2014 Oregon State University Combined Research and Extension Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

In this annual report, the Oregon Agricultural Experiment Station (OAES) will summarize outputs and outcomes from its six Planned Programs.

Collaboration

The Oregon Agricultural Experiment Station (OAES) during the 2013 year continues its tradition of collaboration across disciplinary and organizational lines. This year, collaborative work has been expanded more broadly as the Station has begun implementing six new research projects to address NIFA program areas.

Funding

One of the Experiment Station's state performance metrics is external funds leveraged per dollar of state funding. In 2013-2014, $24.5 million in state appropriations were leveraged by faculty to generate $76.9 million in external fund expenditures, yielding a metric of over 3:1.

NIFA Program Areas

Research programs address the six thematic areas defined by the National Institute for Food and Agriculture. Program foci cover Sustainable Energy (Water and Watersheds), Climate Change, Global Food Security, Food Safety, and Obesity. The following are highlights from these Planned Programs.

Climate Change

An interdisciplinary team of scientists from the College of Agricultural Sciences at OSU is focusing on the adaptation and mitigation impacts of climate change as they relate to key sectors within Oregon, mindful of the regional and global connections. Team members are enhancing existing agricultural and biological models, life cycle models and economic/policy models, and exploring the opportunities and the methods to couple them (formally and informally) to better understand interactions among climate, crop and land use changes, ecological and environmental changes, and policy and economic factors.

Global Food Security and Hunger

Global food security represents access to food at many levels. The health of the animal food sources, as well as plant sources, is important to maintainand expand the nutritionofpopulations.However, disease is still common in food sources. Many pathogens evolved to survive in the prevailing conditions existing during the course of food production and foodconservation may be deficient even in the developed world. Further, if the source of the food is diseased, for example, Johne's disease in cattle or Vibrio tubiashii in seafood or Clostridium perfringens infections inseveral meat animals (pork, poultry, etc) , the security of food will be compromised. We propose objectives which address aspects associated with food security during food animal production, that is, developing diagnostic tests and vaccines and creating a betterunderstanding ofthe mechanismsof pathogenesis of many virulent bacteria and viruses.

Food Safety

The implementation of the Food Safety and Modernization Act (FSMA) will have a major impact on agriculture, especially small farms throughout the U.S. A critical need exists for development of a cost effective and simple-to-implement Food Traceability System(FTS) for small producers and processors. OSU researchers will model several small scale food production systems: berries, tree nuts, seafood and meats in order to identify and report both common andunique barriers to FTS implementation. The team will evaluate current technology in the context of how it's able to be implemented and recommend solutions for FTS implementation for small-scale systems.

Childhood Obesity

The project team will apply a social-ecological fframework to study how exposure and familiarity with more nutritional foods can increase incorporation of these foods into diets of various populations, as well as increase acceptability. The study will also determine if the greater exposure and familiarity with whole grains, vegetables and fruits increases the selection and incorporation of these foods into typical dietary patterns at home and in school lunches as well as among seniors in residential retirement communities.

Sustainable Energy

While methods to ensure sustainability of the energy resources have been sufficiently well developed, other natural resources such as water and nutrients are not often considered in detail in these frameworks.With the emerging nexus of bioenergy production and water there is a need to develop and validate assessment frameworks that can be used to evaluate the sustainability of energy, water and other natural resources in a unified theoretical framework. This is especially important for water limited U.S. Pacific Northwest (PNW) region in the context of global climate change scenarios.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	188.0	0.0	194.0	0.0
Actual	173.0	0.0	328.0	0.0

II. Merit Review Process

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

- Internal University Panel
- Combined External and Internal University External Non-University Panel

- Expert Peer Review

2. Brief Explanation

Merit reviews of collaborative proposals are reviewed by the Director, Associate Directors and the Assistant Director prior to project consideration for internal review. Internal reviews were conducted by staff and faculty prior to each proposal being submitted to expert peer review. Peer reviewer comments were incorporated into the final proposals before submission to NIFA for subsequent review.

III. Stakeholder Input

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

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

Brief explanation.

The Director, as well as Associate Directors, Assistant Director and the External Relations Director, traveled throughout the state to interact at formal and informal stakeholder events. Events included field days, special commodity events, County and State fairs, faculty organized conferences and workshops. They also attended events organized by various industry, public and nonprofit entities to interact with stakeholders. Faculty also attended all events.

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

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys
- Other (blogs, fairs, websites,)

Brief explanation.

Extension, Station, and departmental faculty, as well as unit leadership provide information on critical stakeholders and groups. The deans and the External Relations Director also identify important clientele through their many contacts. The Director's advisory group is composed of industry and community leaders. They meet regularly to update the Station administrators about critical issues and developments around the state or in their industry.

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.

Specific events were scheduled to gather input as well as continually recieving unsolicited input through a variety of public venues open to stakeholders and non-stakeholders alike. The University and College just completed a $1.1 billion dollar capital campaign that generated considerable input from a variety of non-traditional sources. The Strategic Intent process was used to garner input from other University Stakeholders from outside the College to aid with creation of joint mission areas and collaboration that encompasses all entities involved in natural resource management.

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.

The Station and Extension use this information when establishing budget allocations, proposing capital projects, allocation of research dollars and matching funds, and for priority staffing. The College Strategic Intent document is updated annually as stakeholder input shapes research and

extension focus and priorities. Stakeholder input is also important during the faculty and administrator review process to ensure that College personnel are responding to stakeholder needs within budget and staffing limitations.

Brief Explanation of what you learned from your Stakeholders

Public awareness of the impacts of agriculture on health, nutrition, environment and security is demanding broadening of existing research focus while acknowledging the need for additional research and dissemination of that research. Unfortunately, a lack of adequate funding for these programs is constraining the potential positive impacts of new or emerging knowledge.
Stakeholders are demanding more focus on water and water allocation as drought conditions expand across the West. Additionally, food safety appears to be emerging as a contentious issue as food borne pathogen outbreaks occur more frequently within the food supply and the presence of genetically modified materials become more common in the food supply chain.
There is increasing demand for more "urban based" agricultural research particularly for pest management, small farms, farmer's markets, master gardeners, and nursery crops.
Rural areas continue to struggle with declining economies, emigration to areas with better paying jobs, and dramatic changes in landscapes and land ownership as more effluent urban dwellers seek to live at least part time, in rural areas.
Globalization increases the amount of Oregon agricultural products that enter the global market but often creates competition that can suppress prices. Similarly, transportation bottlenecks such as ocean port labor disputes and reduced rail capacity resulting from oil transport continue to hinder market development and expansion.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
3865751	0	3832998	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	1949353	0	4469162	0
Actual Matching	1949353	0	28743507	0
Actual All Other	3801594	0	37560795	0
Total Actual Expended	7700300	0	70773464	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	1303333	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

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
101	Appraisal of Soil Resources	0%		5%	
102	Soil, Plant, Water, Nutrient Relationships	0%		15%	
111	Conservation and Efficient Use of Water	0%		15%	
112	Watershed Protection and Management	0%		5%	
125	Agroforestry	7%		5%	
132	Weather and Climate	0%		5%	
133	Pollution Prevention and Mitigation	0%		5%	
402	Engineering Systems and Equipment	20%		5%	
403	Waste Disposal, Recycling, and Reuse	7%		10%	
404	Instrumentation and Control Systems	0%		5%	
405	Drainage and Irrigation Systems and Facilities	0%		5%	
511	New and Improved Non-Food Products and Processes	21%		5%	
601	Economics of Agricultural Production and Farm Management	8%		10%	
608	Community Resource Planning and Development	7%		3%	
609	Economic Theory and Methods	17%		2%	
903	Communication, Education, and Information Delivery	13%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	6.0	0.0	6.0	0.0
Actual Paid	2.3	0.0	6.0	0.0

Actual Volunteer	31.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
38987	0	421046	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
38987	0	2742558	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
76032	0	2128333	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

In summary:
- Conduct basic and applied research
- Develop models and simulation tools
- Develop new culture strains and metabolic engineering tools
- Develop energy saving techniques and recycling of green waste
- Develop products, resources
- Conduct surveys and assessments
- Conduct data analyses
- Conduct workshops
- Lead short course and training seminars
- Provide training
- Partner and engage with community and environmental organizations
- Contribute to trade and peer reviewed journal publications

2. Brief description of the target audience

The target audiences are:

- public sector
- private sector
- economists
- policy makers
- agricultural biotechnology firms
- farmers and agricultural managers
- livestock growers and managers
- energy (including bioenergy/biofuel, hydrogen and fuel cells) industry,

- forest owners and managers
- research community at large
- environmental organizations
- community members

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1467	2946	105	562

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

Patent Applications Submitted

Year:	2014
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	1	11	12

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Conference Presentations

Year	Actual
2014	14

Output #2

Output Measure

- Number of Courses Developed that include the Planned Program and State Defined Outcomes as part of the curriculum

Year	Actual
2014	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Improved knowledge about composition and conversion of feedstocks for biofuels, bioenergy, and bioproducts, including co-products (number of new technologies developed, feedstocks (crops or organisms) investigated, residues or invasive species addressed)
2	Improved agricultural or engineering applications to advance production systems for bioenergy, e.g., a) new technologies, such as improved water use and quality, optimized photobiological processes to yield higher energy efficiencies, use of waste biomass (such as animal wastes and the organic component of urban wastewater) as feedstock to yield bioenergy and reduce waste and pollution sources, b) improved feedstock logistics c) resource inputs, outputs and quality
3	Models developed to look at biofuel and bioenergy productivity, technological processes, sustainability, and supply chain (numbers of decision tools, economic and life cycle analyses, productivity analyses)
4	Enhanced or improved bioeconomy (analyses of the number of new jobs, increased revenues, gallons of biofuels produced or consumed, gallons of fossil fuel displaced), numbers of farms involved in feedstock production)
5	Increased knowledge regarding the use of agricultural crops for energy production (percent increase in knoweldge of attendees to workshops, field days and demonstrations)
6	Improved sustainability of alternative energy supply chain, including evaluations of land use changes, biodiversity, acreages and tonnage of feedstocks produced and used, distributed conversion and processing,
7	Increased knowledge regarding the use of forest biomass as an energy source (Percentage increase in knowledge of attendees to workshops, field days, and demonstrations)
8	Increased knowledge of wave energy, particularly by coastal stakeholders (Percent increase in knowledge of attendees to workshops, field days, and demonstrations)

Outcome #1

1. Outcome Measures

Improved knowledge about composition and conversion of feedstocks for biofuels, bioenergy, and bioproducts, including co-products (number of new technologies developed, feedstocks (crops or organisms) investigated, residues or invasive species addressed)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
For biomass to become economically feasible as a substitute for fossil fuels, conversion of the biomass and and improved knowledge of the biomass must be improved. The identification of cheaper catalysts as well as utilization of the many components of biomass as other products will improve the value chain

What has been done
Substantial progress has been made in the utilization of agricultural residues, forest residues, invasive species, and purposely grown energy crops for biopower and as a substitute for fossil fuels. This includes the successful torrefaction of and test burns of the torrified material in a coal boiler, successful pyrolysis of juniper to bio-oil and gasification through wet torrefaction of dairy manure to produce energy for dairy farms.

Results
Agronomic studies of Arundo donax as a biopower crop and as a rotation crop for onions, potatoes, corn, and alfalfa in the Columbia River Basin have been completed. Arundo has the ability to provide 30 bdt/ac and torrefied Arundo has a much higher btu content and lower moisture content the PBR coal. The study also confirmed that the invasiveness of Arundo in the CRB is minimal and it is readily controlled through good agricultural practices.

A portable pyrolysis device has been tested on Western Juniper and Pinyon Pine and both materials produce a pyrolysis oil that is readily upgraded to HC fuels

Lignin produced as a byproduct of cellulosic ethanol production can be converted to valuable intermediate chemicals and is an economical source of hydrogen for upgrading alcohol to jet

fuels.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
125	Agroforestry
132	Weather and Climate
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
608	Community Resource Planning and Development
609	Economic Theory and Methods
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Improved agricultural or engineering applications to advance production systems for bioenergy, e.g., a) new technologies, such as improved water use and quality, optimized photobiological processes to yield higher energy efficiencies, use of waste biomass (such as animal wastes and the organic component of urban wastewater) as feedstock to yield bioenergy and reduce waste and pollution sources, b) improved feedstock logistics c) resource inputs, outputs and quality

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Animal wastes from confined feeding operations and dairies are an important source of surface water and groundwater contamination. Elimination or repurposing of these waste streams improves environmental conditions and can improve operational economics

What has been done
Dairy wastes were subjected to two different treatments: torrefaction and subsequent gasification of the wet waste to produce gas for driving electrical generators and to produce biochar for soil amendments, and the dairy effluent was treated with algae ponds to produce a nutrient rich replacement for peat for the ornamental industry.

Results
A rotary torrefier has been successfully tested to convert wet dairy waste to methane gas and biochar. This process has several advantages over anaerobic digestion in terms of waste handling and infrastructure costs.

Algae have been successfully deployed to treat effluents from dairies with two product streams; water that is sufficiently cleaned for reuse and the resultant dried algae biomass shows considerable promise as a substitute for peat moss. This provides an additional revenue stream for the dairy and has the environmental benefits of reducing dairy waste impacts on surface water and groundwater and significantly reducing the harvest of peat in very sensitive habitats.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
125	Agroforestry
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
405	Drainage and Irrigation Systems and Facilities
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
608	Community Resource Planning and Development
609	Economic Theory and Methods
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Models developed to look at biofuel and bioenergy productivity, technological processes, sustainability, and supply chain (numbers of decision tools, economic and life cycle analyses, productivity analyses)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Camelina has been proposed as a possible bioenergy crop to be grown in rotation with dry land wheat. Jet fuel from camelina has been tested and certified by DOD and many airlines. However, only 50,000 acres of camelina has been planted across the US suggesting a general equilibrium model could show issues within the supply chain that would benefit from market interventions.

What has been done
A general equilibrium model was developed that simultaneously accounts for a number of different sectors key to the problem analysis. Parameters were calibrated primarily using a highly detailed IMPLAN data for the PNW and the rest of the United States. The study explicitly models the separate stages of a vertical supply chain, including sourcing from inside and outside a region of the US, and from abroad as well.

Results
Supply chain costs place the cost of biojet fuel derived from camelina at a disadvantage when compared to petroleum based jet fuel. The most realistic scenario to make biojet competitive with petroleum based jet fuel would involve providing a 9% subsidy for biojet and a 9% tax on conventional fuels. This mitigates the gap between the fuel prices and is approximately revenue neutral for government. It is less likely to induce distortions in markets beyond those of central interest to this study.

