2013 Oregon State University Research Annual Report of Accomplishments and Results

Status: Accepted

Date Accepted: 06/17/2014

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 2012-2013, $24.5 million in state appropriations were leveraged by faculty to generate $79.9 million in external fund expenditures, yielding a metric of 3.26:1.

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: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	70.0	0.0
Actual	0.0	0.0	268.0	0.0

II. Merit Review Process

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

- Internal University Panel
- Expert Peer Review

2. Brief Explanation

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

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, social media sites)

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. A new advisory group has been developed this past year and 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 Billion dollar capital campaign that generated considerable input from a variety of non-traditional sources.

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 employed a new strategic intent process to gather input from faculty and administration and is subsequently being prepared for broader distribution to the entire University community and University community stakeholders. This is a dynamic process that will continue throughout the life of the strategic intent life span

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.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	3389599	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	2086265	0
Actual Matching	0	0	15161869	0
Actual All Other	0	0	34164967	0
Total Actual Expended	0	0	51413101	0

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

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Water-Energy Nexus for 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			5%	
102	Soil, Plant, Water, Nutrient Relationships			15%	
111	Conservation and Efficient Use of Water			15%	
112	Watershed Protection and Management			5%	
132	Weather and Climate			5%	
133	Pollution Prevention and Mitigation			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			2%	
204	Plant Product Quality and Utility (Preharvest)			3%	
402	Engineering Systems and Equipment			15%	
403	Waste Disposal, Recycling, and Reuse			5%	
404	Instrumentation and Control Systems			5%	
405	Drainage and Irrigation Systems and Facilities			5%	
511	New and Improved Non-Food Products and Processes			5%	
902	Administration of Projects and Programs			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	3.0	0.0
Actual Paid Professional	0.0	0.0	4.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	291791	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	2236615	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	5626832	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

• Field experiments analyzing crop production responses, including methods that help reduce irigation water demand in various crops were conducted.
• Major analysis is underway to determine the effects of wind turbines on Irrigated agriculture. A graduate student started in the winter of 2014. 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.
• Following activities were conducted for the reporting period: 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. 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.

• Trials were conducted with Giant Reed and annual sorghum as a means to determine thier future use as a feedstock for biopower generation

2. Brief description of the target audience

The target audiences for this research are :

agricultural producers
renewable energy enterprises
policy makers
water mangagers
researchers

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	100	150	0	0

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

Patent Applications Submitted

Year: 2013

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	4	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- OTHER SCHOLARLY EXCELLENCE: participation on professional boards and panels, as well as science panels, awards, etc.

Year	Actual
2013	4

Output #2

Output Measure

- IMPROVED BIOPRODUCT PRODUCTION SYSTEMS . . . Indicators: 1-Improved technologies and production systems for biofuel and bioenergy (solar energy capture, fermentation, sensors); 2-Improved feedstocks (microbial, algal, agricultural byproducts, invasive species, cellulosic)

Year	Actual
2013	0

Output #3

Output Measure

- TECHNOLOGY, MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS REGARDING AGRICULTURAL PRODUCTION: Indicators: 1- theoretical and computation tools (both parametric and non-parametric); 2-determinants of innovation in agricultural biotechnology

Year	Actual
2013	0

Output #4

Output Measure

- Objective 1:Develop and incorporate quantitative water, nitrogen and phosphorous use metrics into the attributional life cycle assessment.

Year	Actual
2013	50

Output #5

Output Measure

- Objective 2:Examine the biofuel and water nexus in the Pacific Northwest.

Year	Actual
2013	0

Output #6

Output Measure

- Objective 3:Evaluate the wind energy and water nexus in the Pacific Northwest.
  Not reporting on this Output for this Annual Report

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	K1...Improved knowledge about composition and conversion of feedstocks for biofuels, bioenergy, and co-products a) enhance use of existing varieties of algae, other micro-organisms, cellulosics, agricultural residues, and invasive species for bio-energy and coproducts b) new feedstock sources, extraction technologies, and co-products c) more acreages and tonnage of feedstocks used d) improved water use and quality
2	K2 ... Improved engineering applications to advance production systems for bioenergy a) optimize photobiological processes to yield higher energy efficiencies. b) demonstrate that waste biomass, such animal wastes and organic component of urban wastewater, used as feedstock can yield bioenergy and reduce waste and pollution sources.
3	K3 ... Models developed to look at biofuel and bioenergy productivity, technological processes, sustainability, and supply chain a) decision tools, economic and life cycle analyses, productivity analyses b) new technologies c) feedstock logistics d) resource inputs, outputs and quality e) land use change f) biodiversity
4	A1...Enhanced or improved bioeconomy a) number of new jobs b) increased revenue c) gallons of biofuels produced or consumed, gallons of fossil fuel displaced
5	A2...Implement sustainable biofuel supply chain a) acres or tons of feedstocks produced, numbers of farms involved in feedstock production b) number of technologies developed c) distributed conversion and processing
6	K4 - A framework for the attrbutional LCA based on the ISO standards will be extended to include water use metrics. These metrics will be defined based on source (confined and unconfined aquifers, surface runoff and precipitation), quality, quantity (consumptive and degradative use) and water stress index (volume of withdrawals in the watershed compared to the annual recharge) by adapting several published methods. Metrics for nitrogen and phosphorous utilization will also be developed along similar lines.
7	KA 5...Outcome 2-1: Biodiesel production from canola in the Pacific Northwest region will be used as a test case for the methodology developed in Objective 1. Previously developed process models incorporating feedstock handling, pretreatment, transesterification, and coproduct utilization, waste water handling will be further refined to incorporate process efficiency variations. Outcome 2-2: Cellulosic ethanol production from agricultural residues such as wheat straw and grass straw will be used to test the methodology developed in Objective 1. Outcome 2-3:Algal biofuels production will be modeled based on algae biomass production using municipal waste water as a nutrient source willbe performed. Processing of algae would be based on recently suggested scheme that consists of harvesting algae biomass using flocculation and processing the resulting slurry into biocrude using hydrothermal liquefaction process and the upgraded into green diesel and jet fuel.
8	KA - 6..Outcome 3-1: Examine idealized cases with LES utilizing simulation modeling compared with theoretical and field work.Outcome 3-2: Construct a model to represent the t the local topography of an individual farm to investigate the coupled effects of topography, spatial variability in water application and wind turbines

Outcome #1

1. Outcome Measures

K1...Improved knowledge about composition and conversion of feedstocks for biofuels, bioenergy, and co-products a) enhance use of existing varieties of algae, other micro-organisms, cellulosics, agricultural residues, and invasive species for bio-energy and coproducts b) new feedstock sources, extraction technologies, and co-products c) more acreages and tonnage of feedstocks used d) improved water use and quality

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Understanding better the role and physiology of nitrifying bacteria in the flow of nitrogen through the Nitrogen Cycle might result in significant reductions in energy required for nitrogen inputs into agriculture or for treatment of societal effluent. Understanding N transformation in unmanaged ecosystems, in wastewater treatment, and in soils amended with ammonia-based fertilizers, requires the thorough characterization of these organisms, singly, and while in the coupled two-step process.

What has been done
Constraints based models were built using a 2001 literature study as a framework. This study provided MFA and energetic models for hypothetical autotrophic nitrifiers with approximately 100 reactions and was done prior to the availability of published sequences for Nitrosomonas and Nitrobacter spp. The models will be updated to reflect current knowledge, with the final number of reactions being on the same order as the original models.

Results
To date, a metabolic reconstruction of N. europaea has been developed in this new effort. A reconstruction of N. hamburgensis has been developed using standard techniques. Both metabolic reconstruction models have been used to update the metabolic map provided by the 2001 .

4. Associated Knowledge Areas

KA Code	Knowledge Area

133	Pollution Prevention and Mitigation
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes

Outcome #2

1. Outcome Measures

K2 ... Improved engineering applications to advance production systems for bioenergy a) optimize photobiological processes to yield higher energy efficiencies. b) demonstrate that waste biomass, such animal wastes and organic component of urban wastewater, used as feedstock can yield bioenergy and reduce waste and pollution sources.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

K3 ... Models developed to look at biofuel and bioenergy productivity, technological processes, sustainability, and supply chain a) decision tools, economic and life cycle analyses, productivity analyses b) new technologies c) feedstock logistics d) resource inputs, outputs and quality e) land use change f) biodiversity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An economic analysis of the potential of western juniper was conducted to determine the use of this feedstock to be used to provide fuel for a biomass power plant. Rangeland and watershed restoration were used as potential economic drivers to support the use of juniper.

What has been done
The initial analysis was completed and a Master's thesis was prepared and accepted.

Results

Logistics of juniper harvesting and handling suggest that prices of $80.00/bdt would be required to support such an effort even when considering ecological services provided by juniper removal.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
204	Plant Product Quality and Utility (Preharvest)
402	Engineering Systems and Equipment
511	New and Improved Non-Food Products and Processes

Outcome #4

1. Outcome Measures

A1...Enhanced or improved bioeconomy a) number of new jobs b) increased revenue c) gallons of biofuels produced or consumed, gallons of fossil fuel displaced

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

A2...Implement sustainable biofuel supply chain a) acres or tons of feedstocks produced, numbers of farms involved in feedstock production b) number of technologies developed c) distributed conversion and processing

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

K4 - A framework for the attrbutional LCA based on the ISO standards will be extended to include water use metrics. These metrics will be defined based on source (confined and unconfined aquifers, surface runoff and precipitation), quality, quantity (consumptive and degradative use) and water stress index (volume of withdrawals in the watershed compared to the annual recharge) by adapting several published methods. Metrics for nitrogen and phosphorous utilization will also be developed along similar lines.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Current LCA models fail to adequately account for water demands associated with biofuel production. The GREET model is applied to a variety of landscape level analyses of the the potential impacts to watersheds from adoption of renewable energy approaches.Based on these previous results we will develop water use metrics that will incorporate the net energy value of the renewable energy, type of water (green/blue/gray water) and the water stress index at the watershed scale. The metrics for nitrogen and phosphorous use can be similar to EROWI concept described above. This metric will account for the net energy value of the fuel and the quantity of the nutrient used and therefore can be used to compare different technology alternatives.

What has been done
Three models will be developed to account for water usage in the production of bioenergy.We are also exploring the use of land as a functional unit to perform comparative analyses to identify differences in conclusions arising from the choice of land-use and energy as functional units.

Results
Preliminary work has been initiated. Access to private lands has created delays in preparation of the models. Models for assessing the impact of agricultural practices and weather on the emissions relevant for life cycle assessment during crop production have been initiated. An LCA for camelina production has be completed as have the LCA models for incorporating GBEP metrics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
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

Outcome #7

1. Outcome Measures

KA 5...Outcome 2-1: Biodiesel production from canola in the Pacific Northwest region will be used as a test case for the methodology developed in Objective 1. Previously developed process models incorporating feedstock handling, pretreatment, transesterification, and coproduct utilization, waste water handling will be further refined to incorporate process efficiency variations. Outcome 2-2: Cellulosic ethanol production from agricultural residues such as wheat straw and grass straw will be used to test the methodology developed in Objective 1. Outcome 2-3:Algal biofuels production will be modeled based on algae biomass production using municipal waste water as a nutrient source willbe performed. Processing of algae would be based on recently suggested scheme that consists of harvesting algae biomass using flocculation and processing the resulting slurry into biocrude using hydrothermal liquefaction process and the upgraded into green diesel and jet fuel.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Biofuel LCA often fail to account for the change in water usage dynamics as a result of the production of feedstocks rather than water inputs as part of the conversion process. This is particularly important in areas with limited precipitation or where existing demand already exceeds available supplies.

What has been done
Three biofuel LCA models will be updated to include the relative impacts of water usage and nitrogen and phosphorus inputs in the production of biofuels from three different biofuel feedstock sources.

Results
This project has just begun with modeling efforts and data collection just beginning.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
204	Plant Product Quality and Utility (Preharvest)
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

Outcome #8

1. Outcome Measures

KA - 6..Outcome 3-1: Examine idealized cases with LES utilizing simulation modeling compared with theoretical and field work.Outcome 3-2: Construct a model to represent the t the local topography of an individual farm to investigate the coupled effects of topography, spatial variability in water application and wind turbines

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

We theorize that wind turbines create additional demands on soil moisture for irrigated crops and dry land cropping systems.While it is not yet possible to simulate the entire range of turbulent motions in the atmosphere, it is possible to simulate a significant portion of the energy-containing scales of motion while accounting for the effects of the smallest-scale
turbulent motions. The largest scales of turbulence contain most of the energy, are influenced by the (heterogeneous) boundary conditions, and are responsible for most of the turbulent transport of water vapor, while the smallest turbulent scales behave in a more idealized manner and are more amenable to parameterization.

What has been done

Lack of access to crop lands for data collection has caused us to revise our approach and use existing climatological data sets. Preliminary simulation models are being revised to accommodate this change. Landsat data is archived for 30 years of observation and evaporation can be extracted from the available images. This long-term observation allows us to assess the impact of wind farm installations by examining the evaporation before and after the wind farm was installed. The satellite approach also allows for a larger degree of replication. A PhD student has been hired to perform this analysis and her appointment begins on 04/01/14.

Results

Project is just beginning and models are being populated with available data. The complex interactions between wind turbine wakes, vertical mixing and horizontal advection are best decoupled in numerical simulations.Majo r analysis is underway to determine the effects o f wind turbines o n Irrigated agriculture. A graduate student started in the winter o f 20 14. 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.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
132	Weather and Climate
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
402	Engineering Systems and Equipment

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Competing Public priorities
- Competing Programmatic Challenges
- Other (Data Access)

Brief Explanation

Farm scale acces to data has been limited by access to private lands. We believe access will eventually be granted over time as awareness concerning the importance of this information is accepted by landowners and renewable energy developerss

Additional funding is being sought to support field activities and students and applications have been submitted to two potential funding sources.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Simulation work for idealized cases is complete. We demonstrated that both field topography and wind turbines have a significant effect on evaporation. Taken together they can increase the evaporation by over 16 % from nominal conditions . The impact of topography on evaporation is of the same order of magnitude as wind turbines . Field work

has not been undertaken, significant barriers for land permissions were encountered. We have shifted strategy to analysis of satellite data to evaluate the impacts of large wind farms . Wind farm locations have been selected, and data analys is started in March o f 2014.

Key Items of Evaluation

The overall research objective is to **develop and test** a modified LCA framework based on land-use that incorporates water, nitrogen and phosphorous use metrics. This represents one of the first attempts to develop a framework for the attrbutional LCA based on the ISO standards that will be extended to include water use metrics. These metrics will be defined based on source (confined and unconfined aquifers, surface runoff and precipitation), quality, quantity (consumptive and degradative use) and water stress index (volume of withdrawals in the watershed compared to the annual recharge) by adapting several published methods. Metrics for nitrogen and phosphorous utilization will also be developed to provide a more comprehensive comparison between renewable and fossil fuels.

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			10%	
102	Soil, Plant, Water, Nutrient Relationships			10%	
112	Watershed Protection and Management			10%	
121	Management of Range Resources			10%	
135	Aquatic and Terrestrial Wildlife			10%	
212	Pathogens and Nematodes Affecting Plants			10%	
311	Animal Diseases			10%	
601	Economics of Agricultural Production and Farm Management			10%	
605	Natural Resource and Environmental Economics			10%	
723	Hazards to Human Health and Safety			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	18.0	0.0
Actual Paid Professional	0.0	0.0	13.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	355916	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	2480024	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	9544970	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The project investigators have identified that a critical area in the study of conservation biology and restoration ecology is the dynamics of populations and natural resources in decline. The risk of extinction increases when population sizes are small, in part because changes in abundance or distribution become less predictable. Ecological processes may become highly variable and unstable when they approach low levels. The composition of communities may shift dramatically and interactions between species change at low abundances. The goal of this program is to inform the public and policy makers about changes in ecosystem function and processes that result from natural resources use and to identify ways to minimize negative consequences and develop knowledge and technologies that enable ecosystem restoration. This entails robust analyses of data deriving from research of these investigators and that available from work within the broader scientific community. The proposed program encompasses diverse scientific expertise of faculty whose training and specialization ranges from ecological modeling to population and community ecology. The project team has identified seven specific focal areas for study that will illuminate processes and consequences related to resources in decline. 1. Develop ecological community models that predict community response to perturbations and disease pathogens; 2. Investigate the function of stream ecosystems and assess the response of these ecosystems to restoration practices; 3. Examine the effects of habitat fragmentation on small populations of amphibians and salmonids and develop watershed restoration planning and prioritization methods; 4. Investigate factors and mechanisms that cause differences between hatchery and wild fish; 5. Evaluate influences of habitat change on populations and communities of vertebrates; 6. Develop and assess techniques and strategies for wetland restoration and management; and 7. Investigate fish life history and evaluate the impacts of

management strategies and fish restoration efforts on population trends. Over time, the data and information generated as
part of this Program will contribute to ecosystem restoration policy decisions and to the continued development of the

theoretical understanding of processes affecting aquatic and terrestrial organisms and ecosystem function

The collaborative project is enabling us to identify agricultural sectors that are at risk to climate-driven changes, to explore potential adaptation technologies and training opportunities, and to design efficient policy and management strategies to deal with the adverse impacts of these changes. These pieces of the research and outreach agendas are critical needs as Oregon moves forward with a goal to sustain our physical, natural and human capital investments and to supports our country's food and fiber needs.

We will enhance existing agricultural response models, life cycle models and economic/policy models, then couple them (formally and informally) to better understand interactions and feedback among climate, crop and land use changes, ecological and environmental changes, and prices and policy factors.

2. Brief description of the target audience

The project approach creates understanding of habitat, population and community ecology for ecological modeling of systems. The seven elements of the project include studies that focus on the development of models of community-level responses to perturbations, population dynamics and habitat management for 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 elements include field studies in Oregon and beyond, and controlled laboratory experiments and database/model development. Over the mid- to long-term, the data and information generated as part of this Program will contribute to ecosystem restoration policy decisions and to the continued development of the theoretical understanding of processes affecting aquatic and terrestrial organisms and ecosystem function.

The stakeholder involvement will be in the form of active participation in the enhanced AgTools^{TM} software to explore the economic potential for both mitigation and adaption strategies, using the existing advisory committees for the CAS and the departments to explore climate change related issues. As mentioned before, the policy and economic dimensions of climate change will be the topic of a forum sponsored by the Center for Agricultural and Environmental Policy (CAEP). The information and materials from this project will also be featured on a project "climate-driven changes in Oregon agriculture" website that is linked from the CAS home page and incorporates other climate science undertaken at OSU by the OCCRI. (http://oregonstate.edu/research/oregon-climate-change-research-institute-occri-0). Production system teams will provide information from the economic studies to their stakeholders at field days and through their online resource systems. Team 1 members plan to provide presentations to local production communities when opportunities arise. This process and format will be studies for its impacts and adopted by the other pilot teams with appropriate modifications. Our intent will be to have biannual forums.

3. How was eXtension used?

eXtension will be used to disseminate modeling results and findings to producers, decisionmakers and NGOs and as part of the educational role of faculty and extension personnel.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	110	500	0	0

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	4	50	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- 1. EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY 1...natural history, e.g., fish life history variation, seasonal distributions of endangered great whales; 2... insect biodiversity, conservation and dynamics; 3...riparian systems and relationships; 4 ... soils factors, fluxes, respiration, landscape evolution, and microbial
  Not reporting on this Output for this Annual Report

Output #2

Output Measure

- 2. PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS 1 - biology and control of diseases in plants, e.g., fire blight and blackberry rust, such as genetic mechanisms, disease spread, and effects of landscape variables; 2 - characterization and control of diseases in animals, including fish, mammals and invertebrates; control of invasive pests): 3 - determining appropriate variables and models, including those that increase our knowledge about impacts of and adaptations to climate change.
  Not reporting on this Output for this Annual Report

Output #3

Output Measure

- 3. STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS OF PLANTS AND ANIMALS 1 - determine life history strategies through emerging statistical and molecular genetic techniques, including those of marine and estuarine species, such as salmon, groundfish, and oysters; 2 - develop selective breeding programs, repositories, and resource center for various species; 3 - identify aspects of human biology and biotechnology of viruses and bacteria that affect human health
  Not reporting on this Output for this Annual Report

Output #4

Output Measure

- 4. PROVIDE TECHNICAL, ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS 1 - develop models, market mechanisms, and policies for water resources, e.g., agricultural and non-agricultural uses, riparian zones; 2 - develop models to characterize and make predictions about habitat and their adaptations to climate change; 3 - develop models for stock assessment and management
  Not reporting on this Output for this Annual Report

Output #5

Output Measure

- 5. DEVELOP EDUCATIONAL STRATEGIES AND DISTANCE EDUCATION OUTLETS TO FURTHER REACH CLIENTELE. - adults and youth will have increased awareness and knowledge of ecosystem processes and functions and how they may adapt to climate change as well as methods for restoring degraded habitats
  Not reporting on this Output for this Annual Report

Output #6

Output Measure

- 6. OTHER SCHOLARLY EXCELLENCE: participation on professional society panels and boards, as well as science panels, and receipt of awards or recognition
  Not reporting on this Output for this Annual Report

Output #7

Output Measure

- K-1. To assess the aggregate and distributional tradeoffs and consequences of policies, programs, and investments to enhance the adaptive capacity of our managed agroecosystems and thus reduce the downside of exposure and vulnerability to climate change and climate variability, to environmental change, and to changes in economic and policy-based incentives. This includes advancing fundamental knowledge about the flexibility and resilience of agricultural (managed) ecosystems to increased variability in climate -LCA and to better understand and expand technologies, innovation and systems that can adapt to increases in uncertainty in environmental conditions and increases in climate variability, regionally and within Oregon

Year	Actual
2013	0

Output #8

Output Measure

- K-2 To assess the technical and economic potential to engage in mitigation strategies for Oregon agricultural and managed resource sectors while quantifying the costs of alternative mitigation efforts for the agricultural and managed resource sectors in Oregon and the Pacific Northwest (PNW).

