses the impact of 4-H through science, healthy living, citizenship and college/career readiness. These evaluation measurements also assist in cross-program comparison by allowing various programs to be examined on similar outcomes and outputs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #2

1. Outcome Measures

Percentage of participants evaluated who applied knowledge or skills from WSU programs.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	78

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
For over 100 years, WSU 4-H Youth Development program has promoted healthy living for its members and families. Today, health issues continue to be significant to the youth of our state. Eating a well-balanced healthy diet and maintaining a healthy weight reduces risk for many diseases including heart disease, cancer, and diabetes. In addition, eating a healthy diet in childhood and adolescence is vital for proper growth and development in all areas of health ? physical, emotional, and social.

What has been done
In WA State, 24% of youth ages 10 ? 17 are overweight or obese. Although the most recent Healthy Youth Survey found rates of sugar sweetened beverage consumption and screen time to be declining in 8-12th graders, youth continue to miss the mark on achieving fruit and vegetable intake and meeting physical activity recommendations. Given these trends, it is imperative that the largest youth development program in WA State actively engage in promoting health living with our youth. The 4-H Food Smart Families presented by Youth Advocates for Health builds on the experience from the 2014 pilot of FSF program. Ten counties across Washington engaged 2750 youth and their families in partnerships with community agencies

Results
Statewide, qualitative evaluation was conducted with 29 teens. Analysis identified themes related to the benefits and challenges of the youth-adult partnership and skills gained from being a teen teacher. Sub-codes were identified under the broader category of benefits of youth-adult partnerships including: mutual respect, the opportunity to independently lead/teach, having an adult as a supportive mentor/coach, friendship with adults and peers, shared responsibilities/partnerships with adults and peers, and having fun. In the process of participating as a teen teacher, youth reported gaining skills related to the four themes of teaching, communication, leadership, and emotional intelligence. Qualitative codes aligned with 4-H Essential Elements of belonging, mastery, independence, and generosity,

4. Associated Knowledge Areas

KA Code	Knowledge Area
801	Individual and Family Resource Management
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

Outcome #3

1. Outcome Measures

Difference in grade point average between former 4-H members and peer students at WSU when they enter as university freshman.

Not Reporting on this Outcome Measure

Outcome #4

1. Outcome Measures

High School graduation rates for 4-H members compared to their Peers.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1717

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Youth who engage in post-secondary education and training far exceed their high school graduation only peers in life-long earning capacity and employment capacity. Some studies has indicated that a Bachelor?s Degree has a value of $1.1M over the lifetime earnings of a high graduate obviously contributing to the overall economic stability of families and communities. US employers say that the inability to find qualified workers is their biggest obstacle to growth. For the first time, young adults risk having lower educational attainment rates than their parents. By 2018, more than 60% of American jobs will require at least an associate?s degree.

What has been done
To date data has been collected from 1717 former 4-H members with 76% of all Washington Counties reporting. IRB approval was completed. Post-secondary programs are defined as certificate programs such as cosmetology school, military, vocational school, formal apprentice programs, community college, 4-year college or university. County educators were recruited to participate. The surveys were completed by club leaders about the graduating 4-Hers in their clubs. The data were sent into a central location where it was summarized for reporting.

Results
Washington 4-H members who have completed the 4-H program by receiving a high school diploma or GED and/or reached the age 19 (too old to be a 4-H member). 38% are attending/enrolled in a post high school education program and are working; 42% are now attending/enrolled in a post high school education program and are working; 17% have a full or part-time job and are not attending/enrolled in a post high school education program; 2% do not have a full or part-time job and are not attending/enrolled in a post high school education program; and 9% are status unknown.

4. Associated Knowledge Areas

KA Code	Knowledge Area
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
806	Youth Development

Outcome #5

1. Outcome Measures

Number of participants that reported an increase in family protective factors as a result of WSU programs.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	450

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research conducted by Washington State Department of Social and Health Services on risk factors for prevention of substance use and abuse in 10-17 year olds show that youth across the state are at risk of early problem behavior as measured by alcohol and drug arrests, property crime arrests, and vandalism arrests in 10-14 year olds. Other risk factors that are prominent across the state are family history of substance abuse, low school achievement in 6th grade, alcohol arrests in 10-17 year olds and substance use in 10-17 year olds.

What has been done
engaging parents and families in the late elementary and middle school years to reduce risk of adolescent substance use and other problem behaviors. Studies by many researchers have found a model that includes both parents and youth to be most effective in long-term behavior change and reducing risk. As an evidence based program whose audience includes tribal and Latino families, a federally funded CYFAR project studied whether and how cultural adaptations should be made to the SFP program and informed future directions for the Latino programs.

