

2011 Oregon State University Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

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

Collaboration

The Oregon Agricultural Experiment Station (OAES) during the 2011 year continues its tradition of collaboration across disciplinary and organizational lines. In the coming years, collaborative work will be expanded more broadly as the Station develops new five year programs of research to address the NIFA program areas.

Funding

One of the Experiment Station's state performance metrics is external funds leveraged per dollar of state funding. In 2010-2011, this metric set a new record of 1 to 2.5 as \$24.5 million in state appropriations were leveraged by faculty to generate \$61.4 million in external fund expenditures.

NIFA Program Areas

Research programs address the five thematic areas defined by the new National Institute for Food and Agriculture. Program foci cover Bioenergy, Climate Change, Global Food Security, Food Safety, and Obesity, as well as a theme critical to Oregon and the Western United States -- Water and Watersheds. The following are highlights from these Planned Programs.

Sustainable Energy

OAES faculty from the Department of Biological and Ecological Engineering continue to make strides in production of bioproducts, biofuels and biohydrogen from sunlight and agricultural and cellulosic feedstocks. Hydrogen, one of the cleanest and most desirable fuels, is expected to play an increasingly important role in our economy but at present, non-renewable fossil fuels including natural gas, oils and coal are the main sources for hydrogen gas production, necessitating research into renewable sources. The focus of one project was to gain a good understanding of the factors affecting hydrogen production from complex woody biomass. This work significantly enhanced the understanding of some fundamental issues about the kinetics and mechanisms of biohydrogen generation from lignocellulosic biomass using microbial electrolysis cells.

Climate Change

This program includes studies that focus on development of models of community-level responses to perturbations, population dynamics and habitat management for individual aquatic and terrestrial species, and development of methods for monitoring ecosystem changes. Researchers throughout the Station are engaged in activity to document, predict and respond to the threats global climate change presents to the human community. OSU College of Agriculture research achievement was recognized by ScienceWatch of Thomson Reuters which ranked OSU fourth in its "U.S. Institutions: Most Prolific in Environment and Ecology, 2005-2009." We recount just a few examples here:

- Marine phytoplankton sequester a significant amount of carbon in the earth's oceans and thus buffer

global climate change. Fifty years of conventional wisdom about these ubiquitous microorganisms have been challenged by results developed by the Department of Botany and Plant Pathology. New views of the role played by marine phytoplankton raise concerns that global warming may curtail, rather than stimulate, ocean productivity.

- Department of Crop and Soil Science faculty are participating in a broad national collaboration to breed climate change-tolerant barley and wheat varieties. Targeted traits will include increased efficiencies in use of water and nitrogen, resistance to disease and tolerance for low temperature. These efforts will expand the global range of these essential foodstuffs and are supported by a \$25 million grant awarded to participants in the national collaboration.
- Work assessing the viability of farming in the inland Pacific Northwest under various climate-change scenarios will better enable growers to respond effectively to climate change and to manage their carbon footprints. The project examines potential effects of climate change on cereal crops and aims to determine which farming methods may promote sustainability. Researchers in the College are contributing to the \$20 million grant-funded region-wide study.

Global Food Security and Hunger

This program comprises a major portion of the research in the Oregon Agricultural Experiment Station (OAES) and includes research activities on animal production systems, crop management, plant biology and genetics, agricultural economics and food science and technology. Researchers work to improve agricultural and food systems through new varietal development, disease identification and abatement, improved animal health and economic models that ultimately will make these systems more efficient and increase revenue for growers and producers.