4. Associated Knowledge Areas

KA Code	Knowledge Area
125	Agroforestry

133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
609	Economic Theory and Methods

Outcome #4

1. Outcome Measures

Enhanced or improved bioeconomy (analyses of the number of new jobs, increased revenues, gallons of biofuels produced or consumed, gallons of fossil fuel displaced), numbers of farms involved in feedstock production)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
125	Agroforestry
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes

601	Economics of Agricultural Production and Farm Management
608	Community Resource Planning and Development
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Increased knowledge regarding the use of agricultural crops for energy production (percent increase in knoweldge of attendees to workshops, field days and demonstrations)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Several energy crops including canola, camelina, and Arundo donax are being considered as potential feedstocks for biofuels and biopower. Agricultural producers lack sufficient information to adopt these crops as part of their existing production plans.

What has been done
Enterprise budget using AgTools are being developed for Arundo and an Experiment Station Bulletin is being prepared on Arundo agronomics. A general equilibrium model has been built for camelina supply chain production and this is readily adaptable to canola.

Results
Future workshops are planned for growers in the CBR to improve knowledge of these important crops.

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
402	Engineering Systems and Equipment

511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
608	Community Resource Planning and Development
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Improved sustainability of alternative energy supply chain, including evaluations of land use changes, biodiversity, acreages and tonnage of feedstocks produced and used, distributed conversion and processing,

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for people to embrace alternative energy, there must be assurances that production of that energy is sustainable, particularly in terms of water usage. Work to date has evaluated improved irrigation efficiencies and the impact of renewable energy on crop production.

What has been done
Field experiments analyzing crop production responses, including methods that help reduce irigation water demand in various crops.

Major analysis is underway to determine the effects of wind turbines on Irrigated agriculture. Current status is the development of data analysis algorithms. Large Eddy simulations have been performed in conjunction with collaborators at the University of Utah to determine the synergistic effects of wind turbines and field patch size on evaporation. A manuscript in under review of this work.
Additional activities involved: 1. Developed DNDC models for assessing the sensitivity of the emissions to the variation in agricultural practices, weather and nitrogen fertilizer use during production of camelina in Pacific Northwest (specifically Pendleton Region). 2. Developed life cycle assessment models in OpenLCA software for camelina production in Pacific Northwest. 3. Completed development of Global Bioenergy Partnership (GBEP) Metrics in OpenLCA.

Results

Above activities resulted in the following outputs: 1. Models for assessing the impact of agricultural practices and weather on the emissions relevant for life cycle assessment during crop production. 2. Life Cycle Assessment models for Camelina production. 3. Life Cycle Impact Assessment models for incorporating GBEP metrics. A UAV was used in conjunction with fiber optic distributed temperature sensing technology to form the basis for a field measurement campaign in September 2014. The data collected will be used to test multiple hypotheses, including the impact of the wind turbine on local mixing processes within a turbine wake. Analysis is complete for the first manuscript, to be submitted 1st quarter, 2015. A secondary experiment of opportunity was installed at no cost to the project. We recognized that the recent solar array at Rabbit Field provided an excellent opportunity to extend our hypotheses. To this end, a longer-term monitoring effort was installed to measure the seasonal and spatial impacts of the solar panels on evaporation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
125	Agroforestry
132	Weather and Climate
133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
608	Community Resource Planning and Development
609	Economic Theory and Methods
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Increased knowledge regarding the use of forest biomass as an energy source (Percentage increase in knowledge of attendees to workshops, field days, and demonstrations)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Western juniper is an invasive species that impacts western watersheds by replacing sagebrush-grassland ecotypes with closed canopy systems that displace native forage species and wildlife. Juniper removal is an expensive operation since there is no market for the wood.

What has been done
Supply curves were developed for juniper to be used as a biopower feedstock occurring on private lands within one half mile of existing roads. The model was further constrained by slope and transportation to a landing site for processing via torrefaction and subsequent transportation to an existing coal fired power plant. The ecological services and improvements to livestock production were also evaluated.

Results
A biomass subsidy of $10/bdt of harvested juniper would allow juniper to be used as an economically viable substitute for PBR coal. Juniper stands of sufficient density located with the allowable transportation constraint could conceivably supply sufficient supplies of torrefied juniper to fire a 300MW power plant for 12 years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
125	Agroforestry
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
601	Economics of Agricultural Production and Farm Management
608	Community Resource Planning and Development
609	Economic Theory and Methods
903	Communication, Education, and Information Delivery

Outcome #8

1. **Outcome Measures**

Increased knowledge of wave energy, particularly by coastal stakeholders (Percent increase in knowledge of attendees to workshops, field days, and demonstrations)

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

There is currently a moratorium on planting canola and camelina in the Willamette Valley based on concerns that these plants represent a threat to the specialty seed producers through cross pollination. Environmental interests object to the production of Arundo because of its invasive characteristics.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Funding for bioenergy research from both government agencies and the private sector has declined with declining fossil fuel prices. As research surrounding sustainable energy has reached the demonstration and commercialization scale, funding and investment to cross "the valley of death" has been difficult to obtain. OSU has had success working with commercial enterprises to continue to advance research on biopower via substitution of torrefied materials for coal and use of forest residues for conversion to intermediate chemicals and jet fuel. Economic research on oilseeds continues to show promise for the use of this crop in rotation with or in conjunction with fallow wheat operations and as a rotation crop for grass seed production. The implications of co-locating wind generation with crop production are now being developed with findings suggesting agricultural producers and wind generation entities will want to avoid each other to maximize the benefits of both operations.

Key Items of Evaluation

The current political climate suggests that research funding, tax incentives, production incentives, and limiting greenhouse gas emissions are no longer a priority and there is a reasonable expectation for this to continue until such time as fossil fuel prices rise in

response to increasing demand. Much work remains to be done regarding the logistics and handling of biomass, storage, development of improved feedstocks, and improved conversion technologies to make bioenergy competitive with fossil energy. Current allocations to USDA for AFRI, BRDI, and CAP make such research very difficult to initiate. Similarly, proposed cuts to USDOE's EERE and BETO programs only magnify the need to restore funding to the bioenergy research portfolio.

V(A). Planned Program (Summary)

Program # 2

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
101	Appraisal of Soil Resources	0%		5%	
102	Soil, Plant, Water, Nutrient Relationships	0%		5%	
112	Watershed Protection and Management	9%		10%	
121	Management of Range Resources	7%		5%	
122	Management and Control of Forest and Range Fires	15%		0%	
123	Management and Sustainability of Forest Resources	8%		0%	
135	Aquatic and Terrestrial Wildlife	17%		25%	
136	Conservation of Biological Diversity	0%		5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		5%	
215	Biological Control of Pests Affecting Plants	0%		10%	
311	Animal Diseases	0%		5%	
601	Economics of Agricultural Production and Farm Management	0%		5%	
605	Natural Resource and Environmental Economics	20%		0%	
609	Economic Theory and Methods	0%		5%	
610	Domestic Policy Analysis	0%		5%	
723	Hazards to Human Health and Safety	24%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	10.0	0.0	70.0	0.0
Actual Paid	3.8	0.0	15.0	0.0

Actual Volunteer	71.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
77974	0	1071640	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
77974	0	6901115	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
152064	0	5325344	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The program includes studies that focus on development of models of community-level responses to perturbations, population dynamics and habitat management for individual aquatic and terrestrial species, and development of methods for monitoring ecosystem changes. The experimental approaches that will be used to meet the specific objectives of these subprograms include field studies in the Oregon, the Pacific Northwest, the U.S., and abroad. In addition, the experimental approaches will also include controlled laboratory experiments and database/model development.

Climate change adaptation focuses on adjusting existing practices in order to reduce negative consequences and take advantage of opportunities. Adaptation begins with identifying and characterizing the problem posed by climate change, a goal this report aims to serve. It then proceeds with identifying, assessing, and selecting alternative actions, and ultimately implementing, monitoring, and evaluating the selected actions. Many federal, state, local, and tribal entities in the Northwest are already engaged in various stages of climate change adaptation, including state-level climate change response strategies; however, adaptation is not yet wide-spread and few efforts have moved beyond planning to implementation. Climate change adaptation focuses on adjusting existing practices in order to reduce negative consequences and take advantage of opportunities. Adaptation begins with identifying and characterizing the problem posed by climate change, a goal this effort aims to serve. It then proceeds with identifying, assessing, and selecting alternative actions, and ultimately implementing, monitoring, and evaluating the selected actions. Many federal, state, local, and tribal entities in the Northwest are already engaged in various stages of climate change adaptation, including state-level climate change response strategies; however, adaptation is not yet wide-spread and few efforts have moved beyond planning to implementation.

Theoretical and empirical models will be developed to examine land-use policies and impacts on water quality, wildlife habitat, watershed health, and other ecological indicators. Models will be used to examine how resource and agricultural policy affects major land use and cropping patterns, and how these may affect water quality.

Research is often carried out at field sites in the state, region, nation, or overseas. We will develop and use novel soil-water instrumentation, update and expand the reference evapotranspiration data currently available for Oregon, develop hydrologic models capable of simulating the interactions and processes between surface water and groundwater, conduct labortory and field observations of physical

and biological processes and functions, benthic macroinvertebrate community, numerical and statistical models play critical roles in understanding the driving principles of watershed and river ecosystems and linkages. Watershed and river basin scale resource simulation models and decision tools will be used to examine coupled natural and human systems and trajectories of change under alternative future scenarios.

OSUES's approach to climate change outreach will involve both traditional and non-traditional methods. We will integrate climate change content into existing educational programs, and address climate-related impacts such as drought and adverse storm damage response. Programs will also be developed and delivered, based on current research, which shows mitigation strategies and adaptations that can be accomplished now. For example, our forest geneticists are now developing revised seed zone maps that account for changing climate. This can assist forest owners and managers who are making planting decision today for forests that will grow for over 50 years and are likely to be under the effects of a different climate 50 years from now.

Other activities will include volunteer-based programs such Climate Masters and Master naturalists, workshops and seminars, consultations and facilitations, web-based instructional programs, web sites, stand alone and web-based videos, publications of all types, mass media, and social networking.

In summary, we will:

- conduct research experiments
- collect data
- conduct assessments
- develop monitoring protocols
- develop products, curriculum resources
- conduct workshops & meetings
- present seminars and professional talks
- provide training
- deliver services
- provide counseling
- partnering
- facilitating

2. Brief description of the target audience

- The general public and those in natural resource-based communities, including growers, ranchers and fishermen
- The research community including scientists working in governmental, industrial, and academic sectors, including biomedical researchers, oceanographers, climatographers, virologists
- Growers, crop consultants, extension faculty and researchers in the agricultural industry; and ecologists, economists, and managers concerned with invasive species.
- Salmonid and other fisheris
- State and federal natural resources management and regulatory agencies, including land managers
- Policy makers.
- Typical citizens in urban settings
- Engineering profession
- Undergraduate and graduate students

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1247	1742	810	2018

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	4	14	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Conference Presentations

Year	Actual
2014	21

Output #2

Output Measure

- Number of Courses Developed that include the Planned Program and State Defined Outcomes as part of the curriculum

Year	Actual
2014	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Developed new or better tools, technologies, practices, and models for understanding and managing: water and irrigation, soil, food production (crops and animals) systems and land, pests and pathogens, natural resources, and land-use
2	Understand impacts of climate change on and responses of: food systems, land use, watersheds and water systems, species, habitat and ecosystems, genes, pests and pathogens, marine food webs
3	Evaluated resource management strategies and best practices for climate change mitigation, such as: a) chemical control, b) biological control, c) stock assessments, d) fishery management tools, e) nitrogen applications, f) water use efficiency, g) acres planted for carbon sequestration, h) coastal hazards, i) community resilience
4	Understand changes in societal views with regard to the value of habitats and conservation and how to manage them
5	Understand changes in ecosystems from carbon management strategies, soil microbial health, natural resource or ecosystem policies
6	New genotypes developed and planted that show enhanced adaptive capacity to climate change
7	Understand the role of international trade as a vehicle by which adaptations can be made to global climate change: a) key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade; b) Numerical estimates regarding how climate change will affect crop prices, production costs, and the economic welfare of producers, consumers, and society at large.
8	Conservation strategies adopted, for example: - Conservation bio-control strategies are implemented differently and active restoration strategies occur. Land owners and managers assess ecosystem services provided by their riparian restorations via a user-friendly web tool. - Watershed councils, watershed stewards and Oregon Water Schools implement projects or programs based upon knowledge transmitted - Growers adopt improved, scale-dependent practices selected for various market niches with emphasis on reducing environmental degradation and impact. Commercial small farms will have more diverse and economically viable technologies and production techniques or systems available for their use - Growers implement drip irrigation and produce more marketable yields of onions, potatoes, and poplar trees than with furrow or sprinkler irrigation, and achieve efficient use of soil nitrate and the other available N sources under drip irrigation. - Generation of the viral vectors for grapevine disease control and functional genomics vectors have a potential for replacing current strategies of using chemical fungicides and bactericides with viral biocontrol strategies.
9	Participants who increase their knowledge of management practices and understanding of climate variability and change. (Percentage)
10	Participants in educational programs who improve mitigation strategies for climate, such as reducing greenhouse gas emissions and increasing carbon sequestration in agricultural production and natural resource management systems. (Percentage)
11	Clients who employ climate adaptation strategies or incorporate climate-based management practices. (Percentage)

Outcome #1

1. Outcome Measures

Developed new or better tools, technologies, practices, and models for understanding and managing: water and irrigation, soil, food production (crops and animals) systems and land, pests and pathogens, natural resources, and land-use

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Broad expansion of microirrigation is needed. Unless timely action is taken, it is anticipated that water supply and water quality related crises will affect economies and resources of national and international importance. Microirrigation can reduce the waste of water to a negligible amount and reduce the transport of contaminants to surface water and groundwater. Irrigation events can be fine-tuned to spoon feed water and nutrients just in time to minimize plant water stress. Microirrigation can optimize crop production (more crop per drop) and in many cases increase the quality of agricultural products. Successful experimental microirrigation results will be scaled up to commercial size through this project. Microirrigation information will be transferred to growers through many venues.

What has been done
Technical advances in soil water sensors and their increasing commercial viability help focus the need for more research and extension of soil-based irrigation scheduling. Confirming the reliability and improving the convenience and accessibility to growers of soil water sensors will be addressed in a number of studies. Remote grower access to soil water data by computer or smart phone will be evaluated for irrigation scheduling. In OR, soil-based scheduling for onion will be compared to weather-based scheduling, and a fixed irrigation schedule compared to soil- and weather-based scheduling for seed production from native plants.