Results
Successful engagement of youth across the state.

4. Associated Knowledge Areas

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

803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services
806	Youth Development

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Decreased state funding for higher education has resulted in reduced FTE for youth and family programs.
The legalization of recreational marijuana use in Washington has resulted in additional funding (due to increased sales tax) for proven parenting and prevention programs. This has increased the demand and interest in the program.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Our evaluation methodologies are designed to assess the amount of acquired learning; degree of application of that learning; and the social, environmental and economic value of this application. We will used post-program, retrospective, and before and after assessments to document changes in knowledge. We used survey methodologies after an appropriate time lag to assess how much of the new knowledge was actually applied. Finally, we will use research methodologies, industry assessments, and survey responses to determine the social economic and environmental values derived from the application of new techniques.

Key Items of Evaluation

Regarding Strengthening Families, facilitators administer evaluations to parents and youths separately on the first and last nights of the program (pretest-posttest). The evaluation consists of validated measures assessing risk and protective measures in the domain of family functioning (e.g. family conflict, parents' rule setting). Four out of five parent measures show significant improvement from pretest to posttest ($p < .001$).
The 4-H Youth Development program's key items of evaluation include all major statewide adult leadership training events and the statewide teen program outreach efforts. Additionally, all age-out 4-H youth were reviewed for their high school graduation attainment and their post-secondary education and training engagement.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Community and Economic Development

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
604	Marketing and Distribution Practices	10%		0%	
608	Community Resource Planning and Development	50%		0%	
610	Domestic Policy Analysis	20%		0%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	20%		0%	
	Total	100%		0%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2016	Extension		Research	
	1862	1890	1862	1890
Plan	44.0	0.0	0.0	0.0
Actual Paid	46.0	0.0	0.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Institution Name: Washington State University

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
518467	0	0	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
518467	0	0	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
3991283	0	0	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research-based programs will be delivered by extension professionals. Communities, local/state government agencies, and non-profits will be engaged to collectively analyze situations and recommend mechanisms to enhance public services. CED applied research and education programs will be customized based upon community need and delivered by programs such as Food Processing, the new Metropolitan Center for Applied Research and Extension, the WSU Division of Governmental Studies and Services, the William D. Ruckelshaus Center, and the Composite Materials and Engineering Center. Finally, county-based programs will be delivered that lead to enhanced non-profit capacity.

2. Brief description of the target audience

Community leaders
Local/state government officials, policy-makers and staff
Non-profit leaders and staff
Latino and other small business owners
Special interest groups
Economic development professionals
Private sector leaders in the composite materials and food processing industries
Limited income families

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2016	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	23110	115550	5727	29391

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

Patent Applications Submitted

Year:	2016
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2016	Extension	Research	Total
Actual	22	27	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- The number of communities increasing their use of digital technologies.

Year	Actual
2016	9

Output #2

Output Measure

- The number of local governments, state agencies and non-profits assisted.

Year	Actual
2016	1646

Output #3

Output Measure

- The number of existing or new businesses and entrepreneurs assisted.

Year	Actual
2016	1305

Output #4

Output Measure

- The number of people receiving family asset building education.

Year	Actual
2016	50

Output #5

Output Measure

- The number of people/agencies provided information that promote export of Washington products.

Year	Actual
2016	288

Output #6

Output Measure

- The number of scholarly products produced by CED educators.

Year	Actual
2016	171

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Number of communities enacting processes to increase economic development or the use of digital technologies.
2	Number of local, state, or non-profit entities increasing their capacity to function more effectively.
3	Number of existing or new businesses and entrepreneurs assisted through increased knowledge, including good business practices, food processing safety, composite manufacturing, and exporting.
4	Number of people who initiate family wealth building activities.

Outcome #1

1. Outcome Measures

Number of communities enacting processes to increase economic development or the use of digital technologies.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	9

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Recovery from the recession in our rural areas continues to lag far behind our metropolitan areas. Thirteen (13) of Washington?s rural counties are suffering unemployment rates of 8% to 11.5%. Broadband access has become a necessity whether you live in downtown Seattle or rural eastern Washington. Latino entrepreneurs continue to suffer high failure rates when starting a new small business (up to 50% in the first year of operations and another 35% by the fifth year). Helping communities to diversify their economies is an important part of Extension efforts.