- An understanding of the economic efficiency and ecological impacts of development in areas of low-density population is the anticipated outcome of a theoretical model developed in the Department of Agriculture and Resource Economics. The model will provide a benchmark against which land use policies may be evaluated.
- In a multi-state effort, called the Northern Organic Variety Improvement Collaborative, faculty from the Department of Horticulture are collaborating with colleagues from three other universities, the Organic Seed Alliance and organic farmers. This \$600,000 USDA-funded project will identify or breed vegetable varieties adapted to organic production systems. The project will increase availability of certified organic seed supplies, increasing the organic sector's compliance with National organic program regulations. It will also educate farmers on organic seed production and plant variety improvement.
- Those who manage food systems are acutely aware the food production is always at risk of a new threat whether that is an insect, a disease, or weeds. Sophisticated cross-disciplinary team science is required to monitor, detect and addresses these pest threats. Collaborating broadly, College researchers and Extension faculty are leading a \$5.8 million multi-state applied research project for immediate control strategies for the Spotted-Wing Drosophila, an introduced pest that infests ripening fruits. Fruit production in Washington, Oregon and California (with handling and value-added activities) contributes billions of dollars in direct and indirect impacts to the states' economics. Through proactive collaborations, many of the same faculty are positioned to respond to the anticipated expansion of a pest that feeds on an array of crops, the Brown Marmorated Stink Bug.
- The farm-gate value of bee pollination for many crops in Oregon has been estimated at \$460 million. Legislative action led to the tenure-track hire of a honeybee specialist within the Department of Horticulture to ensure the health of honey bees. Also an on-campus diagnostic Honey Bee Laboratory makes it possible to examine thousands of bees for a variety of diseases and parasites; beekeepers can quickly access research-based guidelines to promote and maintain the health of their hives. Work from this lab is estimated to save Oregon's beekeepers \$1.4 million annually in hive medication costs.
- According to the United Nations' Food and Agriculture Organization, as much as one-third of food produced for human consumption is lost or wasted: fruits and vegetables are the food category most impacted. An edible coating developed in the Department of Food Science and Technology slows deterioration of fresh blueberries, increasing market value and creating possibilities for a new market

sector in pre-washed, ready-to-eat fruit. Use of the coating with other fresh fruits such as strawberries, a highly perishable fruit, is under investigation.

- Applied research from the Malheur Experiment Station has promoted the conversion from flood irrigation to drip irrigation on at least 25 percent of Oregon's onion acreage. The result is a 40 percent reduction in water and nitrogen fertilizer use. Coupled with precise irrigation scheduling, this practice has increased onion yield and quality. Station faculty have been key players in enabling growers to effect the transition.

Food Safety

OAES faculty from the Colleges of Agricultural Sciences, Health and Human Sciences and Veterinary Medicine are working toward improved animal and human health through better nutrition, safer food products, more efficient pharmaceuticals and a reduction in exposure or mitigation of exposure to toxic chemicals.

- Researchers in the Department of Environmental and Molecular Toxicology are investigating the impact of man-made nanoparticles on cells. Working at the interface between research and policy, faculty have begun to contribute to an understanding of potential impacts of nanobased pesticides, a relatively new area within nanotechnology. While these applications may have positive impacts, such as more highly targeted applications with reduction in active ingredient loading, researchers are urging caution, because materials at the nanoscale interact differently with surfaces, including cellular surfaces.

- Faculty in the Department of Botany and Plant Pathology working on the molecular biology of potyviruses and closteroviruses have advanced the knowledge of the genomics of viruses and sub-cellular life forms, leading to better understanding of protein complexes and protein trafficking between cell compartments. This knowledge offers promise for the production of vaccines, other pharmaceuticals and plant antibodies.

- Researchers from the College's Integrated Plant Protection Center and Department of Environmental and Molecular Toxicology continue their partnership with colleagues in West Africa on a pesticide risk assessment and management program in West Africa. The project focuses on integrated pest and production management, climate and weather-based pest risk assessment, biological pest control, sustainable agrochemical use, and food security. It is supported by more than \$5.9 million of funding from the USDA, the United Nations Food and Agriculture Organization, and others.

Childhood Obesity

Research has addressed the importance of teaching women to make changes in their own health behaviors that become part of their lifestyle, and then to model these healthy behaviors in the home to improve the health of the family. Study results suggest that changes in both diet composition and level of physical activity are important to reverse risk factors for chronic disease in individuals who are overweight or obese as well as modelling behaviors for their families, especially children in the household.

Further, youth gardens implemented with the collaboration of local faith-based organizations have provided youth from underrepresented groups access to affordable and healthy food as well as provide them information on how grow nutritious food and incorporate it into their diet.

Water and Watersheds

This OAES program uses advances in technology and field observations of physical and biological processes and functions, benthic macroinvertebrate community, numerical and statistical models to understand the driving principles and linkages of watershed and river ecosystems.

- Project members from the College's departments of Biological and Ecological Engineering and Agricultural and Resource Economics and collaborators across departments, colleges, and universities are at the heart of an NSF-funded project led by OSU's Institute for Water and Watersheds. Willamette Water 2100 brings together faculty for a comprehensive, highly integrated examination of hydrological, ecological

and socio-economic factors in the Willamette River basin. The team is applying Envision, a theoretical framework developed at OSU to evaluate how climate change, population growth and economic growth may alter the availability and use of water in the Willamette River Basin during the next century. Its goals are to predict where climate change will create water scarcities and where those scarcities will exert the strongest impacts on basin residents. Interdisciplinary relationships formed for this project are expected to endure and promote achievements in teaching, research, and Extension.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	3.0	0.0	70.0	0.0
Actual	0.0	0.0	338.4	0.0

II. Merit Review Process

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

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

2. Brief Explanation

Comments are still being collated.