Results
Soil-, weather-, and plant-based or combined microirrigation scheduling approaches will provide valuable choices for a diverse clientele of growers to improve their crop production and

profitability while reducing irrigation withdrawals. Increased adoption and proficient management of microirrigation scheduling by growers will improve water productivity and promote improved water quality over a wider range of end-user characteristics and constraints.
Risks of negative impacts to environment, soil, and water quality that affect all of society through massive irrigation methods will be minimized through reduced leaching or other off-site /non-target chemical movement possibly opening up previously non- productive lands to microirrigation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
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
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

Understand impacts of climate change on and responses of: food systems, land use, watersheds and water systems, species, habitat and ecosystems, genes, pests and pathogens, marine food webs

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Changes in precipitation and increasing air temperatures are already having, and will continue to have, significant impacts on hydrology and water resources in the Northwest. Reduced snowpack and shifts in streamflow seasonality due to climate change pose an additional challenge to reservoir system managers as they strive both to minimize flood risk and to satisfy warm season water demands. Reduced water supply combined with increased water demands in the summer could lead to water shortages, reducing the proportion of irrigable cropland and the value of agricultural production.

What has been done
Models were constructed for individual water basins using historical flow data and irrigation demand and the historical data was subjected to 20 separate climate models that project rainfall and snowpack levels through 2080.

Results
Researchers simulated potential climate change effects on reservoir system operations and irrigated agriculture in a regional River Basin. Using modeled historical streamflow and current water demands and infrastructure, the simulated River Basin experienced water shortages (i.e., years in which substantial prorating of deliveries to junior water users was required) in 14% of years between 1940 and 2005. Using downscaled climate simulations from 20 climate models, showed that the number of years with water shortages under the SRES-A1B scenario (continued" "growth of greenhouse gas (GHG) emissions peaking at mid-century) is projected to increase from the historical 14% to 27% (with a range of 13?49% acres of the 20 models)in the 2020s, to 33% in the 2040s, and to 68% in the 2080s without adaptations. For the SRES-B1 scenario characterized by substantial emissions reductions, water shortages occur in 24% (7?54%) of years in the 2020s, 31% for the 2040s, and 43% for the 2080s.
The scenarios also indicate an increasing frequency of historically unprecedented conditions in which senior water rights holders suffer shortfalls (Vano et al. 2010). Such water shortages could impact the amount of acreage in the region that can be irrigated and the amount of water that can be applied during the growing season.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
609	Economic Theory and Methods
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Evaluated resource management strategies and best practices for climate change mitigation, such as: a) chemical control, b) biological control, c) stock assessments, d) fishery management tools, e) nitrogen applications, f) water use efficiency, g) acres planted for carbon sequestration, h) coastal hazards, i) community resilience

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Human responses to climate change have the potential to impact aquatic ecosystems. Irrigation diversions, trade-offs between hydropower and flow augmentation (released from storage reservoirs) for endangered salmon, and changes to water supply infrastructure all have the potential to affect the survival of native and endangered species, as well as the distribution and extent of suitable habitat. As streamflow rates decline during the summer, irrigators are likely to rely more heavily on storage allocations and increased usage of groundwater supplies to fulfill their water demands.

What has been done
New storage facilities may alter temperature regimes downstream, inundate habitat, and create migration barriers. Design and construction of these facilities will need to take into account the potential for such projects to impact natural systems. Reservoir operations may mitigate temperature increases through the release of cold water from lower layers in the reservoir, however the uniform temperature regime of these bottom draw releases may also disrupt important environmental cues for spawning and migration. Researchers are working with agricultural and municipal watershed managers to design measures that will minimize impacts on water dependent species.

Results
Adaptation opportunities in response to a decrease in summer streamflows. Conservation practices and improvements in water use efficiency such as upgrading to more efficient agricultural water application systems and intensive irrigation management techniques, changing to crops that require less water, and adapting to dryland agriculture would help mitigate the

effects of a reduced supply. Groundwater and surface water supply assessments, evaluations of projected drought risk, impacts, and vulnerabilities, and expanding remote sensing and streamflow monitoring capabilities would help prepare for a decrease in available supply. Adaptation in response to changes in the timing of peak runoff. The development of new storage and retention structures, modification of current water delivery systems, and aquifer recharge using early season runoff would increase the available water supply. Improved forecasting and prediction methods can be developed to assist in decision-making for water management planning and operations. Existing laws, regulations, and policies related to water allocation and management could be modified, and flood control rules for reservoir operations could be changed to allow greater flexibility and adaptation to an altered hydrologic regime.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics
610	Domestic Policy Analysis
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Understand changes in societal views with regard to the value of habitats and conservation and how to manage them

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmer-to-farmer learning is a well-documented strategy for nhancing information sharing that encourages adoption of better practices, and it is important to facilitate interactions among

farmers and other stakeholders. Collaboration with farmers and their associates drives development of multiple extension-based projects in REACCH that inform them about agriculture and climate change. Three examples of specific farmer-focused REACCH projects currently underway include:(1) surveys, (2) a decision tool for climate change communication, and (3) case studies.

What has been done
Several grower case studies are being developed by REACCH as digital documents that include short video pieces. The goal is to highlight farmers? conscientious efforts to improve their current farming strategies?strategies that may also allow them to adapt to a changing climate. The case studies focus on a variety of practices with specific environmental and economic benefits in four agroecological zones (AEZs), including: (1) variable-rate nitrogen application in the high rainfall zone; (2) intensive and alternative crop rotation in the intermediate rainfall zone; (3) flex cropping in the low rainfall zone; and (4) diverse crops, intensive rotation, and cover cropping in the irrigated zone. Each one examines how farmers make decisions and manage risk and offers suggestions about the challenges and benefits that farmers have experienced when implementing these practices.

Results
Products from the three projects identified in this report are expected this coming year. Involving farmers and their associated stakeholders in needs assessments and resource development is crucial for creating effective education materials and decision support. In the face of new challenges, it is necessary to learn from past experiences. Farmers have tremendous creativity and experience when dealing with risks, and REACCH will continue to collaborate with them in meeting future challenges and opportunities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
609	Economic Theory and Methods
610	Domestic Policy Analysis

Outcome #5

1. Outcome Measures

Understand changes in ecosystems from carbon management strategies, soil microbial health, natural resource or ecosystem policies

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Soil carbon (C) sequestration is a major agriculturally based strategy for mitigating rising atmospheric concentrations of greenhouse gases. Soil organic carbon (SOC) levels are dynamic, depending on C additions and losses. Carbon is added from unharvested plant residues and roots, organic amendments, and erosional deposits. Carbon is lost through decomposition of organic materials and C transport via soil erosion. Conversion of native lands to agricultural production results in a 20 to 60% loss of SOC within 40 to 50 years.

What has been done
Overall objectives under REACCH regarding SOC are to: (1) continue to quantify agricultural impacts on SOC sequestration for dryland cropping systems in different agroecological zones (AEZs) of the Pacific Northwest; (2) characterize site-specific changes in SOC (0 to 1.53 m) due to management practices within fields typical of the region; and (3) assess chemical, physical, and biological methods of measuring active SOC pools.

Results
They reported SOC changes under different soil management scenarios: native conversion, adoption of NT, and use of a mixed perennial-annual rotation (Table 1). These analyses showed that 75% of converted native land lost at least 0.14 to 0.70 Mg C ha-1 yr-1 over an average of 55 to 74 years depending on AEZ. Converting from CT to NT was predicted to increase SOC at least 0.12 to 0.21 Mg C ha-1 yr-1 over 10 to 12 years in 75% of studies analyzed and was also AEZ specific. Compared to annual cropping, mixed perennial-annual systems would be expected to gain at least 0.69 Mg C ha-1 yr-1 over 12 years in 75% of AEZ
2 (annual cropping) sites. Regional assessments of active SOM pools in long-term REACCH study areas in each of three dry land AEZs as well as an irrigated site were initiated in 2013.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources

136	Conservation of Biological Diversity
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

Outcome #6

1. Outcome Measures

New genotypes developed and planted that show enhanced adaptive capacity to climate change

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
OSU plant breeders have been working to develop new wheat and barley strains that are more resistant to drought and diseases associated with warmer temperatures

What has been done
Plant breeding trials have been completed for a new varietal of winter soft wheat and spring hard red wheat. One new varietal of barley that can be grown in rotation with dry land winter wheat has been developed.

Results
All three varieties have been released.

4. Associated Knowledge Areas

KA Code	Knowledge Area
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
601	Economics of Agricultural Production and Farm Management

Outcome #7

1. Outcome Measures

Understand the role of international trade as a vehicle by which adaptations can be made to global climate change: a) key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade; b) Numerical estimates regarding how climate change will affect crop prices, production costs, and the economic welfare of producers, consumers, and society at large.

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Conservation strategies adopted, for example: - Conservation bio-control strategies are implemented differently and active restoration strategies occur. Land owners and managers assess ecosystem services provided by their riparian restorations via a user-friendly web tool. - Watershed councils, watershed stewards and Oregon Water Schools implement projects or programs based upon knowledge transmitted - Growers adopt improved, scale-dependent practices selected for various market niches with emphasis on reducing environmental degradation and impact. Commercial small farms will have more diverse and economically viable technologies and production techniques or systems available for their use - Growers implement drip irrigation and produce more marketable yields of onions, potatoes, and poplar trees than with furrow or sprinkler irrigation, and achieve efficient use of soil nitrate and the other available N sources under drip irrigation. - Generation of the viral vectors for grapevine disease control and functional genomics vectors have a potential for replacing current strategies of using chemical fungicides and bactericides with viral biocontrol strategies.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goals of the State IPM Coordination program are to advance PAMS IPM in all of its applications in Oregon: the critical needs being addressed include development of statewide

partnerships to enable the benefits of IPM to be leveraged in the marketplace, and establishment of a more integrated suite of decision support tools that enable farmers to respond to increasing uncertainties in climate, pests and markets. The goals of the Specialty and Agronomic Crop IPM component of this program are to engage in effective IPM and pesticide stewardship with farmers, to maximize the impact of IPM in pest suppression and environmental protection, and to increase adoption of biologically based IPM.

What has been done
Develop three short courses (each course involves a full day in winter and a full day in summer) in three distinct Oregon farming systems over three years; the dry plains row cropping systems of eastern Oregon, the Columbia Plateau orchard systems of the Columbia Gorge area vegetable systems of the Willamette Valley. The target audience will be farmers and personnel that support the implementation of agricultural conservation practices that include and are not limited to industry, conservation, non-profit and extension personnel. The winter course content will include examples of functional agricultural biodiversity practices and research appropriate to the different farming systems maximizing local resources and support personnel connections. The winter course will be coupled with a summer 2015-17 field courses on at least one site worked upon in each class.

Results
Preliminary results will be available during the next reporting period.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
215	Biological Control of Pests Affecting Plants
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics

Outcome #9

1. Outcome Measures

Participants who increase their knowledge of management practices and understanding of climate variability and change. (Percentage)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

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

What has been done
{No Data Entered}

Results
{No Data Entered}

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
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
136	Conservation of Biological Diversity
215	Biological Control of Pests Affecting Plants
311	Animal Diseases
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #10

1. Outcome Measures

Participants in educational programs who improve mitigation strategies for climate, such as reducing greenhouse gas emissions and increasing carbon sequestration in agricultural production and natural resource management systems. (Percentage)

Not Reporting on this Outcome Measure

Outcome #11

1. **Outcome Measures**

   Clients who employ climate adaptation strategies or incorporate climate-based management practices. (Percentage)

   Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

The impact of climate change on agricultural production practices and natural systems functions is only now beginning to be understood. With drought conditions prevalent across much of the west, water management and conservation has become a critical issues as people, endangered species and agricultural producers compete for the same resource. While we are making significant progress, some impacts may already be beyond our ability to react with sufficient speed to mitigate these impacts.

Many of the changes set in motion are unavoidable, caused by greenhouse gases already emitted (Solomon et al. 2009), though they may be temporarily obscured by the Northwest's highly variable climate (Hawkins and Sutton 2009; Deser et al. 2012). What risks will a changing climate bring for the region as a whole and for specific sectors and locations? What strategies are emerging for evaluating and altering management of regional water and energy supplies, infrastructure, transportation, health, and ecological and agricultural systems to address these risks? To what extent is the region preparing?

Much of our works has been to begin to synthesize currently available information to provide answers to these questions. It focuses on impacts that matter for the region as a whole, chosen with an eye toward the likely major drivers of regional change and consequences of highest regional and local importance. Our work will provide an assessment of existing knowledge that builds on and augments previous assessments (e.g.,

Climate Impacts Group 2009, Oregon Climate Change Research Institute 2010) and draws on a wealth of resources from local government and state agency reports to academic peer-reviewed journal articles. It is intended to be a resource for preparing the Northwest for climate change.

Key Items of Evaluation

While we can do our best to discern the most likely consequences of climate change for NW ecosystems and communities, the ultimate consequences of the changes now in motion remain partially contingent on future societal actions and choices. Whether the consequences of the climate impacts outlined in this report are severe or mild depends in part on the degree to which regional social, economic, and infrastructural systems are adjusted to align with the changing climate, and the degree to which natural systems are provided with the room, flexibility, and capacity to respond. The regional consequences of climate change will also be strongly shaped by past choices--of what to build where, what to grow where--and by the laws, institutions, and procedures that shape how natural resources are managed and allocated, risks from natural hazards are identified, and trade-offs among conflicting objectives resolved.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	9%		5%	
111	Conservation and Efficient Use of Water	7%		5%	
121	Management of Range Resources	11%		0%	
202	Plant Genetic Resources	0%		15%	
204	Plant Product Quality and Utility (Preharvest)	9%		15%	
205	Plant Management Systems	9%		5%	
206	Basic Plant Biology	0%		5%	
216	Integrated Pest Management Systems	6%		5%	
301	Reproductive Performance of Animals	5%		10%	
302	Nutrient Utilization in Animals	3%		0%	
307	Animal Management Systems	9%		0%	
311	Animal Diseases	0%		15%	
501	New and Improved Food Processing Technologies	5%		0%	
502	New and Improved Food Products	6%		10%	
601	Economics of Agricultural Production and Farm Management	5%		10%	
602	Business Management, Finance, and Taxation	7%		0%	
603	Market Economics	3%		0%	
903	Communication, Education, and Information Delivery	6%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890

Plan	60.0	0.0	75.0	0.0
Actual Paid	71.9	0.0	32.0	0.0
Actual Volunteer	1461.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
1520495	0	2139011	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
1520495	0	13693150	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
2965243	0	26110507	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Organic, value-added, and technological (bio-based, information-centered, robotic, nanotechnology, etc.) approaches complement conventional agriculture. By utilizing contemporary research tools in agronomy, animal or soil science, plant nutrition and pest management, and molecular or genetic techniques, this program will develop improved practices for crop and animal production systems. New or enhanced techniques and information will enhance the potential use of alternative crops, reduce soil erosion, reduce the economic, social, and environmental costs of crop pests, and maintain or increase soil biological, chemical and physical properties. New knowledge will reduce disease, wastes and discharges in animal systems while improving husbandry, productivity and food safety.