Year	Actual
2013	0

Output #9

Output Measure

- K-3 To provide educational opportunities for undergraduate students, graduate students, and stakeholders in the areas of climate change, risk, agroecosystem technologies, and interdisciplinary policy analysis. We will also enhance partnerships with industry and stakeholders for innovative and more resilient technologies, practices, policies and management strategies.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	1. New or better analytical tools, practices, and models for irrigation and water management, soil management, food production, natural resources management, and land-use decisions
2	2. Impacts of land use change on water quality, species and ecosystems
3	3. 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
4	4. Species, habitat and ecosystem responses to changes in environment as well as resource management strategies to mitigate
5	5. Genetic responses to climate and other environmental factors
6	6. Understand environmental and ecological factors affecting pathogenesis and spread of pathogens and pests
7	7. Understand use of water and production lands
8	8. Improved technologies and practices for control of pests and pathogens in crop and animal production
9	9. New approaches for combating diseases to provide improved health and safety
10	10. Improved strategies are used to manage natural resources
11	11. Understand changes in environments for food systems, e.g., managing plant disease, stable marine food webs
12	12. Understand changes in societal views with regard to the value of habitats and conservation and how to manage them
13	13. Understand changes in ecosystems from carbon management strategies, soil microbial health, natural resource or ecosystem policies
14	A1. New genotypes developed and planted that show enhanced adaptive capacity to climate change
15	14. Show that international trade will be an important vehicle by which adaptations can be made to global climate change * key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade. * Numerical estimates regarding how climate change will affect crop prices, production costs, and the economic welfare of producers, consumers, and society at large
16	A2. Conservation strategies adopted, for example: o 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. o 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 o 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. o 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.
17	15 - Understand how climate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade.
18	16-New or improved models and understanding about water resources related to organisms, soils, or management systems
19	K-1: Develop an applied policy framework to quantify the direct and indirect impacts of alternative policy options and mandates for a sustainable biofuel system and explicitly address the economic and environmental tradeoffs at multiple scales. This will include a science-based methodology for assessing the tradeoffs (production levels, economic, environmental, social) associated with alternative management practices and technologies and a regional Computable general equilibrium model for assessing the regional impacts of changes in the PNW
20	K-2 Develop a web-based decision support tool (AgToolsTM) for growers to assess alternative management pathways for sustaining agricultural production under a changing climate. The tool will integrate data from ongoing OSU field work in these areas and will establish a structured process to solicit input from growers regarding adaptation choices under alternative price, policy and climate scenarios
21	K-3 Develop an integrated research framework that is linked to carbon supply curves, leveraging the efforts of biological and social research and findings. These findings will be used as a means to gauge grower interest in mitigation policies such as carbon sequestration and carbon trading.
22	K-4 Provide a first level assessment of impacts of changing climate for dryland production systems, rangeland animal production systems, and marine fisheries. The team will identify critical variables that need to be measures, data collection schemes, and a subset of critical analyses that need to be undertaken over the next decade in useful outcomes are to be expected. A second task is, armed with the preliminary findings of the first task, to make some assessment of the priorities for the research efforts with a given subset of activities and sectors. The researchers in the first six months will determine a scheme for prioritizing efforts and determining reasonable scopes/scales of the efforts. The decision-criteria for selection of projects will be transparent and modified as new information, collaborators (personnel) and data are developed
23	K-5 Consequential life cycle models will be explored to understand indirect effects such as land use change and market fluctuations on agricultural production in specific areas. Realistic economic data on land use changes at the strata scale will be generated by the TOA component and at the regional scale by the CGE model (see related outcomes). Technology adoption will be generated using TOA-MD models. Results from the attributional LCA will also be used as an input to the consequential LCA. In summary, the results from the LCA will be useful to assess policy option impacts on environmental concerns such as reductions in GHG emissions . Attributional LCA results will be useful in quantifying the environmental impacts of alternative technologies adopted at the farm scale.
24	K-6 Develop and promote undergraduate classes on climate change impacts to Oregon Agriculture, both on-line and on-campus offerings. Develop an interdisciplinary graduate seminar on impact assessment methods and biological and crop science information that pertains to climate change. Workshops and educational/training forums will be co-sponsored

by appropriate federal and state agencies using AgToolsTM and other software programs. Workshops will include participation from non-OSU researchers with appropriate expertise.

Outcome #1

1. Outcome Measures

1. New or better analytical tools, practices, and models for irrigation and water management, soil management, food production, natural resources management, and land-use decisions

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

2. Impacts of land use change on water quality, species and ecosystems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The state, region, nation, and world face enormous challenges in conserving intact and functioning resources and in restoring species and resources that are declining because of habitat loss and change. The desire of Oregonians to restore altered resources and systems requires information at many spatial and social scales. Conservation and restoration actions must be designed at scales ranging from local habitats to stream reaches, stands, watersheds, ecoregions, the state of Oregon, and the Pacific Northwest. Any restoration attempt must determine the degree to which human intervention is needed to accomplish the desired future conditions and explicitly identify the risks associated with either active or passive restoration. All management actions must decide whether it would be most effective to restore processes, physical structure, populations, or community structure. Local resource managers are expected to understand the status of the state's resources, identify trends in their abundance, and then manage those resources appropriately.

What has been done

The fish and habitat information expands the technical basis for conservation and restoration opportunities in the Willamette River and eastern Oregon, as well as establishes ecological priorities for guiding river management. Overall, researchers aim to restore the natural function of waterways, which addresses several goals of the state, including the improvement of water quality based on temperature, and the levels of nutrients and toxins. Prior to this study, no monitoring system of fish communities in the Willamette tied to conservation planning had been completed before. Thermal work established that there is a temperature threshold above which steelhead performance declines rapidly and in a nonlinear manner, a temperature above which populations are likely at risk.

Results
OSU researchers developed ways to measure the population of fish communities and habitat quality in the upper Willamette River to its mouth, finding that the mainstem of the waterway supports 24 native fish species and 17 non-native species; more than 90 percent of the fish found the river were native. Another project studied how animal populations and communities are influenced by rapid changes to their habitats, such as fragmentation through agricultural practices, burning and/or climate change. Researchers seek answers to the extent and length of disruptions to bird and mammal habitats, including how fast birds and other wildlife return to affected areas and if so, how long do these animals stay, and what is the food chain like OSU investigators also studied four forest fire test cases, the longest being nearly 30 years after the burning event. Researchers counted birds and nests to measure reproductive success, trapped small mammals to estimate populations, among other field work. In addition, the effect of livestock grazing practices on the habitat of grassland animals and their ecological functions was studied. OSU researchers continue to study the value of remnant wetlands in the Willamette Valley and the biological function they serve to insects and birds. Researchers intend to establish which freshwater species are declining, threatened and/or endangered. For example, investigators are measuring the thermal habitat quality of eastern Oregon streams and how this relates to the health and survival of native fish. OSU researchers developed a quick, non-lethal, and accurate experiment to measure thermal quality of streams based on the level of heat shock proteins, which are indicators of thermal stress in a fish's body.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

3. 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

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

4. Species, habitat and ecosystem responses to changes in environment as well as resource management strategies to mitigate

Not Reporting on this Outcome Measure

Outcome #5

1. **Outcome Measures**

5. Genetic responses to climate and other environmental factors

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

6. Understand environmental and ecological factors affecting pathogenesis and spread of pathogens and pests

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

7. Understand use of water and production lands

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

8. Improved technologies and practices for control of pests and pathogens in crop and animal production

Not Reporting on this Outcome Measure

Outcome #9

1. Outcome Measures

9. New approaches for combating diseases to provide improved health and safety

Not Reporting on this Outcome Measure

Outcome #10

1. Outcome Measures

10. Improved strategies are used to manage natural resources

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Work on forest fragmentation effects on small vertebrates and birds in Panama have prompted parallel collaborative projects across tropical forests of the world; a "Tropical Forests in a Changing World" NSF Research Coordination Network has brought together ornithologists together to evaluate ways forward in Latin America, Southeast Asia, and tropical Australia. Other team research indicated that while agricultural wetlands may not contribute as much to regional invertebrate biodiversity, are important as producers of food for species that feed on aquatic insects. Research on grasslands concluded that grassland preferring species appear soon after a fire but disappear within 10 years as shrubs return to the landscape; some forest bird species will not or cannot commute across open habitats between fragments of forest; and that habitat isolation can contribute to loss of species diversity for decades afterward. OCAMP and Oregon STEM activities have reached dozens of teachers and their students, as well as bringing $1.3 million (over 5 years) in educational funds and science programs to two economically and socially challenged areas of Oregon.

What has been done
Another project studied how animal populations and communities are influenced by rapid changes to their habitats, such as fragmentation through agricultural practices, burning and/or

climate change. Researchers seek answers to the extent and length of disruptions to bird and mammal habitats, including how fast birds and other wildlife return to affected areas and if so, how long do these animals stay, and what is the food chain like OSU investigators also studied four forest fire test cases, the longest being nearly 30 years after the burning event. Researchers counted birds and nests to measure reproductive success, trapped small mammals to estimate populations, among other field work. In addition, the effect of livestock grazing practices on the habitat of grassland animals and their ecological functions was studied. OSU researchers continue to study the value of remnant wetlands in the Willamette Valley and the biological function they serve to insects and birds. Researchers intend to establish which freshwater species are declining, threatened and/or endangered.

Results
Our research findings and many others were distributed via a public website, extension bulletins and agency reports. Our work and outreach has affected policy indirectly through scientific publications that have been used in species recovery plans and fishery management plans, and through direct interactions with management agencies and councils. Our Oregon Hatchery Research Center colleagues have been a major partner in two large educational projects, the Oregon Coast Aquatic Marine Project (OCAMP) and the Oregon Coast STEM Center (Oregon STEM).

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
605	Natural Resource and Environmental Economics

Outcome #11

1. Outcome Measures

11. Understand changes in environments for food systems, e.g., managing plant disease, stable marine food webs

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The project investigators have identified that a critical area in the study of conservation biology and restoration ecology is the dynamics of populations and natural resources in decline. The risk of extinction increases when population sizes are small, in part because changes in abundance or distribution become less predictable. Ecological processes may become highly variable and unstable when they approach low levels. The composition of communities may shift dramatically and interactions between species change at low abundances. The goal of this program is to inform the public and policy makers about changes in ecosystem function and processes that result from natural resources use and to identify ways to minimize negative consequences and develop knowledge and technologies that enable ecosystem restoration.

What has been done

Results
Our Nassau grouper work discovered that the entire adult population of Little Cayman Nassau grouper can be found in one small discrete location, making them extremely vulnerable to overfishing. Results of this work led to the management agency recommending to the Cayman Islands Parliament the expansion of protections to include both seasonal and spatial closures of the fishery to protect spawning adults (pending rule of law).

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
135	Aquatic and Terrestrial Wildlife
212	Pathogens and Nematodes Affecting Plants
311	Animal Diseases
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #12

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #13

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #14

1. **Outcome Measures**

A1. New genotypes developed and planted that show enhanced adaptive capacity to climate change

Not Reporting on this Outcome Measure

Outcome #15

1. **Outcome Measures**

14. Show that international trade will be an important vehicle by which adaptations can be made to global climate change * key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade. * 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 #16

1. **Outcome Measures**

A2. Conservation strategies adopted, for example: o 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. o 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 o 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. o 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.

Not Reporting on this Outcome Measure

Outcome #17

1. Outcome Measures

15 - Understand how climate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade.

Not Reporting on this Outcome Measure

Outcome #18

1. Outcome Measures

16-New or improved models and understanding about water resources related to organisms, soils, or management systems

Not Reporting on this Outcome Measure

Outcome #19

1. Outcome Measures

K-1: Develop an applied policy framework to quantify the direct and indirect impacts of alternative policy options and mandates for a sustainable biofuel system and explicitly address the economic and environmental tradeoffs at multiple scales. This will include a science-based methodology for assessing the tradeoffs (production levels, economic, environmental, social) associated with alternative management practices and technologies and a regional Computable general equilibrium model for assessing the regional impacts of changes in the PNW

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
This new climate change collaborative research provides a unique opportunity to link the economic and feasibility components to both the attributional LCA, which addresses farm scale impacts, and the consequential LCA which represents a more aggregated (regional) scale.

What has been done
Work has begun that represents a systematic assessment of both the economic and environmental implications of policy options for achieving sustainable regional biofuels production and commercialization that meet the expressed demand for aviation fuel. Unique to this project is the integrated research framework which encompasses three components: engineering/environmental aspects of Life-Cycle Analysis, environmental/economic aspects of multi-dimensional Tradeoff Analysis, and the economic/market aspects of Computable General Equilibrium analysis.

Results
Team members have developed LCA models, including attributional and consequential LCA frameworks (aLCA and cLCA). These models have been applied them to several projects involving climate change technologies including the production of ethanol from napier grass. In a recent paper, the team demonstrated that water and energy use, both of which are impacted by climate change and changes in environmental and economic conditions, in cellulosic ethanol plants is dependent on technologies used for conversion of feedstock.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #20

1. Outcome Measures

K-2 Develop a web-based decision support tool (AgToolsTM) for growers to assess alternative management pathways for sustaining agricultural production under a changing climate. The tool will integrate data from ongoing OSU field work in these areas and will establish a structured process to solicit input from growers regarding adaptation choices under alternative price, policy and climate scenarios

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In order for producers to respond to a changing climate, decision tools need to be developed that can compare adaptation strategies against current agricultural production systems to better identify and understand constraints, opportunities and trade-offs associated with production management, policy frameworks and pricing mechanisms.

What has been done
Team members are working with graduate students who are developing enterprise budgets and software (AgToolsTM) for alternative agricultural crops and systems in the grains in the PNW. These budgets and software tools will be modified to reflect the systems and areas of interest in this more inclusive climate change project. The enterprise budget analysis is described at the AgToolsTM website (https://www.agtools.org/).

Results
AgToolsTM will be part of the suite of frameworks we are adopting to quantify economic impacts and identify technology innovations in Oregon and the PNW. AgToolsTM is a body of information designed to help agricultural producers make short, medium and long-run capital investment and management decisions. The program consists of a suite of software: AgProfitTM, AgLeaseTM, and AgFinanceTM ; budget files containing return and cost information for crops and livestock; and educational programs such as AgToolsTM Academy, and online grower training courses with video instruction modules.

AgProfitTM helps producers make short, medium, and long-term capital investment decisions, such as assessing profitable crop and livestock systems, conservation practices, and/or implementing technologies. AgLeaseTM helps growers and landowners establish equitable short and long run crop share and cash rent payment leases based on their contributions to the lease. AgFinanceTM is designed to assist agricultural producers make long run decisions on a whole farm and ranch basis centered on financial ratios and performance measures.

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
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #21

1. Outcome Measures

K-3 Develop an integrated research framework that is linked to carbon supply curves, leveraging the efforts of biological and social research and findings. These findings will be used as a means to gauge grower interest in mitigation policies such as carbon sequestration and carbon trading.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Climate change is linked to carbon emissions. Some agricultural tillage, cropping, and grazing practices can reduce carbon emissions but these practices must be incentivized by developing carbon supply curves that determine price signals that will engage producers in mitigation practices.

What has been done
The efforts for this objective are in the form of a pilot project the team is evaluating the extent that mitigation policy and carbon sequestration are part of the current policy options in Oregon. Team members have numerous papers on estimating carbon supply curves for dryland wheat agriculture and this research can serve as the foundation for additional methods and applications in Oregon. Other supporting data and ongoing field trails by researchers at the OSU Ag research stations will be used in the pilot analysis. The results may help to fine-tune further field work and data development and visualization.

Results
An assessment of the technical potential to engage in GHG mitigation strategies will require a full LCA of carbon use and emissions in agricultural industries for both baseline practices and for proposed new technologies and management practices. The LCA project has been initiated as part of another outcome for this project.

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
723	Hazards to Human Health and Safety

Outcome #22

1. Outcome Measures

K-4 Provide a first level assessment of impacts of changing climate for dryland production systems, rangeland animal production systems, and marine fisheries. The team will identify critical variables that need to be measures, data collection schemes, and a subset of critical analyses that need to be undertaken over the next decade in useful outcomes are to be expected. A second task is, armed with the preliminary findings of the first task, to make some assessment of the priorities for the research efforts with a given subset of activities and sectors. The researchers in the first six months will determine a scheme for prioritizing efforts and determining reasonable scopes/scales of the efforts. The decision-criteria for selection of projects will be transparent and modified as new information, collaborators (personnel) and data are developed

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The need to begin to establish baseline data for each production system is necessary to develop the fundamental relationships and connections to changes in climate and the technical potential of each system to to adapt to a changing climate.

What has been done
Researchers have initiated a process for prioritizing efforts and determining reasonable scopes/scales for each effort.

Results
There are no results to report at this time. This project was only recently approved.

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
135	Aquatic and Terrestrial Wildlife
311	Animal Diseases
723	Hazards to Human Health and Safety

Outcome #23

1. Outcome Measures

K-5 Consequential life cycle models will be explored to understand indirect effects such as land use change and market fluctuations on agricultural production in specific areas. Realistic economic data on land use changes at the strata scale will be generated by the TOA component and at the regional scale by the CGE model (see related outcomes). Technology adoption will be generated using TOA-MD models. Results from the attributional LCA will also be used as an input to the consequential LCA. In summary, the results from the LCA will be useful to assess policy option impacts on environmental concerns such as reductions in GHG emissions . Attributional LCA results will be useful in quantifying the environmental impacts of alternative technologies adopted at the farm scale.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Attributional LCAs (aCLA?s) are appropriate for estimating environmental impacts that are directly attributable to activities at the farm and firm level and comparing environmental performances among individual farms and firms. Despite their suitability to compare environmental impacts at individual farm and firm level, aLCA?s are unsuitable for understanding the indirect effects of large scale production changes caused interaction effects, climate and policy initiatives. Consequential LCAs (cLCA) are designed to account for these interactions and thus are suitable to investigate the environmental impacts of different policy choices, technology adoption behaviors of farmers and interaction effects.

What has been done

A key challenge in implementing this approach is characterizing the degree of heterogeneity that may be observed as a result of this new system, defined as the spatial variability in expected returns from the system. In addition to economic outcomes, the TOA-MD model can incorporate quantifiable environmental or social outcomes. In this project, farm-level outcomes estimated by the LCA will be used to estimate environmental parameters of outcome distributions. Outcome selections can be modified to meet specific project and stakeholder needs.

Results
Team members have been adapting findings from an existing NIFA funded project. The project includes the input of producers, bioenergy researchers, and bioenergy commercialization groups for key calibration information for technical and policy analysis. The outputs of this project include: (a) a set of enterprise budgets and processing costs that reflect the production of camelina under alternative scenarios and management schemes and are responsive to policy-induced prices changes for energy and commodities; (b) an integration framework that employs the economic and environmental models, and (c) a suite of empirical results that capture the sensitivity of the economic and environmental outcomes for this regional biofuels system to changes in prices for energy inputs, to the presence of an aviation biofuels mandate(s), and to changes in related federal, state and local policies. This approach serves as a template for conducting the LCA on production systems other than bioenergy crops.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

Outcome #24

1. Outcome Measures

K-6 Develop and promote undergraduate classes on climate change impacts to Oregon Agriculture, both on-line and on-campus offerings. Develop an interdisciplinary graduate seminar on impact assessment methods and biological and crop science information that pertains to climate change. Workshops and educational/training forums will be co-sponsored by appropriate federal and state agencies using AgToolsTM and other software programs. Workshops will include participation from non-OSU researchers with appropriate expertise.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2013 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research on climate change impacts to agricultural operations need to be shared with undergraduate and graduate students, stakeholders, and appropriate federal agencies. Workshops and other venues will be used to provide information to producers, decision makers, and other stakeholders.

What has been done
Three new classes have been developed and additional classes are in the pipeline for the next fiscal year.

Results
Each new class was taught as a 1hr credit class to adjust the curriculum to student interest and participation. All three classes will be taught as three hour classes next academic year.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
121	Management of Range Resources
135	Aquatic and Terrestrial Wildlife
601	Economics of Agricultural Production and Farm Management
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

Changes in environmental conditions, in climate variability, and in economic and policy factors over the next number of decades will affect agricultural production patterns, management/technology alternatives, and spatial and locational choices as well as impact

the current levels of use of many key resources including water and land. In 2010, the U.S. government announced many major new research initiatives to deal with these factors including one on climate change impact and adaptation, in part under the U.S. Department of Agriculture's newly reorganized research agency, the National Institute for Food and Agriculture, as well as other federal agencies (see also National Research Council 2010). Thus it is an opportune time to research and assess agriculture's ability to adapt to possible types of climate and environmental/economic changes and the policy implications, and to consider how to improve our research capabilities to understand and address the impacts of changing environmental and economic landscapes. These are critical needs as we move forward with a research agenda that focuses on the sustaining our physical, natural and human capital investments and at the same time supports our food and fiber needs.

The climate change outcomes from the National Institute for Food and Agriculture (NIFA) planned program guidelines provided by U.S. Department of Agriculture (USDA) include the following:

- Enhance the adaptive capacity of production and natural systems to reduce exposure and vulnerability to climate change and variability
- Improve mitigation strategies for reduction of greenhouse gas (GHG) emissions, including carbon sequestration practices
- Development of new knowledge and technologies and transfer of this knowledge to clientele and stakeholders

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Significant progress has been made linking LCA and economic models to better understand the impacts of climate change on production agriculture. Work is continuing to develop stakeholder input that can be incorporated in enterprise budgets to guage grower responses to new cropping, tillage, and grazing responses to climate change. Previous work conducted by OSU researchers is complementing this effort.

Key Items of Evaluation

Co-PI's Antle, Capalbo and Reimer are currently involved in a Regional Approaches to Climate Change in the PNW (REACCH, a five year NIFA-CAP project) which also uses the Tradeoff Analysis Model for Multi-Dimensional Impact Assessment (TOA-MD). TOA-MD is designed to simulate the impacts (economic, environmental or social) of farms adopting a new production technology (Antle 2011; Antle and Valdivia 2006). This approach has been adopted by many researchers and institutions around the world (including projects at international agricultural research centers) on projects dealing with new technology assessment, and environmental and resource changes.. This collaborative project builds on the ongoing work to model wheat-based systems in the PNW region as part of the project the Regional Approaches to Climate Change in the PNW project. Antle and Capalbo are also engaged in numerous projects dealing with impact assessment of agricultural systems, and with the National Climate Assessment as lead authors for regional chapters.

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
121	Management of Range Resources			5%	
202	Plant Genetic Resources			5%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			5%	
211	Insects, Mites, and Other Arthropods Affecting Plants			8%	
216	Integrated Pest Management Systems			5%	
301	Reproductive Performance of Animals			5%	
302	Nutrient Utilization in Animals			10%	
307	Animal Management Systems			10%	
311	Animal Diseases			30%	
502	New and Improved Food Products			10%	
903	Communication, Education, and Information Delivery			2%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	35.0	0.0
Actual Paid Professional	0.0	0.0	4.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	490514	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	4378479	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	2896871	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 this program will develop improved practices for cropping and animal production systems that 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. Animal systems will reduce wastes and discharges while improving productivity and husbandry techniques.

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, with a special emphasis on rural markets in America; (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.

- 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, extension faculty, 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, Extension personnel and other educators
- Genetic companies
- Nutritional consultants
- Nonprofit conservation groups and ecologists
- General public and consumers

3. How was eXtension used?

eXtension will be used to disseminate modeling results and findings to producers, decisionmakers and NGOs and as part of the educational role of faculty and extension personnel.

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	110	500	0	0

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	4	14	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- BASIC PHYSIOLOGY OF PLANTS AND ANIMALS...1- Environmental response by plants, 2 - Animal reproductive factors

Year	Actual
2013	0

Output #2

Output Measure

- DECIPHER GENOMES, GENETICS AND MECHANISMS...1- Niches and functions served by Bacteria And Viruses And Other Microorganisms, 2 - Genetic diversity, pathways and function, 3 - Genes and Mechanisms in disease resistance and tolerances, 4 - Reproductive factors in plants and animals

Year	Actual
2013	0

Output #3

Output Measure

- BREEDING PROGRAMS THAT RESULT IN DESIRABLE TRAITS, CULTIVARS AND VARIETIES...Indicator - improved traits, germplasm, and varieties.

Year	Actual
2013	0

Output #4

Output Measure

- IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS...1 - improved animal reproductive success rates, 2 - animal nutrition, feeding and forage relationships, 3 - inputs for plant systems in dryland and irrigated production and on small farms

Year	Actual
2013	0

Output #5

Output Measure

- PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS...1 - pest management systems and strategies, 2 - disease resistance, 3 - herbicide identification and resistance

Year	Actual
2013	0

Output #6

Output Measure

- ENVIRONMENTAL HEALTH AND ECOLOGY...1 - erosion control, 2 - animal effects, 3 - green management practices

Year	Actual
2013	0

Output #7

Output Measure

- ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...1 - land use management analyses, 2 - profitability and productivity studies

Year	Actual
2013	0

Output #8

Output Measure

- VOLUNTEER PROGRAMS o Reach Master Gardners (new, past, and current) through MG training programs and materials, websites, and other distance education programs o Refine OSU Urban and Community Horticulture Website to reach new audiences.