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
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public
- Survey specifically with non-traditional groups
- Survey of selected individuals from the general public

Brief explanation.

The Dean and Director, as well as Associated Directors and the External Relations Director, traveled through 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

workshop. They also attended events organized by various industry, public and nonprofit entities to interact with stakeholders.

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

1. Method to identify individuals and groups

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

Brief explanation.

Extension, Station, and departmental faculty, as well as unit leadership provided information on critical stakeholders and groups. The deans and the External Relations Director also identified important clientele through their many contacts.

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

1. Methods for collecting Stakeholder Input

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

Brief explanation.

Meetings allowed two-way interactions, social media allowed comments on current activities, and surveys collected directed questions on various topics.

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.

Given the budget reductions expected in FY2011-14, stakeholder input was critical in identifying program priorities and staffing. An expanded development campaign, entitled "Innovation for Life," has been organized around new and revamped priorities.

Brief Explanation of what you learned from your Stakeholders

Regional issues are not always identifiable or covered by national programs or competitions. New mechanisms need to be identified in lieu of the now defunct, or moribund, special research grants program.

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	3707778	0

2. Totaled Actual dollars from Planned Programs Inputs				
Extension			Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	3707779	0
Actual Matching	0	0	26174023	0
Actual All Other	0	0	31940663	0
Total Actual Expended	0	0	61822465	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

S. No.	PROGRAM NAME
1	Sustainable Energy
2	Climate Change
3	Global Food Security and Hunger
4	Food Safety
5	Childhood Obesity
6	Excellence in Water and Watersheds: Advance understanding and effective management of

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Sustainable Energy

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation			10%	
402	Engineering Systems and Equipment			20%	
511	New and Improved Non-Food Products and Processes			40%	
609	Economic Theory and Methods			30%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	3.3	0.0
Actual Paid Professional	0.0	0.0	10.8	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	143227	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	908370	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1068158	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

In summary:

- Conduct Research Experiments
- Develop models and simulation tools
- Develop new culture strains and metabolic engineering tools
- Develop Products, Resources.
- Conduct surveys
- Conduct data analyses
- Conduct workshops
- Provide Training.
- Assessments.
- Partnering.

2. Brief description of the target audience

The target audiences for this research are :

- public sector
- private sector
- economists
- policy makers
- agricultural biotechnology firms
- farmers
- bioenergy and biofuel producers
- industrial manufacturers of hydrogen and fuel cells

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	240	1000	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	1	17	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
2011	8

Output #2

Output Measure

- DEVELOP IMPROVED BIOPRODUCT PRODUCTION SYSTEMS: Indicators - Type 1...Improved technologies and production systems for biofuel and bioenergy a) better solar energy capture for hydrogen production b) improved fermentation processes c) new and improved sensors for bioprocessing

Year	Actual
2011	2

Output #3

Output Measure

- DEVELOP IMPROVED BIOPRODUCT PRODUCTION SYSTEMS: Indicators - Type 2... Improved feedstocks a) microbial and algal feedstocks for biodiesel production b) use of agricultural by-products as feedstock c) use of invasive species as feedstock d) development of a cellulosic feedstocks for hydrogen, ethanol, and biodiesel production

Year	Actual
2011	3

Output #4

Output Measure

- PROVIDE TECHNOLOGY, MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS REGARDING AGRICULTURAL PRODUCTION: Indicator ...theoretical and computation tools development and application a) generate tools, both parametric and non-parametric, for evaluating technological change, capacity utilization, and productivity growth b) apply economic tools to a number of industries and products c) identify