Research and extension will also look at key areas of various social changes in the marketplace impacting producers, retailers and consumers. The research aims to determine (1) how technology impacts producers/retailers/consumers in the market place; (2) how society impacts consumer demand for goods and services with a goal of improving the well-being of consumers; and (3) how to develop economic linkages among producers, retailers, and consumers for the community development.

In addition, a broad coalition of agricultural, environmental and food groups has coalesced around the need for integrated efforts for sustainable agriculture and food systems information, research, and education. Outcomes include more economically and ecologically sustainable farms and ranches; a more resilient rural economy; stronger bonds between rural, urban, and periurban residents; and a healthier environment for all Oregonians.

- Conduct Research Experiments.
- Conduct surveys
- Conduct Workshops, Meetings.
- Deliver Services.
- Develop Products, Curriculum, Resources.
- Provide Training.
- Provide Demonstrations
- Provide Counseling.
- Assessments.

- Work with Media.
- Partnering
- Facilitating.

2. Brief description of the target audience

- Professional peers and scientific communities, veterinarians, vaccine producers
- State commodity commissions, grower groups, packers, crop consultants
- Natural resource industry clientele - growers, field representatives, grower co-ops and partnerships, processors and handlers, export companies, importing companies
- County, state and federal agencies - USDA-ARS, Oregon Department of Agriculture, Natural Resources Conservation Service, Bureau of Indian Affairs, Confederated Tribes of the Umatilla Indian Reservation, US Forest Service, and Bureau of Land Management.
- Policy makers, public health officials, and community leaders
- Teachers and students, and other educators
- Genetic companies
- Nutritional consultants
- Nonprofit conservation groups and ecologists
- General public and consumers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5451	3469	2397	3276

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

Patent Applications Submitted

Year: 2014

Actual: 1

Patents listed

Interspecific Hybrid Bermudagrass (Cynodon transvaalensis >C. dyctylon

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total

Actual	66	41	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Conference Presentations

Year	Actual
2014	29

Output #2

Output Measure

- Number of Courses Developed that include the Planned Program and State Defined Outcomes as part of the curriculum

Year	Actual
2014	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Improved and sustainable plant and animal production systems, including precision systems, cultural practices, conservation and population management strategies, innovations, pest control, organic systems, better fertility and reduced uterine infections in dairy and beef cattle and sheep, as well as better understanding of reproductive genetics and developmental biology
2	Expanded nutrient knowledge in plant and animal systems
3	Improved plant and animal breeding for improved or novel attributes and for human health benefits, including fertility, health, productivity
4	Develop optimum pest management by identifying factors affecting herbicide activity, registering herbicides, controlling weeds in organic and no-till production; learning basic pest biology, registering new pesticides, finding application rates, and identifying risks associated with a pest as it becomes established
5	Conduct economic studies to help Producer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade
6	Number of growers (commercial, small and fresh market) that adopt new varietals and methods to reduce yield losses and expenses, rejuvenate orchards, achieve better productivity and efficiency, provide environmental benefits (less fungicide applications, etc.), and effectively compete on the world market
7	Number that adopt conservation strategies and practices
8	Number in improved agricultural and fisheries/aquaculture sectors, e.g., commodities
9	Number of policy makers and other stakeholders that are better informed about plant or animal production methods, technologies, and mnanagement techniques.
10	Improved knowledge of consumer and market conditions and factors that affect business survival and competitiveness such as market conditions, process map, business management, types of consumers and their food choices, motivations for food choice, marketing approaches for local markets and community food systems
11	Improved information about biology, control and resistance of viral, bacterial, fungal diseases, especially disease reproduction, transport and spread; postharvest decay; models to predict risk; and relationships between disease susceptibility and disease resistance
12	Produce the next generation of growers and agricultural eduactors by integrating agricultural education into high school curriculums and community education
13	Number whose consumer business knowledge leads to improved opportunities, and more successful starts, activity, survival, and profitability in food enterprises, as well as new and improved value-added products
14	Improved animal health

Outcome #1

1. Outcome Measures

Improved and sustainable plant and animal production systems, including precision systems, cultural practices, conservation and population management strategies, innovations, pest control, organic systems, better fertility and reduced uterine infections in dairy and beef cattle and sheep, as well as better understanding of reproductive genetics and developmental biology

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
White mold is a serious foliar and pod disease of snap beans grown for processing in western Oregon as well as in all major snap bean production regions in the US. Fields with > 6% infected bean pods are rejected by the processor, resulting in a complete crop failure. Ronilan (vinclozolin, a Class B1/B2 carcinogen), a highly effective fungicide used through 2005 for the control of both white and gray mold is no longer available to conventional bean growers. Alternative WM management is the top research need identified by conventional snap bean growers. White mold is also a serious disease on other vegetable crops including squash, peppers, cauliflower, broccoli, and potato."

What has been done
This project analyzed four separate research objectives: 1) Evaluate the cumulative impact on disease severity of applying low rate Contans applications to each of 4 crops in a two year double-crop vegetable rotation 2) Evaluate the impact on white mold disease severity of low rate Contans applications combined with a moderately resistant bean cultivar 3) Evaluate the impact on white mold disease severity and sclerotial Cm infection of applying Contans through the irrigation system during snap bean bloom, with and without at-bloom conventional foliar fungicide applications. 4) Evaluate the economics of Contans use in snap bean and vegetable rotations.

Results
The strategies to be evaluated in this proposal would may reduce inoculum potential and bean susceptibility. If effective, these strategies would become additional tools in the overall

disease and risk management toolbox. Conventional snap bean farmers are participating in sustainability certification programs requiring progress in bio-intensive IPM. A small group of processed vegetable farmers are interested in growing snap beans organically. Diversified organic vegetable farmers grow many crops that are hosts to white mold, including carrots, peppers, cabbage family crops, squash, lettuce, beans, and peas. Because the host range is so wide, organic farmers growing a diversity of crop species find it difficult to rotate out of host crops for 4 years. These farmers require an organic white mold management toolbox. This project's main goal is to evaluate and demonstrate the integration of a biological control agent into a multi-tactic mold management plan for both conventional and organic farmers, including cultural practices, resistant germplasm, and where appropriate, fungicides. This project has the potential to reduce costs and improve environmental quality and human health.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics

Outcome #2

1. Outcome Measures

Expanded nutrient knowledge in plant and animal systems

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Meadowfoam (Limnanthes alba Benth.) is a new oil seed crop native to the Pacific Northwest. The stable, long chain fatty acids in the oil have unique physical and chemical properties that are valued in the cosmetic industry. The oil also has potential as a raw material in biolubricants, waxes and polymers. Degradation products from glucosinolates in the seed meal have been shown to have biopesticidal properties, and development of commercial outlets for the seed meal would add considerable value to the crop. On a national level, this research addresses the need for renewable sources of industrial chemicals and crop diversification. On a local level, meadowfoam plays a vital role as a winter annual rotation in grass seed cropping systems.

What has been done

Meadowfoam (Limnanthes alba Benth.) is a new oil seed crop native to the Pacific Northwest. The stable, long chain fatty acids in the oil have unique physical and chemical properties that are valued in the cosmetic industry. The oil also has potential as a raw material in biolubricants, waxes and polymers. Degradation products from glucosinolates in the seed meal have been shown to have biopesticidal properties, and development of commercial outlets for the seed meal would add considerable value to the crop. On a national level, this research addresses the need for renewable sources of industrial chemicals and crop diversification. On a local level, meadowfoam plays a vital role as a winter annual rotation in grass seed cropping systems.

Results

To regenerate seed for future trials and breeders seed increases, experimental varieties MF189, MF190, MF191, MF192, and MF197 were produced in isolated field plots in collaboration with the OMG Meadowfoam Oil Seed Growers Cooperative. The OMG assists the breeding project at OSU to identify growers' fields for seed increases and to refine selection criteria to meet grower and end-user needs and priorities. OSU scientists present research findings at the annual OMG meeting and participate in OMG field days. New crop cultivars and bioproducts developed through this project are made available through the OMG network for rapid dissemination and adoption by growers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Improved plant and animal breeding for improved or novel attributes and for human health benefits, including fertility, health, productivity

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The mechanisms of hormonal regulation of seed dormancy and germinaiton have been analyzed, using genetic, genomic, molecular, and biochemical techniques. A positive feedback mechanism in the abscisic acid pathway was discovered from Arabidopsis seeds.

What has been done
The results from the Arabidopsis experiments are being replicated for several wheat varieties and dependent upon available funding, may be expanded to other problematic cereal grains.

Results
The foundationn of the technology, which prevents precocious germination, such as preharvest sprouting (PHS) in wheat, was established. This technology has potential to be applied to many crop species. Wheat growers suffering from PHS issues will benefit from this technology when it is transferred to wheat.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
502	New and Improved Food Products

601 Economics of Agricultural Production and Farm Management

Outcome #4

1. Outcome Measures

Develop optimum pest management by identifying factors affecting herbicide activity, registering herbicides, controlling weeds in organic and no-till production; learning basic pest biology, registering new pesticides, finding application rates, and identifying risks associated with a pest as it becomes established

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Tan spot of wheat is a serious disease of world-wide, economic importance caused by the fungus, Pyrenophora tritici-repentis. Yield losses up to 50% have been reported in the US and Canada. Increases in disease incidence are due to changes in cultural practices including, shorter rotations and continuous wheat cultivation, growth of highly susceptible cultivars, and change from stubble burning to its retention. Pathogenicity (virulence) of this pathogen is dependent on the production of multiple, host selective toxins. As part of our ongoing effort to understand disease compatibility, and control tan spot of wheat, we are systematically characterizing the toxins produced by this pathogen and attempting to understand how they influence the host. Molecular evaluation of tan spot of wheat will not only provide outcomes that could be exploited for control of this wide-ranging and serious disease, but a disease interaction that also has the potential to become a "model"system for understanding virulence and disease susceptibility (compatibility).

What has been done
The experimental component for the microarray studies on genes expressed in ToxA- and mock-treated leaves has been completed. The quality of microarray data was analyzed using standard tools implemented in the Bioconductor packages simpleaffy and affyPLM. All microarrays were normalized together using RMA. Differentially expressed probesets were
identified using four methods: PaGE, SAM, LIMMA, and BRAT.For gene identification a new annotation for the Wheat GeneChip was obtained. The Wheat GeneChip probesets were re-annotated by aligning the probeset targets to current wheat cDNAs, transcript assemblies and

ESTs (http://plantta.tigr.org/) using BLAT. When available the annotations of the wheat sequences were retained. Otherwise the corresponding wheat sequences were mapped to their best match in the rice proteome (TIGR v5) using blastx. The descriptive and GO annotations of the best-matching rice protein were assigned to the wheat sequence (Manuscript in Preparation). Ptr ToxB experiments are in progress.

Results
Given that ToxA sensitivity is dependent on a single gene and that the product of this gene mediates toxin uptake, our results suggest that once internalized, the ToxA site-of-action is common to at least all wheat plants and likely common to all plants. This inference is supported by our previous findings that transient expression of ToxA in wheat leads to necrosis even in wheat genotypes that are not normally toxin-sensitive. Further, transient expression of ToxA in plants, which do not exhibit naturally occurring toxin sensitivity such as tobacco and barley also lead to necrosis. Thus, the internal site of ToxA action appears to be common to all plants. Using BSMV-induced gene silencing (VIGS), we have found that silencing of ToxABP1 leads to a severe chlorotic phenotype, partially recapitulating the effects of ToxA. Therefore, cumulative data strongly implicate that ToxA interacts with ToxABP1 and this interaction is biologically significant. Our current hypothesis is that ToxA interaction with ToxABP1 would disrupt PS II function leading to oxidative stress.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #5

1. Outcome Measures

Conduct economic studies to help Producer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2014 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Climate change researchers project that fall and winter rainfall will increase in the Pacific Northwest. These changes pose interesting management decisions for wheat farmers in the low rainfall regions of the Pacific Northwest.The general trend toward increased winter precipitation increases the possibility of successfully planting on an annual basis within the 12- to 18-inch precipitation zone. Some farms within this zone already successfully plant on an annual basis and are interested in adding diversity to their operations by adding peas or biofuel crops such as canola and camelina into their rotations.

What has been done

University research and Extension faculty, industry representatives, and agricultural lenders were consulted to obtain current loan and balance sheet information, along with expected future yields and prices for winter wheat, spring dry peas, winter canola, and camelina over a 10-year period. This information was inputted into the AgToolsTM software to conduct an economic assessment of the various cropping rotation options to determine how changes in input and output costs and changes in projected debt-to-asset ratios would impact the financial position of this representative farm in the future. Three alternative crop rotations were considered: winter wheat followed by dry peas, winter wheat followed by canola, and winter wheat followed by camelina. The cash flow was estimated for each of the owned and leased fields on the farm to project net income on the farm.

Results

From a profitability perspective, a continuous winter wheat and canola cropping system was the most profitable across all field types on the farm. The second most profitable system on the north and east fields was winter wheat and camelina, while winter wheat after dry peas fared slightly better on the leased south and west fields. Looking at the feasibility of each cropping system on a whole-farm basis, the winter wheat following canola cropping system generated higher net incomes, lower debt-to-asset ratio, and higher current ratios over the 10 years. Thus, the additional investment in machinery to switch to a continuous cropping system of winter wheat and canola would generate higher profits for this farm then their current practices.