Year	Actual
2013	0

Output #9

Output Measure

- DISTANCE and OTHER EDUCATION OUTLETS o Develop new databases and frequently most asked questions for eXtension o Compare perceptions of science teachers and agriculture teachers on integrating science into the agriculture curriculum

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	1a. improved plant production management systems, including precision systems, cultural practices, conservation strategies, innovations, pest control, and organic systems
2	2a - improved animal reproductive biology and management for better fertility and reduced uterine infectionsin dairy and beef cattle and sheep; as well as better understanding of reproductive genetics and developmental biology
3	2b - expanded forage and nutrient management knowledge to understand how management practices can synchronize the relationship between forage nutrient supply and cow nutrient requirements, and how feedstuffs can influence the health and physiological stress of the calf.
4	4a - plant breeding for improved or novel plant attributes and for human health benefits, e.g., antioxidants
5	5a - 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
6	6a - economic studies help Producer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade
7	A4 - Adoption of new varietals will reduce yield losses and expenses, rejuvenate orchards, achieve better productivity and efficiency, provide environmental benefits (less fungicide applications, etc.), allow effective competitiveness on the world market o Commercial processors and fresh market growers, as well as home gardeners, achieve greater production efficiency, more stable productivity, and reduced costs from the use of improved varieties.
8	2c - improved animal fertility and genetic stock, for example: o Producers and animal health professionals improve fertility and prevent uterine infections in dairy cattle from implementing every-day on-farm practices. o Industry stores sperm cells with minimal loss of function for use as a commodity and for long-term maintenance of genetic stock
9	A3 - Animal producers improve their economic competitive advantage and improve the ecological sustainability of production system
10	A1 - Conservation strategies adopted o 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. o 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 o 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. o 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.
11	A6a - Improved agricultural economies o The knowledge generated about productivity-convergence will be crucial in designing policies to improve the welfare of agricultural producers and food processors and the general public who will be affected by the evolution

	of these industries (e.g., food quality and safety, resource scarcity and pollution). o Domestic policymaking and multilateral trade negotiations will mitigate effects of climate change in reduction of trade barriers and subsidies. o Climate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade. This information will be important in the context of domestic policymaking and multilateral trade negotiations as it pertains to reduction of trade barriers and subsidies.
12	Change Indicator 1 - Ecological / Environmental o Landscapes will impact the way Oregonians use and manage plants to create beauty, modify environment, and improve health and well-being of individuals and communities. This program will change the way people use plants to modify their environment such as moderating temperature on buildings, improving water infiltration on surfaces, contributing to ecosystem services at landscape or watershed scales, etc. o Food/farm systems reduce surface and/or groundwater or other pollution in the environment, while improving nutrient and water budgets, and organic production systems. o New reduced risk, environmentally safer pest control tools will be available that are target pest specific will facilitate the implementation of IPM programs. o Environmental change will occur from temperature modifications; enhanced water conservation and wildlife; reduced runoff, fire incidence and pests; improved nutrient use and recycling; and other ecosystem services. o Better ecological methodologies will lead to more social, economic, and environmental benefits and cost effective and sustainable restoration. Improved valuation of ecological services associated with restorations will greatly facilitate market-based conservation practices such as mitigation banking and effluent trading. Better conservation bio-control strategies will decrease the costs associated with insect losses and the use of insecticides. o enhance the nation's natural resource base and environment by revealing cost-effective means to control plant diseases and reduce the need for pesticides. o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets. o Improved soil, water, and crop management practices and strategies that protect Oregon resources o Management of public and private rangelands will sustain and improve ecological values as desired by the public and the rural communities that depend on the natural resources. o Strategies for avoiding invasive pests will be in place o Plant disease resistance will lower the amount of pesticide use, resulting in a more healthful environment and reduced exposure of humans to hazardous chemicals.
13	Change Indicator 2 - Societal o Social change will occur through new perceptions of green technologies and social value or capital of horticultural landscapes to enhance human health, therapy, wellness, and social networks. o Social impacts include consumer awareness and appreciation of the abundance of locally grown ornamental plant materials and native species for use in landscapes will increase; also awareness of invasive species. o Social change will enhance quality of life in rural areas by improving economic stability of family farms, wineries, wine tasting, and tourism with new practices and cropping systems and/or livestock management practices/systems. o Social change will improve economic stability of families and quality of life with improved cropping systems. o Worker safety with bio-based pest control and dwarf rootstocks (short ladders) will be improved; farm workers will find other employment with increased mechanization. Local and community markets increase social networking in rural communities. o Increased opportunities for rural community marketers and processors will be developed; o Public health will be improved through the use of crops with improved nutritional value o Sustainable and economically viable wheat and dryland cropping industry for vibrant rural economy in eastern Oregon o The public has access to an ongoing research data base that allows for natural resource/land management decisions to have a fundamental basis in science.

14	Change Indicator 3 - Economic o The economic value of landscapes will increase. Cost and benefit analyses of plants usage to modify environments with green technologies will reveal positive economic impacts and improved health and wellness from horticultural therapy. o Economic impacts include reduced costs, increased benefits, and production efficiencies from use of water and nutrient budgets in recycled water systems, improved pest management, and diagnosis of plant problems to increase sales of quality products. Costs of regulatory procedures will be reduced with water and nutrient budgets and management systems. o Profitability of berry crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Machine harvest technologies will be adapted or developed for Oregon to reduce production costs and improve competitiveness in global markets. o Profitability of vegetable and specialized seed crops is expected to improve as new cropping systems, cover crops, nitrogen management, reduced tillage, and cultivars are adopted by growers. Communication networks will enable timely communication and utilization of technologies to alert growers of weather related pest incidence, educational events, and practices. o Profitability of viticulture in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Niche markets, wine tasting, and tourism are primary outlets for Oregon wines. o Profitability of tree fruits and nut crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. High density orchards are expected to improve production efficiencies and increase markets. o Agricultural producers will realize greater economic return in their cropping enterprises; Plant nutrient and other production input use will be optimized o Producers maximize the control of postharvest decay within the various production and marketing objectives of producers. o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets. o Higher-value niche markets will be established o Beef producers in the Intermountain and Great Basin areas remain completive on a regional, national, and global basis. o Producers greatly improve their reproductive efficiency by removing bad genes thus increasing productivity and economics of the industry. Industry thus has improved resource and economic sustainability through reduced costs and/or increased productivity. o Better understanding of the costs, benefits, and potential impact of legislation on the dairy industry, and thus more economically and environmentally sustainable systems for dairy and beef production. o Intense selection reduces needs for assistance in pasture lambing conditions. o Economic viability of farmers markets will be enhanced o Agricultural producers will realize greater economic return in their enterprises; o Increased potato yield will increase potato farmers' income as well as the stability of potato production of the world. The potential increase from 29,000 acres to as much as 100,000 acres will increase Oregon's market share and economic benefits.
15	1b - sustainable gardening practices (eg. fertilizers, water, and pest management including organic), horticulture and aboriculture principles and practicea
16	1c - dryland production management systems use agronomic practices for commercially promising alternative crops under reduced tillage. * Producers, NRCS, conservation districts and environmental agencies learn about whole farm nutrient management. * Basic agronomic practices for commercially promising alternative crops under reduced tillage systems.
17	1d - irrigated production management systems use drip and micro sprinkler irrigation systems to produce increased crop yield and crop quality with less water and nitrogen than with furrow and regular sprinkler irrigation
18	6b - improved knowledge of consumer and market conditions and factors that affect business survival and competitiveness - Improved understanding of market conditions and knowledge to determine business choices. - Development of a process map for food business

	development and planning. - Training of nascent and existing food entrepreneurs in food business management. - Expanded knowledge base of factors important to distinguish different types of consumers and their food choices - Develop an understanding of motivations for food choice and strategies to impact them - Improved marketing approaches for local markets and community food systems
19	4c - identify genes involved in critical plant processes to improve plant qualities
20	5b - 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
21	5c - Elucidation of the underlying molecular mechanisms of pathogenicity (virulence), disease susceptibility (compatibility) and disease development, gene evolution, and engineered gene expression vectors
22	7 - integrate agricultural education into high school curriculums and community education
23	A2 - Plant management tools are used by private and public sector, for example: * Farmers will more strategically plan for crop production * Crop rotation sequences and green manure crops in combination with reduced or no nematicide use, particularly for short season potato crops to suppress nematode populations.
24	A5 - pest and pathogen management tools are used by growers, for example: * End users adopt new pesticide and pest management systems and strategies for working with invasive pests * District-specific control programs will reduce usage of fungicides with low efficacy and emphasize integrated control practices. * Growers, packers and extension faculty incorporate practices to lower decay risk, including reduced fungicide usage, and identify high risk fruit lots and to market these before decay has time to develop in storage. * Interaction of program components and the overall efficacy of various combinations of orchard, postharvest, and storage factors will be the guides to the description of programs for implementation in the pear industry. * Determine packinghouse water system contamination by fungal pathogens. Commercial service lab can apply PCR technology to maintain sanitation determine most effective fungicides for each species. * Customized decay control program for each unique pathogen complex.
25	A7 - Agricultural education produces the next generation of growers and eduactors
26	A6b - Consumer business knowledge leads to improved opportunities, survival, and profitability in food enterprises, as well as new and improved value-added products - New and existing businesses expand markets based on new understanding about market factors - Increased business activity and success in the Northwest food industries. - More successful starts by food businesses
27	1e - protection of natural environment from agricultural chemicals, for example: - Reduce the fate of agricultural chemicals in remote aquatic ecosystems - Improve policies or regulation of pesticides
28	4b - create new plant varietals for improved attibutes

Outcome #1

1. Outcome Measures

1a. improved plant production management systems, including precision systems, cultural practices, conservation strategies, innovations, pest control, and organic systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
On a small scale, drones are already in Oregon airspace. Researchers are using drones to study potatoes in Eastern Oregon. Don Horneck, an agronomist at the research station, reports that the Columbia Basin produces some of the highest yields of potatoes of anywhere in the world. Oregon farmers sold more than $170 million worth of potatoes last year. But it's a plant that's both expensive to grow and susceptible to problems associated with insects or disease.

What has been done
Remotely-piloted vehicles (UAVs) leased from Boeing are used at the OSU Hermiston Agricultural Research and Extension Center. Horneck will deliberately stress potato plants by cutting back the amount of water and fertilizer they get in different sections of the field. Researchers fly the UAV over the crops and see whether the UAV digital camera can note insect or disease issues via different light wavelengths before workers can see it."

Results
Farmers already scout their fields with traditional airplanes, but because the UAVs are able to fly at lower altitudes than the farmer's planes these cameras should be able to captures images with much higher resolution. Also, many of the fields are massive, hundred-plus acres. But with more information, growers can be more efficient with inputs like water, fertilizer and pesticides. Use of the UAVs have the potential to revolutionize precision agriculture. In irrigated fields, operators can program each of the nozzles running along the sprinkler system. If the UAV can indicate insect infestation or lack of moisture, the operator can open or close a nozzle or add fertilizer or pesticide to certain parts of the field, not the entire field. The technology can be applied to other fields of research for things like water quality, forest management or invasive species.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

2a - improved animal reproductive biology and management for better fertility and reduced uterine infectionsin dairy and beef cattle and sheep; as well as better understanding of reproductive genetics and developmental biology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
For the past seven years, summer upwelling has brought acidified water onshore, creating ocean acidification (OA) conditions that adversely affect the growth and survival of oyster larvae at commercial hatcheries. As a result, a ?seed crisis? has afflicted the West Coast oyster growers, limiting availability of oyster seed for outplanting. The industry produces over six million pounds of oyster meat each year which sells for almost $5 million. In 2010, the oyster industry?s production was found to have affected 91% of the economic sectors in Oregon.

What has been done
The Molluscan Broodstock Program (MBP) of the Coastal Oregon Marine Experiment Station has been working to develop oysters with enhanced traits through traditional oyster breeding. MBP was collaboratively funded over a number of years by USDA Special Grants, OSU formula grants, and industry and foundation funding, along with assistance from USDA-ARS personnel. ARS has contributed through genetic evaluation of oyster families to provide information for improved survivability, reproduction, and growth.

Results

Hatchery operators reported that larvae derived from selected MBP broodstock from the performed better than larvae from wild oysters or non-MBP stock in OA conditions. As a result, the industry has been able to outplant larvae in the face of adverse conditions. Growers has said that without the program, the industry would have faced major economic hardships, including failures of some oyster farms. Information gained through the MBP research has been shared at annual meetings of the oyster growers and researchers. Future studies will focus on experiments to provide a better understanding of OA on larval physiology and provide genetic tools that can be used to evaluate the degree of stress in larvae exposed to OA conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #3

1. Outcome Measures

2b - expanded forage and nutrient management knowledge to understand how management practices can synchronize the relationship between forage nutrient supply and cow nutrient requirements, and how feedstuffs can influence the health and physiological stress of the calf.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Selenium is found in heavy concentrations in some parts of the country, and at low ones in others, like Oregon. Ranchers often provide selenium to livestock as a supplement, but applications must be monitored carefully because too much of the mineral be harmful to animals. Selenium delivered through plants in an organic form is safer than directly feeding to calves in an inorganic form, such as salt, says Jean Hall, a researcher with the OSU College of Veterinary Medicine. Application in this way may also be cost-effective for ranchers.

What has been done

During field trials, selenium was added at varying levels to alfalfa fields after the first of three scheduled cuttings. Regardless of the application level, over 80% was taken up by the time of the second cutting. The remaining selenium by taken up by the last cutting. Regardless of the amount of selenium applied, the take up percentage remained the same. So double the application level, twice as much selenium was taken up. Researchers fed the fortified hay to weaned beef calves. Several weeks later, these calves had higher selenium blood levels than control calves, and weighed 10% more. It also appeared that selenium boosted efficacy of vaccinations, helping to boost anti-body production.

Results
The study shows that selenium boosts growth and vaccination response of weaned beef calves, which results in decreased mortality and improved slaughter weights. While Oregon is the only state that permits fields to be artificially fertilized with selenium, the results may be a strategy for ranchers in other areas where selenium is very low. Results of the study have been published in PLOS ONE.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #4

1. Outcome Measures

4a - plant breeding for improved or novel plant attributes and for human health benefits, e.g., antioxidants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Barley is one of the oldest cultivated grain. However, while it is the fourth largest grown grain crop, it is grown primarily for animal feed. Yet, it has many attributes that could enhance human health and food security. The crop has also an important asset in the growing microbrewery industry, both in the Pacific Northwest, as well as elsewhere in the world.

What has been done

: Pat Hayes, barley breeding lead at OSU, evaluates how well the grain performs in the kitchen and brewery. The research team looks at genes that deal with cold tolerance, disease resistance, and lower water and fertilizer requirements; they also seek genes responsible for malting quality, nutritional properties and flowering time. The team uses a double haploid production technique, which regenerates plants from pollen and creates genetically pure lines in one generation, as opposed to six to eight years in traditional breeding. Hayes is also making crossed with multicolored barley from Mongolia, hoping to develop varietals with different flavors and aromas to attract consumers.

Results

Craft brewers want to create unique flavors, and have turned to Hayes for varietals that reflect the terroir ?the soil and climate ? of Oregon, much like the approach in wine grapes. Additionally, the team are breeding barleys that have desirable malting qualities; this work has caught the attention of California?s Sierra Nevada Brewing Co. and Wisconsin?s New Glarus Brewing Co. The brewers plan to make beer from 50 to 100 exotic varieties of barley from the world grown in 2012 by OSU. Then they?ll analyze how the beer tastes. Hayes also wants to see barley grow in the percentage of people?s diets. Barley contains beta-glucan, which has been shown to reduce cholesterol. Low glycemic index and high fiber content makes barley a good food choice for those with diabetes or for people seeking to lose weight. In conjunction. Andrew Ross, OSU food scientist, has developed consumer recipes for bread and related food stuff from barley, which requires more liquid and produces a denser product due to the high fiber. His pretzels have been served in the OSU?s president?s box at football games.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #5

1. Outcome Measures

5a - 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 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Growers are concerned about the arrival of the brown marmorated stink bug, a voracious, nonpicky eater of apples, berries, vegetables, grain and even ornamental trees. Sheltering in homes over winter allows this particular pest to continue to grow, and they quickly multiply. They cause the flavor of berries to resemble the stink of the bugs, their bite causes blemishes in vegetables, and attacks cause fruit and nuts to shrivel.

What has been done
OSU, part of a consortium of partners funded by USDA, continues to seek control measures and management solutions for growers. They work on how to identify BMSB and their favorite plants, document damage, extract and identify the proteins in saliva from stink bugs to pave the way for new pest control methods. OSU researchers are testing specific insecticide controls for the brown marmorated stink bug, as none are registered for the insect. Herbicides and fungicides are not known to be effective.

Results
OSU researchers issued a warning in late summer 2013 of an increased risk of damage to late-ripening crops after discovering record levels of the brown marmorated stink bug, a newly established invasive pest in Oregon. OSU's statewide survey for the bug is ongoing and early returns this year show higher population densities in nearly every area of Oregon. While the stink bug been established in urban counties near Portland and the Willamette Valley for years ? and in Hood River and Wasco County since 2012 ? the survey found the range of the bugs has recently expanded to more rural environments, including farms of all sizes. Growers also now have access to a number of print and online resources.

The alert comes at a critical time with harvest looming for many crops

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #6

1. Outcome Measures

6a - economic studies 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 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Specialty crops, such as fruits, nuts and vegetables, are some of the highest value agricultural products and account for about one-third of cash receipts from all crops in the United States. These crops have important export, as well as domestic, economic import. Many specialty crops thrive in the West under irrigation, but are vulnerable to extreme climate events, including frosts, heat waves, drought, and excess moisture. Such events can ruin crops and hurt a farmer financially. Specialty crops? sensitivity to irrigation and climate extremes suggests that it is prudent to better understand how extreme climate events affect irrigation management for them.

What has been done
OreCal is a policy research collaboration between the Center for Agricultural & Environmental Policy at Oregon State University and the University of California Agricultural Issues. Center at UC Davis. OreCal recently announced the release of a new issues brief from research over the past couple of years that analyzes the vulnerability of specialty crops to extreme climate events and adaptive irrigation management (OreCal Issues Brief 012, http://orecal.org).

Results
The research provides a number of useful economic and precision agriculture information. Using irrigation to mitigate frost damage to crops increases the likelihood to adopt sprinklers by 18% for vegetables and 9% for orchard/vineyard. It decreases the likelihood to adopt gravity technologies by 13% for vegetables and 4% for orchard/vineyard. Using irrigation to reduce heat stress in orchards and vineyards increases the likelihood to adopt sprinklers by 15% and decreases the likelihood to adopt drip by 18%. Several irrigation management decisions have a climate threshold. How farmers respond to climate change depends on whether they are located below the threshold (cooler and wetter locations) or above it (warmer and dryer locations).

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

Outcome #7

1. Outcome Measures

A4 - Adoption of new varietals will reduce yield losses and expenses, rejuvenate orchards, achieve better productivity and efficiency, provide environmental benefits (less fungicide applications, etc.), allow effective competitiveness on the world market o Commercial processors and fresh market growers, as well as home gardeners, achieve greater production efficiency, more stable productivity, and reduced costs from the use of improved varieties.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Farmers often make their variety selection based on disease resistance and can neglect other factors. This is especially critical in water limited eastern Oregon.

What has been done
OSU researchers help wheat farmers make better choices by offering pros and cons of various options. For example, Mike Flowers, extension cereals specialist, and Bob Zemetra, OSU wheat breeder, advised growers to plant a mix of wheat varieties for different attributes, including maturity. In wet, cool years, late-maturing varieties tend to perform better. In dry years, early-maturing varieties tend to be better. Breeders work to find varieties that higher yielding, disease resistant and meets a local market to reduce the need to store sees or reduces growers? shipping costs.

Results
Planting a mix of varieties help farmers spread their risk across a greater reach and not just counting on one thing to carry them through. Getting farmers to walk their fields, beginning in the spring. In dry spells, certain strip rust and crown rot will emerge, which growers tend to forget about because they weren?t seen for several years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #8

1. Outcome Measures

2c - improved animal fertility and genetic stock, for example: o Producers and animal health professionals improve fertility and prevent uterine infections in dairy cattle from implementing every-day on-farm practices. o Industry stores sperm cells with minimal loss of function for use as a commodity and for long-term maintenance of genetic stock

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Producer experience indicates that high strung, poorly tempered stock often do not perform as well as herd mates with a more moderate disposition. Feedlot studies show steers with calmer dispositions out gaining steers with the most excitable temperaments. Links are also being made by research between disposition and health, including response to vaccination. Determining if a link exits between reproductive performance and disposition has been difficult to prove. Anecdotally, producers and A.I. technicians have noted that cows with bad temperaments are less likely to conceive to A.I.

What has been done
Reinaldo Cooke, OSU Eastern Oregon Agricultural Research Center researcher, compared weaned crossbred heifers that were not handled with those acclimated to people and going through a working chute. Both groups were tested for levels of Cortisol, a hormone associated with stress. At the end of the experiment Cortisol levels for the trained group were lower than those of the control group.

Results

: The trained group reached puberty at a faster rate than the controls, with nearly a 20% difference. Having heifers start cycling sooner can greatly improve reproduction by allowing heifers to be bred sooner and calve early in the calving season, also allowing the heifers to have a longer recovery period before breeding again. Furthermore, previous work by Cooke with mature cows showed that their disposition (agitation and aggression scores) was improved with acclimation to humans and higher aggression scores resulted in lower pregnancy rates in the breeding season. Results provide additional basis to existing reasons for culling cattle with bad temperaments. Including disposition as part of the breeding criteria may yield both improved reproductive health, breeding rates and handling ease.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #9

1. Outcome Measures

A3 - Animal producers improve their economic competitive advantage and improve the ecological sustainability of production system

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is an ongoing debate over whether grazing on western public lands worsens ecological alterations caused by climate change.

What has been done
Researchers, who work for nine universities and the U.S. Department of Agriculture, responded to the debate in a peer-reviewed journal article published by the journal Environmental Management.

Results
Based on the summary of scientific studies, the 27 authors dispute the notion that eliminating grazing will provide a solution to problems created by climate change. To cope with a changing climate, the authors say land managers will need access to all available vegetation management tools, including grazing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #10

1. Outcome Measures

A1 - Conservation strategies adopted o 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. o 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 o 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. o 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 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Federal land-use agencies, such as the Bureau of Land Management, Forest Service, Natural Resources Conservation Service and highway districts, are in need of native plant seed to restore large areas of land following wildfires in the Pacific Northwest and Western states. Stand establishment and week control are two of the toughest issues facing growers interested in producing seed for this market.

What has been done
OSU researchers, especially those at the Malheur Experiment Station, have developed numerous tactics to produce needed native seed. This has allowed increasing numbers of farmers who are growing seed. The station is growing about 40 different native plant species. The researchers have been willing to take on a lot of new species that have never been grown in an agricultural situation before, thus, needing to develop all facets of information. Many of the plants have extremely small seed that has trouble growing through hardened soil that crusts over the winter and birds enjoy the small seedlings that emerge in spring.