determinants of innovation in agricultural biotechnology

Year	Actual
2011	0

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Knowledge Type 1...Improved knowledge about composition and conversion of feedstocks for biofuels, bioenergy, and co-products a) production and harvesting of algae and micro-organisms b) cellulosic feedstock composition c) essential oils found in invasive species d) metabolic engineering for photobiological hydrogen
2	Knowledge Indicators 2 ... Improved engineering applications to advance production systems for bioenergy: - biomimetic models to create biobased generators to produce molecular H ₂ and O ₂ from water and light, with these generators incorporated into integrated H ₂ energy systems, providing generation, storage, and utilization of H ₂ in one unit. - optimize the photobiological process to yield higher energy efficiencies. - demonstrate that waste biomass, such animal wastes and organic component of urban wastewater, used as feedstock can not only yield biohydrogen, but that waste can be reduced.
3	Knowledge Indicators - Type 3...Models to look at productivity and technological processes a) Model to look at production simultaneous with negative externality outputs b) Productivity in the agricultural sector and electric utilities c) Network models d) biomimetic models to create biobased generators to product molecular hydrogen and oxygen
4	Action Indicators - Type 1...Industry apply production systems a) Energy producers optimize photobiological process to yield higher energy efficiencies b) new biobased hydrogen generators are incorporated into integrated hydrogen energy systems, providing generation, storage, and utilization of hydrogen in one unit. c) microbial fuel cells provide on-farm electrical generation
5	Action Indicators - Type 2...economic activity in rural areas a) bioenergy facilities are located close to potential feedstocks to generate additional economic activity
6	Action Indicators - Type 3...improved feedstocks are produced a) algae outproduce terrestrial oilseed crops and oil is easily extracted b) organic materials harvested from animal wastes and urban wastewater generate bio hydrogen and eliminate waste
7	Co-product development

Outcome #1

1. Outcome Measures

Knowledge Type 1...Improved knowledge about composition and conversion of feedstocks for biofuels, bioenergy, and co-products a) production and harvesting of algae and micro-organisms b) cellulosic feedstock composition c) essential oils found in invasive species d) metabolic engineering for photobiological hydrogen

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Making ethanol from straw is difficult compared to obtaining it from corn kernels or the soft, starchy kernels of grain. Straw is loaded with lignocellulose, which requires that the tightly packed cell walls be broken down to allow yeast and enzymes access to the long sugar molecules they will ferment into ethanol. Native lignocellulosic biomass is highly resistant to degradation, hence the need for pre-treatments which make the cellulose more accessible to subsequent enzymatic saccharification. Such treatments also generate non-sugar compounds that inhibit subsequent fermentation. Our work has addressed the problem of how to overcome inhibition of fermentation caused by acetic acid generated during both acidic and alkaline pre-treatments that hydrolyze acetyl groups from native acetylated hemicellulose.

What has been done

Mike Penner, fermentation scientist, explains that the holy grail of biofuels is to develop a strain of yeast that will generate the enzymes to break down the tough cell walls of straw at the same time it hydrolyzes the material into fermentable sugars. So far no single strain of yeast has been found that can withstand the process; Researchers around the world are searching for microorganisms to do the job, exploring inside the hay-churning stomachs of cattle and in the wood-digesting guts of termites. Our approach has been to isolate acetic acid-resistant mutants of *Saccharomyces cerevisiae*.

Results

One major outcome is the discovery that high levels of acetic acid inhibit nutrient uptake by yeast. While we have shown that uptake of tryptophan, leucine and uracil is inhibited, we suspect the impairment is not limited to these nutrients. We also discovered that a large class of acetic acid-resistant mutants is partially defective in endocytosis, the process by which membrane proteins,

including nutrient transporters, are recycled. We speculate that the net result of the defect slows transporter turnover, allowing greater nutrient uptake to occur than in normal cells. Several undergraduate and graduate students obtained experience in biological research by working on this project.

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

Knowledge Indicators 2 ... Improved engineering applications to advance production systems for bioenergy: - biomimetic models to create biobased generators to produce molecular H₂ and O₂ from water and light, with these generators incorporated into integrated H₂ energy systems, providing generation, storage, and utilization of H₂ in one unit. - optimize the photobiological process to yield higher energy efficiencies. - demonstrate that waste biomass, such animal wastes and organic component of urban wastewater, used as feedstock can not only yield biohydrogen, but that waste can be reduced.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Biosolar production of hydrogen (H₂) from water using algal or cyanobacterial strains has great appeal as an environmentally sustainable, long-term solution to energy needs. Biosolar energy systems that produce H₂ would be clean and could serve as distributed, stand-alone power sources. The major feedstocks (sunlight, water and CO₂) are abundant and widely distributed, and the quantities of H₂ that could be produced through biosolar approaches far exceed current and projected global energy requirements. However, very little or no H₂ production by algae or cyanobacteria is known to occur in the light, partly because all known algal or cyanobacterial [Ni-Fe] enzymes are extremely sensitive to O₂, and partly because our understanding of the metabolism underlying H₂ production is limited.