As shown by this example, AgToolsTM provides a useful decision tool for growers. It allows them to better understand financial and planting options, as well as associated impacts to farm profitability under uncertain future climates, technologies, and prices.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
601	Economics of Agricultural Production and Farm Management
603	Market Economics

Outcome #6

1. Outcome Measures

Number of growers (commercial, small and fresh market) that adopt new varietals and methods to reduce yield losses and expenses, rejuvenate orchards, achieve better productivity and efficiency, provide environmental benefits (less fungicide applications, etc.), and effectively compete on the world market

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal of this project is to develop new weather forecasting decision support tools that can extend the forecast horizon used by agricultural producers in planning multiple management activities, especially those involving crops and pests, that are affected by the weather. Our specific objectives are to: 1. Develop, calibrate, and verify downscaled NOAA NWS 15, 30, and 90 day forecast anomaly grids as daily temperature and precipitation forecasts for multiple IPM and crop management modeling products. 2. Implement, extend, support, and validate the new medium- and extended-term forecasts to serve a variety of IPM challenges including for insects, plant diseases, and for invasive species pest event maps. 3. Document and evaluate adoption and usage of the forecast systems and provide opportunities for further integration into US IPM decision support modeling infrastructures.

What has been done
Much of the effort for this project involves data processing to convert NWS 8-14, 15-45, and 46-105 day forecast "outlook anomalies" (deviations from 30-year normals) into formats that can be used in a wide array of pest and crop models. First, we will perform statistical conversion from NWS outlook anomalies that are expressed as probabilities above or below normal into actual values of temperature and rainfall in degrees F. and inches rainfall. Second, we will blend, smooth and interpolate the forecasts for the three intervals into daily values. Our team of crop modeling, weather forecasting, mathematical, and statistical experts will devise and evaluate the procedures needed for the conversions. Two types are needed, "smoothed temperature" forecasts that look similar to adjusted 30-year normal data, and "realistic rainfall pattern" forecasts that are generally produced by weather generator programs used to drive crop growth models. We will perform calibration and rescaling exercise to produce the proposed data types, and verify

that these two approaches work as intended using archival forecast and weather data, and will document error rates as forecast skill, difference from forecast vs. observed degree-day (temperature heat unit) accumulations, and days prediction error for selected agricultural pest events such as first adult emergence. We will use geographic information systems (GIS) analysis and PRISM climate maps to spatialize the forecasts to a high spatial resolution of ca. 800 meters for the full continental US. These extended forecasts will then be matched to all available public weather stations (at least 16,000 stations in U.S. at last count), for virtual weather station locations (which use interpolated data to create virtual weather stations) and be available as GIS data grids for degree-day mapping needs.

Results
Outcomes are anticipated to include greater adoption of best management practices including temperature and moisture-driven models for agricultural decision making, more informed data-driven pest management decisions, a greater understanding and acceptance of extended-range weather forecasts as impacted by climate change, greater understanding of how the weather drives pest activities, leading to more informed consideration of risks and trade-offs of multiple pest control tactics, and a more strategic approach to farm management. This should also include less reliance on calendar-based management practices and more sustainable production practices, and more efficient timing of pest control measures.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Number that adopt conservation strategies and practices

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Number in improved agricultural and fisheries/aquaculture sectors, e.g., commodities

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

Number of policy makers and other stakeholders that are better informed about plant or animal production methods, technologies, and mnanagement techniques.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Special interest groups are increasingly focusing on policy regarding plant and animal production systems. This often leads to adversarial policies that limit the use of conventional or newly developed technologies that can improve production systems. This project seeks to provide better information to special interests and policy makers about these systems.

What has been done
This project is still in the development phase and preliminary results are expected next year.

Results
Nothing to report

4. Associated Knowledge Areas

KA Code	Knowledge Area

102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
121	Management of Range Resources
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
311	Animal Diseases
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics

Outcome #10

1. Outcome Measures

Improved knowledge of consumer and market conditions and factors that affect business survival and competitiveness such as market conditions, process map, business management, types of consumers and their food choices, motivations for food choice, marketing approaches for local markets and community food systems

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The proposed research will addresses organic blackberry production in the northwestern and southern USA (represent 91% of US acreage). There is a strong, emerging market for fresh and processed organic blackberry fruit, yet a lack of information on.suitable organic production systems. Growers interested in the processed blackberry market have questions as to whether labor-saving machine harvesting technology can be used in organic systems when even beneficial insects could be harvest contaminants. Machine-harvested fruit are thought to be of more uniform ripeness and of better sensory quality than hand harvested fruit, although this has not been proven. Little is known about the impact of cultivar response to organic production systems on nutritive/phytochemical value of fresh or processed fruit. Enterprise budgets are needed to determine whether best organic blackberry production systems are economically sustainable.

What has been done

Collected a fourth year of data on the impact of weed management and cultivar on plant growth and production in organic blackberry, machine-harvested for processing.Two processing cultivars and two fresh market cultivars were studied at a grower collaborator site. There was little impact of fertilizer source on yield or fruit quality over the two-year study.Sensory analysis on flavor intensity of six different descriptors by an experienced panel was performed on 'Black Diamond' berries harvested during the 2013 season. The effect of three different weed management strategies, non-weeding, hand weeding, and weed mat, were examined.

Results

Total cumulative costs, including materials and installation (weed mat) over the 5 years were $3,302/ha for weed mat, $3,231/ha for hand-weeded, and $370/ha for non-weeded. Despite the relatively low cost of the non-weededmanagement strategy, low yield significantly reduced the net returns (gross fruit sales - weed management costs) of this production system. The hand-weeded and weed mat management strategies increased net returns by 40% and 71% compared to non-weeded, respectively. Weed mat had a cumulative net return 22% greater than that of the hand-weeded.There was little impact of fertilizer source on yield or fruit quality over the two-year study.Turning off irrigation after harvest had no effect on yield in either cultivar but reduced water use by 67,000 gallons/acre.Weed management showed a marked effect on flavor intensity. The intensity of sensory attributes for 'Black Diamond' appear to possibly be inversely related to phenolic and anthocyanin content, with the weed mat management strategy resulting in the highest values for virtually all sensory attributes.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
204	Plant Product Quality and Utility (Preharvest)
206	Basic Plant Biology
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics

Outcome #11

1. Outcome Measures

Improved information about biology, control and resistance of viral, bacterial, fungal diseases, especially disease reproduction, transport and spread; postharvest decay; models to predict risk; and relationships between disease susceptibility and disease resistance

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
WE continued breeding of three market classes of winter wheat, soft white, hard white and hard red winter wheat. The team identified four hard white breeding lines with commercial grade quality for potential release in 2015 and 2016. These classes were also evaluated for fire blight resistance.

What has been done
The first hard red winter wheat breeding lines were advanced into elite nursery evaluation and we Initiated transfer of resistance to BYDV and sbWMV into soft white winter, hard white winter and hard red winter wheat backgrounds. Initiated graduate research project on using an over-expressing glutenin allele to produce good bread quality hard winter wheat with sub-optimum grain protein

Results
Research on a recombinant inbred line population identified QTLs associated with stripe rust and Cephalosporium stripe resistance and identified an epistatic OTL that modified expression of stripe rust resistance genes in some genetic background. We are conducting experiments to evaluate if progeny of Cotoneaster resulting from susceptible x resistant crosses exhibit fire bight resistance. These same progeny are triploids and will be evaluated for fertility.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources

204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
502	New and Improved Food Products

Outcome #12

1. Outcome Measures

Produce the next generation of growers and agricultural eduactors by integrating agricultural education into high school curriculums and community education

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Motivated students are needed to replenish the rapidly aging agricultural demographics as well as to position American agriculture as a sustainable, worldwide leader. Research related to student engagement has the potential to increase the success and retention of agriculture students, resulting in a larger, more diverse and educated workforce. Very little research
exists that examines the motivational and engagement variables in the context of agriculture. The purpose of this research project is to carefully examine the influences on college student motivation and identify ways to improve or impact student motivation and engagement.

What has been done
The program goals, broadly defined, are to: (1) Identify needs areas in relation to the motivation and engagement of college of
agriculture students, and (2) Develop strategies to improve student motivation and engagement in college of agriculture
students. The Program Objectives for the upcoming project period are to: 1) Identify the current levels of motivation in
selected college of agriculture students; 2) Analyze student motivation (self-efficacy, task value and autonomy) in relation to
learner-centered teaching approaches; 3) Develop programs and coursework which have the

ability to impact and improve
student motivation and engagement; AND 4) Identify exemplary methodologies for increasing student engagement through
qualitative and quantitative assessment of teachers.

Results
Specific to goal 1, a national assessement of faculty involved in agricultural leadership education was conducted to determine the size and scope of agricultural leadership education. The results have been accepted for publication in the Journal of Leadership Studies and will be published in 2014. Specific to goal 2, a research study regarding undergraduate student motivation was conducted and the results published in the journal of the North American Colleges and Teachers of Agriculture.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
903	Communication, Education, and Information Delivery

Outcome #13

1. Outcome Measures

Number whose consumer business knowledge leads to improved opportunities, and more successful starts, activity, survival, and profitability in food enterprises, as well as new and improved value-added products

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Consumer tests are utilized by medium and large food companies to evaluate new products or test new product formulations on potential buyers. The typical objective is to examine various sensory attributes for liking and to examine whether adjustable product attributes such as saltiness, sweetness and texture are "Just About Right" or need reformulation, but packaging,

message, and purchase intent questions can be incorporated or emphasized to evaluate the market. These pieces of information may help a company market its product to retailers or distributors by proof of liking or willingness to purchase. However, though this information is perhaps needed even more by those interested in starting-up a food company. A consumer test could help avoid serious losses in launching a product that consumers either don't like sufficiently or which will require a price which consumers aren't willing to pay. A consumer test can also help discover if small adjustments in formulation are needed. Properly executed such a study can also provide evidence to start marketing to retailers or look for financing. Unfortunately the costs of a professionally executed test can be prohibitive.

What has been done
A self-executed consumer test protocol for food entrepreneurs has been designed and is undergoing testing in Portland, Oregon. The key elements of the protocol are a template and instructions for development and execution of a survey, and a spreadsheet which automatically produces useful tables and charts from the survey data. The protocol was developed to allow entrepreneurs to evaluate their product and its market potential on a small, local scale.

Results
The survey protocol has been beta-tested at a craft market and three farmers markets with four different products. These beta testers all have recently started their small, local business with limited funds. Three have sold their products in farmers markets and at a small number of local retailers. One was still in product formulation stage. Further beta tests are expected to take place at a grocery store and at a restaurant. The protocol is expected to completed and available at the end of 2015.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
603	Market Economics

Outcome #14

1. Outcome Measures

Improved animal health

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Weaned beef calf performance is believed to be influenced by the availability of selenium.Our goal was to test whether feeding Se-fertilized forage increases WB-Se concentrations and performance in weaned beef calves. A second goal was to test whether beef calves fed Se-enriched alfalfa hay during the transition period between weaning and movement to a feedlot also have improved immune responses and slaughter weights.

What has been done
Recently weaned beef calves (n = 60) were blocked by body weight, randomly assigned to 4 groups, and fed an alfalfa hay based diet for 7 wk, which was harvested from fields fertilized with sodium-selenate at a rate of 0, 22.5, 45.0, or 89.9 g Se/ha.Blood samples were collected weekly and analyzed for WB-Se concentrations. Body weight and health status of calves were monitored during the 7-wk feeding trial. Increasing application rates of Se fertilizer resulted in increased alfalfa hay Se content for that cutting of alfalfa (0.07, 0.95, 1.55, 3.26 mg Se/kg dry matter for Se application rates of 0, 22.5, 45.0, or 89.9 g Se/ha, respectively).

Results
Feeding Se-fertilized alfalfa hay during the 7-wk preconditioning period increased WB-Se concentrations (PLinear < 0.001) and body weights (PLinear = 0.002) depending upon the Se-application rate. Based upon our results we suggest that soil-Se fertilization is a potential management tool to improve Se-status and performance in weaned calves in areas with low soil-Se concentrations.Calves fed the highest versus the lowest level of Se-enriched alfalfa hay had higher antibody titers (P = 0.02), thioredoxin reductase-2 mRNA levels (P = 0.07), and a greater neutrophil total antioxidant potential (P = 0.10), whereas mRNA levels of interleukin-8 receptor (P = 0.02), L-selectin (P = 0.07), and thioredoxin reductase-1 (P = 0.07) were lower. In the feedlot, calves previously fed the highest-Se forage had lower mortality (P = 0.04) and greater slaughter weights (P = 0.02). Our results suggest that in areas with low-forage Se concentrations, feeding beef calves Se-enriched alfalfa hay during the weaning transition period improves vaccination responses and subsequent growth and survival in the feedlot.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
311	Animal Diseases
502	New and Improved Food Products
601	Economics of Agricultural Production and Farm Management
903	Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

High throughput technologies for genotyping organisms such as plants and their pests and pathogens have dramatically accelerated in their power over the last two decades. This has been especially true for DNA sequencing and DNA-based genotyping methodologies. The cost of sequencing has dropped 10,000-fold over the last ten years as second generation and third generation technologies have been introduced and have matured. The rapidly decreasing cost of sequencing is increasing the feasibility of whole genome sequencing and genotyping-by-sequencing (GBS). For example OSU participants in this project have used these tools for sequencing the Fragaria (Shulaev et al., 2011) and Brachypodium (Fox et al., 2013) genomes and detecting SNPs via restriction fragment amplification digests (RADs) in barley (Chutimanitsakun et al., 2011). In species with smaller genomes, larger numbers of individuals can now be genotyped by whole genome sequencing, providing access to millions of SNPs. For larger genomes and population sizes, reduced complexity sequencing can be used. These approaches are being used by OSU participants in two NIFA CAP projects (RosBREED and Triticeae CAP). A fourth generation of emerging sequencing technologies has the potential to drive costs down another 10-100-fold over the next five years.

Advances in genetic technology facilitate identification of genes determining the complex traits that will be targeted by breeding programs and allied research groups in addressing the challenges identified by this project. Candidate genes can be identified via genome wide association scanning (GWAS) and map-based cloning with reference to whole genome sequences. OSU researchers, for example, have identified candidate genes for low temperature tolerance QTLs in barley (vonZitzewitz et al., 2011) and eastern filbert blight resistance in hazelnut (Mehlenbacher et al., 2011). When coupled with the ever-expanding toolkit of analysis procedures, genomics resources allow for deeper mining of the phenotype data sets routinely generated by plant breeding programs and for the

exploitation of high throughput phenotyping systems. As a consequence, molecular breeding strategies - such as marker-assisted selection (MAS) and genomic selection (GS) - are currently feasible in a range of economically important plants and are being used by OSU participants in this project. The OSU Center for Genome Research and Biocomputing (CGRB) plays a central enabling role in providing access to technology and analysis. For example, the CGRB is currently implementing a GBS pipeline that will play a central role in multiple GS projects.