Results
OSU researcher Erik Feibert found that using row covers in the fall and winter has been found to be the best way to help native plants and grasses establish a stand. These covers protect the seed from bird damage and help maintain a more uniform soil moisture level and temperature, which helps prevent soil crusting.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #11

1. Outcome Measures

A6a - Improved agricultural economies o The knowledge generated about productivity-convergence will be crucial in designing policies to improve the welfare of agricultural producers and food processors and the general public who will be affected by the evolution of these industries (e.g., food quality and safety, resource scarcity and pollution). o Domestic policymaking and multilateral trade negotiations will mitigate effects of climate change in reduction of trade barriers and subsidies. o Climate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade. This information will be important in the context of domestic policymaking and multilateral trade negotiations as it pertains to reduction of trade barriers and subsidies.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In years past, Harry & David (HD) would only have locally grown signature Royal Riviera brand Comice pears available from September through February. For decades that meant months passed before the Medford, Oregon, gourmet food and gift company could once again offer pears to its mail-order customers. HD needed to reduce the gap.

What has been done

Comice pears aren't suited for growth just anywhere, said David Sugar, OSU horticulture professor based at the Southern Oregon Research and Extension Center in Medford. He has worked with growers and food industry representatives in Chile and Argentina and keeps in contact with former students in both countries. His research has helped growers in Chile improve pear appearance, storage life and eating quality up to the standards of HD. With Comice, in particular, five months is about as long as you can hold them in storage, Sugar said. "To provide a steady supply, the six-month stagger between southern and northern hemispheres is very useful."

Results

HD turned to growers in Chile and New Zealand in the early 1990s, seeking to capitalize on the popularity of its high-end fruit offerings. Without the Southern Hemisphere countries, HD would have limited offerings at certain times of the year, as well as fewer opportunities. In 2013 HD expected to import 2.5 million pounds of fruit from Chile, with pears accounting for just over half of the total. This is only a fraction of the some 2.6 million tons of fresh fruit, worth $3.6 billion, exported to the U.S., led by grapes, apples and blueberries, according to the Fruit Growers Federation of Chile. The first Chilean pears arrive two to three weeks ahead of those from New Zealand. Economic conditions, both in Chile and the United States, have resulted in consolidations and changing ownerships, according to HD. One Chilean grower said that when the U.S. sneezes, Chile gets a cold. HD has set an 85 percent gift-grade standard for the Chilean growers. If the standard is exceeded once the fruit arrives in Medford, the growers collect on incentives. If it falls below, payments fall.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

Outcome #12

1. Outcome Measures

Change Indicator 1 - Ecological / Environmental o Landscapes will impact the way Oregonians use and manage plants to create beauty, modify environment, and improve health and well-being of individuals and communities. This program will change the way people use plants to modify their environment such as moderating temperature on buildings, improving water infiltration on surfaces, contributing to ecosystem services at landscape or watershed scales, etc. o Food/farm systems reduce surface and/or groundwater or other pollution in the environment, while improving nutrient and water budgets, and organic production systems. o New reduced risk, environmentally safer pest control tools will be available that are target pest specific will facilitate the implementation of IPM programs. o Environmental change will occur from temperature modifications; enhanced water

conservation and wildlife; reduced runoff, fire incidence and pests; improved nutrient use and recycling; and other ecosystem services. o Better ecological methodologies will lead to more social, economic, and environmental benefits and cost effective and sustainable restoration. Improved valuation of ecological services associated with restorations will greatly facilitate market-based conservation practices such as mitigation banking and effluent trading. Better conservation bio-control strategies will decrease the costs associated with insect losses and the use of insecticides. o enhance the nation's natural resource base and environment by revealing cost-effective means to control plant diseases and reduce the need for pesticides. o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets. o Improved soil, water, and crop management practices and strategies that protect Oregon resources o Management of public and private rangelands will sustain and improve ecological values as desired by the public and the rural communities that depend on the natural resources. o Strategies for avoiding invasive pests will be in place o Plant disease resistance will lower the amount of pesticide use, resulting in a more healthful environment and reduced exposure of humans to hazardous chemicals.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
: Irrigation from the Owyhee Project and research from the Malheur Experiment Station have helped make the Western Treasure Valley a major producer of sugar beets, potatoes and some of the best onions in the nation. But with little rainfall each year and precious few sources of water, farming successfully in the high desert is a unique challenge. This region receives only 9 inches of rain a year.

What has been done
Using the latest in crop technology and working hand-in-hand with local farmers, OSU researchers at the Malheur station are working toward producing crops in the high desert through precision irrigation. Wires crawl through fields like tentacles. The wires measure soil-water tension, the natural force needed for plants to pull water from the soil. When the sensors detect high soil-water tension, it means that the soil is thirsty and the system prompts the release of just the right amount of irrigation dripped onto the plant roots to quench the thirst.

Results
No local farmers used drip irrigation when OSU began researching precision irrigation systems in the early 1990s. Since then, more than half of Malheur County growers have installed drip in their

fields. Additionally, after more than 30 years of research, Shock continues to push the boundaries of research, to grow bigger onions at lower cost using fewer inputs and less water while helping farmers make more money. Thanks to OSU research, onions have swelled so large that some have earned the category of super colossal. Sales have also swelled, helping Oregon onion harvest rack up $115.8 million in farm gate sales in 2012.Since Shock started his research, local farmers have more than tripled onion plantings. And groundwater quality has also improved, as Malheur research has offered ways to reduce fertilizer, pesticide, and water use while producing outstanding onions. Finally, OSU researchers, led by Malheur superintendent Clint Shock, have also developed specific equations for calibrating the sensors, work that has enabled manufacturers to successfully market precision irrigation instruments worldwide.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #13

1. Outcome Measures

Change Indicator 2 - Societal o Social change will occur through new perceptions of green technologies and social value or capital of horticultural landscapes to enhance human health, therapy, wellness, and social networks. o Social impacts include consumer awareness and appreciation of the abundance of locally grown ornamental plant materials and native species for use in landscapes will increase; also awareness of invasive species. o Social change will enhance quality of life in rural areas by improving economic stability of family farms, wineries, wine tasting, and tourism with new practices and cropping systems and/or livestock management practices/systems. o Social change will improve economic stability of families and quality of life with improved cropping systems. o Worker safety with bio-based pest control and dwarf rootstocks (short ladders) will be improved; farm workers will find other employment with increased mechanization. Local and community markets increase social networking in rural communities. o Increased opportunities for rural community marketers and processors will be developed; o Public health will be improved through the use of crops with improved nutritional value o Sustainable and economically viable wheat and dryland cropping industry for vibrant rural economy in eastern Oregon o The public has access to an ongoing research data base that allows for natural resource/land management decisions to have a fundamental basis in science.

Not Reporting on this Outcome Measure

Outcome #14

1. Outcome Measures

Change Indicator 3 - Economic o The economic value of landscapes will increase. Cost and benefit analyses of plants usage to modify environments with green technologies will reveal positive economic impacts and improved health and wellness from horticultural therapy. o Economic impacts include reduced costs, increased benefits, and production efficiencies from use of water and nutrient budgets in recycled water systems, improved pest management, and diagnosis of plant problems to increase sales of quality products. Costs of regulatory procedures will be reduced with

water and nutrient budgets and management systems. o Profitability of berry crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Machine harvest technologies will be adapted or developed for Oregon to reduce production costs and improve competitiveness in global markets. o Profitability of vegetable and specialized seed crops is expected to improve as new cropping systems, cover crops, nitrogen management, reduced tillage, and cultivars are adopted by growers. Communication networks will enable timely communication and utilization of technologies to alert growers of weather related pest incidence, educational events, and practices. o Profitability of viticulture in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. Niche markets, wine tasting, and tourism are primary outlets for Oregon wines. o Profitability of tree fruits and nut crops in Oregon is expected to improve as new cropping systems, cultivars, practices, and efficiencies are implemented. High density orchards are expected to improve production efficiencies and increase markets. o Agricultural producers will realize greater economic return in their cropping enterprises; Plant nutrient and other production input use will be optimized o Producers maximize the control of postharvest decay within the various production and marketing objectives of producers. o Biocontrols will reduce environmental damage and costs of grape growing and facilitate the development of the table and wine grapes with improved quality and nutritional value and therefore to increase competitiveness of the US grape growers and wine makers at the world markets. o Higher-value niche markets will be established o Beef producers in the Intermountain and Great Basin areas remain completive on a regional, national, and global basis. o Producers greatly improve their reproductive efficiency by removing bad genes thus increasing productivity and economics of the industry. Industry thus has improved resource and economic sustainability through reduced costs and/or increased productivity. o Better understanding of the costs, benefits, and potential impact of legislation on the dairy industry, and thus more economically and environmentally sustainable systems for dairy and beef production. o Intense selection reduces needs for assistance in pasture lambing conditions. o Economic viability of farmers markets will be enhanced o Agricultural producers will realize greater economic return in their enterprises; o Increased potato yield will increase potato farmers' income as well as the stability of potato production of the world. The potential increase from 29,000 acres to as much as 100,000 acres will increase Oregon's market share and economic benefits.

Not Reporting on this Outcome Measure

Outcome #15

1. **Outcome Measures**

1b - sustainable gardening practices (eg. fertilizers, water, and pest management including organic), horticulture and aboriculture principles and practicea

Not Reporting on this Outcome Measure

Outcome #16

1. **Outcome Measures**

1c - dryland production management systems use agronomic practices for commercially promising alternative crops under reduced tillage. * Producers, NRCS, conservation districts and environmental agencies learn about whole farm nutrient management. * Basic agronomic practices for commercially promising alternative crops under reduced tillage systems.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New alternative crops can improve agricultural production and provide diversity to growers? portfolios in the dryland wheat growing areas of eastern Oregon and Washington. However, research is needed to find herbicides that can manage weeds without damaging the crop, and timing harvest to gather seeds that mature at different times in the same plant. The whole package for growers is needed for new crops.

What has been done
Stephen Machado recently began test plots on the Columbia Basin Agricultural Research Center acreage of quinoa as a potential dryland crop for the area. Quinoa, typically produced in the Andes Mountains of South America, is highly nutritious.

Results
Quinoa may provide a new alternative to growing traditional dryland wheat. A surge in global demand is driving the price as high as $3,200 per ton, according to reports. This is about 10 times the current value of wheat.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #17

1. Outcome Measures

1d - irrigated production management systems use drip and micro sprinkler irrigation systems to produce increased crop yield and crop quality with less water and nitrogen than with furrow and regular sprinkler irrigation

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
: Irrigation from the Owyhee Project and research from the Malheur Experiment Station have helped make the Western Treasure Valley a major producer of sugar beets, potatoes and some of the best onions in the nation. But with little rainfall each year and precious few sources of water, farming successfully in the high desert is a unique challenge. This region receives only 9 inches of rain a year.

What has been done
Using the latest in crop technology and working hand-in-hand with local farmers, OSU researchers at the Malheur station are working toward producing crops in the high desert through precision irrigation. Wires crawl through fields like tentacles. The wires measure soil-water tension, the natural force needed for plants to pull water from the soil. When the sensors detect high soil-water tension, it means that the soil is thirsty and the system prompts the release of just the right amount of irrigation dripped onto the plant roots to quench the thirst.

Results
OSU researchers, led by Malheur superintendent Clint Shock, have also developed specific equations for calibrating the sensors, work that has enabled manufacturers to successfully market precision irrigation instruments worldwide.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

216 Integrated Pest Management Systems

Outcome #18

1. Outcome Measures

6b - improved knowledge of consumer and market conditions and factors that affect business survival and competitiveness - Improved understanding of market conditions and knowledge to determine business choices. - Development of a process map for food business development and planning. - Training of nascent and existing food entrepreneurs in food business management. - Expanded knowledge base of factors important to distinguish different types of consumers and their food choices - Develop an understanding of motivations for food choice and strategies to impact them - Improved marketing approaches for local markets and community food systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the food business, competition is fierce and the cost of marketing is high. These days, price and taste are not the only factors influencing grocery shoppers? decisions to buy. Some also want to know how and where a product was produced or caught. Enter the ?eco-label? that certifies dolphin-safe tuna, organic pasta, and fair-trade coffee. Researchers at the Food Innovation Center, the first urban agricultural experiment station in the United States, are studying how this kind of packaging can affect shoppers? behavior, choices, and thinking.

What has been done
According to Cathy Durham, a marketing economist at the center, eco-labels can connect with consumers? attitudes about the environment, health, and social justice. Durham is also studying the feasibility of an artisan cheese industry in Oregon, how local foods are defined and marketed, and the differences in consumer attitudes toward wine bottles topped with corks or screw caps. Consumer research by the center can reduce risk and help pave the way for success in the market.

Results
In one study, shoppers showed a preference for apples packaged with eco-labels over those produced and labeled in a conventional way?at an appropriate price point; in other words, eco-labels can positively influence consumer decisions if the price is right.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
903	Communication, Education, and Information Delivery

Outcome #19

1. Outcome Measures

4c - identify genes involved in critical plant processes to improve plant qualities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Developing new varietals often takes years.

What has been done
By combining traditional plant breeding with ever-faster genetic sequencing tools, researchers are making fruits and vegetables more flavorful, colorful, shapely and nutritious. In the last 10 years or so they have been able to approach their work in completely new ways in part because genetic sequencing technology is becoming so fast and cheap. ?There?s been a radical change in the tools we use,? says Jim Myers of Oregon State University, who has been a plant breeder for more than 20 years and recently created an eggplant-purple tomato. What is most exciting to Myers, and what he never thought he would be doing, is going in and looking at candidate genes for traits. As the price of sequencing continues to drop, it will become more and more routine to do sequences for every individual population of plants of interest.

Results
In particular, these tools are helping breeders pivot their attention toward qualities of food that are important to consumers, instead of fixating solely on the needs of growers. Aided by genomics and related molecular tests, breeders have managed to create a cornucopia of new foods that are already available at some grocery stores and farmer?s markets, including cantaloupe that?s firm and ripe in the winter, snack-size bell peppers, broccoli that brims with even more nutrients than

usual, onions that do not offend the eye and tomatoes that do not disappoint the tongue.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)

Outcome #20

1. Outcome Measures

5b - 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 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Zebra chip has been a significant pest for Southwestern U.S. potato growers since it was discovered in Texas in 2000. It was not considered a significant problem in the Pacific Northwest until 2011, although the insect that vectors zebra chip, the potato psyllid, has been in evidence since the late 1990?s. The disease caused significant crop loss in isolated fields in 2011 and led to a temporary ban on fresh potato shipments from the Northwest overseas in 2012.

What has been done
OSU researchers have conducted research for the past three years and have presented their findings to growers at Experiment Center field days, at grower workshops and farm fairs.

Results
Sylvia Rondon, OSU Extension entomologist based at the Hermiston Agricultural Research and Extension Center, found that the pathogen that causes zebra chip appears to survive better in mild temperatures, as the pathogen is heat sensitive, shutting down in temperatures above 90 degrees Fahrenheit. Monitoring the edges of fields may be sufficient in cases where insect pressure is low, research showing that there was no significant difference between monitoring psyllid populations in the middle of fields and the edges. However, researchers also found that the psyllid can survive the Pacific Northwest?s winters on a weed plentiful in the Columbia Basin

and Idaho, the bittersweet nightshade, thus, enabling overwintering of the pathogen and creating a reservoir of disease. Thus, monitoring, although time consuming work, is an important management tool.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #21

1. Outcome Measures

5c - Elucidation of the underlying molecular mechanisms of pathogenicity (virulence), disease susceptibility (compatibility) and disease development, gene evolution, and engineered gene expression vectors

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Highly contagious fire blight (Erwinia amylovora) disease affects pear and apple orchards throughout the western United States. In the state of Oregon, nearly 250,000 acres can be negatively impacted by this pathogen, which causes affected plant tissue to appear blackened or scorched by fire. Up to now methods for fire blight detection have been lacking due to time needed for results and expense of testing.

What has been done
Ken Johnson in the OSU Department of Botany and Plant Pathology has worked on early detection of the pathogen. Johnson says that molecular technology is hard to put in the hands of just anyone. To this end, he developed a new tool called loop-mediated isothermal amplification or LAMP. This technique utilizes design primers to detect and amplify sequences of DNA unique to fire blight. A LAMP reaction can be done with a 12-volt power supply under field conditions. Thus, LAMP has the potential to implement early detection of fire blight at a local level (on-farm)

instead of in a laboratory.

Results
Logistically there are some drawbacks to the technology: performing the assay requires personnel with excellent laboratory skills and a thorough understanding of the risk of molecular contamination, the rapid development of populations of fire blight when temperature conditions were favorable, and the requirements for routine sampling of flowers, overnight shipping and quick dissemination of LAMP results. However, the team evaluated the ability of this assay to detect blight in washes of pear and apple flowers where it grows prior to infection. Results thus far have been promising. More promising are expected technological advances that offer the potential for point-of-care (i.e., on-site) detection by non-professionals, such as the recent adaptation of LAMP to lateral flow devices. With further development of pathogen detection technologies for use on-site, this early warning protocol will become a key component of fire blight prediction systems.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #22

1. Outcome Measures

7 - integrate agricultural education into high school curriculums and community education

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Currently, a shortage of scientists for agricultural positions exists throughout the country. Efforts are needed to revitalize an interest in agriculture as a career path and ensure that secondary

school students have the requisite competencies to succeed in college and careers.

What has been done
OSU Agricultural Education Program director Greg Thompson participates on a USDA multistate project with a focus on a framework for secondary schools agriscience education programs that emphasizes the STEM content in agriculture. The desired end result of this research project will be an abundant supply of well-educated workers in careers that require agricultural scientific knowledge.

Results
The project was just approved by NIFA in May, 2013, so efforts are focused primarily on addressing Objectives 1 and 2 of the project during FY2014. These are to: 1) Identify practices, cross-cutting concepts, and disciplinary core ideas to be included in a secondary school agriscience program; and 2) Identify teaching methods, resources (facilities, equipment, materials, etc), and techniques currently utilized by exemplary teachers. The group also proposed coordinating activities with the American Association for Agricultural Education's Special Interest Group (SIG) on Academic Integration.

4. Associated Knowledge Areas

KA Code	Knowledge Area
903	Communication, Education, and Information Delivery

Outcome #23

1. Outcome Measures

A2 - Plant management tools are used by private and public sector, for example: * Farmers will more strategically plan for crop production * Crop rotation sequences and green manure crops in combination with reduced or no nematicide use, particularly for short season potato crops to suppress nematode populations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Nurseries are among many types of growers that face depredation of insect pests on their crops.

What has been done
The use of biocontrols, or predator bugs, has grown steadily since the mid-1990s. Evergreen Growers Supply, a distributor of beneficial insects, estimates their sales have increased about 20 percent a year over the past decade. Growers use the program to control aphids, whiteflies, fungus gnats, mites, thrips and other pests. Some crops are more conducive to beneficial insects and some pests are more easily controlled with beneficials than others.

Results
Ron Tuckett, a plant protection manager at Monrovia, said its nursery is saving between 30 and 70 percent in its mite control program since it started releasing thousands of beneficial bugs in its greenhouses. This has contributed to a major reduction in their chemical usage. But Tuckett said it is not all just about the costs as they see a big improvement in quality. The production crew at at Woodburn Nursery and Azaleas, also noticed that plant quality had looked as good as it does after initiating biocontrols. The tough part in implementing a biocontrol program is believing that it actually works. OSU Extension entomologist Robin Rosetta said it is a long learning curve, but people can have success right away. Biocontrols is an area within pest management where the more knowledge you have, the more successful you can be. For example, Woodburn Nursery has found biocontrols work best in greenhouses. On outdoor nursery operations, winds tend to disperse the beneficial insects before they can do their work. The nursery also has found it crucial to release the good bugs before insect pest numbers build, that is, the nursery needs to be preventative.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #24

1. Outcome Measures

A5 - pest and pathogen management tools are used by growers, for example: * End users adopt new pesticide and pest management systems and strategies for working with invasive pests * District-specific control programs will reduce usage of fungicides with low efficacy and emphasize integrated control practices. * Growers, packers and extension faculty incorporate practices to lower decay risk, including reduced fungicide usage, and identify high risk fruit lots and to market these before decay has time to develop in storage. * Interaction of program components and the overall efficacy of various combinations of orchard, postharvest, and storage factors will be the guides to the description of programs for implementation in the pear industry. * Determine packinghouse water system contamination by fungal pathogens. Commercial service lab can apply PCR technology to maintain sanitation determine most effective fungicides for each species. * Customized decay control program for each unique pathogen complex.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
When an invasive fruit fly was found in Mexico's important agricultural states, the Mexican government reached out to the experts at OSU's Spotted Wing Drosophila Project to help them deal with this new threat to fruit exports.

What has been done
SWD Project member, Linda Brewer of the OSU Department of Horticulture, consulted the experts at the OSU Technology Across the Curriculum to optimize a Spanish-language research review and protect agricultural interests across North America. The resulting presentation, funded entirely by the Mexican government, married an audience-appropriate pedagogy with interactive technology to present SWD research findings to state, national, and privately supported field advisors to the strawberry industry in the states of Michoacán and Jalisco and to convey species identification techniques for field workers.

Results
The effort was a resounding success, one that enhanced the Project's international reputation. The project included: 1) A dichotomous key poster helped field advisors learn how to visually identify Spotted Wing Drosophila; 2) A PowerPoint presentation walked participants through project findings and posed pop quiz questions, which were announced by way of an old-fashioned desk bell, to the audience's delight; and 3) TurningPoint clickers added interactivity to the quizzes, slides, and audience discussion. Although twice as many people enrolled as anticipated, Brewer was able to facilitate lively audience discussion using clicker responses as a springboard. Visit the SWD website (http://spottedwing.org/) for information on how the project is performing research and developing resources to help the Pacific Northwest small fruit industry, growers, gardeners, and researchers manage this invasive fruit fly.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #25

1. Outcome Measures

A7 - Agricultural education produces the next generation of growers and eduactors

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
: Students and the general population are losing touch with agriculture and critical issues facing agriculture and natural resources.

What has been done
To better prepare students for the world beyond school, a new course has been developed at OSU to introduce them to the structure and purpose of the Land Grant mission of education, extension and research. Students are provided an overview of the critical issues facing agriculture and natural resources industries through learning more about the Oregon system of Agricultural Experiment Stations. Weekly discussions will be led by faculty from OSU?s Agricultural Experiment Stations located throughout Oregon and enriched by inclusion of key stakeholders representing industry and other agencies. One field trip to a selected OSU Agricultural Experiment Stations will be required.

Results
Students will be able to: 1) Identify and define important factors in a selected critical issues of Oregon agriculture and natural resources; 2) Explain the history and purpose of the Land Grant institution; and 3) Effectively communicate through short written and oral formats. Additionally, this course will enhance Bioresource Research, an interdisciplinary science program administered by the College of Agricultural Sciences. This 20-year old major offers research opportunities to undergraduates by requiring students to complete a thesis by graduation. They get to work with faculty mentors on unique research and ultimately write and present their findings at their thesis defense. Students have found tremendous success both in and out of school. 40% have graduated with honors and about 20% have graduated with an additional University Honors College degree. Graduates have a 100% success rate at either finding work within three months of graduating or getting accepted to a graduate program; about 60% go on to graduate school, many with full funding.