What has been done

Three phycobilisome (PBS) mutants and the wild-type strain of the cyanobacterium *Synechocystis* sp. PCC 6803 were examined for pigment production, glycogen accumulation, and hydrogen (H₂) production after encapsulation in silica gel. Cultures were conditioned in nutrient-replete media prior to being transferred to less rich media optimized for fermentative H₂ production via glycogen accumulation. Chlorophyll, phycocyanin, allophycocyanin, and glycogen content were measured before and after conditioning in the less rich media, and cells were then encapsulated in silica gel and incubated anaerobically in the dark for fermentative H₂ production.

Results

Increased light intensity during conditioning generally yields increased glycogen accumulation. However there was little variation between the strains whilst one strain accumulated approximately 25% less glycogen. Two of the mutant strains produced more H₂ than wild-type when conditioned under intense light and encapsulated in silica gel derived from aqueous precursors, accumulating approximately 1.2% H₂ in the headspace. H₂ production from all strains encapsulated in gels derived from aqueous precursors was approximately 2.5 to 3.5 times higher than liquid controls. These results illustrate that PBS mutants of *Synechocystis* sp. PCC 6803 and encapsulation in silica gel can be used to enhance indirect photobiological H₂ production.

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 #3

1. Outcome Measures

Knowledge Indicators - Type 3...Models to look at productivity and technological processes a) Model to look at production simultaneous with negative externality outputs b) Productivity in the agricultural sector and electric utilities c) Network models d) biomimetic models to create biobased generators to product molecular hydrogen and oxygen

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Microbial electrochemical systems (MES) have attracted much research attention in recent years due to their promising applications in renewable energy generation, bioremediation, and wastewater treatment. In an MES, microorganisms interact with electrodes via electrons, catalyzing oxidation and reduction reactions at the anode and the cathode. The most-described type of MES is microbial fuel cell (MFC), in which useful power is generated from electron donors, typically biodegradable organic materials. Various novel MES have recently been developed to produce hydrogen (microbial electrolysis cells (MECs)), to reduce bioremediation targets, and to desalinate water. The key feature shared by these systems is the microbe-catalyzed electron transfer from organic matter to electrodes (anodes). Enhancing the anodic current output, which highly depends on the performance of the electrodes, is critical for the successful application of all these processes.

What has been done

Anode properties are critical for performance of MES. Iron nanoparticle modified graphite disks were used as anodes to investigate the effects of nanoparticles on the performance of *Shewanella oneidensis* MR-1 in MES.

Results

Electric current densities produced with iron nanoparticle decorated anodes were up to 8.25-fold higher than plain graphite anodes. Whole genome (DNA) microarray analysis showed that biofilm formation was significantly enhanced in bacteria exposed to nanoparticle decorated anodes. Increased or modified production of nanowires, flavins and c-type cytochromes may also have contributed to the enhanced transfer of electrons from the anode observed. The majority of the remaining indicators from the DNA analysis suggested that there was a system wide response to increased power loads.

4. Associated Knowledge Areas

KA Code	Knowledge Area
609	Economic Theory and Methods

Outcome #4

1. Outcome Measures

Action Indicators - Type 1...Industry apply production systems a) Energy producers optimize photobiological process to yield higher energy efficiencies b) new biobased hydrogen generators are incorporated into integrated hydrogen energy systems, providing generation, storage, and utilization of hydrogen in one unit. c) microbial fuel cells provide on-farm electrical generation

Not Reporting on this Outcome Measure

Outcome #5

1. Outcome Measures

Action Indicators - Type 2...economic activity in rural areas a) bioenergy facilities are located close to potential feedstocks to generate additional economic activity

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Action Indicators - Type 3...improved feedstocks are produced a) algae outproduce terrestrial oilseed crops and oil is easily extracted b) organic materials harvested from animal wastes and urban wastewater generate bio hydrogen and eliminate waste

Not Reporting on this Outcome Measure

Outcome #7

1. Outcome Measures

Co-product development

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The demand for ultra-light weight and effective bulk textile thermal insulation materials has increased markedly over the last decade. Many synthetic fibers have been engineered for this purpose. However, the production and use of most of these synthetic insulation materials are associated with significant environmental impacts. Of potential relevance to this need, several species of poplar trees, often grown for wood products or biofuels, produce tubular seed hair fibers that are fine, soft, and extremely light-weight. In addition to these special physical characteristics that are inherently suitable for thermal insulation, poplar seed hairs are derived

from a renewable resource, are biodegradable, and are ready to be used after harvest without chemical cleaning. Despite this promise, the fiber properties have not been evaluated.

What has been done

The goal of this project is to investigate poplar seed hair fibers as a sustainable, environmentally friendly alternative to synthetic fibers used in bulk thermal insulation applications, such as jackets, sleeping bags, and comforters.