Key Items of Evaluation

In the coming years, agricultural research, extension and education will need to address the "constraints of a growing population, pressure on natural resources, and the challenges of climate variability and change...to increase agricultural and natural resource sustainability" as pointed out in the Agriculture and Food Research Institute (AFRI) Fiscal Year 13 Request for Applications in Food Security. There are many issues to address and resolve, including the uncertainties on the magnitude of climate change, the effects of technological changes on productivity, global food demands, and the numerous possibilities of new crops and new production areas for existing crops. Climate change is expected to lead to a net warming of the planet and increased volatility in temperature, moisture, and weather events. These factors will exacerbate the demands of food systems due to decreases in potential yields likely caused by shortening of the growing period, an overall decrease in water availability and changes in temperature-dependent physiological processes. Other challenges for agricultural research to address include:

- Achieving greater efficiencies in terms of water and nutrient usage
- Improving durable resistance to new pathogens and new strains of existing pathogens
- Improving resistance to abiotic stresses, including temperature, moisture, and salinity
- Developing maximum flexibility in cropping systems in response to changing patterns of land use and availability

The diversity of crops, environments and microclimates of Oregon and the Pacific Northwest afford our faculty and the Experiment Station the opportunity to investigate the challenges of crops important to both in Oregon and the world. Climate change is expected to provide additional diversity. Even in this increasingly complex scenario, there are unifying themes across the state, from the high rainfall valleys of the west to the deserts of the east. This "state-as-laboratory" provides an excellent model for integrating research targeting complex stresses. For example, on the west side more than 70 specialty crops have an annual farm-gate value of about $3 billion. Much of the east side winter wheat crop is dependent on stored soil moisture. Both cropping systems share challenges in terms of such fundamental processes as germination, growth and development, and seed biology. In turn, each of these biological phenomena can be addressed using fundamental research and breeding tools enabled by the CGRB.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Food Safety

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
204	Plant Product Quality and Utility (Preharvest)	0%		5%	
306	Environmental Stress in Animals	0%		5%	
308	Improved Animal Products (Before Harvest)	0%		5%	
311	Animal Diseases	0%		10%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals	0%		10%	
501	New and Improved Food Processing Technologies	0%		5%	
502	New and Improved Food Products	0%		5%	
701	Nutrient Composition of Food	21%		10%	
702	Requirements and Function of Nutrients and Other Food Components	0%		10%	
703	Nutrition Education and Behavior	22%		10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources	0%		5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		10%	
723	Hazards to Human Health and Safety	26%		10%	
724	Healthy Lifestyle	26%		0%	
903	Communication, Education, and Information Delivery	5%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	6.0	0.0	40.0	0.0
Actual Paid	7.7	0.0	10.0	0.0
Actual Volunteer	225.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
175442	0	538874	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
175442	0	3463658	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
342143	0	3376198	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

This program will result in multiple outputs as a result of the following proposed activities:

- Conducting laboratory, pilot-plant experiments and data collection
- Conducting research experiments
- Developing quality monitoring protocols
- Developing and applying new technology of food processing systems
- Developing products, curriculum, resources
- Developing services
- Presenting seminars and professional talks
- Conducting workshops and training sessions
- Publishing scientific findings
- Partnering
- Providing community education classes
- Maintaining a statewide food safety hotline
- Working with and supervising volunteers to deliver high quality information and programming about food safety topics

2. Brief description of the target audience

There are diverse audiences for information this program generates. They can be classified into five general groups: (1) the general public and food consumers; (2) state and federal food regulatory agencies; (3) the research community including scientists working in government, industry, and academic sectors; (4) the commercial food processing industry and commodity groups; and (5) professional food handlers in organizations such as schools and other institutions, as well as restaurants.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	3997	2167	1959	3262

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

Patent Applications Submitted

Year:	2014
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	2	40	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Conference Presentations

Year	Actual
2014	39

Output #2

Output Measure

- Number of Courses Developed that include the Planned Program and State Defined Outcomes as part of the curriculum

Year	Actual

2014 4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Understand nutritional relationships to health, such as * mechanisms behind the health benefits of fruits and vegetables * novel dietary modifications to reduce the incidence of prostate cancer * role of antioxidants from berries in preventing health disease
2	Improve animal food production systems that impact food safety * improve diets to produce safer foods and human benefits * enhance efficacy and safety of vaccination programs * develop diagnostic methods
3	Characterize and model pathogens and toxins in food and food systems * agents, mechanisms * toxicity to animals or humans * mechanisms behind immune suppression
4	Improved food handling and regulations * food production and handling practices. * Intervention strategies reduce bacterial contamination, increase shelf life, and reduce occurrences of food-borne illnesses.
5	Improved animal husbandry that reduced food safety issues
6	Number of specialty food and mainstream food processors accessing and applying science based information to produce and distribute safe, nutritious, high-quality foods.
7	Number of individuals improving their practices of safe food handling, food preparation, and food preservation.
8	Develop technologies and control strategies to improve food safety
9	Detect incidences and trace pathways of food borne illnesses
10	Number of policy makers and managers informed about safe food handling and processing

Outcome #1

1. Outcome Measures

Understand nutritional relationships to health, such as * mechanisms behind the health benefits of fruits and vegetables * novel dietary modifications to reduce the incidence of prostate cancer * role of antioxidants from berries in preventing health disease

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research shows vitamin B1, also known as thiamine, can boost the immune system of plants, including rice, cucumbers and tobacco. OSU's researchers are hoping that sustained accumulation of thiamine can make rice immune to bacterial leaf blight and rice blast, which cause significant yield losses in Southeast Asia, the world?s top rice-growing region.The results of this research will also see if the rice grain itself contains more thiamine, which is present only in low amounts in white rice. In areas of the world where white rice is the cornerstone of most diets, thiamine deficiencies are common. Thiamine helps create acids for digestion, supports carbohydrate metabolism and is essential for the overall health of the nervous system.

What has been done
Greenhouse work has begun to produce rice crosses with higher levels of B1 and additional breeding work will continue through 2015 to create new varietals with resistance to leaf blight and rice blast.

Results
Preliminary results from this research is expected to be available in 2016.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
502	New and Improved Food Products

701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Improve animal food production systems that impact food safety * improve diets to produce safer foods and human benefits * enhance efficacy and safety of vaccination programs * develop diagnostic methods

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Enterotoxin-producing Clostridium perfringens isolates have been associated with C. perfringens type A food poisoning, which currently ranks as the third most commonly reported food-borne illness in the USA. C. perfringens type A food poisoning is acquired when people consume a food (typically a beef or poultry product) contaminated with large numbers of vegetative cells of enterotoxigenic C. perfringens type A isolates. This single food poisoning affects more than 250,000 humans annually, and result in economical losses of over $120 million in the USA. C. perfringens also associated with gastrointestinal diseases in various species of animals. C. perfringens has the ability to form metabolically dormant spores that are extremely resistant to environmental stresses such as heat, radiation and toxic chemicals. However, to cause deleterious effects, dormant spores must first go through germination then outgrowth to be converted to vegetative cells. Although spore germination is a very crucial step for the pathogenesis of C. perfringens, no detail understanding of the mechanism of C. perfringens spore germination is available. Moreover, there are gaps on the fundamental knowledge on inactivation of C. perfringens spores using mild treatments such as, heat and disinfectants.

What has been done
(1) Mechanism of Spore Germination: We performed a study to identify and characterize amino

acid germinants for spores of enterotoxigenic C. perfringens type A. One publication appeared from this study as:
Udompijitkul P, Alnoman M, Banawas S, Paredes-Sabja D, Sarker MR. 2014. New Amino Acid Germinants for Spores of the Enterotoxigenic Clostridium perfringens Type A Isolates. Food Microbiology, 44:24-33.
(2) Spore inactivation: In a process of developing spore inactivation strategy, we evaluated the inhibitory effects of organic acid salts, sorbate and benzoate, against C. perfringens type A food poisoning (FP) and non-food-borne (NFB) disease isolates. The results are submitted for publication to Food Microbiology journal and the manuscript is currently under second revision. The title and the abstract of the manuscript are given below:
Maryam Alnoman, Pathima Udompijitkul, Daniel Paredes-Sabja, and Mahfuzur R. Sarker. 2015. The Inhibitory Effects of Sorbate and Benzoate Against Clostridium perfringens Type A Isolates. Food Microbiology. Under revision.

Results
The first step of germination is the binding of germinants to their cognate GRs. Identification of GerKC is the main GR protein for germination of spores of FP strain SM101 with L-cysteine, L-glutamine, and L-asparagine makes this protein of interest for development of inhibitors, since such compounds would block spore germination and thus the ability of spores to cause disease. Germination also makes the now fully germinated spores much less resistant to common decontamination procedures. Consequently, a drug that could rapidly activate spore germination would also be useful, as this would allow decontamination of germinated C. perfringens spores under less harsh conditions than needed for destruction of the more resistant dormant spores.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #3

1. Outcome Measures

Characterize and model pathogens and toxins in food and food systems * agents, mechanisms * toxicity to animals or humans * mechanisms behind immune suppression

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cyprinid herpesvirus 3, or koi herpesvirus (KHV), is a deadly virus that affects koi and carp worldwide. It causes severe gill necrosis and nephritis, dermal ulceration , hemorrhage, and mass mortality of up to 100% of affected fish. Fish that survive KHV infection are latently infected lifelong carriers. Little is known about the molecular mechanisms and control of latency of KHV. Our previous studies have identified ORF6 mRNA is present during latent infection

What has been done
In this study, the expression of a protein from ORF6 mRNA was investigated by a polyclonal antibody specific to a synthetic peptide derived from predicted ORF6 protein (anti-ORF6). By immune fluoresces assay (IFA), positive staining to the anti-ORF6 were observed in both KHV infected CCB cells in vitro and IgM+ B cells from koi latently infected with KHV. No IFA staining was observed in uninfected CCB cell and IgM- B cells from koi latently infected with KHV. The ORF6 protein expressed during productive infection was found to be around 140 KDa, which is bigger than the predicted protein, ~80 KDa. The ORF6 protein at similar size as the predicted protein can be produced in an expression vector of pet6XHN in E Coli. Based on software GPS-SUMO analysis, 5 potential sumoylation sites were identified in the ORF6 proteins. Our study demonstrated that ORF6 protein is expressed during latency and may be sumoylated in infected cells.

Results
This is the first demonstration that a member of the Alloherpesviridae, cyprinid herpesvirus 3 (CyHV-3), express a viral protein, ORF6 protein, during latency. The protein appears to be around 140 kDa in molecular mass and may be sumoylated or modified post-transnationally. ORF6 protein has homology to a conserved domain of EBNA-3B from Epstein Barr Virus and ICP4 from Herpes simplex virus 1, which are genes important for latency. Our results suggest that ORF6 protein may have a potential regulating role in KHV latency

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other

	Hazards Affecting Animals
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #4

1. Outcome Measures

Improved food handling and regulations * food production and handling practices. * Intervention strategies reduce bacterial contamination, increase shelf life, and reduce occurrences of food-borne illnesses.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In 1996, the USDA began an ambitious program to replace a generation of highly toxic pesticides with less environmentally harsh alternatives. Terminating the use of potent broad-spectrum pesticides would be safer for people but tough for business. Developing, manufacturing, and registering pesticides targeted to a specific crop is expensive work required by U.S. law. Therefore, companies often choose to focus on major crops. But in the language of industry, all but a handful of Oregon?s 220 commercially grown crops are considered minor. Few pesticides are developed specifically for, say, turnips. So when turnip growers need a safe and effective product to control aphids, they turn to North Willamette researchers.

What has been done
Research on pesticide alternatives is being conducted at the IR-4 Field Research Center at NWREC, which is Oregon?s part of the Interregional Project No. 4, a federal program to help producers find pest management tools for minor crops. From pumpkins to hops, these minor crops are major contributors to Oregon?s economy. DeFrancesco provides the research required

by the Environmental Protection Agency to label pesticides for crops that are generally too limited in scale to be profitable for pesticide manufacturers to research on their own.

Results
The goal of the program is to provide growers with alternatives. IR-4 has helped register many of the Bt products organic growers rely on. Researchers assure growers and regulators that pest management should be thoughtful and integrated, using cultural and biological methods, in addition to the judicious use of chemicals. This work ensures safe, high-quality produce for consumers.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Improved animal husbandry that reduced food safety issues

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Traditional cattle feed mixtures of corn, grains, alfalfa hay and grass silage result in dairy products with low concentrations of omega-3 and other polyunsaturated fats. As meat consumption continues to increase, this study evaluated the use of flax seed as a feed supplement to increase omega-3 and poly-unsaturated fatty acids and reduce saturated fats.

What has been done
en pregnant cows at OSU's dairy were fed different amounts of flaxseed ? up to seven percent of their daily diet. Researchers attempted to pinpoint the amount of flaxseed that would maximize the amount of omega-3 in milk and dairy products without negatively affecting their production and texture.Collaborators in OSU's food science and technology department assisted in turning milk into butter and fresh cheese, which were then tested for texture and nutritional composition.

Results
The study found that feeding cows up to six pounds of extruded flaxseed improved the fat profile without negatively affecting the production and texture of the milk and other dairy products. Extrusion presses raw ground flaxseed into pellets with heat.

At six pounds per day, saturated fatty acids in whole milk fat dropped 18 percent, poly-unsaturated fatty acids increased 82 percent, and omega-3 levels rose 70 percent compared to feeding no flaxseed. Similar improvements were observed in butter and cheese.

Still, saturated fat accounted for more than half of the fatty acids in the dairy products while the increase in polyunsaturated fats compromised no more than nearly nine percent of the total.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
724	Healthy Lifestyle

Outcome #6

1. Outcome Measures

Number of specialty food and mainstream food processors accessing and applying science based information to produce and distribute safe, nutritious, high-quality foods.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Workers at Oregon?s nurseries are on the front line in making sure their plants are healthy. But some don?t speak English, have limited education, and don?t have formal training in horticulture. So if they come across an infected plant, they might not be able to diagnose the cause or understand why it?s important to tell their supervisor so any potential spread of disease can be curtailed. If action isn?t taken, sick plants can mean lost income for nurseries.