4. Associated Knowledge Areas

KA Code	Knowledge Area
202	Plant Genetic Resources
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #26

1. Outcome Measures

A6b - Consumer business knowledge leads to improved opportunities, survival, and profitability in food enterprises, as well as new and improved value-added products - New and existing businesses expand markets based on new understanding about market factors - Increased business activity and success in the Northwest food industries. - More successful starts by food businesses

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The food industry is very competitive. Profits are made or lost depending on consumer response to subtle differences in products and marketing. Sensory science provides an objective, experimental approach to measure consumer response towards particular products before they go to market, providing real-life data that industries can use to guide their product development and marketing decisions. A recent consumer project asked if school children prefer hamburgers made from local Northwest-grown beef or pre-cooked standard-issue USDA patties.

What has been done
Ann Colonna, who runs the OSU Sensory Science Program at the Food Innovation Center (FIC), conducted taste tests. In the first experiment, she tested another group of school-age kids and found they could tell the difference between the two types of burger. A second experiment was set up to find out if the subjects had a preference for one or the other burger. The students were presented with two samples, identified with numbers, and are asked to examine and taste the burgers.

Results

FIC clients use test results to create people-oriented products. The results from the elementary school?s burger preference test were not definitive. Votes split down the middle: half the kids preferred the USDA burgers (?it tasted like bacon?), and half preferred the Northwest beef (?it tasted like what we have at home?). The kids went home that day encouraged to think about why they?re eating what they?re eating. The results also were informative about the influence of taste experiences on food preferences.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

Outcome #27

1. Outcome Measures

1e - protection of natural environment from agricultural chemicals, for example: - Reduce the fate of agricultural chemicals in remote aquatic ecosystems - Improve policies or regulation of pesticides

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The highly contagious fire blight (Erwinia amylovora) disease affects pear and apple orchards throughout the western United States. In the state of Oregon, nearly 250,000 acres can be negatively impacted by this pathogen, which causes affected plant tissue to appear blackened or scorched by fire.

What has been done
Johnson continues his research for alternative pathogen control in organic fruit orchards, of which there are nearly 20,000 acres in Oregon. Johnson has been using beneficial bacteria as pathogen control with good results.

Results
The work with non-antibiotic control has proven timely since a recent rule change by the National Organic Program removed antibiotics from the approved list for organic agriculture. This research should allow organic growers to transition to non-antibiotic programs for fire blight with a minimum of disease losses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #28

1. Outcome Measures

4b - create new plant varietals for improved attibutes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

We have seen significant improvement in irrigation practices, pest managment, and sustainability of agricultural operations. Grower preferences for sustainable agricultural practices is growing as is consumer demand for these practices. Breeding programs continue to produce cultivars with higher drought tolerance and lower demands for soil and fertelizer inputs.

Key Items of Evaluation

Research at OSU continues to promote improved agronomics that broaden grower opportunities at reduced costs and greater returns.

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
112	Watershed Protection and Management			3%	
112	Watershed Protection and Management			3%	
133	Pollution Prevention and Mitigation			3%	
204	Plant Product Quality and Utility (Preharvest)			3%	
501	New and Improved Food Processing Technologies			55%	
502	New and Improved Food Products			5%	
602	Business Management, Finance, and Taxation			3%	
603	Market Economics			3%	
604	Marketing and Distribution Practices			3%	
604	Marketing and Distribution Practices			3%	
606	International Trade and Development			2%	
607	Consumer Economics			2%	
702	Requirements and Function of Nutrients and Other Food Components			3%	
703	Nutrition Education and Behavior			2%	
723	Hazards to Human Health and Safety			3%	
724	Healthy Lifestyle			4%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.0	0.0

Actual Paid Professional	0.0	0.0	9.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	304459	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	2096704	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	2337393	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 experinments
- Developing knowledge and new technology of food processing systems
- Developing curricular materials
- Developing quality monitoring protocols
- Developing products, curriculum, resources
- Developing services
- Presenting seminars and professional talks
- Conducting workshops and training sessions
- Publishing scientific findings
- Partnering

2. Brief description of the target audience

There are diverse audiences for information this project generates. They can be classified into four general groups: (1) the general public and food consumers; (2) state and federal food regulatory agencies; and (3) the research community including scientists working in government, industry, and academic sectors; and (4) the commercial food processing industry or commodity groups.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2013

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	11	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS...1 - number of experiments or tests to reduce percentage of mortality, to enhance hatchability, or to identify a marker of immunity

Year	Actual
2013	0

Output #2

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN and ENVIRONMENTAL/ECOLOGICAL HEALTH...1 - Agricultural/Environmental chemical analyses to - assess risks of toxins - develop analytical methods and biomarkers for agricultural chemicals and other contaminants - evaluate the variation and patterns in the incidence of human pesticide exposures - identify, validate, localize and characterize specific responsive genes, which have the potential to serve as biomarkers of toxins - develop and evaluate transgenic lines that show changes in reporter gene expression in response to toxicants

Year	Actual
2013	0

Output #3

Output Measure

- TECHNOLOGY, MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS REGARDING FOOD PRODUCTS...1 - determine best food processing technology and method for food product development and safety, including high pressure processing, laser technology, and radio frequency identification tags, 2 - develop value-added products through a systematic product development strategy

Year	Actual
2013	0

Output #4

Output Measure

- OTHER SCHOLARLY EXCELLENCE: participation on professional boards and panels, as well as science panels, awards, etc.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	2a - Characterize and model toxins arising from food production and processing (analytical) * New analytical methods and biomarkers to cost-effectively identify and track agricultural chemicals and other contaminants through time and space * Develop and transgenic lines of zebrafish for response to toxicants
2	3 - Methods to improve Animal Health production systems, for example through - improvement of maternal diet - enhancement of the efficacy of vaccination programs - development of diagnostic methods to assess immune health
3	A2 - Percentage of health risks reduced due to information regarding toxins arising from food production and processing
4	A4 - Improved food handling and regulations - Individuals and industry modify food production and handling practices. - Intervention strategies reduce bacterial contamination, increase shelf life, and reduce occurrences of food-borne illnesses.
5	A3 - Improved animal husbandry, such as - Poultry industry changes feed formulations to reduce embryonic mortality during incubation (thereby enhancing hatchability) and to improve animal health and to produce health-enhancing nutrients (thus developing value-added poultry foods). - Livestock producers use diagnostic methods and new vaccination programs to increase immunity (innate and acquired) in domestic animals
6	A6 - Informed policy-making and management related to food processing that prevent incidences of food-borne illnesses.
7	Change Indicator - Economic: - Application of knowledge and new leading-edge food technologies will result in improved food quality, value and safety with positive impacts on value-added food production, processing, handling, and distribution systems. - Sustainable competitive advantage for Northwest food industries that are able to accurately gage consumer demand for their products. - Improve the food economy by developing new, stronger, and growing food businesses in the state. - Help reduce the state's unemployment through the creation of jobs in these food companies. - Hatchability and value-added poultry foods will bring increased economic returns to the US poultry industry.
8	Change Indicator - Societal: - Better human and animal health, well-being, and survivability result with the use of nutrition and nutrigenomics and organic production. - Reduce health care costs associated with prostate cancer and improve the quality of life of thousands of American men . - Control the growth in the rate of obesity and osteoporosis among youth and solutions reverse trends in childhood obesity - Build environmental public health capacity - Mitigate how federal expenditures related to the farm subsidy program are linked to Medicaid expenditures for obesity related health conditions.
9	Change Indicator - Environmental (risk assessment, policies and management of exposure): - Enhanced environmental quality within an economically responsible context. - Reduced exposure of human and aquatic organisms to fluorochemicals - Moderate the relative contribution of regional U.S. and Canadian agricultural sources (both current and historic uses of these chemicals) and long-range or global sources in contributing to the deposition of agricultural chemicals to remote ecosystems in the Western U.S. - Minimize the risk of adverse impact of pesticide use on human health.
10	1 - Understanding nutritional relationships to health, such as a) learn the mechanisms behind the health benefits of fruits and vegetables, and b) new risk factors in prostate cancer and novel dietary modifications to reduce the incidence of prostate cancer.

11	2b- Characterize and model toxins arising from food production and processing (mechanisms, effects) * Identify agents, mechanisms, and dose response for reducing fetal risk from toxic chemicals * evaluate dioxin toxicity to humans and characterize specific responsive genes to toxicants * Examine mechanisms that underlie the immune suppression * Identify role of polymorphisms and mediators in relieving dioxin toxicity * Evaluate effects of aging on bioavailability of agricultural contaminants * Determine ways to evaluate extent that landfills are a significant source of fluorochemicals and the extent to which they are present in crops intended for human consumption
12	2c - Characterize and model toxins arising from food production and processing (education) * Provide technical training and resources to agricultural and regulatory stakeholders on ecotoxicology of pesticides and integrated pest, nutrient, and water management.
13	A1 - Nutritional health or additives provide disease mitigation, e.g., zinc supplementation will be an effective strategy in limiting the incidence of prostate cancer and effective dietary intervention strategies are broadly applied to reduce obesity
14	4 - Develop technologies and control strategies to improve food safety
15	5 - Detect incidences and pathways of food borne illnesses to: * reduce regulatory actions * reduce potential economic loss from diminished productivity * reduce incidences reported and absences due to illness.
16	6 - Prepare information about food processing that informs policy makers and managers

Outcome #1

1. Outcome Measures

2a - Characterize and model toxins arising from food production and processing (analytical) * New analytical methods and biomarkers to cost-effectively identify and track agricultural chemicals and other contaminants through time and space * Develop and transgenic lines of zebrafish for response to toxicants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
133	Pollution Prevention and Mitigation
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

3 - Methods to improve Animal Health production systems, for example through - improvement of maternal diet - enhancement of the efficacy of vaccination programs - development of diagnostic methods to assess immune health

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It has been estimated that approximately one third of all cancers are related to diet. Diet, if contaminated with carcinogens such as aflatoxin B1, markedly increase the risk of cancer. However, consumption of diets rich in fruits and vegetables have been repeatedly shown to decrease the incidence of a number of cancers in humans. One of the most effective classes of such phytochemical cancer chemopreventive agents are those found in cruciferous vegetables (Brussels sprouts, broccoli, kale, watercress, etc.). Two of the most widely studied phytochemicals from cruciferous vegetables are indole-3-carbinol and sulforaphane. Very little work has been done addressing the question of: "can we protect the fetus from chemical carcinogens which are known to be ingested by the mother, cross the placenta and cause cancer in the offspring.

What has been done
A major thrust of this program examines mechanisms of cancer prevention by food (now with additional funding from the National Cancer Institute) to test phytochemicals from cruciferous vegetables (indole-3-carbinol and sulforaphane) and compare the efficacy of these dietary supplements to the whole foods from which they were derived. We have developed a mouse model for testing chemoprevention by foods and phytochemicals against transplacental carcinogens. Studies are also underway to further investigate mechanisms of action of mycotoxins in food, primarily aflatoxin B1, the potential for this mycotoxin to cross the placenta and cause liver cancer later in life in the offspring and how we can supplement the mother's diet to provide protection from that exposure.

Results
The program is now partnering closer with The Linus Pauling Institute at Oregon State University to maximize the impact of the research and we have a new emphasis on the exciting area of epigenetics. The goals and objectives of these studies are to maximize the benefits of foods containing anti-cancer phytochemicals, identify any risks associated with their consumtion to, as far as possible, eliminate the specific toxicants in the food supply that contribute to health deficits.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

A2 - Percentage of health risks reduced due to information regarding toxins arising from food production and processing

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
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 #4

1. Outcome Measures

A4 - Improved food handling and regulations - Individuals and industry modify food production and handling practices. - Intervention strategies reduce bacterial contamination, increase shelf life, and reduce occurrences of food-borne illnesses.

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

A3 - Improved animal husbandry, such as - Poultry industry changes feed formulations to reduce embryonic mortality during incubation (thereby enhancing hatchability) and to improve animal health and to produce health-enhancing nutrients (thus developing value-added poultry foods). - Livestock producers use diagnostic methods and new vaccination programs to increase immunity (innate and acquired) in domestic animals

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

A6 - Informed policy-making and management related to food processing that prevent incidences of food-borne illnesses.

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Change Indicator - Economic: - Application of knowledge and new leading-edge food technologies will result in improved food quality, value and safety with positive impacts on value-added food production, processing, handling, and distribution systems. - Sustainable competitive advantage for Northwest food industries that are able to accurately gage consumer demand for their products. - Improve the food economy by developing new, stronger, and growing food businesses in the state. - Help reduce the state's unemployment through the creation of jobs in these food companies. - Hatchability and value-added poultry foods will bring increased economic returns to the US poultry industry.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In recent years, greater concerns with respect to diet and nutrition have led to an increased number of marketing and promotional messages focused on the benefits of eating fresh fruit and vegetables. Both consumers and retailers have responded to the spotlight on fresh produce, resulting in increased purchases, marketing resources and even new legislation to promote Specialty Crop production in the US. Consumers and households are also fueling changes in the food system as they seek to purchase their produce through channels as diverse as direct marketing and traditional supermarkets, and with expectations as broad as picking their own produce to highly branded products with 3rd party certifications. Still, little is known about the response of increasingly demanding consumers and food supply chain partners, the changing coordination and supply chain responses of fruit and vegetable enterprises or the response to regulations and policies developed to oversee and guide new innovations in this sector. Our

intended outcomes and impacts are to inform policymakers on the market performance of fresh produce enterprises under new policies and marketing strategies, and guide industry stakeholders in their long-term planning on consumer behaviors and demand changes.

What has been done
Objective 1: Develop demand and market valuation models for the produce sector that can be used to evaluate effects of increasingly complex product differentiation schemes (organic, enhanced health claims, biodynamic), trade, commodity marketing programs, labeling programs (local, food miles, Fair Trade), traceability systems, and food safety events in the U.S. produce markets. Objective 2: Analyze the relative benefits and costs, to producers and consumers, of government and industry-led marketing and policy programs (certifications, Leafy Greens marketing order, Country of origin labeling, farmers markets) using both theoretical approaches and empirical evidence from multi-state applied research projects. Objective 3: Assess the changing coordination and supply chain management strategies being implemented in the fruit and vegetable sector and identify strategic organizational and marketing implications for a set of firms that are diverse in terms of commodity, marketing approach and size of operation (including small and mid size farms).

Results
New methods were developed and utilized for evaluating industry-led variety development in the context of a consumer sensory test. Findings were disseminated to agricultural students and to domestic and international visitiors at the Food Innovation Center Experiment Station.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
602	Business Management, Finance, and Taxation
603	Market Economics
604	Marketing and Distribution Practices
604	Marketing and Distribution Practices
606	International Trade and Development
607	Consumer Economics
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #8

1. Outcome Measures

Change Indicator - Societal: - Better human and animal health, well-being, and survivability result with the use of nutrition and nutrigenomics and organic production. - Reduce health care costs associated with prostate cancer and improve the quality of life of thousands of American men . - Control the growth in the rate of obesity and osteoporosis among youth and solutions reverse trends in childhood obesity - Build environmental public health capacity - Mitigate how federal expenditures related to the farm subsidy program are linked to Medicaid expenditures for obesity related health conditions.

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

Change Indicator - Environmental (risk assessment, policies and management of exposure): - Enhanced environmental quality within an economically responsible context. - Reduced exposure of human and aquatic organisms to fluorochemicals - Moderate the relative contribution of regional U.S. and Canadian agricultural sources (both current and historic uses of these chemicals) and long-range or global sources in contributing to the deposition of agricultural chemicals to remote ecosystems in the Western U.S. - Minimize the risk of adverse impact of pesticide use on human health.

Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

1 - Understanding nutritional relationships to health, such as a) learn the mechanisms behind the health benefits of fruits and vegetables, and b) new risk factors in prostate cancer and novel dietary modifications to reduce the incidence of prostate cancer.

Not Reporting on this Outcome Measure

Outcome #11

1. **Outcome Measures**

2b- Characterize and model toxins arising from food production and processing (mechanisms, effects) * Identify agents, mechanisms, and dose response for reducing fetal risk from toxic chemicals * evaluate dioxin toxicity to humans and characterize specific responsive genes to toxicants * Examine mechanisms that underlie the immune suppression * Identify role of polymorphisms and mediators in relieving dioxin toxicity * Evaluate effects of aging on bioavailability of agricultural contaminants * Determine ways to evaluate extent that landfills are a significant source of fluorochemicals and the extent to which they are present in crops intended for human consumption

Not Reporting on this Outcome Measure

Outcome #12

1. **Outcome Measures**

2c - Characterize and model toxins arising from food production and processing (education) * Provide technical training and resources to agricultural and regulatory stakeholders on ecotoxicology of pesticides and integrated pest, nutrient, and water management.

Not Reporting on this Outcome Measure

Outcome #13

1. Outcome Measures

A1 - Nutritional health or additives provide disease mitigation, e.g., zinc supplementation will be an effective strategy in limiting the incidence of prostate cancer and effective dietary intervention strategies are broadly applied to reduce obesity

Not Reporting on this Outcome Measure

Outcome #14

1. Outcome Measures

4 - Develop technologies and control strategies to improve food safety

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
General human populations are exposed to polyaromatic hydrocarbons (PAHs) primarily though diet, including environmental contamination of food stuffs, through production of PAHs during cooking or processing, and through environmental contaminates such as tobacco smoke or pollution. The goals of this research are to explain mechanisms by which (i) chemical agents commonly available in foods can prevent cancer and (ii) natural cellular systems suppress cellular damage by environmental compounds like PAHs. Chemoprevention/carcinogenic studies will use (live) transgenic mouse models to investigate whether individuals whose genetic makeup puts them at increased risk may benefit from dietary chemoprevention. Biochemical experiments will employ purified human proteins and complex human nuclear extracts. The information gained will directly enhance two of the most promising approaches to prevention (as opposed to treatment) of environmentally-induced cancers: (i) identification by genetic screening of individuals at particular risk (here, to environmental polyaromatic hydrocarbons-induced cancers) and (ii) chemoprevention by relatively simple dietary changes and/or supplements.

What has been done

In this project, we expect to elucidate mechanisms by which (i) chemopreventive agents commonly available in foods - represented here by red raspberry extract (RE) and major RE components, cyanidin-3-O-glucosides (C3OGs) - antagonize transplacental cancer by olyaromatic hydrocarbons (PAHs) and (ii) natural cellular systems, particularly mismatch repair (MMR), suppress mutagenesis, hence carcinogenesis, by (PAHs). Exposure to PAHs has been implicated as causative in human carcinogenesis. Common underlining premises are (1) that PAHs are well-known environmental mutagens and carcinogens, (2) that individual chemically different PAHs are likely to pose different intrinsic risks, and (3) that obvious strategies for minimizing risk to humans are (3a) dietary supplementation with chemopreventative agents expected to antagonize carcinogenesis and (3b) screening for partial genetic deficiencies in cellular systems expected to suppress (with different) efficiencies mutagenesis and carcinogenesis. The program objectives are to test the hypothesis that specific chemopreventative agents (RE and C3OG) efficiently antagonize transplacental lymphomas induced by specific PAHs, and to determine the biomedical mechanisms and efficiencies of mismatch repair (MMR) processing of DNA containing specific PAH-purine adducts to determine effects of deficient nucleotide excision repair (NER) and/or MMR on PAH-induced mutation in transgenic mice.

Results

This project was initiated in 2013. Preliminary results are expected in 2014.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
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
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #15

1. Outcome Measures

5 - Detect incidences and pathways of food borne illnesses to: * reduce regulatory actions * reduce potential economic loss from diminished productivity * reduce incidences reported and absences due to illness.

Not Reporting on this Outcome Measure

Outcome #16

1. **Outcome Measures**

6 - Prepare information about food processing that informs policy makers and managers

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

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

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
608	Community Resource Planning and Development			5%	
701	Nutrient Composition of Food			20%	
702	Requirements and Function of Nutrients and Other Food Components			20%	
703	Nutrition Education and Behavior			25%	
704	Nutrition and Hunger in the Population			20%	
802	Human Development and Family Well-Being			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.0	0.0
Actual Paid Professional	0.0	0.0	4.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	47435	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	305971	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	230238	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

We will survey rural Oregon communities and carry out statistical analyses using primary and secondary data sources to better understand the barriers and opportunities in rural places for low-income and high-income workers, the migration patterns that flow from their work and location decisions, the implications of these changes for rural community vitality, and the effectiveness of public policies in strengthening the viability of rural places.

We will also a) determine factors that drive the decisions of educated rural householders to move to an urban locality through surveys, and b) examine factors to explain why low human capital people are attracted to rural places or otherwise reluctant (or unable) to leave them (thru surveys)

Further, we will develop an econometric model to study rural-urban migration and rural residential choice.

In summary:
- Conduct surveys
- Conduct data analyses
- Conduct mixed-methods longitudinal research (interviews,
- Conduct Research Experiments
- Develop models
- Develop Products, Curriculum, Resources.

- Provide Training.
- Assessments.
- Partnering.

2. Brief description of the target audience

The primary target audiences for this research/extension effort are (1) federal, state, and local government officials and their staff members; (2) those working in the media who cover federal, state and local economic and social trends and conditions; (3) state and local community leaders who are involved in local public affairs; (4) social scientists who want to understand economic and social transformation of rural people and places.

- extension educators.

- commercial producers.
- youth aged 13-18.
- elderly residents
- rural residents
- Latino populations
- economists.
- policy makers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	50	100	44	80

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	8	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

● OTHER SCHOLARLY ACHIEVEMENTS: panel, awards, presentations

Year	Actual
2013	0

Output #2

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH AND COMMUNITIES ...Rural health and communities models and data sets regarding a) determinants of rural residential choice b) processes that account for physical activity and the associated health outcomes among youth across ethnic and class boundaries in the context changing rural communities

Year	Actual
2013	0

Output #3

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH ...Obesity intervention strategies or measures * Identify strategies (message, pricing, foods) that will increase choosing healthful food choices among adolescents and young adults * Identify key parent-child relationships that contribute to childhood overweight and resiliency in various populations. * Identify opportunities for preventive interventions * Identify objective, physiological-based measures for tailoring interventions for specific groups and subgroups. * Develop new or improved intervention strategies targeted to childhood overweight in low income families.

Year	Actual
2013	0

Output #4

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH...Avenues developed for better access to healthy foods

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	1 - Improved understanding about rural populations a) health, social, and economic opportunities in rural communities b) rural human capital in and outmigration
2	2 - Conceptual model will promote understanding of the processes that account for physical activity and the associated health outcomes among youth across ethnic and class boundaries in the context changing rural communities
3	A1 - Improved strategies in rural policies for - rural family and community welfare, local community vitality, poverty reduction - maximizing physical activity and physical and mental health of rural youth and adults
4	3 - Improved outreach, education, and professional practice in serving the needs of rural low-income families to improve the well-being and functioning of these families, including programmatic interventions that reduce the physical inactivity and promotes well-being of lower-income and ethnic minority youth across rural America
5	A2 - Improved governmental decisions about rural areas
6	Change...Improved well-being of lower-income and ethnic minority youth across rural America
7	4 - Understanding human health and nutritional behaviors * Understand the relationship between farm subsidy program and increasing obesity rates in the United States * Identify new or improved obesity intervention strategies in the community setting * Identify objective, physiological-based measures that correspond to target behaviors (bio-behavioral markers) for use later as measures of intervention progress and success or means for tailoring effective interventions * Identify key parent-child relationships that reflect resiliency and the interaction of these relationships with targeted nutritional behaviors * Understand various inputs and interactions of family and child, SES, nutrition, physiology and behavior * Identify strategies (message, pricing, foods) that will increase choosing healthful food choices among adolescents and young adults
8	A3 - Improved nutrition * More schools offer/encourage healthful foods * More effective programs and student experiences related to healthful foods * Markers and strategies become the standards of methods and measurement of childhood overweight and resiliency. * Policies consider health and financial implications of the farm subsidy program.
9	A4 - Families, children, and youth have access to healthy foods

Outcome #1

1. Outcome Measures

1 - Improved understanding about rural populations a) health, social, and economic opportunities in rural communities b) rural human capital in and outmigration

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Rural people want to understand how to improve labor market outcomes and to prepare for changes in demographic trends affecting rural America. They also want to understand how to revitalize economies and to decide what investments are most effective in improving rural economic well-being. Most poor households have working adults, and current anti-poverty policies emphasize work-related avenues out of poverty. Oregon state and local policymakers have made a priority of reducing hunger in Oregon, and promoting economic conditions favorable to reducing hunger and poverty, without a clear knowledge about which economic conditions are most important. There is particular interest in whether community-based policy can play an important role. A multi-disciplinary team of researchers at Oregon State University and the Rural Policy Research Institute Rural Poverty Research Center examined a number of factors thought to be related to hunger and poverty in Oregon and nationally,using both Oregon and national data. Research findings suggest that job growth speeds poverty reduction nationally, and that high housing costs are positively related to food insecurity among low-income families in Oregon.