Results

In the preliminary study of poplar seed hair fiber, key physical and chemical properties of poplar seed hairs relevant to their use as textile thermal insulation material have been investigated. Thermal insulation properties of poplar seed hair fiber were also examined using a thermal manikin and the results were compared to that of hollow core polyester, wool, and down fibers. The results showed that poplar seed hair fiber has similar insulative property when compared to a hollow core polyester, while the insulative property of poplar seed hair fiber outperforms that of both wool and down. Results were published in trade journals. Since the Textile Insight magazine is circulating among most textile and apparel industry, the preliminary results from this research project will certainly make the public to become aware of the potential environmental and sustainable alternative fiber for textile thermal insulation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
511	New and Improved Non-Food Products and Processes

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

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change

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			5%	
103	Management of Saline and Sodic Soils and Salinity			5%	
112	Watershed Protection and Management			5%	
121	Management of Range Resources			5%	
125	Agroforestry			5%	
135	Aquatic and Terrestrial Wildlife			10%	
136	Conservation of Biological Diversity			10%	
201	Plant Genome, Genetics, and Genetic Mechanisms			5%	
212	Pathogens and Nematodes Affecting Plants			5%	
215	Biological Control of Pests Affecting Plants			5%	
302	Nutrient Utilization in Animals			5%	
303	Genetic Improvement of Animals			5%	
311	Animal Diseases			5%	
604	Marketing and Distribution Practices			5%	
605	Natural Resource and Environmental Economics			5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			5%	
723	Hazards to Human Health and Safety			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890

Plan	0.5	0.0	15.0	0.0
Actual Paid Professional	0.0	0.0	71.8	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	704736	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	5732480	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	7084319	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

The program includes studies that focus on development of models of community-level responses to perturbations, population dynamics and habitat management for individual aquatic and terrestrial species, and development of methods for monitoring ecosystem changes. The research approaches that will be used to meet the specific objectives of these subprograms include a) field studies in the Oregon, the Pacific Northwest, the U.S., and abroad; b) controlled laboratory experiments; and c) database/model development. Theoretical and empirical models will be developed to examine land-use policies and impacts on water quality, wildlife habitat, watershed health, and other ecological indicators, while models will be used to examine how resource and agricultural policy affects major land use and cropping patterns, and how these may affect water quality.

In summary:

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

2. Brief description of the target audience

- The general public and those in natural resource-based communities, including ranchers and fishermen
- The research community including scientists working in governmental, industrial, and academic sectors, including biomedical researchers, oceanographers, climatographers, virologists.
- Growers, crop consultants, extension faculty and researchers in the fruit and wheat industry;

and ecologists, economists, and managers concerned with invasive species. Salmonid industry

-
- State and federal natural resources management and regulatory agencies, including land managers
- policy makers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1300	2500	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 1

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	10	139	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY - Indicator 1a (natural history) - evaluate fish life history variations and migration behaviors, compare information gained through life history information synthesis, molecular genetic laboratory analyses, otolith elemental and isotopic analyses (Miller) - characterize seasonal distributions of endangered great whales and characterize their year-round critical habitats (Mate)

Year	Actual
2011	2

Output #2

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS - Indicator 1a (biology and control of diseases-plants): - control of fire blight of pear and apple with the use of avirulent pathogens, including whether they induce defense responses in the host - risk of movement of the fire blight pathogen with mature symptomless pear fruit. - rust spores timing released in spring and the minimum environmental requirements for infection of leaves. - potential impact of the introduced pathogen, blackberry rust, in the Pacific Northwest region and evaluate chemical control programs for susceptible cultivars. - host abundance, heterogeneity, and spatial structure influence on the spatiotemporal spread of disease. - factors that speed the onset of velocity increase over time. - disease spread and effects of landscape variables are similar at different spatial scales. - genetic mechanisms of plant pathogens

Year	Actual
2011	1

Output #3

Output Measure

- STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS OF PLANTS AND ANIMALS - Indicator 1 (life history strategies) - use emerging statistical and molecular genetic techniques to determine distinctions among alternate life history strategies and separate breeding units among fishery components, particularly in salmon, groundfish, and oysters. (Banks)

Year	Actual
2011	1

Output #4

Output Measure

- DEVELOP IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS - develop microparticulate diets for marine fish larvae(Langdon)for aquaculture and restoration projects

Year	Actual
2011	1

Output #5

Output Measure

- PROVIDE TECHNICAL, ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...Indicator 1 - develop models for water resources. - assess changes in policies that influence supply and cost of water in agricultural and non-agricultural uses - assess market mechanisms governing water and private land-use decisions - riparian zones that incorporate different ecological processes than upland models (state-and-transition models)

Year	Actual
2011	1

Output #6

Output Measure

- DEVELOP EDUCATIONAL STRATEGIES AND DISTANCE EDUCATION OUTLETS TO FURTHER REACH CLIENTELE. - Approximately 8,000 adults and 2,500 youth per year will have increased awareness and knowledge of ecosystem processes and functions and methods for restoring degraded habitats.