What has been done
In classes offered primarily in Spanish, nursery workers are taught how to prevent the introduction and spread of diseases and pests. Researchers tour greenhouses and fields with employees, pointing out potentially problematic areas. The researcher and employees then develop a list of best practices. For example, workers learn not to overwater to prevent Phytophthora and Pythium water molds. Workers are advised to space plants out so air can circulate and dry any water on the leaves. The researcher also encourages them to water in the morning when it?s cooler, so dangerous spores don?t germinate. Additionally, the workers are taught to sanitize their tools, like clippers, which can transmit microorganisms from one plant to another. Employees also learn about the importance of disinfecting pots before reusing them, and why reusing untreated water could spread diseases.

Results
Since starting these workshops in 2010, researchers have trained more than 340 people from 24 businesses. About 40 of these employees were from two Christmas tree farms. They learned to scout for and address problems like root rot, aphids, and fungi. Researcher Santamaria shared with them a bilingual pocket guide that she co-authored called ?Identifying and Managing Christmas Tree Diseases, Pests, and Other Disorders.?

The research has also helped berry growers prevent outbreaks of foodborne illnesses. Through workshops in Spanish and English, more than 300 contractors, farm owners, and managers have been trained on how to teach their own fieldworkers about preventing contamination during the harvest season. The trainings were in response to a 2011 outbreak of E. coli caused by deer droppings on an Oregon strawberry farm. Seven people were hospitalized and an elderly woman died.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
501	New and Improved Food Processing Technologies

502	New and Improved Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Number of individuals improving their practices of safe food handling, food preparation, and food preservation.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The implementation of the Food Safety and Modernization Act (FSMA) will have a major impact on agriculture, especially small farms throughout the U.S. It requires new harvest and post-harvest handling practices and record keeping that minimize the risk of food-borne disease hazards. Small farms are artisanal in nature, have 1-5 employees and lack the capital (human and financial) to adopt such a system on their own. A critical need exists for development of a cost effective and simple-to-implement Food Traceability System (FTS) for small producers and processors

What has been done
Researchers organized and participated in a Pesticide Risk Assessment and Risk Reduction Workshop held in Algiers, Algeria, December 15-18, 2013. The workshop was sponsored by the Foreign Agricultural Service (FAS) of the United States Department of Agriculture (USDA), with funding support from the United States Department of State. Its purpose was to provide and opportunity for countries in the region (Algeria, Egypt, Jordan, Morocco, Tunisia, and Yemen) to better understand the risk assessment processes being followed in the region, as well as the process used in the United States; a major focus of the workshop was pesticide regulation to

meet international trade, food safety and security goals.
Researchers held workshops in 3 Oregon locations with stakeholders (growers and processors) to explain and discuss new FDA FSMA proposed Rules. Held organizational meetings with internal and external stakeholders to leverage funding for activities to support our ongoing work. Training was provided to the food industry through workshops on HACCP as well as the better process control school. Held workshop to cover the changes and amendments to the FDA Food Safety and Modernization Act.

Participated as an instructor in workshops aimed at teaching good aquaculture practices, good fishing vessel practices and seafood safety practices, the latter being required by FDA regulation, to an international processors and government inspectors in Indonesia and Ecuador. A specific segment in both workshops is focused on issues with traceability. Work directly benefits attendees as they obtain certification for the instruction they receive that is recognized by FDA. Work indirectly benefits FDA by helping to reduce seafood safety hazards imported into the country. It also indirectly benefits US consumers since 90% of all seafood consumed in the US is imported. Work in this area has directly benefited the faculty in better understanding how product is produced and processed at international sites, which aides in understanding issues with traceability and understanding CTEs and KDEs.

Results
Producers, food processors, workers, and consumers are becoming better informed about food safety and traceability and compliance is greatly improved. The program will be expanded further next year across Oregon and in several foreign countries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #8

1. Outcome Measures

Develop technologies and control strategies to improve food safety

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pacific Northwest growers of tall fescue and perennial ryegrass straw provide an important source of forage for livestock producers in the Far East and Middle East.Fescue toxicosis and perennial ryegrass staggers are two of the most common toxic plant diseases plaguing livestock in the United States, and result from consumption of forage containing the endophyte-produced mycotoxins ergovaline and lysergic acid (fescue toxicosis) and lolitrem B (ryegrass staggers). It is estimated that the toxicological effects of ergot and lolitrem alkaloids cost between $0.5 and $1 billion in livestock losses annually in the United States alone.

What has been done
Work has progressed on understanding how these mycotoxins elicit clinical signs which impact livestock production including decreased weight gain and diminished reproductive performance. In addition, we have begun delineating the metabolism of these toxins in animals so that a better risk assessment can be conducted which evaluates the presence of these toxins and their metabolites in by-products available for human consumption. Research on these toxins is warranted, as the possible impact of bioaccumulation of these toxins under varying exposure conditions on both toxicity and as residues in food products has not been thoroughly investigated and could affect the manner by which these compounds are regulated.

Results
This past year the industry shipped over 33,000 containers for a total of $350M. Since these tests to insure safe feed started in 2000, the number of clinical cases of endophyte disease seen in Japan has dropped from 54,000 cases in 2000 to zero cases over the past four years.
infected perennial ryegrass (Lolium perenne) with high levels of lolitrem B. HPLC-fluorescent analytical methods for these mycotoxins are described and were used to determine threshold levels of toxicity for ergovaline and lolitrem B in cattle, sheep, horses, and camels. In addition, six

clinical cases in cattle are presented to illustrate diagnosis of these three diseases. Our experiment confirmed that lolitrem B is not secreted in bovine urine, and that lysergic acid can be detected in bovine urine in a dose-dependent manner. The tendency for lysergic acid to be excreted in aqueous matrices raises concerns for human consumption of milk products from exposed animals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #9

1. Outcome Measures

Detect incidences and trace pathways of food borne illnesses

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
While traditional food safety methods rely mostly on chemical preservatives to combat disease microbes, OSU researchers are searching for natural ingredients that do the same thing. These

approaches are revolutionizing the food industry by providing alternative uses for foods while cutting production costs.

What has been done
Research has been directed at using a series of obstacles that will cumulatively wear down microbes without using chemicals and without affecting the quality of the food product. Simple treatments such as heating slightly or decreasing moisture content can stress microbes and inhibit their growth. Natural antimicrobials can provide a final blow.

Results
Research has focused on a group of bacterial proteins, called bacteriocins, that have the ability to destroy bacteria. One well-studied bacteriocin called nisin attacks bacteria that can cause deadly outbreaks of food poisoning, such as botulism and listeria. Searching for new uses, OSU researchers found that coating food processing equipment with nisin can help prevent microbial spoilage. They found that nisin, as well as an enzyme called lysozyme, which occurs naturally in egg whites, can function as effective natural preservatives in beer and wine.

Electrolyzed water has been discovered as a powerful antimicrobial agent for fresh vegetables and researchers have found that anything with strong sensory response is a likely candidate to have antimicrobial properties?spices, garlic, orange peels, even sauerkraut. And by using one kind of food to preserve another kind of food, this research circumvents the costly process of chemical development and testing. The cost of developing a food-based preservative, for example, can be one-tenth the cost of chemical additive development. And developing alternative uses for existing food products adds value with no extra cost.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
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
724	Healthy Lifestyle

Outcome #10

1. Outcome Measures

Number of policy makers and managers informed about safe food handling and processing

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Future lifestyles will emphasize maintaining health and preventing diseases that now limit human lifespan. As our understanding of the complex relationships between diet and health expands, markets will grow for safe, highly nutritious foods and for functional foods and biopharmaceuticals that have disease prevention and health promotion effects. Our existing strengths in areas such as biotechnology and genomics, agricultural production systems, food processing and food safety, environmental toxicology and agricultural marketing, trade, and economics position the Oregon Agricultural Experiment Station to further understand and develop the agriculture and food system in Oregon and the region. A combination of conventional, organic, and biotechnology-based approaches will provide an array of strategies for sustainable production of nutritionally enhanced crops and food. These agricultural and food products will ensure a range of marketing niches for producers while providing the consumer with robust choices within a safe and secure food system. Research will support producers and marketers in the production of certified organic and health-enhanced foods. Research will also provide analyses of health effects of agricultural and environmental chemicals as well as the use of foods and phytonutrients to maintain well-being. Expanded consumer education about the relationships of food, nutrition, and health will provide U.S. citizens with information for making individual choices among an array of foods and food products.

Key Items of Evaluation

This AFRI Challenge Area promotes and enhances the scientific discipline of food safety, with an overall aim of protecting consumers from microbial and chemical contaminants that may occur during all stages of the food chain, from production to consumption. This requires an understanding of the interdependencies of human, animal, and ecosystem health as it pertains to food-borne pathogens. The long-term outcome for this program is to reduce food-borne illnesses and deaths by improving the safety of the food supply, which will result in reduced impacts on public health and on our economy.
In 2014, Food Preservation programming was reported in 27 counties. There are 12 active Master Food Preserve/Family Food Education programs at this time. Most of those

encompass more than one county. 382 new and veteran MFP/FFE volunteers contributed over 25,524 hours of time in 21 counties, including: Central Oregon (Deschutes, Crook, Jefferson), Clackamas, Coos/Curry, Douglas, Hood River/Wasco, Jackson/Josephine, Klamath, Lane, Linn/Benton, Marion/Polk/Yamhill, Tillamook, Wallowa and Washington/Multnomah. They educated the public about safe food handling and preservation over the phone, at workshops, and at exhibits and demonstrations at sites such as farmers' markets and county fairs. Over 41,000 contacts were made by volunteers, faculty and Extension staff in throughout Oregon, with 3,041 of these from callers throughout Oregon receiving assistance from the Food Safety/Preservation Hotline. The Hotline is operated with volunteer assistance during the food preservation and holiday season. In addition, over 260,000 Oregonians were reached by our faculty and volunteers through radio and television broadcasts, social media sites, and newspaper articles related to food safety and food preservation topics.

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
610	Domestic Policy Analysis	8%		0%	
703	Nutrition Education and Behavior	42%		25%	
704	Nutrition and Hunger in the Population	4%		25%	
724	Healthy Lifestyle	11%		25%	
802	Human Development and Family Well-Being	6%		10%	
806	Youth Development	21%		15%	
901	Program and Project Design, and Statistics	4%		0%	
903	Communication, Education, and Information Delivery	4%		0%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2014	Extension		Research	
	1862	1890	1862	1890
Plan	6.0	0.0	3.0	0.0
Actual Paid	6.8	0.0	5.0	0.0
Actual Volunteer	417.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
136455	0	298591	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
136455	0	1943026	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
266112	0	620413	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

We will determine factors that drive the decisions of individuals and householders to adopt and maintain healthy lifestyle choices. Further, we will use a social-ecological framework to study how exposure and familiarity with more nutritional foods can increase incorporation of these foods into diets of various populations, as well as acceptability.

We will also:

• Conduct evidence-based educational programs and activities that are directed at parents, children, professionals, partner agencies, and other audiences.
• Develop or select new 4-H foods curricula that focus on the youth learning to prepare healthy, local foods.
• Develop a curriculum designed to help older youth become local advocates for healthy eating and physical activity in their communities. The curriculum will help young people learn how to conduct community assessments and lead community change efforts that focus on education, system building, and policy development.
• Develop research programs that can employ "learning by doing" approaches to allow parents and children to adopt healthy eating habits and promotion of exercise.

In summary, we will:
- Conduct surveys
- Conduct data analyses
- Conduct mixed-methods longitudinal research (interviews,
- Conduct Research Experiments
- Develop models
- Develop Products, Curriculum, Resources
- Provide Training.
- Assessments.
- Partnering
- Partnering.

2. Brief description of the target audience

- children, youth, and families across Oregon
- schools and others youth educators

- elderly residents
- urban and rural residents
- Latino populations
- economists.
- policy makers and agency personnel who work with children and families .

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2014	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	6248	6340	3267	8166

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

Patent Applications Submitted

Year: 2014

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2014	Extension	Research	Total
Actual	6	5	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

● Conference Presentations

Year	Actual
2014	18

Output #2

Output Measure

- Number of Courses Developed that include the Planned Program and State Defined Outcomes as part of the curriculum

Year	Actual
2014	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Conceptual model will guide research to understand the factors & processes that account for physical activity and the associated health outcomes among youth across ethnic and class boundaries in the context changing communities
2	Knowledge gained for developing strategies for maximizing physical activity and physical and mental health of youths and adults
3	Improved outreach, education, and professional practice in serving the needs of low-income families, including programmatic interventions that reduce the physical inactivity and promotes well-being of lower-income and ethnic minority youth across America
4	Develop understanding of human health and nutritional behaviors * obesity intervention strategies * bio-behavioral markers * key parent-child relationships * family interactions * peer interactions * personal choices
5	Improved nutrition * schools offer/encourage healthful foods * More effective programs and student experiences * Markers and strategies become the standards of methods and measurement of childhood overweight and resiliency.
6	Identify tactics, strategies and factors that provide families, children, and youth access to healthy foods
7	Children practice healthy eating as defined by the current U.S. Dietary Guidelines for Americans (Percent of target audience indicating positive change in measured outcome)
8	Children engage in healthy levels of physical activity as defined by national physical activity guildeines (Percent of target audience indicating positive change in measured outcome)
9	Increases in positive levels of Knowledge, Attittude, Skills and Aspiration (KASA) outcomes, as per Bennett & Rockwell, 1995, related to goals of reducing obesity (Percent of target audience indicating positive change in measured outcome)

Outcome #1

1. Outcome Measures

Conceptual model will guide research to understand the factors & processes that account for physical activity and the associated health outcomes among youth across ethnic and class boundaries in the context changing communities

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Weight management is difficult for most individuals, as indicated by the high levels of overweight and obesity seen in the United States (US) and around the world (5). Currently, approximately 66% of the US adult population is either overweight and/or obese, with ~34% being obese (1,3). Unfortunately, the obesity epidemic is not limited to adults. Currently 32% of children and youth between the ages 2 and 19 are above the 85% percentile for body mass index (BMI, kg/m2) for age (4). Obesity prevention involves maintenance of current body weight within a healthy body weight range and/or the prevention of further weight gain (e.g. maintaining energy balance: energy intake = energy expenditure). If the goal is to lose weight, the static energy balance approach no longer applies since weight is changing. In this situation, energy balance is a dynamic process (2) and changing one factor on the energy intake side also impacts the energy expenditure side even if there was intentional effort to do so. Thus, numerous factors are working together to influence each side of the energy balance equation, which ultimately determines body weight.