What has been done
The policy of protecting natural capital through implementation of the NWFP appears to have increased community wealth, as measured in real property value per capita of the communities close to the NWFP land, except if they were dependent on logging. Not surprisingly perhaps, Federal forest policy appears to have affected the prosperity of logging and mill towns differently than other types of rural communities. In the 1990s, NWFP had a negative effect on the wealth and income of communities whose economic base had historically been tied to the wood products industry, including mill towns and other logging dependent communities.
After 2000, however, negative logging- and mill-related NWFP impacts appear to have subsided, and the NWFP induced amenity-migration effects continued: NWFP-adjacent communities experienced higher growth in community wealth than communities more than 10 miles from NWFP-protected land, even among those that were dependent upon logging. The NWFP appears

to have redistributed the benefits associated with the federal forestland, and the impact has evolved during the almost two decades since implementation. For timber dependent communities, the mill towns and logging towns. The implementation of the NWFP reduced growth in community wealth and median income during the initial decade of implementation due to reduced timber harvest in federal forestland. But in the longer run, NWFP appears to have had a more positive impact on the wealth creation in rural Oregon communities, even in those timber-dependent communities that initially went through difficult economic transformations. It is possible, of course, that there were also important within-community shifts in well-being between original residents and newcomers as has been found in other studies of amenity-related development, where growth in real property values has priced original residents out of local housing.

Results

These findings have been cited in local, state and national media and used in policy discussions about hunger and poverty reduction. They are being used by regional foundation leadership to support locally-driven community strategies to create better opportunities for low income workers and their families.

The primary impact of much of the research on the impact of federal forest policy and rural-urban interdependence is on Oregon citizens, business leaders and policymakers who seek to understand these issues. This information informs and changes the nature and content of civic discussion around these issues. One primary form of impact comes with the journalists who come to OSU to seek the research-based knowledge about forest policy impacts and rural-urban linkages. In 2011, 5 national and Pacific Northwest reporters for both television and print media (an AP reporter in Iowa and newspaper reporters in Oregon and Washington) interviewed project investigators for stories on the termination of the SRS funding and the future of rural communities.

Results of the research conducted under this project has been sought by the Oregon Legislature and the U.S. Congress. Oregon House Speaker Tina Kotek ordered copies of Toward One Oregon for each of the 100 Oregon legislators, and she has indicated an interest in having the co-editors of this book testify before the legislature later this session.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
802	Human Development and Family Well-Being

Outcome #2

1. Outcome Measures

2 - Conceptual model will promote understanding of the processes that account for physical activity and the associated health outcomes among youth across ethnic and class boundaries in the context changing rural communities

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
802	Human Development and Family Well-Being

Outcome #3

1. Outcome Measures

A1 - Improved strategies in rural policies for - rural family and community welfare, local community vitality, poverty reduction - maximizing physical activity and physical and mental health of rural youth and adults

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
802	Human Development and Family Well-Being

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
802	Human Development and Family Well-Being

Outcome #5

1. Outcome Measures

A2 - Improved governmental decisions about rural areas

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since its inception in 1985, there has been concern that retirement of farmland from production will adversely affect at least some sectors in nearby communities as demand for local agricultural inputs and marketing services declines. Congress attempted to address this concern by limiting enrollment in the program to 25 percent of a county's cropland. Yet, particularly
in farm-dependent counties, many have wondered whether such limits can cushion the negative impacts of the CRP on rural businesses, civic organizations, community services (education, public safety, roads and other infrastructure), and, ultimately, on community viability.

What has been done
Much economic research has been conducted to look at effects on local communities and a comprehensive review of this literature was conducted this year. Research on the economic and social impact of the CRP on rural counties has concluded that "the adverse impacts of CRP are generally small and fade over time." [T]he negative impacts on rural communities anticipated in the early reports appear to have been moderated as community economies have adjusted. If the CRP program decreases or is downsized, there would, of course, be some business in rural communities that would be negatively affected. The size of these impacts is expected to vary across different types of businesses and communities.

Results
The 2012 research on the Conservation Reserve Program was featured in a Congressional Briefing examining the impacts of reduction of CRP on rural communities and the environment. The briefing was hosted by the Council on Food, Agricultural and Resource Economics in early 2013.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
704	Nutrition and Hunger in the Population
802	Human Development and Family Well-Being

Outcome #6

1. Outcome Measures

Change...Improved well-being of lower-income and ethnic minority youth across rural America

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
802	Human Development and Family Well-Being

Outcome #7

1. Outcome Measures

4 - Understanding human health and nutritional behaviors * Understand the relationship between farm subsidy program and increasing obesity rates in the United States * Identify new or improved obesity intervention strategies in the community setting * Identify objective, physiological-based measures that correspond to target behaviors (bio-behavioral markers) for use later as measures of intervention progress and success or means for tailoring effective interventions * Identify key parent-child relationships that reflect resiliency and the interaction of these relationships with targeted nutritional behaviors * Understand various inputs and interactions of family and child, SES, nutrition, physiology and behavior * Identify strategies (message, pricing, foods) that will increase choosing healthful food choices among adolescents and young adults

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
802	Human Development and Family Well-Being

Outcome #8

1. Outcome Measures

A3 - Improved nutrition * More schools offer/encourage healthful foods * More effective programs and student experiences related to healthful foods * Markers and strategies become the standards of methods and measurement of childhood overweight and resiliency. * Policies consider health and financial implications of the farm subsidy program.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
802	Human Development and Family Well-Being

Outcome #9

1. Outcome Measures

A4 - Families, children, and youth have access to healthy foods

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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
802	Human Development and Family Well-Being

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

Amenity related growth has been enthusiastically pursued as an alternative way of promoting rural growth. A descriptive
analysis of rural recreation population trends in the U.S. reveals that population has become relatively more concentrated at
the county level. We provide an explanation by developing a two-region model with mobile labor, production externalities and
endogenous natural amenities. We find that strong preferences for natural amenities generally foster population dispersion.
However, it also can lead to population concentration when ecological degradation is low and manmade capital is a relatively
scarce input into natural amenity production. Investments that enhance natural amenities are found to reduce the divergence
between the steady state and optimal outcomes.

Key Items of Evaluation

Under the context of amenity related growth, ecosystem management in the presence of a threshold is more challenging
because the ecosystem management policies can potentially induced unintended behavioral responses by the economic
agents. The essential policy challenge is to achieve optimal levels of ecosystem services and urbanization given that
improvements to ecosystem service will induce additional migration and urbanization in the region with attendant ecological impacts. We show that policies that ignore the recursive relationship between urbanization and ecosystem service unintentionally exacerbate boom-bust cycles of regional growth and decline and risk pushing the system towards long-run economic decline.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Diseases of Animals as Important Inhibitors of Food Security

☑ Reporting on this Program

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
121	Management of Range Resources			5%	
132	Weather and Climate			5%	
135	Aquatic and Terrestrial Wildlife			10%	
303	Genetic Improvement of Animals			10%	
311	Animal Diseases			20%	
312	External Parasites and Pests of Animals			10%	
313	Internal Parasites in Animals			10%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			10%	
704	Nutrition and Hunger in the Population			10%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	0.0	0.0	11.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	247293	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1355174	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	6275966	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Global food security represents access to food at many levels. Worldwide, millions of people live hungry due to poverty or lack food security intermittently. As theglobal population grows, the need to develop better ways of providing enhanced food quality and production and improving land use whilepreventing food degradation, as well as distributing the food efficiently and without spoiling, will become key research foci.The health of the animal food sources, as well as plants ources, is important to maintain and expand the nutrition of populations. However, disease is still common in food sources. Many pathogens evolved to survive in the prevailing conditions existing during thecourse of food production and food conservation 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 in several mea tanimals (pork, poultry, etc), the security of food will be compromised. This project will address aspects associated with food animal security, that is, developing diagnostic tests and vaccines and creating a better understanding of the mechanisms of pathogenesis of or immunity to many virulent bacteria, viruses and health conditions.

2. Brief description of the target audience

Animal disease professionals
Animal producers
Food processors
Shellfish industry including growers and hatchery operators
Pharmaceutical companies
World health organizations
FDA
USDA APHIS
Policy Makers
CDC

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	25	70	210	0

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	6	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- 1. To study mechanisms of important bacterial diseases affecting food sources in seafood production and meat production.

Year	Actual
2013	0

Output #2

Output Measure

- 2. To create diagnostic approaches to important conditions such as bovine herpesviru

Year	Actual
2013	0

Output #3

Output Measure

- 3. To develop strategies to increase immunity, including the development of vaccines, against pathogens that impact the food sources.

Year	Actual
2013	0

Output #4

Output Measure

- 4. To study toxins that affect food sources

Year	Actual
2013	0

Output #5

Output Measure

- 5. To enhance partnerships with industry and stakeholders for the application of resilient technologies, practices, and management strategies.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Study mechanisms of important bacterial diseases affecting food sources in seafood production by enhancing the capacity and sustainability of salmon and trout populations.
2	Develop targeted intervention strategies to prevent pathogen contamination in bivalve rearing systems
3	To study mechanisms of important bacterial diseases affecting food sources in meat production.
4	To create diagnostic approaches to characterize the genetic difference between bovine herpesvirus type 1 variants and vaccine strains.
5	Develop strategies to increase immunity, including the development of vaccines, against pathogens that impact food sources. Identify the role of mother cow immunization on calf protection agains MAP.
6	Strategies to increase immunity in animals through dietary supplementation of selenium.
7	Strategies to increase immunity in animals through development of vaccines against influenza.
8	To evaluate the toxicity of various mycotoxins in food.

Outcome #1

1. Outcome Measures

Study mechanisms of important bacterial diseases affecting food sources in seafood production by enhancing the capacity and sustainability of salmon and trout populations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
We plan a long-term commitment to understanding Renibacterium salmoninarum pathogenesis, which causes a progressive, multifocal granulomatous disease, Bacterial Kidney Disease (BKD), that involves the kidney and other internal organs.
We have completed the genome sequence of the pathogen and a logical next step is to examine the level of expression of candidate antigens during growth of the pathogen in fish.

What has been done
Collection of RNA was extremely challenging and efforts continue to improve our techniques and methodology. Current work suggests that a change in the objectives for this particular outcome may be warranted and the team will suggest an alternative approach in the immediate future. Our laboratory is currently assessing possible transcriptional analysis programs can be used in these studies. At the end of this set of experiments we will have a relative abundance of each transcribed gene within the bacterium cultured in fish or in laboratory medium. The initial analyses of transcriptional activity will be repeated three times in order to define the reproducibility of the analyses.

Results
Several students have developed excellent skills in the manipulation of nucleic acids collected from the cells.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
311	Animal Diseases

313	Internal Parasites in Animals
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #2

1. Outcome Measures

Develop targeted intervention strategies to prevent pathogen contamination in bivalve rearing systems

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Research is needed to attempt to stabilize production in shellfish hatcheries by reducing occurrence of larval mortalities in shellfish by Vibrio tubiashii, through development of targeted intervention strategies aimed at preventing pathogen contamination in bivalve rearing systems i.e. by developing sensitive detection systems. Here, we propose to increase our understanding of the molecular mechanisms underlying the pathology of bacillary necrosis as well as to provide the shellfish industry with genetic markers which will help them transform hatchery bacterial populations from an uncontrolled to a controlled variable, thus stabilizing production at a consistent and productive level.

What has been done
We have determined the pathogenicity of strains of Vibrio tubiashii for larvae of mussels and oysters and found that a threshold of about 1000 cells per ml was necessary to cause adverse effects. We were also successful in determining the effects of probiotics in controlling the pathogenicity of Vibrio tubiashii for oyster larvae. The probiotics included algal species, baccterial strains and various seawater treatments. We found that sterilizing seawater increased the survival of Vibrio tubiashii, perhaps by eliminating competing bacterial species.

Results
Our research suggests that hatchery operators should maintain concentrations of Vibrio tubiashii below 1000 cells per m l to avoid outbreaks and that it is best not to attempt to sterilize seawater entering the hatchery because this could lead to greater growth of Vibrio tubiashii in the hatchery. It is best to maintain a "balanced" natural flora of bacteria in seawater to com bat outbreaks of Vibrio tubiashii.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
311	Animal Diseases
313	Internal Parasites in Animals
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #3

1. Outcome Measures

To study mechanisms of important bacterial diseases affecting food sources in meat production.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Clostridium perfringens type A food poisoning (FP) ranks as the third most commonly reported food-borne illness, affecting more than 250,000 individuals annually and causing economic losses of over $120 million in the USA. The food industry is interested in developing spore-inactivation alternatives to conventional heat processing technologies, including pressure-assisted thermal processing (PATP) approved by FDA as a novel food sterilization process, meeting consumer expectations for increased food safety, extended shelf life and improved food quality. Although the application of high pressure (HPP) (400 to 800 MPa) has been reported to inactivate pathogenic and spoilage bacteria, the inactivation of bacterial spores has been a major challenge as spores are extremely resistant to pressure.

What has been done

Alternative strategies to kill bacterial spores using pressure and temperature allowed by commercially available high pressure processing units can be developed by the use of our spore germination knowledge on how to sensitize spores towards inactivation treatments. Such approaches include: i) adding to the food species-specific spore germinants (e.g., L-asparagine

and KCl (AK) for C. perfringens FP strain SM101); ii) using heat and/or pressure treatment as primary activation steps of spore germination; iii) providing time for a germination step, in which the activated spores senses the presence of specific germinants and germinate in ≤ 30 min at optimum temperature; iv) inactivating germinated spores by PATP. In our recent studies (12) we have shown that C. perfringens spores can complete their germination in ~30 min in the presence of AK and PATP could efficiently inactivate C. perfringens spores in poultry meat formulated with AK. However, the feasibility of this alternative novel technology for various C. perfringens strains and meat products have not been determined, as only one strain and one meat product was used in our previous study

Results
Until this information becomes available, it will be difficult to design and develop novel strategies to control C. perfringens growth in meat products and prevent GI diseases caused by C. perfringens. This study will: i) define optimal conditions for efficient inactivation of C. perfringens spores, and ii) identify the basis for further development of protocols to generate unique opportunities for high-quality and minimally-processed foods. Work to date involves culturing various C. perfringen strains from a variety of meat products to allow the study to move forward.

4. Associated Knowledge Areas

KA Code	Knowledge Area
704	Nutrition and Hunger in the Population
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #4

1. Outcome Measures

To create diagnostic approaches to characterize the genetic difference between bovine herpesvirus type 1 variants and vaccine strains.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Bovine herpesvirus type 1 (BHV-1) is the causing agent of Infectious bovine rhinotracheitis (commonly called IBR or red nose). An efficacious BHV-1 vaccine has been in use for many

years, but recently BHV-1 vaccine related abortion has been reported in an increasing number of herds. We plan to establish strain specific single nucleotide polymorphism profiles to assist the diagnosis of BHV-1 infection and to develop diagnostic tools that can quickly differentiate BHV-1 strains in abortion
cases.

What has been done

We are currently working with Pfizer to sequence BHV-1 isolates associated with vaccine related abortion cases. There are 5 BHV-1 isolates that have been obtained from BHV-1 vaccine related abortion incidences. The 2010 MLV vaccine, virus isolates from abortion cases, and wild type reference BHV-1 from NVD will be all sequenced at the same time. Once the whole genome sequence available for different BHV-1 strains or isolates, it is possible to identify specific single nucleotide polymorphisms (SNP) that could differentiate specific strains or isolates from each other. The SNP will be analyzed by alignment of whole genome from different strains using Geneious software. Once BHV-1 unique SNP profile is determined for each stain or isolate, the SNP profile of each virus can be used to identify specific strain by Sanger sequencing of PCR amplicons.

Results

A preliminary analysis of available BHV-1 gene sequences has demonstrated nucleotide variation is conserved between strains, suggesting strain specific SNP markers do exist (Table 1 and Fig 1). In addition to the SNP profile, a specific SNP of pathogenic strain could also be identified with the whole genome sequence comparison. These strain-specific SNP and pathogenic SNP will be useful for disease diagnosis and surveillance program, which is important for food security.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

Outcome #5

1. Outcome Measures

Develop strategies to increase immunity, including the development of vaccines, against pathogens that impact food sources. Identify the role of mother cow immunization on calf protection agains MAP.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual

2013 0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mycobacterium paratuberculosis (MAP) is the cause of a severe and chiefly fatal condition in ruminants. It is mainly acquired by oral route in young calves, following ingestion of contaminated milk or infectious stools. We have shown that MAP, when in milk, changes phenotype and becomes more infectious both in vitro (epithelial cells) and in vivo (mice). Additional studies showed that mother cow antibodies against MAP-binding/invasion proteins, will prevent MAP uptake into the intestinal mucosa in the oral infection model, and impact the development of disease. We will study whether inhibition of the interaction of those MAP surface proteins with the intestinal mucosa will partially or completely inhibit uptake of MAP by the intestinal mucosa.

What has been done
Our understanding of the basic biology and mechanisms of pathogenesis of MAP has unfortunately lagged behind that of other pathogenic Mycobacterium spp. It is well recognized that the ability to identify the route of invasion and the host-pathogen interactions at a molecular level is important for the future development of strategies to prevent MAP infections or to limit the spread of the infection. Similarly, the elucidation of gene products specific to in vivo growth holds great promise in identifying new antigens for diagnostics or vaccine development, as well as products essential to pathogenesis. Hence, we have begun the process of addressing this through the development and characterization of transposon mutant libraries for MAP, along with gene and genome scale-
analyses of the basic biology of the organism and its interaction with the host.

Results
Current results have revealed significant information, which has allowed for better understanding of the mechanisms of entry. We also have identified an important regulator of MAP genes encoding for key proteins associated with invasion of the intestinal mucosa. MAP0482 (LuxR) is upregulated significantly when MAP is exposed to raw milk. Exposure to raw milk is associated with a significant increase in MAP invasion of bovine epithelial cell. Now, it is necessary to characterize the roles of the proteins in infection models.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
312	External Parasites and Pests of Animals

Outcome #6

1. Outcome Measures

Strategies to increase immunity in animals through dietary supplementation of selenium.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Se is an essential micronutrient in cattle, and Se-deficiency can affect morbidity and mortality. Provision of adequate Se is important to prevent Se-responsive diseases in growing cattle such as nutritional myodegeneration and Se-responsive unthriftiness [reviewed Koller, et. al., 1983]. Many parts of the world, including Oregon and many states in the South of the USA, are known to have soil conditions conducive to deficient forage-Se content, potentially leading to clinical signs of Se deficiency in livestock grazing or fed crops raised on them (Stevens, et. al., 1985). Although the essentiality of Se has been known for five decades, the most effective method of Se delivery to cattle for optimum performance is still being investigated.

What has been done
Based on our preliminary data with the UPJOHN J-5 BACTERIN? vaccine, we hypothesize that higher Se in the diet may enhance adaptive immune responses. The CD4+ T helper cells (Th) orchestrate both cell-mediated and humoral immune responses and are necessary for the establishment of immunological memory following vaccination. Therefore, we anticipate that a Se-enriched diet will enhance Th cell functions leading to enhanced adaptive immunological responses.

Results
In order to determine if Th cell responses are in fact enhanced by Se supplementation, we will isolate peripheral blood Th cells from animals by magnetic separation.

Autologous cultures of leukocytes are pulsed with inactivated virus particles present in the Bovi-Shield GOLD® 5 vaccine (BVD types 1 and 2 and BRSV). Professional antigen presenting cells (APC) within the leukocyte cultures will engulf and process the viral proteins into short peptide sequence that will bind to MHC class II molecules expressed by APC. The peptide-MHC class II complex is the ligand for viral specific Th cells, and when isolated T cells are added in excess to antigen-pulsed APC, viral specific T cells will respond by releasing the cytokine IL-2. We have measure IL-2 levels by either a standard ELISA protocol or by intracellular IL-2 staining followed by flow cytometry (to specifically identify the T cell subsets producing IL-2). We hypothesize that an increase in IL-2 concentrations in calves fed Se- enriched diets correlates with the increased antibody titers we have previously observed

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals

Outcome #7

1. Outcome Measures

Strategies to increase immunity in animals through development of vaccines against influenza.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Vaccination provides protection from severe disease caused by influenza virus. The current influenza vaccine production system, i.e. embryonated chicken eggs, is considered suboptimal in capacity for production of annual seasonal influenza virus vaccine, and ineffective in several respects for production of vaccines against highly pathogenic avian influenza virus. Thus, there is an immediate need for methods to enhance the production of influenza virus vaccine from chicken eggs, and mammalian cell lines being considered for vaccine production.

What has been done
We expect to ascertain a PPMO which will enhance the production of influenza virus in chicken eggs and potential vaccine cell lines. A potential caveat in this project is the translation of the human siGENOME findings in A549 cell lines across to avian (embryonated chicken eggs). This is likely to be impacted by issues of conservation of gene sequence, gene function, and variations between species in redundancy of individual gene function. The availability of the chicken and canine genome sequences, and associated gene expression datasets, will enable bioinformatic filtering of PPMO candidates. It is also possible that the impact the inhibition of a single gene will not be sufficient to markedly increase virus production. In this case, more than one gene will be targeted by PPMOs. Regardless, the results from the proposed study will provide very useful preliminary results for the feasibility of PPMO-based approach for future grant applications.

Results
This project is just beginning with preliminary results to be reported in our annual report for 2014.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases

Outcome #8

1. Outcome Measures

To evaluate the toxicity of various mycotoxins in food.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Mycotoxins are secondary metabolites produced by fungi which reside in our food supply and on every surface in our environment and have been associated with a myriad of adverse health effects. Neurological and developmental effects from mycotoxin exposure have been reported but the mechanism(s) responsible for eliciting these toxic responses remain elusive. Moreover, little research has been done evaluating the toxicological effects of multi-mycotoxin exposure, which is generally how humans and animals are exposed to these toxins. Therefore, we propose to evaluate the developmental toxicity of four groups of the most predominantly detected mycotoxins in food (aflatoxins, fumonisins, ochratoxins and trichothecenes), both individually and in combination with each other, using the zebrafish (Danio rerio) model. Uncovering some of the mechanisms of toxicity that mycotoxins utilize to exert their effects can help design more specific studies investigating how to prevent mycotoxins induced diseases.