What has been done
Notable activities included: (1) the development of woody biomass aviation fuel, (2) a local investment network pilot program with the Association of Washington Cities, (3) the development of a new salmon fishery at the mouth of the Columbia River, (4)the development of community structures and capacity to support local rural businesses, including Latino small businesses, and (5) assisting rural communities and tribes address broadband access by mounting broadband planning and adoption programs and launching a tribal technology training initiative. Additional activities included conducting extramural fund development, surveys, focus groups, community forums, presentations, training, applied research, and providing information to the public.

Results
WSU hosted Washington Rural Pathways to Prosperity Conference, which won the national Leadership and Collaboration Award of Excellence from the University Economic Development Association in 2015. https://news.wsu.edu/2015/10/02/extension-program-to-boost-rural-economies-earns-award/
Completed in 2016 the NARA was a five-year, $40 million project supported by USDA to explore woody biomass as a source of aviation bio-fuels. The project included a broad alliance of private industry and educational institutions from throughout the Northwest. Outcomes for the NARA initiative can be found at https://nararenewables.org/.

In 2016 WSU Extension faculty continued working with rural communities and regional economic development councils to promote small business support system. During 2016, CED expanded its efforts in local food systems development on the Olympic Peninsula and in the north eastern areas of Washington.
Extension assisted the Sauk-Suiattle Indian Tribes explore expanding their reservation in order to enhance geographic safety and economic opportunity for their community. WSU has conducted a number community design planning workshops provide to identify community issues. These workshops will result in the development of a set of conceptual models of an expanded tribal village.
WSU Extension?s Program for Digital Inclusion had a number of successes:
provided technical assistance to the Stevens County Broadband Action Team.
assisted the Spokane Tribe with the development of a new telecom company.
Lead broadband activities for the SR530 Recovery WSU Team.
Supported disaster support and recovery efforts on the SR530 team.
Assisted with research and development of The 50 States of Broadband study.
Presented the 50 States of Broadband Report to NTIA State Broadband Leaders.
Co-presented the 50 States Broadband Report to RTC-Broadband Communities.
Presented at the RTC National Summit.
Participated in the NARA-culminating Alaska Air biofuel flight from Seattle to Washington DC.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #2

1. Outcome Measures

Number of local, state, or non-profit entities increasing their capacity to function more effectively.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	1225

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It can be argued that the success of the United States is the result of its strength in private enterprise, good governance and a healthy non-profit sector. It is through government that we meet the majority of our collective basic needs: safety, healthy environment, and education. In addition, it is through a vigorous non-profit sector that we undertake actions that benefit our communities and/or contribute to our quality of life.

What has been done

WSU Extension?s efforts in local and state government assistance primarily took place through the William D. Ruckelshaus Center (Center) and the Division of Governmental Studies and Services (DGSS), and included:
o(DGSS) High quality research, training, and technical assistance to federal, state, and local government agencies throughout Washington State. http://dgss.wsu.edu/
o(Ruckelshaus Center) provide expertise to improve the quality and availability of voluntary collaborative approaches for policy development and multi-party dispute resolution. http://ruckelshauscenter.wsu.edu/
oProvided grants development workshops, leadership training, and other organizational development assistance. However, it must be noted the vast majority of the time, Extension work with non-profits consistence of an equal partnership to meet shared goals and serve the people of Washington.
oEstablished the Metropolitan Center for Applied Research and Extension (. http://metrocenter.wsu.edu/

Results

WSU provided key assistance to the America?s Best Communities (ABC) competition for the City of Arlington and the Town of Darrington, advancing them to the national final.
Developed and made available Ripple Effect Mapping, a tool that allows the organizations to identify and evaluate their programming outcomes http://www.joe.org/joe/2012october/tt6.php.
WSU Leadership Academy is a program designed to help non-profit, community and local government leaders expand their skills.
DGSS was on point for response to the 2016 wildfires in north-central and northeastern Washington.
The Law Enforcement Mountain Operations School provided two one-week and three single-day sessions on essential skills for LE operations in austere wilderness environments.
DGSS has been working with the Washington Association of Sheriffs and Police Chiefs (WASPC) to develop a series of citizen perception surveys for Washington State law enforcement agencies to support the Public Trust in Law Enforcement initiative.
WSU Extension?s 2016 outcomes in multi-party collaborative public policy development included the efforts of Ruckelshaus Center. Current and past projects can be found at http://ruckelshauscenter.wsu.edu/projects/index.html.
1.A Road Map to Washington?s Future (Growth Management)
http://ruckelshauscenter.wsu.edu/a-roadmap-to-washingtons-future/
2.Snohomish County Health Leadership Coalition
3.Washington State Coastal Resiliency
4.Snohomish Health District--

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #3

1. Outcome Measures

Number of existing or new businesses and entrepreneurs assisted through increased knowledge, including good business practices, food processing safety, composite manufacturing, and exporting.