What has been done
The Oct, 2012 USDA, ACSM and AND Conference titled: Energy Balance at a Crossroads: Expert Panel Meeting has resulted in a publication in two organizational journals (Med Sci Sport Ex and J Academy of Nutrition and Dietetics), which will were published simultaneously in July, 2014. In addition, the PI is now chair of the Energy Balance Work Group (ACSM, USDA, AND) and they have a number of initatives that have come out of this meeting, which are moving forward including identifying physical activity experts for USDA to help with obesity prevention, joint credentially between ACSM and AND for professionals, survey of professinoals in both fields to see what each tells clients regarding nutrition/PA. A push toward educating public school teachers about energy balance and the importance of nutrition and PA for obesity prevention.

Results

. We have completed an intervention examining the effect of two different levels of exercise on appetite, both objective and subjective assessments. We asked people to rate their level of hunger/appetite before and for designated times up to 24-h after each exercise. We also collected blood samples to measure gut appetite hormones to determine if these hormones changes before and over 60 minutes post exercise. Data have been collected and we are now in the process of analyzing data in conjunction with faculty at the U of Wyoming.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
802	Human Development and Family Well-Being
806	Youth Development
903	Communication, Education, and Information Delivery

Outcome #2

1. Outcome Measures

Knowledge gained for developing strategies for maximizing physical activity and physical and mental health of youths and adults

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

According to a new study, there is no direct link between parents' own level of physical activity, and how much their child may exercise. In fact, parents' perceptions of their children's athleticism are what have a direct impact on the children's activity.

What has been done

The study by Oregon State University researchers , published in the journal Preventive Medicine, studied 268 children ages 2 to 5 in early childhood education center. Of these children, 156 parents or caregivers were surveyed on their parental practices, behaviors related to physical activity and demographic information.

The study suggests that parents' level of physical activity is not directly associated with their children, but instead that the direct link was between parental support and a child's level of physical activity.

Active parents were more likely to have active children because they encourage that behavior through the use of support systems and opportunities for physical activity. Conversely, there was no statistical evidence that a child is active simply because they see that their parents exercise.

Results
The study found that parents who think their children have some sort of athletic ability were much more likely than other parents to provide instrumental and emotional support for young children to be physically active. The results underscore the need for parents to provide emotional support, as well as opportunities for activity. Regardless of whether a child is athletic or is perceived to be physically gifted, all children need opportunities and encouragement of physical activity. Parental support of physical activity did not translate to a child's behavior once they were not in the home and were in a childcare setting. This adds to the body of research showing that both parents as well as childcare providers must provide support for physical activity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
703	Nutrition Education and Behavior
724	Healthy Lifestyle
802	Human Development and Family Well-Being
806	Youth Development

Outcome #3

1. Outcome Measures

Improved outreach, education, and professional practice in serving the needs of low-income families, including programmatic interventions that reduce the physical inactivity and promotes well-being of lower-income and ethnic minority youth across America

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
OSU researchers are working to establish youth gardens with the goal of increasing sustainability of fruit/vegetable intakes in low-income communities while also teaching youth how to garden and sell their products in the market place. Fruits/vegetables are low energy dense foods that are high in fiber, water and nutrients, and can help improve overall health and help maintain a healthy weight.

What has been done
The goal of this project was to bring together low-income youth transitioning to adulthood, members of faith-based communities in two Oregon towns, and university researchers, in a project designed to:

1) provide training, employment, and improve health outcomes for vulnerable youth,

2) offer opportunities for adults from faith-based congregations to address issues of social injustice, and

3) build community partnerships leading to a sustainable youth garden entrepreneurship program.

Using a Community-Based Participatory Research design, this project aimed to increase access to locally grown organic foods and promote physical activity while providing training and education for youth at risk.

Results
Results are currently being analyzed and two manuscripts are in preparation. Results will be presented in next year's ARA

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
802	Human Development and Family Well-Being
806	Youth Development
903	Communication, Education, and Information Delivery

Outcome #4

1. Outcome Measures

Develop understanding of human health and nutritional behaviors * obesity intervention strategies * bio-behavioral markers * key parent-child relationships * family interactions * peer interactions * personal choices

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
OSU is examining the impact of a low-energy dense, high fiber food (e.g. barley) on appetite compared to oatmeal, a commonly consumed breakfast cereal that is also high in fiber. Barley is a crop grown in Oregon and she is working with faculty in the College of Agriculture to incorporate barley into breakfast to see if appetite is blunted and post-breakfast energy intake is blunted.

What has been done
Conducted an experiment analyzing the sensory and satiety acceptability of barley cereal in comparison to oatmeal. Study finalized August, 2014. Manuscript drafted but not submitted. This research benefited the project effort to identify the potential to develop barley foods and uses in US food culture. The results indicated that barley consumption increased satiety compared to oatmeal. Undergraduate students (N~35) learned how to develop and utilize barley and became more aware of the health benefits of barley and its soluble fiber content.

Results
For the Barley study, data was gathered and analyzed comparing subjects' sensory acceptability ratings and self-reported satiety following consumption of a barley versus oatmeal meal. Total intake following consumption of barley versus oatmeal breakfast cereal resulted in significantly lower caloric intake at the following lunch meal. This important result suggests that barley may result in decreased total food intake and facilitate weight management. This research is in preparation for publication. For the Farm to Cafeteria project, viewers of the poster were able to understand how a collaborative effort in promoting barley was possible that included farmers, undergraduate and graduate students, research can work together to promote barley.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
806	Youth Development
901	Program and Project Design, and Statistics
903	Communication, Education, and Information Delivery

Outcome #5

1. Outcome Measures

Improved nutrition * schools offer/encourage healthful foods * More effective programs and student experiences * Markers and strategies become the standards of methods and measurement of childhood overweight and resiliency.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Barley may provide an important replacement for wheat derived foods. The nutritional value of barley is much better than wheat and barley exhibits properties that suggest it is an effective deterrent to overeating and obesity. This project seeks to develop recipes for the use of barley and to test its effectiveness in meeting satiety and public acceptance - particularly in school nutrition programs.

What has been done
Researchers developed 12 barley recipes for use in homes and institutions. Nutritional information was also written.The recipes were taken to school food operation and to a long term care facility for acceptability. The school recipes have not been incorporated due to limitations in purchasing requirements limiting the ability to acquire barley. The LTC facility recipes were tested but they were not popular, as the dishes had to be able to be able to "hold" during service time to maintain optimal texture. This is an area for additional research. Students liked the sensory qualities of the barley products produced.

Results

During 2014, more work on testing experimentally, the acceptability of barley products was conducted among college students. We are considering conducting a new study that looks at consumption of barley over a longer period of time to see if in a 3-5 day pattern of food consumption with barley; total caloric intake decreases. We plan to continue to develop healthy recipes which focus on other whole grains.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
724	Healthy Lifestyle
802	Human Development and Family Well-Being
901	Program and Project Design, and Statistics
903	Communication, Education, and Information Delivery

Outcome #6

1. Outcome Measures

Identify tactics, strategies and factors that provide families, children, and youth access to healthy foods

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
A high fiber diet is key to good nutrition, prevention of obesity, and is key to preventing other diseases such as colon cancer, diabetes, and heart disease. Fiber derived from the by products of grape and apple processing provide a unique opportunity to incorporate these high fiber byproducts (skins and seeds) into the food supply while simultaneously eliminating a waste stream from the processing of these foods.

What has been done
Research conducted at OSU has developed a process of converting fruit waste products (seeds

and skins of grapes and apples) into a phytofiber product that can be used in the wet or dry form and incorporated into typical food products (e.g. granola bars, muffins, bread). This phytofiber is high in soluble fiber and phytonutrients. The wet phytofiber may be an excellent addition to a whole grain ?breakfast bar?, which would blunt appetite, yet provide a quick, easy breakfast for busy people. This product has yet to be tested to see if it blunts appetite and subsequent energy intake. However, incorporation of the product in yogurt and salad dressings has been tested with promising results.

Results

This study demonstrated that Pinot Noir wine grape pomace may be utilized as an alternative source of antioxidant dietary fibre to fortify yogurt and salad dressing for not only increasing dietary fibre and total phenolic content but also delaying lipid oxidation of samples during refrigeration storage. Although products fortified with the pomace extracts (liquid and freeze dried) obtained the most similar physicochemical properties to the control (no pomace added), those fortified with dried whole pomace powders (WP) had higher dietary fibre content. Unfortunately, total phenolic content (TPC) and DPPH radical scavenging activity (RSA) of fortified sam- ples decreased during storage, in which more reduction was ob- served in yogurt than that in salad dressings, probably due to the interactions between proteins in yogurt and phenolic compounds in pomace. Therefore, it is necessary to further investigate the mechanisms and methods of retention of TPC and RSA in the prod- ucts in the future studies by using chromatographic techniques to profile the change of pheonolic compounds. Based on the balance in DF and TPC contents, RSA value, physicochemical qualities and consumer acceptance, the best received products were 1% (w/w) WP fortified yogurt, 0.5% (w/w) WP fortified Italian dressing, and 1% (w/w) WP fortified Thousand Island dressing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
903	Communication, Education, and Information Delivery

Outcome #7

1. Outcome Measures

Children practice healthy eating as defined by the current U.S. Dietary Guidelines for Americans (Percent of target audience indicating positive change in measured outcome)

Not Reporting on this Outcome Measure

Outcome #8

1. Outcome Measures

Children engage in healthy levels of physical activity as defined by national physical activity guildeines (Percent of target audience indicating positive change in measured outcome)

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2014	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Obesity is caused by unhealthy eating habits and a lack of physical activity. Researchers at OSU developed an intervention program in three Oregon counties ? Marion, Polk and Yamhill to teach students about creating a healthy lifestyle.

What has been done
About 500 teens ages 15 to 19 will engage in three different life skills programs developed by OSU. One of the programs will be a real-world scenario where teens will learn about growing their own food, cooking healthy, preparing inexpensive meals at home, and staying active.The other two programs use new cutting-edge technology to create virtual environments, where teens will practice these same skills but as an avatar in a 3-D virtual world. One virtual world will be ?realistic,? based on the real environment; the other will be a fantasy world where anything is possible. The approach seeks to tap into technology that kids spend a lot of time with it, and develop a program that can be used both at home and in the classroom to encourage healthy behavior. The goal is to see how teens who are already physically active due to involvement in team sports can develop lifestyle skills that will stay with them past school age. Part of the intervention will include working with the young people?s parents or primary caregivers to ensure they understand about proper nutrition and exercise.

Results
At the end of the five-year project, an OSU biostatistician will lead the researchers to examine the data to see which of the three programs, the real world, the virtual world, and the virtual fantasy world, resulted in better outcomes. The research team will measure the teens' body mass index, physical activity levels (using sensor and cloud infrastructure developed by OSU engineering faculty), and their ability to meet USDA's Choose MyPlate recommendations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
703	Nutrition Education and Behavior

724	Healthy Lifestyle
802	Human Development and Family Well-Being
806	Youth Development
901	Program and Project Design, and Statistics
903	Communication, Education, and Information Delivery

Outcome #9

1. Outcome Measures

Increases in positive levels of Knowledge, Attittude, Skills and Aspiration (KASA) outcomes, as per Bennett & Rockwell, 1995, related to goals of reducing obesity (Percent of target audience indicating positive change in measured outcome)

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Barley recipes for use in institutional settings, e.g., school cafeterias need further development as the palatability of the recipes decline as the food is "held" while making preparations to feed large number of students. Subsequent recipes developed during the project will be evaluated to overcome this property.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Obesity is multi-factorial, involving complex interactions between physiological, behavioral, social, and environmental variables. While obesity has been increasing among adults, it is also becoming more prevalent in children. Currently, ~ 32% of children and adolescents aged 2-19 years if age are overweight, while 17% are obese. The increasing number of youth experiencing weight problems is troubling, since it puts them at risk for one or more chronic diseases earlier in life. The project team is applying a social-ecological framework to study how exposure and familiarity with more nutritional foods can increase incorporation of these foods into diets of various populations, as well as increase acceptability. The study is also determining if the greater exposure and familiarity with whole grains, vegetables and fruits increases the selection and incorporation of these foods

into typical dietary patterns at home and in school lunches as well as among seniors in residential retirement communities. The project has examined what environmental and social factors predict how groups (e.g. communities, schools, families) and/or individuals (e.g. mothers, family food providers, etc.) make long-term positive changes in dietary patterns, healthy eating and physical activity (PA) behaviors for obesity prevention and reduction of chronic disease risk. Finally, we determining the impact of diet (types of foods) and levels of PA intensity on appetite, food selection and weight management.

Key Items of Evaluation

Research is needed to determine strategies to increase taste preference or liking for low energy dense foods, especially vegetables and whole grains. Decreased rates of home meal consumption and cooking, and increased popularity of non-vegetable snacks, sweetened beverages, and processed grains have diminished the incorporation of these healthy foods into our diets. In addition, children's lack of exposure or familiarity with these foods, limited opportunity to gain experience in developing likeness, and an unwillingness to try healthy food options also reduce intake. Encouraging these foods will require increasing awareness of preparation that meets time and cost limitations of families, is culturally acceptable, and that can be readily incorporated into meals and snacks. This includes having healthy foods consumption role modeled within households and among peers, and having access and availability of those foods in the household and at school.
Families also live in communities, where the opportunities to be active and grow and select healthy foods are important. Rural communities provide an excellent context in which to examine the fruit and vegetable consumption patterns of youth at risk while also engaging youth in productive work within their own communities. By engaging low-income youth in the construction and maintenance of gardens and in harvesting and marketing organically grown produce, we have found that youth not only consume more produce, but they also become more visible and engaged in their communities. Although youth garden projects initially may not produce enough vegetables to provide a living wage for more than one or two youth, the Producing for the Future Project has found that the increased visibility of the youth participants at the local farmers market can lead to other economic opportunities for youth. Further, mentorship from supportive adults within their own community can encourage youth at risk to stay in school and may even open avenues to higher education.
Community youth gardens may be both a strategy for developing collaborations in rural communities while also providing exposure to produce, nutrient dense foods that can serve to prevent the development of overweight and obese in our youth. Familiarity with the process of growing vegetables potentially increases the consumption of such items. Developing gardens that target low-income youth within communities has the potential to foster supportive adult-youth collaborations that are beneficial for the health of vulnerable residents and the vitality of the community.

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)	
3	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)	
2	Number of new or improved innovations developed for food enterprises.
Food Safety (Outcome 1, Indicator 1)	
4	Number of viable technologies developed or modified for the detection and
Sustainable Energy (Outcome 3, Indicator 2)	
2	Number of farmers who adopted a dedicated bioenergy crop
Sustainable Energy (Outcome 3, Indicator 4)	
0	Tons of feedstocks delivered.