What has been done
A major goal is to define the full concentration response to each of the input chemicals by calculating the No Observed Adverse Effect Level (NOAEL) and EC100 for each produced endpoint (morphological and behavioral). Initially, we have defined the NOAEL and EC100

concentrations in our 5D tropical wild type strain of zebrafish. We hypothesize that chemicals that produce toxicity at higher concentrations may produce non- obvious, subtle effects and lead to important adult functional deficits at lower concentrations. We will initiate all exposures 6 hours post fertilization (hpf) with dechorionated embryos and sustain them continuously until 120 hpf.

Results

Preliminary results will be reported in 2014. We plan to assess of a battery of 18 body morphology endpoints at 5 days post fertilization (dpf) from high-resolution digital images. We have developed our own imaging system based on a Nikon Eclipse Ti inverted scope with a fully motorized, PC-controlled stage. With our custom software, it can image 96 wells in less than 3 minutes. The system automatically uploads the images to our own 100TB server for archiving and recalls them via barcode identifier for visual scoring of the 18 endpoints. This system also captures video for assessing cardiac endpoints. We have established a long track record of productive, rapid-throughout, phenotypic and behavioral screens in zebrafish (Mandrell 2012, Chen 2011, Truong 2011, Saili 2012, Tal 2012, Truong 2011, Harper 2011).

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
312	External Parasites and Pests of Animals
313	Internal Parasites in Animals
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

All of the objectives and outcomes reported here are in the first year of a five year program. All research projects under this planned program have been initiated and we expect that we will have significant progress to report beginning with the 2014 annual report.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Establishment of food security involves many important aspects, from the source of the food to storage and transportation. We need to address gaps in our existing knowledge if

we are expected to create efficient ways to ensure food security to the broader population. The goal of this project is to develop a comprehensive approach to address infectious diseases and toxins in food animals. We will study infectious conditions and toxins that have impact on food sources. Better diagnosis of diseases as well as prevention and treatment measures are crucial for the establishment of safe source of nutrients.

Because the research described above has only just been initiated, we expect most evaluative results to be reported in our 2014 annual report.

Key Items of Evaluation

Although the spectrum of the proposed program seem broad, the main focus is to develop knowledge about infectious disease that affects the health of animals (food sources), establish diagnostic tests and attempt to progress towards creating new forms of therapy/prevention, such as vaccines and antisense morpholinos. The major NIFA outcome area to be addressed by this project is "Enhanced capacity of a sustainable global food system including new/improved plans, animals, technologies and management systems." Chosen indicators include: Improved animal genetics, Filed patents and licensing agreements, Increased efficiencies, Adoption of best practices and technologies.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Prevention of Obesity through Improving Dietary Patterns, Healthy Eating, and Physical Activity

☑ 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
607	Consumer Economics			10%	
608	Community Resource Planning and Development			10%	
701	Nutrient Composition of Food			10%	
702	Requirements and Function of Nutrients and Other Food Components			10%	
703	Nutrition Education and Behavior			10%	
704	Nutrition and Hunger in the Population			10%	
724	Healthy Lifestyle			10%	
802	Human Development and Family Well-Being			10%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities			10%	
805	Community Institutions, Health, and Social Services			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	0.0	0.0	4.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	84085	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	460788	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3099306	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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 will 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.The project will examine 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 are interested in the impact of diet (types of foods) and levels of PA intensity on appetite, food selection and weight management.

2. Brief description of the target audience

We will work on better waysof communicating the dynamic energy balance messages (e.g. the integrated effect of diet and PA on weight) to future health professionals, current Extension and professional faculty working in the area of nutrition and PA, and parents and children. Understanding the factors that impact one's weight and the weight of their children will improve decision making around weight management. It will also help health professionals working with parents and children.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	200	0	75	0

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	5	5

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Determine what factors, such as creative, new tasty healthy dishes, realistic methods for incorporating healthy foods into daily dietary patterns, result in greater frequency of consumption

Year	Actual
2013	0

Output #2

Output Measure

- Examine how community gardens in rural communities may increase healthy eating and encourage economic growth through the development of microenterprise ventures designed to market produce within the local community.

Year	Actual
2013	0

Output #3

Output Measure

- Determine key factors for positive long-term changes in weight and waist circumference (WC) by exploring how low-energy dense diets can reduce total energy intake through increased satiety and improve overall dietary patterns. A secondary aim is to examine how the interaction of low-energy dense diets and different levels of PA impact weight, WC and risk of chronic disease. Focus will be on children, young adults and parents.

Year	Actual

2013	0

Output #4

Output Measure

- Determine the key factors that link the above projects and their individual outcome goals into a larger project that can be submitted for external funding for obesity prevention in young adults and their families.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Generate and test healthy easy-to-prepare and acceptable recipes for use in homes, schools and senior care facilities. Original and OSU Extension Service Food Hero recipes will be developed within the OSU kitchens. This will involve recruiting OSU students to work as volunteers and on projects in classes to develop recipes. Dr. Cluskey, OSU students and partners from the Food Hero Project and the Moore Family Center for Whole Grains and Preventive Nutrition will collaborate on recipe development and testing, and quantifying recipes for home and use in larger food operations. Post and promote recipes on Websites for Moore Family Center and Food Hero. The team will focus on efforts to test sensory acceptability of recipes. This will involve identifying objectionable flavors, aromas and textures in barley/vegetables and to see if we can identify strategies to manipulate recipe or other characteristics and improve sensory ratings. Acceptable recipes will be modified into quantity based recipes and provided to colleagues working in school foodservice, healthcare feeding programs and others for sensory testing in those locations. Efforts to modify recipes targeting their specific needs and audiences (e.g., low salt versions) and based on poor sensory attribute ratings (dislike) will be attempted to improve acceptability as needed.
2	Drs. Cluskey, Lim, Hayes and Ross will collaborate on efforts to test sensory acceptability of recipes. This will involve identifying objectionable flavors, aromas and textures in barley/vegetables and to see if we can identify strategies to manipulate recipe or other characteristics and improve sensory ratings. Sensory attribute acceptability will be measured (hedonic or other scale) using experimental approaches with student engagement and support from enrollees of the Undergraduate Research Assistant Program, and/or graduate student and OSU dietetic intern research theses and projects. Various populations will be recruited for tasting including college students, OSU staff and faculty and children from the Kid Spirit Program.Acceptable recipes will be modified into quantity based recipes and provided to colleagues working in school foodservice, healthcare feeding programs and others for sensory testing in those locations. Efforts to modify recipes targeting their specific needs and audiences (e.g., low salt versions) and based on poor sensory attribute ratings (dislike) will be attempted to improve acceptability as needed. URAP students and graduate students will be used in conducting these research activities. Dr. Cluskey will lead the team in conducting evaluations to measure the frequency and popularity of offerings, and ultimately consumption at home, and in schools or other institutional settings. Dr. Cluskey will work with Drs. Hayes and Ross on exploring methods to enhance acceptability and promote use of barley recipes; with Drs. Zhao and Manore on acceptability and promotion of vegetables, berries recipes and pomace as an ingredient and with Dr. Richards in exploring the role of family, peers and community gardens on influencing healthy food consumption among youth and other populations.
3	Determine the role of garden-based nutrition curriculum in youth knowledge and consumption of foods grown. This will allow us to successfully develop and deploy training modules based on participant feedback for garden planning, nutrition education and cooking classes, marketing and business management, and to measure how the project is/is not meeting the needs and interests of the community. Finally we will measure the impact of community garden growing of vegetables, fruits, and barley on changes in dietary consumption of low-income youth.
4	We will Develop and deploy dietary approaches for breakfast and snacks that incorporate both low-energy dense foods (whole fruits, whole vegetables, whole grains) and foods containing a dietary fiber/polyphenol pomace derived from fruit and/or grape skins/ and

seeds. These dietary approaches will be evaluated against adherence to diet and PA plans and the impact of energy density and various levels of PA on objective and subjective determinants of appetite.

Outcome #1

1. Outcome Measures

Generate and test healthy easy-to-prepare and acceptable recipes for use in homes, schools and senior care facilities. Original and OSU Extension Service Food Hero recipes will be developed within the OSU kitchens. This will involve recruiting OSU students to work as volunteers and on projects in classes to develop recipes. Dr. Cluskey, OSU students and partners from the Food Hero Project and the Moore Family Center for Whole Grains and Preventive Nutrition will collaborate on recipe development and testing, and quantifying recipes for home and use in larger food operations. Post and promote recipes on Websites for Moore Family Center and Food Hero. The team will focus on efforts to test sensory acceptability of recipes. This will involve identifying objectionable flavors, aromas and textures in barley/vegetables and to see if we can identify strategies to manipulate recipe or other characteristics and improve sensory ratings. Acceptable recipes will be modified into quantity based recipes and provided to colleagues working in school foodservice, healthcare feeding programs and others for sensory testing in those locations. Efforts to modify recipes targeting their specific needs and audiences (e.g., low salt versions) and based on poor sensory attribute ratings (dislike) will be attempted to improve acceptability as needed.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The consumption of whole fruits and vegetables, whole grains and low-fat dairy and meats in lieu of higher fat, energy dense foods, results in a diet lower in energy density, higher in fiber, and rich in micronutrients and phytochemicals. These healthier eating habits and food choices may also result in reduced consumption of sugary beverages, which can increase energy intake without adding nutritional benefits. The consumption of soda beverages has been associated with unhealthy eating behaviors and sedentary behaviors in a large study of middle and high school students (Ranjit et al, 2010). The benefit of a low-energy dense, high- fiber diet is that it offers meal satiety, which can result in reducing total energy intake (Rolls, 2009; Sweat and Manore, 2012). This type of diet can also protect against weight gain and abdominal obesity with aging (Fogelholm et al 2012). Taken together these factors reduce risk of chronic disease and the prevention of weight gain.

What has been done
Team members participated in a conference titled: Energy Balance at a Crossroads: Expert Panel Meeting. This conference has resulted in a publication two organizational journals (Med Sci Sport Ex and J Academy of Nutrition and Dietetics), which will be published simultaneously in July, 2014. In addition, the PI is chair of the Energy Balance Work Group (ACSM, USDA, AND) and we have a number o f initatives that have come out o f this meeting, which are moving forward including identifying physical activity experts for USDA to help with obesity prevention, joint credentials between ACSM and AND for professionals, survey of professionals in both fields to see what each tells clients regarding nutritio n/PA. We are also initiating a push toward educating public school teachers about energy balance and the importance of nutrition and PA for obesity prevention.

Pro ducts: 1. Journal article that will be widely publicized. 2. Presentations at national meetings (Annual meetins o f ACSM and AND) 3. Joint credentials so both nutrition and exercise science professions understand the importance of both for energy balance. 4. USDA NIFA recognizing the importance of both professions for the prevention of obesity. 5. Publishing a paper in JOE (in press) about USDA's Supertracker for obesity prevention research and education.

Results
Recipe testing is being done with whole grains, results gathered and then incorporated into the next round o f testing. Graduate and undergraduate students are working on the project. A total of nine recipes have been developed and tested on 225 participants including teens, adults, and seniors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
805	Community Institutions, Health, and Social Services

Outcome #2

1. Outcome Measures

Drs. Cluskey, Lim, Hayes and Ross will collaborate on efforts to test sensory acceptability of recipes. This will involve identifying objectionable flavors, aromas and textures in barley/vegetables and to see if we can identify strategies to manipulate recipe or other characteristics and improve sensory ratings. Sensory attribute acceptability will be measured (hedonic or other scale) using experimental approaches with student engagement and support from enrollees of the Undergraduate Research Assistant Program, and/or graduate student and OSU dietetic intern research theses and projects. Various populations will be recruited for tasting including college students, OSU staff and faculty and children from the Kid Spirit Program.Acceptable recipes will be modified into quantity based recipes and provided to colleagues working in school foodservice, healthcare feeding programs and others for sensory testing in those locations. Efforts to modify recipes targeting their specific needs and audiences (e.g., low salt versions) and based on poor

sensory attribute ratings (dislike) will be attempted to improve acceptability as needed. URAP students and graduate students will be used in conducting these research activities. Dr. Cluskey will lead the team in conducting evaluations to measure the frequency and popularity of offerings, and ultimately consumption at home, and in schools or other institutional settings. Dr. Cluskey will work with Drs. Hayes and Ross on exploring methods to enhance acceptability and promote use of barley recipes; with Drs. Zhao and Manore on acceptability and promotion of vegetables, berries recipes and pomace as an ingredient and with Dr. Richards in exploring the role of family, peers and community gardens on influencing healthy food consumption among youth and other populations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
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.

What has been done
Dr. Hayes works in collaboration with the breeding and genetics efforts for the creation of barley varieties that will improve nutritional composition of barley for human consumption. The potential impact will be that consumers will have access
to whole cereal grains that reduce chronic risk factors for cardiovascular disease, type 2 diabetes, and metabolic syndrome. Specific outcomes include the improvement of food barley varieties; food barley production packages; food barley product standards and formulations; basic knowledge regarding the genetics and environmental plasticity of agronomic and quality traits published in international peer-reviewed journals; and a model breeding system that efficiently and cost-effectively provides varieties on a sustained basis.

Results
Nine new barley recipes have been developed and tested as part of school lunches and lunches provided at senior centers. Reception has been good and the recipes have been disseminated through the Extension website.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
805	Community Institutions, Health, and Social Services

Outcome #3

1. Outcome Measures

Determine the role of garden-based nutrition curriculum in youth knowledge and consumption of foods grown. This will allow us to successfully develop and deploy training modules based on participant feedback for garden planning, nutrition education and cooking classes, marketing and business management, and to measure how the project is/is not meeting the needs and interests of the community. Finally we will measure the impact of community garden growing of vegetables, fruits, and barley on changes in dietary consumption of low-income youth.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
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 foryouth. 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.

What has been done

To examine the impact of gardens on healthy eating, Dr. Langellotto and a graduate student used meta-analytical techniques to analyze published data. They found that children participating in nutrition education programs without a gardening component increased their nutrition knowledge, but not preference for or consumption of fruits or vegetables. Meanwhile, children participating in a nutrition education program with a gardening component showed no increase in nutrition knowledge, but increased their preference for vegetables and their consumption of both fruits and vegetables. Kids who garden eat more fruits and vegetables, even if they don?t know why it is good to eat more fruits and vegetables! On this project, Dr. Langellotto will be responsible for recruiting Master Gardener volunteers to support overall project objectives, as well as to participate in the research project, itself.

Results

Community gardens will be placed in operation at several locations this spring. Preliminary results will be available in 2014.

4. Associated Knowledge Areas

KA Code	Knowledge Area
608	Community Resource Planning and Development
703	Nutrition Education and Behavior
704	Nutrition and Hunger in the Population
724	Healthy Lifestyle
802	Human Development and Family Well-Being
803	Sociological and Technological Change Affecting Individuals, Families, and Communities
805	Community Institutions, Health, and Social Services

Outcome #4

1. Outcome Measures

We will Develop and deploy dietary approaches for breakfast and snacks that incorporate both low-energy dense foods (whole fruits, whole vegetables, whole grains) and foods containing a dietary fiber/polyphenol pomace derived from fruit and/or grape skins/ and seeds. These dietary approaches will be evaluated against adherence to diet and PA plans and the impact of energy density and various levels of PA on objective and subjective determinants of appetite.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Dr. Zhao?s recently completed activities significant to this project include research in the area of ?antioxidant dietary fibers from fruit and wine grape pomace as value-added food ingredients?. Fruit and wine grape pomace are rich in dietary fibers and contain significant amount of polyphenolics with antioxidant capacity, thus can be classified
as ?antioxidant dietary fibers (ADF)? to be used as a value-added food ingredient for providing health benefit to consumers.

What has been done
Polyphenolics are sensitive to temperature and oxygen, and can be easily destroyed while preparing fresh pomace to dried powders. Hence, different drying methods, including air-, vacuum- and freezing-drying were investigated to identify the mostly healthy and economically feasible method for creating ADF powders. Developed ADF powders were then used as a functional food ingredient to be fortified in yogurts, muffins, cookies, breads and salad dressings for increasing the intake of dietary fibers and extending product shelf-life by controlling lipid oxidation as ADF has shown its capability as an antioxidant to delay lipid oxidation in some high fat products. ADF powders and ADF fortified products were evaluated for their content of dietary fiber, phenolics, and other bioactive compounds, as well as antioxidant capacity. The fortified food products were also examined for their physicochemical properties and for consumer acceptance.

Results
The development of ADF from fruit and wine grape pomace and its application as food ingredient would benefit the society by reducing bio-waste for protection of environment, the wine industry by adding more economic outputs, and the consumers by providing health promotion products.

4. Associated Knowledge Areas

KA Code	Knowledge Area
607	Consumer Economics
701	Nutrient Composition of Food
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

This collaborative project is just beginning and we expect more substantive preliminary results in 2014. As with all research the addition of additional grant funds would allow this research to be expanded through the support of graduate students and to enlist community participation.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This proposed collaborative project will use this model for behavioral change, by examining what environmental and social factors predict how groups (e.g., communities, schools, families) and/or individuals (e.g., children, youth, young adults, women, especially mothers, and family food providers) make long-termpositive changes in dietary patterns, healthy eating and physical activity (PA) behaviors for obesity prevention and reduction of chronic disease risk. We expect that exposure to better dietary choices that do not involve substantial increases in cost will heighten awareness and lead to better eating habits and PA.

Key Items of Evaluation

Although there are numerous factors that contribute to obesity, two key factors that determine overall health and across the lifespan are access to, and the composition of healthy foods and engagement in PA (2008 PA Guidelines; Dietary Guidelines for Americans, 2010). In addition, children live in families where adultshave the opportunity to influence their dietary and physical activities. For families to make healthy lifestyle changes, they need to value health or the outcomes of health suchas less sick days and improved

performance at work or school. Parents also have the opportunity to pass on a legacy of health to their children, which can impact their childfor alifetime. Thus, targeting adult women with children, helping themachieve healthier behaviors around diet and PA, will also give theman opportunity to influence the health of their children. By targeting young and young adults, we can help set a life time pattern of healthy food and PA. We can also determine the impact that dietary factors and types of PAhave on appetite and food selection. Finally, by targeting women, especially overweight women with abdominal obesity prior to the impact of advancing age and menopause, we expect to demonstrate the effects of a modestly changes in diet and exercise on abdominal obesity and chronic disease risk factors.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Food Safety - Overcoming Implementation Barriers to Food Traceability

☑ 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)			10%	
401	Structures, Facilities, and General Purpose Farm Supplies			10%	
404	Instrumentation and Control Systems			10%	
501	New and Improved Food Processing Technologies			10%	
503	Quality Maintenance in Storing and Marketing Food Products			10%	
512	Quality Maintenance in Storing and Marketing Non-Food Products			10%	
601	Economics of Agricultural Production and Farm Management			10%	
604	Marketing and Distribution Practices			10%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			10%	
902	Administration of Projects and Programs			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	0.0	0.0	9.5	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	217780	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1193442	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	3832855	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The implementation of the Food Safety and Modernization Act (FSMA) will have a major impact on agriculture, especially small farmsthroughout the U.S. It requires new harvest and post-harvest handling practices and record keeping that minimizethe risk of food-borne disease hazards. Small farms are artisanal in nature, have1-5 employees and lackthe capital (human and financial) to adopt such a systemon 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. This project 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. The solutions we suggest to overcome barriers to FTS implementation will enable small scale systems to fully integrate a FTS systemthat will allow themto be proactive and prevent or minimize microbial outbreaks by integrating food safety and harvesting practices.

2. Brief description of the target audience

Small farm producers
Organic producers
Policy makers (state and federal)
Decision makers (state and federal)
Food processors
Fodd marketers
Researchers
Consumer Stakeholders
Federal Regulatory Agencies
State Regulatory Agencies

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	220	300	0	0

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	6	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Identtfy current trace3ability practices by small producers and processors,

Year	Actual
2013	0

Output #2

Output Measure

- Identification of Critical Tracking Events (CTEs) and Key Data Elements (KDEs)

Year	Actual
2013	0

Output #3

Output Measure

- Evaluate current FTS technologies

Year	Actual

2013	0

Output #4

Output Measure

- Identification of benefits and costs to implementing FTS

Year	Actual
2013	0

Output #5

Output Measure

- Training for stakeholders

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Identify Current traceability practices by small producers and processors
2	Identification of Critical Tracking Events (CTEs) and Key Data Elements (KDEs)
3	Identification of benefits and costs to implementing FTS
4	Training for Stakehoders

Outcome #1

1. Outcome Measures

Identify Current traceability practices by small producers and processors

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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. Large farms have the human capital and financial resources to incorporate existing programs such as the Produce Traceability Initiative (PTI), but 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. Not having small farms up to speed will leave the whole food safety system vulnerable, resulting in an unreliable and ineffective food safety system. A critical need exists for development of a cost effective and simple-to-implement Food Traceability System (FTS) for small producers and processors. However, in order to develop an effective FTS, in-depth knowledge about the barriers (economic, logistical) faced by small scale systems must be obtained.

What has been done
We formed a multi-disciplinary research and outreach team, recruited collaborative stakeholders, and identified critical industry needs and barriers in traceability system through a three-day specialty crop traceability conference in Aurora, Oregon. A total of sixty-five stakeholder representatives participated in this three-day conference, including NW hazelnut and berry growers, processors, retailers, industry trade organizations, and technology solution providers. Over 89% of industry participants considered product tracing to be very important to their business.

Results
The workshop and other communications with producers Identified several needs including effective product tracing tools and information platforms for data capturing and information

sharing among trading partners. The barriers to adoption included cost, privacy concerns, resistance to change, lack of benefits or incentives, technical support and training. In addition to work with stakeholders, the group also identified outside industry and academic expertise and formed the advisory panel for technical oversight and guidance on the project.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
401	Structures, Facilities, and General Purpose Farm Supplies
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
512	Quality Maintenance in Storing and Marketing Non-Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
902	Administration of Projects and Programs

Outcome #2

1. Outcome Measures

Identification of Critical Tracking Events (CTEs) and Key Data Elements (KDEs)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Northwest (NW) grows a variety of specialty food products. It contains a diverse array of micro- climates: high desert, dry plains, mountainous, valley, and coastal. Due to the strong demand for ?local,? ?organic,? ?natural? and ?wild? foods, there are many small producers and processors of foods in the NW. These producers and processors provide excellent models for the study of the challenges faced by small/artisanal food processors in implementing traceability

systems. Many of the operations are multi-generation farms; most of them still rely on manually written paper records for product tracing, resulting in delayed and unreliable recall.

The IFT has conducted several FDA funded studies on US food traceability systems. Based on their findings, the following key elements have been recommended to the FDA for implementation of future food traceability (IFT 2009a;IFT 2009b): (1) identifying Key Data Elements (KDE) for traceability, (2) defining Critical Tracking Events (CTEs), (3) establishing an electronic record of key data elements for each CTE, (4) selecting and implementing a standard data format, (5) providing education and training on government guidance, and (6) establishing third party audits. This project will address points 1, 2, and 5 of the FDA recommended elements.

What has been done

The Cornell University Produce Safety Alliance (PSA) was recently established under funding from the USDA and FDA (http://producesafetyalliance.cornell.edu). Committee members of PSA are developing a national curriculum to increase understanding of the principles of GAPs and to facilitate the implementation of food safety practices on fresh fruit and vegetable farms and in packinghouses. We are working closely with existing programs such as the Produce Safety Alliance (Cornell University), Western Institute for Food Safety and Security (University of California, Davis), and the Food Safety Program (Washington State University) and share information to facilitate implementation of FSMA and other food safety practices.