2. Associated Institution Types

- 1862 Extension

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2016	288

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The small business sector remains a vital component of most local economies. The health of this sector is fundamental to the sustainability of our communities. This sector of the economy suffered greatly during the last recession and has been slow to recover. Additionally, the supply chain businesses of Washington?s local food systems remain a substantial part of the State?s economy. Lastly, Washington remains both a substantial hub for both exports and imports of goods from Asian markets.

What has been done
Business development and assistance provided through WSU Extension focuses on agriculture, agri-businesses, business in small rural communities, and composite/wood manufacturing. Currently, there is an emphasis on serving small businesses and entrepreneurs in Washington?s growing Latino population. WSU Extension fields a number of different programs:
1. WSU Extension lead the Cascadia Grains Conference bringing together farmers, processors, and end-users as well as investors, brokers, and local government officials. https://cascadiagrains.com/
2. Extension?s Community and Regional Economics program focuses on the analysis of Washington state exports and Regional Economic Modeling.
3. The Composite Materials and Engineering Center (CMEC), develops new building materials

from a range of recycled and virgin resources. http://cmec.wsu.edu/
4. The WSU Food Processing Program focusing on food safety, process improvement, and new product development. http://foodprocessing.wsu.edu/
5. Extension supports The Latino Community Studies Program.
http://ext100.wsu.edu/latinocommunity/

Results
During 2016, a select example of outcomes in this program area include:
1. The Cascadia Grain Conferences was the largest to date, with 293 attendees.
https://cascadiagrains.files.wordpress.com/2016/05/2016-cascadia-grains-conference-final-report.pdf
2. CMEC continued to provide direct assistances to manufactures involved in composite materials production or the reuse of waste materials for composites. They provided technical assistance, R&D services, consultation and/or information to 90 firms throughout the Northwest through 22 major projects and an additional 68 short-term consultations.
3. The Latino Community Study grew from 1 academy of 8 workshops in 2015 to 3 academies with a total of 24 workshops in 2016.
4. The Local Investment Network pilot project with the Association of Washington Cities reached 10 rural communities seeking to increase local investment in local businesses

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
608	Community Resource Planning and Development
610	Domestic Policy Analysis
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #4

1. Outcome Measures

Number of people who initiate family wealth building activities.

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The national economy while seemly fully recovered has not yet resulted in positively impacting higher education funding at all levels. Once again in 2016, private foundations in the West seemly are remaining on the sideline and were not investing in intermediary organizations such as Extension. While we have excellent staff and well-structured programs with innovative approaches, the lack of available and consistent funding to continue our efforts or implement new ones remains an obstacle.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

In 2016, we continued to see the positive result of WSU Extension's restructuring to three program units. In CED, we increased our efforts with tribal communities and concentrated on assisting the communities of Darrington and Arlington which were impacted by the landslide that killed 43 people. At the same time, the unit also worked with communities, non-profits, and public agencies throughout the state through multi-disciplinary project teams that drew upon faculty from four WSU colleges/schools and the University of Idaho, Portland State University, Montana State University, and the University of Washington. Again, the outcomes of CED faculty work included both helping decision-makers formulate state policy and assisting local communities strengthen their governmental, non-profit, and private sectors.

Key Items of Evaluation

The metrics chosen for WSU Extension's CED work reflects an orientation towards supporting local economic development, better governance, and support for select industrial sectors. A premium is placed on activities that simultaneously move multiple program agendas forward (e.g., our Latino business development work that supports the establishment of community level organizations that assist small businesses and director assistance to small business owners increase the success of their business which in turn contributes to the vitality of the community).
The metrics utilized to evaluate our work consist of the recognized key metrics for success formulated by the communities we serve. Primarily, our economic development assistance is aimed at creating new business and entrepreneurs. These metrics are at the top of list of our community, state, federal, and private sector partners as well. With regards to our community capacity building efforts, the metrics chosen are indicators that act as surrogates for evaluations, measuring increases in social capital. These include better

governance work through informed public policy development (e.g., work done through the William D. Ruckelshaus Center) and improved local and state agencies processes (e.g., work done through the Division of Governmental Studies and Services).

Lastly, our scholarly activities are aimed at contributions to the discipline of Extension and disseminating best practices and new program innovations to those we serve: the residents of Washington State.

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.