Year	Actual
2011	2

Output #7

Output Measure

- OTHER SCHOLARLY EXCELLENCE: participation on professional society panels and boards, as well as science panels, and receipt of awards or recognition

Year	Actual
2011	22

Output #8

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY - Indicator 1b (invertebrates) - floral components and landscape features that contribute to insect biodiversity - conservation efforts evaluated through long-term trends in population dynamics of insects - species previously unknown are described

Year	Actual
2011	1

Output #9

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY - Indicator 1c (riparian) - functional groups and a functional group key for meadow riparian systems - riparian relationships and issues associated with livestock grazing

Year	Actual
2011	1

Output #10

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY - Indicator 1d (soils) - fluxes of energy and mass in soils - influence of abiotic and biotic factors on size and composition of microbial communities in soil and how microorganisms affect key soil

and plant processes - soil-landscape evolution in Oregon and partition soil respiration measurements on the landscape scale

Year	Actual
2011	1

Output #11

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS - Indicator 1b (control of diseases-animals): - characteristics of and changes due to zebrafish and salmonid diseases

Year	Actual
2011	2

Output #12

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS - Indicator 2 (control of invasive pests): - Biological controls

Year	Actual
2011	1

Output #13

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS - Indicator 3 (modeling and variables): - host variables (abundance, heterogeneity, or spatial structure) to be included in models to make predictions about disease risks, and to determine the relative importance of each to disease spread.

Year	Actual
2011	1

Output #14

Output Measure

- STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS OF PLANTS AND ANIMALS - Indicator 2 (breeding) - develop selective breeding program, repository, and resource center for various desirable traits of Pacific oysters (Langdon)

Year	Actual
2011	10

Output #15

Output Measure

- STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS OF PLANTS AND

ANIMALS - Indicator 3 (human system) - identify aspects of biology and biotechnology of viruses and bacteria that affect human health - identify characteristics of food and water systems

Year	Actual
2011	2

Output #16

Output Measure

- PROVIDE TECHNICAL, ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...Indicator 2 - develop models habitat. - characterize sagegrouse habitat, e.g., a new and simpler global positioning system as well as techniques integrating infrared wavelengths of light for more accurate classification algorithms, and on the landscape modeling side, a kinetic resource and environmental spatial systems modeler (KRESS modeler 3.0) developed in 2006 will allow predictions of the suitability of locations on landscapes for either plants or animals.

Year	Actual
2011	2

Output #17

Output Measure

- PROVIDE TECHNICAL, ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...Indicator 3 - develop models for stock assessment and management. - stock assessments to evaluate stock status, harvest management policies, and areas of misunderstanding or disagreement between fishery scientists and fishing industry (Sampson) - drivers of fishing change plus incentive-based and other management tools, their applicability to Oregon fishery problems and fishing community sustainability (Hanna) - fisheries management and marketing in Oregon and the Pacific Northwest (Sylvia)