Results

We are currently developing a database of recently published materials on traceability and this information is being disseminated through a variety of workshop that were held in three Oregon locations with growers and processors to explain FDA FSMA proposed rules. Meetings and calls have been held with other researchers to further explore current availability of traceability software and practices to facilitate deployment and testing of the applications.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
512	Quality Maintenance in Storing and Marketing Non-Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
902	Administration of Projects and Programs

Outcome #3

1. Outcome Measures

Identification of benefits and costs to implementing FTS

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Some members of the supply chain do not envision the potential economic incentives in implementing full-chain traceability systems. Some businesses interested in implementing traceability systems, fear losing their competitive edge due to the added time and costs involved (IFT 2009a). Consequently there are social and economic barriers to implementing product tracing, even with the passage of recent federal legislation, FSMA.

What has been done
Many small producers and processors are businesses with gross sales less than $500,000. The cost of implementing FTS is a critical factor for successful adoption by these stakeholders. Limited research exists on the cost of food traceability systems (IFT 2009a). An analysis of implementing FTS is being conducted in terms of currently available hardware and software, operation and maintenance cost, and training and education in food safety, production efficiency and sustainability.

Results
Dr. Gil Sylvia has led the development of FisTraxTM (http://fishtrax.org and http://pacificfishtrax.org) which is an electronic fish information system (eFIS) designed to provide multiple data and information services to the fishing and seafood industry. The system is designed to collect data from fishing vessels, laboratories, and other data sources and transform that data into knowledge useful to the broader fishing community as well as specific audiences including fishermen, processors, scientists, resource managers, the marketplace, consumers, and the public. The system uses a variety of tools to upload science and fishery data including computers, smart phones, and Ipads and stores that data in a central database. FishTraxTM has many design features similar to those needed for terrestrial farming and natural

resource systems including low cost electronic data collection systems and devices, interactive databases, multiple portals, traceability, and a focus on information and knowledge, rather than data. Current efforts suggest it may be possible to integrate and/or adopt many FishTraxTM features to specific farming and terrestrial systems to improve management of food safety, product quality, marketing, and farming production and sustainability.

4. Associated Knowledge Areas

KA Code	Knowledge Area
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
512	Quality Maintenance in Storing and Marketing Non-Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices

Outcome #4

1. Outcome Measures

Training for Stakehoders

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Training through workshops, conferences and seminars will bring stakeholder up-to-date with latest changes that are occurring in the Food Safety and Modernization Act with regard to traceability. Opportunities at these events will also be used to monitor how growers and processors are implementing traceability elements into their food systems.

What has been done
Team members have attended or participated in numerous workshops on FTS, including a

Pesticide Risk Assessment and Risk Reduction Workshop held in Algiers, Algeria, December 15-18 , 20 13. 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 an opportunity for countries in the region (Algeria, Egypt, Jordan, Morocco , Tunisia, and Yemen) to better understand the risk assessment pro cesses 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.

Results
Regulators and those that provide services to food production and processing in the participating countries have been trained to better understand the relationship between pesticide use and the potential for pesticide residues in food, as well as the regulatory procedures design to insure food safety through the dietary risk assessment.

Numerous presentations have been made and/or scheduled with specialty crop producers and processors, fish and shellfish industry, and meat producers and processors.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
401	Structures, Facilities, and General Purpose Farm Supplies
404	Instrumentation and Control Systems
501	New and Improved Food Processing Technologies
503	Quality Maintenance in Storing and Marketing Food Products
512	Quality Maintenance in Storing and Marketing Non-Food Products
601	Economics of Agricultural Production and Farm Management
604	Marketing and Distribution Practices
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Brief Explanation

Researchers at OSU have worked with small producers and processorstounderstandtheiroverallattitudes and practices for food safety and traceability. What is needed now is information on detailed practices such as the type of data (data fields andformat), when, where and how they capture those data and how they use the data.

This information is crucial to designing and developing effective tools and information platformfor small scale producers and processors. CTEs and KDEs are the key traceability data for effective trace fromfield to fork since it determines what, where, when and how muchtraceability data and information have to be captured for a business. Well defined CTEs and KDEs at every supply chain will minimize the amount of traceability data while providing an effective tracing system. However, the CTEs and KDEs will vary depending on the production, inventory, andshipping systems of the particular food product.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This project was just initiated in late 2013. As the project matures, we expect to reveal a number of technological opportunities for tracking agricultural products from farm to fork. Similarly our researchers are uncovering numerous new techniques for improving food safety and making that information available to consumers. It will be imperative that policy makers continue to allow these new technologies to adequately mature and be made available to the market prior to enforcing restricitions for small producers.

Key Items of Evaluation

Our principal role is to evaluate the potential for providing small producers the same technology as that employed by larger producers and processors. Ideally, this technology can be made available at a cost that does not adversely impact producers or consumers. At the same time, new methods are being evaluated that will aid small producers to ensure that all agricultural products can be delivered to market wtih assurances that food borne pathogens have been eliminated without negative impacts to food quality.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Breeding Crops For Adaptation to Changing Environments: Addressing Food Security and Global 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			5%	
111	Conservation and Efficient Use of Water			5%	
112	Watershed Protection and Management			5%	
131	Alternative Uses of Land			5%	
132	Weather and Climate			10%	
201	Plant Genome, Genetics, and Genetic Mechanisms			10%	
202	Plant Genetic Resources			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			5%	
211	Insects, Mites, and Other Arthropods Affecting Plants			10%	
212	Pathogens and Nematodes Affecting Plants			10%	
215	Biological Control of Pests Affecting Plants			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2013	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	0.0	0.0	11.6	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

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

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	46992	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	654672	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	320536	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Global food security will provide adequate access to food for the world's population. Worldwide, millions of people live with inadequate nutrition due to poverty or lack of access to food security. As the global population grows, there is a need to increase productivity per hectare, enhance water use efficiency and improve the nutritional value of crops in order to provide enhanced food quality. Increasing production must coincide with improving land use and reducing negative environmental impacts of intense agriculture. Finally, these accomplishments must take place in response to a changing climate and the resulting abiotic stresses that can influence production. This project provides a coordination of research in plant breeding and genetics to make fundamental and applied contributions to plant science that will lead to economic development and an equitable, sustainable and nutritious food supply. Objectives include a) accelerated programs to create desirable traits in crop cultivars; b) identification of novel genes and molecular breeding techniques for adapted germplasm; c) identification of growth and development pathways; and d) a better understanding of the mechanisms and resistance to abiotic and biotic stresses.

2. Brief description of the target audience

Agricultural producers
Pant breeders
Extension agents
Researchers
Policy makers
Decision makers
Food processors
Consumers
Water managers
Climate adaptation specialists

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2013	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	1000	40	0

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

Patent Applications Submitted

Year:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	36	36

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Use molecular breeding tools to develop resistance to abiotic and biotic stressors and to improve traits related to human health and nutrition in cultivars of importance in agriculture systems.

Year	Actual
2013	0

Output #2

Output Measure

- Use a systems biology approach to better understand mechanisms affecting target traits in cultivars of importance in agriculture systems.

Year	Actual
2013	0

Output #3

Output Measure

- Evaluate new germ plasm, cultivars or varieties for commercial viability.

Year	Actual
2013	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	1. Use molecular breeding tools to develop resistance to abiotic and biotic stressors and to improve traits related to human health and nutrition in cultivars of importance in agriculture systems. a) Conduct a systematic evaluation of germplasm resources to identify sources of genetic variation i. Develop new high throughput markers anchored in genome sequences ii. Map genes/QTLs determining target traits iii. Characterize gene/QTL networks and interactions iv. Measure gene/QTL x environment interaction v. Validate and fine map putative genes/QTLs vi. Transfer identified genes/QTLs into economically useful backgrounds, using accelerated generation advance strategies
2	Improve the nutritional value of important food grains; 2) reduce the impact of wheat storage proteins on human health; and 3) target nutrient development with ripening control. Examples at OSU include barley (Hayes and Ross), wheat (Zemetra, Flowers, and Ross), and grape (Deluc).
3	The mission of the Ornamental Plant Breeding Program is to develop new cultivars that are ecologically sound for producers and consumers as well as economically viable for producers. We seek to develop sterile forms of non-native species, insect and disease resistant cultivars, and low input cultivars that can be grown in nurseries and landscapes with less water or nutrient inputs.
4	Fundamental Research Supporting Multiple Breeding Programs. Two research groups are engaged in fundamental research relevant to multiple breeding programs. These include seed dormancy and germination (Nonogaki) and a systems biology approach to stress tolerance (Jaiswal).
5	Validation of cultivar performance and stripe rust resistance for wheat.

Outcome #1

1. Outcome Measures

1. Use molecular breeding tools to develop resistance to abiotic and biotic stressors and to improve traits related to human health and nutrition in cultivars of importance in agriculture systems. a) Conduct a systematic evaluation of germplasm resources to identify sources of genetic variation i. Develop new high throughput markers anchored in genome sequences ii. Map genes/QTLs determining target traits iii. Characterize gene/QTL networks and interactions iv. Measure gene/QTL x environment interaction v. Validate and fine map putative genes/QTLs vi. Transfer identified genes/QTLs into economically useful backgrounds, using accelerated generation advance strategies

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

In Oregon there are over 38,000 farms producing crops on over 16 million acres. Because 25% of Oregon?s economy is based on agriculture; successful breeding programs directly influence and affect the success of a good portion of that value. Fruits, nuts, berries, vegetables, seed and specialty crops are produced on over 320,000 acres, and production has been increasing by 12% per year, generating $30-50 million per year. Cereal grains, potatoes and row crops account for over 10% of agricultural farm gate value in a typical year. The Oregon greenhouse and nursery industry typically accounts for approximately 15% of farm gate value annually.

Oregon? crops are hosts to a wide variety of pathogens, pests, and stresses for which durable resistance genes are actively sought. At the same time, allelic variation in genes and gene networks associated with plant growth and development are targets for optimization in order to ensure maximum plasticity, productivity, and efficiency.

What has been done

Pests, such as diseases, nematodes and weeds, continue to extract an economic, environmental, and social cost and are exacerbated by variable weather conditions. Efforts are needed to improve crop production efficiency by integrating genetic resistance and/or tolerance. Examples at OSU include wheat stripe rust (Mundt and Flowers), eastern filbert blight (Mehlenbacher), white mold (Myers), and multiple diseases of potato (Sathuvalli). The fundamental work involving the

Pto gene in tomato (Chang) provides a foundational example for the more applied projects.

Results
Faculty participating in this project published 22 peer reviewed articles on breeding efforts and new developments in genomics of disease resistance.

Pests, such as diseases, nematodes and weeds, continue to extract an economic, environmental, and social cost and are exacerbated by variable weather conditions. Efforts are needed to improve crop production efficiency by integrating genetic resistance and/or tolerance. Examples at OSU include wheat stripe rust (Mundt and Flowers), eastern filbert blight (Mehlenbacher), white mold (Myers), and multiple diseases of potato (Sathuvalli). The fundamental work involving the Pto gene in tomato (Chang) provides a foundational example for the more applied projects.

White mold (caused by Sclerotinia sclerotiorum) is the most economically significant disease of snap beans (Phaseolus vulgaris), currently grown on 13,400 acres for processing in Oregon. While some variation for resistance is found within common bean, the best source of resistance is found in scarlet runner bean (P. coccineus) (Gilmore, 2007). Resistance QTL were identified and mapped in three runner bean x common bean backcross-inbred (BCIB) populations (Haggard, 2007; Zimmerman, 2010). Additional sources of resistance in common bean have been identified. In order to ensure the continued viability of beans as a crop in Oregon, and to contribute to global solutions to this disease, research is needed to identify, introgress, and characterize new sources of resistance (Miklas et al., 2013).

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #2

1. Outcome Measures

Improve the nutritional value of important food grains; 2) reduce the impact of wheat storage proteins on human health; and 3) target nutrient development with ripening control. Examples at OSU include barley (Hayes and Ross), wheat (Zemetra, Flowers, and Ross), and grape (Deluc).

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Population growth and climate change will continue to stress available resources and limit our ability to meet the nutritional needs of the world population. Advances in genetic enhancements of food crops have improved yields and resistance to biotic and abiotic stresses. The same approaches can be used to further improve production agriculture by seeking genetic enhancements that: 1) improve the nutritional value of important food grains; 2) reduce the impact of wheat storage proteins on human health; and 3) target nutrient development with ripening control.

What has been done
we are developing healthy foods that will assist the nation in addressing the challenges of serious health issues aggravated by diets high in processed foods, sugars, and fats (Park et al., 2011). Americans are increasingly becoming overweight and even obese; more healthy foods are needed. Part of the solution is the development, promotion, and adoption of whole foods, including fruits and grains. We have used, and are currently using these molecular breeding tools for a range of traits in barley and improvement (Fisk et al., 2012; Von Zitzewitz et al., 2011). Foremost among the quality traits of interest are dietary fiber, antioxidants and phenolics, which are recognized as having potential health benefits in human nutrition (Chutimanitsakun, 2013).

There is evidence that the incidence of celiac disease has increased in recent decades and not simply as a result of increased diagnosis (Rubio-Tapia and Murray 2010). The increase in celiac disease has generated interest about the impact of wheat storage proteins on human health and the potential role of wheat breeding through selection for improved end-use bread quality. We are determining if selection away from dough strength such as practiced in development of soft white wheat cultivars results in a decrease in the level of the offending gliadin proteins.

Using an asynchronous grape berry cluster, we identified a natural regulatory mechanism, named ?ripening synchronization?, aimed to reduce the inherent variability between developmentally different berries towards maturity. The nature of this mechanism must be elucidated before proposing a mechanistic model of the ripening control in grape. Moreover, understanding this biological process will enhance our understanding of the overall ripening in grape and will provide insights into other fruits and cereal crop models that suffer from biological variability.

Results
Because this project was initiated in late 2013, we expect to have preliminary results in 2014.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants

Outcome #3

1. Outcome Measures

The mission of the Ornamental Plant Breeding Program is to develop new cultivars that are ecologically sound for producers and consumers as well as economically viable for producers. We seek to develop sterile forms of non-native species, insect and disease resistant cultivars, and low input cultivars that can be grown in nurseries and landscapes with less water or nutrient inputs.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Nursery and greenhouse represents the largest sector of Oregon?s agricultural production and was valued at nearly $742.5 million in 2011. Historically, most new cultivars of woody nursery crops arose as chance seedlings or vegetative sports from plants being grown on nurseries or in landscapes. Climate change, changing consumer attitudes, access to new tools, and growers? desire to market ecologically sound cultivars has led to increased targeted breeding of woody nursery crops for traits such as drought tolerance, insect and disease resistance, and sterility (Harding et al., 1991; Li et al., 1996; Vining et al., 2012).

What has been done
We are developing sterile forms of non-native species, insect and disease resistant cultivars, and low input cultivars that can be grown in nurseries and landscapes with less water or nutrient inputs. A major focus of our program is with Cotoneaster, which is a genus of landscape plants that has lost favor in the industry due to losses from fire blight (Erwinia amylovora) and concerns about invasive potential of the genus. However, most species in the genus are extremely hardy landscape plants that can be grown in harsh conditions with little water, thus would fit well into sustainable landscape situations.

Results
Team members are conducting experiments to evaluate if progeny of Cotoneaster resulting from susceptible X resistant crosses exhibit fire blight resistance. These same progeny are triploids and will be evaluated for fertility. To date, we have germ plasm from which we will select im[roved forms based on fertility, disease resistance, fruit size, and growth characteristics.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants

Outcome #4

1. Outcome Measures

Fundamental Research Supporting Multiple Breeding Programs. Two research groups are engaged in fundamental research relevant to multiple breeding programs. These include seed dormancy and germination (Nonogaki) and a systems biology approach to stress tolerance (Jaiswal).

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

PHS is a serious problem in wheat production, since precocious germination dramatically reduces the quality of final products, which causes substantial financial losses for wheat growers and affects food supply in our society. Understanding the mechanisms of seed dormancy and germination will provide solutions to these agricultural problems.

Systems biology approaches to understanding stress response. There is a compelling need to understand pathogens, light, moisture, salt and temperature. This can be addressed using a reference species approach to build tools and models to profile the transcriptome of important crops, such as wheat. Assembly of de novo transcriptomes and alignment of expressed gene sequences identify (1) genetic markers and (2) stress responsive differentially expressed genes. Our strategy is to further knowledge in the de-novo transcriptome assembly of large plant genomes and to create a reference for the annotation and enrichment of wheat and related crops.

What has been done
The plant hormone abscisic acid (ABA) plays an important role in imposing seed dormancy (Martinez-Andujar, Ordiz, et al., 2011). To establish strategies to prevent PHS, expression of ABA metabolism and signaling genes will be characterized and enhanced. The promoter and coding regions of ABA metabolism and signaling genes will be isolated from wheat and sorghum and analyzed for their potential for technology development. Gene function will be tested in model plants such as Arabidopsis and Brachypodium, while transformation to crop species will also be tested. Transcriptional profiling on the CGRB?s Illumina HiSeq2000 platform will be used to examine the consequence of modifying target genes that are associated with seed dormancy and germination.

The project will attempt to identify a reference set of SNP markers and transcriptomes from the founder A, B and D genome diploid wheats in phase-I. These references will be used for performing a large-scale genotype and transcriptome sequencing-based GWAS analysis. A similar approach will be attempted on hexaploid (cultivated) wheat. It is expected that during phase-II of this project the hexaploid wheat genome will be published and its availability will further strengthen the investigation on GWAS. The wheat survey sequences from the heaxploid genome (Brenchlet et al 2012), A-genome (Ling et al 2013) and D-genome (Jia et al (2013) reference transcriptomes from T. monococcum (Fox et al. 2013) are already available. The process will include growing wheat A, B and D genome donors in controlled and growth chambers and separate experiments involving cold and hot temperature regimes, drought and salt stresses.

Results
This project was approved in late 2013. Necessary greenhouse experiments are currently beginning and we expect to begin reporting preliminary results in 2014.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
202	Plant Genetic Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems

Outcome #5

1. Outcome Measures

Validation of cultivar performance and stripe rust resistance for wheat.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The OSU Department of Crop and Soil Science hosts breeding programs for five crops? barley, hops, meadowfoam, potatoes, and wheat ? which account for over 10% of agricultural farm gate value in a typical year. Hence, roughly 2% of Oregon?s economy can be directly influenced and affected by the success of these breeding programs. The OSU Department of Crop and Soil Science hosts breeding programs for five crops? barley, hops, meadowfoam, potatoes, and wheat ? which account for over 10% of agricultural farm gate value in a typical year. Hence, roughly 2% of Oregon?s economy can be directly influenced and affected by the success of these breeding programs. Via integration of fundamental and applied research, CSS researchers work hand-in-hand with their producer clientele to improve the sustainability of growing these crops in Oregon. Researchers strive to develop crop varieties with the best disease and pest tolerance possible and with quality attributes that allow growers to expand and enter new markets. At the same time, the plant breeders make significant contributions to a fundamental understanding of plant genetics, biology and chemistry.

What has been done
Systems biology approaches to understanding stress response. There is a compelling need to understand pathogens, light, moisture, salt and temperature. This can be addressed using a reference species approach to build tools and models to profile the transcriptome of important crops, such as wheat. Assembly of de novo transcriptomes and alignment of expressed gene sequences identify (1) genetic markers and (2) stress responsive differentially expressed genes. Subsets of stress responsive genes and the association of gene expression and polymorphic genetic marker site associations are functionally annotated and computationally analyzed for identifying expression QTLs (quantitative trait loci) and compared to the known/novel QTL from the genomes of closely related species. This computational approach has been successfully adopted by the NSF funded Gramene database (www.gramene.org) where researchers can query the database for a set of genes and their association to trait phenotypes, regulatory and

metabolic networks, and gene function at the molecular level (Ni et al 2009). Our strategy is to further knowledge in the de-novo transcriptome assembly of large plant genomes and to create a reference for the annotation and enrichment of wheat and related crops.

Results

This research involves field screening of wheat cultivars and elite germplasm for resistance to common wheat disease in Oregon (stripe rust, and septoria are examples). Trials will be conducted at a maximum of 15 and a minimum of 9 locations in Oregon, northern California, and southwestern Idaho. 25 ? 40 entries will be tested per experiment. Trial sites are chosen to represent a diverse array of production conditions; from very low rainfall to full irrigation, shallow to deep soils, and low residue to high residue management practices. Exact location of the trials may vary each year. Data from each experiment will be collected, analyzed and made available to growers soon after harvest. Data will be summarized and distributed via web, email, newsletters, print media, and various extension outlets as well as delivered to clientele through presentations at grower meetings, crop tours, and field days. The trials also provide grain samples to evaluate stability and consistency of end-use quality traits by the OSU Wheat Quality Improvement Program and ARS Western Wheat Quality Lab.

This project was initiated in late 2013. We expect to begin disseminating results in 2014 as field trials have just begun during the 2014 growing season.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
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V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

This project was initiated in late 2013 and we expect initial results in 2014. Researchers involved in this project published 36 peer reviewed articles on various aspects

of the project that will provide the basis for continued investigations over the 5 year life span of the project.

The continued prevalence of drought, water stress, and emerging resistance of plants to various pathogens demonstrates the importance of this project for a variety of producers (grapes, barley, hazelnuts, beans, potatoes, wheat, tomato, and berry crops). The Center for Genome Research and Biocomputing (CGRB) at OSU will provide the necessary technical backdrop to allow this project to move forward.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Researchers need to address gaps in our existing knowledge if we are to create efficient ways to ensure food security for the broader population. The goals of this project are to develop comprehensive approaches to (i) improving productivity and (ii) controlling or mitigating losses. Better diagnosis of plant diseases as well as prevention and treatment measures are crucial for the productivity and sustainability of food systems as well as the establishment of safe food sources. This project provides important insights into the coordination of fundamental and applied research to achieve demonstrable advances in plant breeding to alleviate the impacts of biotic and abiotic stresses associated with climate change and an expanding human population.

Key Items of Evaluation

Plant genetics, breeding, physiology and entomology are disciplines that directly impact every Oregonian, have stakeholders in multiple sectors of the state's economy, and have significant economic, environmental, and political impacts. Internationally and nationally, population growth and climate change make providing nutritious, diverse, and abundant food an imperative. There is also a shortage of highly trained college graduates to address these challenges. Herein lies an opportunity for OSU to contribute to the PNW economy, to train the next generation of agriculture and food system scientists and producers, and to meet global challenges for food, fiber, and a healthy environment. Meeting the needs of our students and PNW growers will provide new information on how crops can be bred to deal with abiotic and biotic stressors. Many of the crops now grown in the Oregon and region were originally from elsewhere, and what we learn from improving the quality and quantity in the new growing region, i.e., the PNW, will provide the basis for advancing our basic understanding of plant biology and related issues. New genetic technologies will be instrumental in developing, and building on, our knowledge.

This project has two major priorities: 1) integrate basic and applied science to yield on-the-ground deliverables with high impacts in the state and the region; and 2) develop gene validation and expression genetics in economically important crop plants. This project will allow integration of these two priorities. Leadership in this integration aspect will be provided by the OSU Center for Genome Research and Biocomputing (CGRB), which provides services in the areas of Genomics, Functional Genomics, Biocomputing and BioInformatics, and Imaging and Image Analysis. The plant breeding and genetics faculty at OSU are members of the CGRB and reside in two academic units: Crop and Soil Science (CSS) and Horticulture (HORT). Research and teaching functions are integrated in an emerging Plant Breeding and Genetics Program.