Year	Actual
2011	3

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Knowledge Indicator 1a - New tools, models for irrigation and water management - new set of tools to help farm operators make better irrigation scheduling decisions, e.g., deficit irrigation, models and web-based tools to schedule irrigation applications to reduce water use and maximize farm profit
2	Knowledge Indicator 2 - Understand impacts - of land use change on water quality and ecosystems by examining land-use policies at the national scale, using land cover and land use maps, and spatially-explicit policy simulations. - of land use change on populations of different wildlife species.
3	Knowledge Indicator 3 - Economic feasibility, best practices - chemical control programs for susceptible cultivars - biological control to combat invasive plant species - stock assessments can be used to evaluate stock status, harvest management policies, and areas of misunderstanding or disagreement between fishery scientists and fishing industry - incentive-based fishery management tools, spatial ocean management approaches, community-based management, and ecosystem-based management. - new approaches for managing the fishery to increase economic benefits. - market-based tools for managing the environmental impacts of fishing
4	Knowledge Indicator 4a - Environmental and ecological management (life history, migration) - critical life history and migratory issues, e.g., whether there is genetic variation associated with the variations in juvenile migratory behavior of Chinook and coho salmon within coastal watersheds, if stream-estuary ecotone is important to the survival of coastal coho in Oregon, and larval dispersal and juvenile and adult movement patterns in Pacific rockfish and Pacific herring - location and migration patterns of whales
5	Knowledge Indicator 5a - Basic information on ecosystem (habitats) - Understand threshold concepts within riparian systems as they relate to channel morphology, water table and plant community dynamics - Greater awareness of watersheds/invasive species/animal behaviors/watershed conditions.
6	Knowledge Indicator 6 - Genetic information - susceptibility of blackberry germplasm - genotypes of <i>P. violaceum</i> present in the Pacific Northwest as compared to the genotypes in other regions - structure, function and regulation of the VV G1L proteinase and the role that it plays during the assembly and maturation of infectious progeny virions - role a number of critical proteins play in baculovirus genome replication and processing. - molecular mechanisms of quorum sensing function and consequences of these distinct properties, which will have important implications for the development of antivirulence strategies as well as for the particular role of each signaling system in <i>P. aeruginosa</i> group behavior and pathogenesis. - molecular biology of RNA viruses affecting crops, animals and humans, e.g., early stages of viral infection, Trojan horse model, translational enhancer sequences, dicistronic expression. - how the GALLS protein participates in gene transfer to plants and its role in plant transformation - new microorganisms and the mechanisms by which microorganisms acquire and utilize foreign DNA
7	Action Indicator 1a - Better decision-making, behaviors, and policies (water and land use). - Researchers investigate, compare, and integrate the environmental and economic impacts of various land-use policies - Research on soil-landscape evolution will allow for use of remote-sensing and modeling techniques to predict the affects of human, biotic and abiotic forces on soil formation and to use this information in soil mapping, land use planning and other activities. - Farmers learn how to use water more efficiently

8	Action Indicator 2a - Improved technologies and practices (for control of pests and pathogens) - U.S pear and apple industry suppress disease through economical chemical control programs for susceptible cultivars - Novel control approaches to other diseases of plants. - Epidemic modeling at large scales - application of baculovirus technology to a variety of investigations dependent upon the use of this remarkable group of viruses. - assay development and biochemical details of proteolysis
9	Action Indicator 3 - Improved safety - new assays and technology help combat viruses - potential antiviral drugs from rational drug design and high throughput screening efforts designed to develop G1L inhibitors - information about molecular biology of RNA viruses used in designing new approaches for combating pathogenesis by these viruses.
10	Economic Changes in food systems - Risk management of fire blight pathogen could lead to larger export markets for U.S. grown pears. - Enhanced fish, shellfish, and whale populations will be of economic value in coastal tourism - Ocean resource management approaches that integrate ecological and economic components and promote sustained economic productivity for the Oregon seafood industry. - Traceability will increase marketing success and generate higher ex-vessel prices and profits for fishermen, processors, and retailers; Traceability will also be used to collect science information to improve science and management. - The adoption of rights based approaches for managing the environmental effects of fishing will improve economic performance of the industry while also protecting marine species, habitats, and ecosystems. - Improvements in marine fish nutrition will result in expansion of marine aquaculture to meet the increased global demand for fish. - The Pacific oyster breeding program will provide significant benefits to this \$3.7 billion dollar industry as well as provide global benefits through its approach to oyster breeding.
11	Environmental Changes 1 - food systems - Provide more sustainable approaches for managing plant disease - Restored health and stability to marine food webs - Adoption of rights based approaches for managing the environmental effects of fishing will improve economic performance of the industry while also protecting marine species, habitats, and ecosystems - The pacific oyster breeding program will provide significant benefits to this \$3.7 billion dollar industry as well as provide global benefits through its approach to oyster breeding - Reduce impact of disease on wild and cultured salmonids
12	Societal Changes - more enlightened populace with regard to the value of habitats and conservation.
13	Knowledge Indicator 1b - New tools, models for crop production - Simplified, realistic crop growth models easily applied to variety of soils, climates and irrigation technologies which also help make decisions regarding economic tradeoffs between various decisions or competing goals - weather-based models that indicate when spores are first released in spring and the minimum environmental requirements for infection of leaves. - know which host variables (abundance, heterogeneity, or spatial structure) need to be included in models to make predictions about disease risks, and to determine the relative importance of each to disease spread.
14	Knowledge Indicator 1c - New tools, models for land-use decisions - regional econometric models that reveal the importance of localized factors such as climate and access to commodity markets on private land-use decisions, and incorporate these results into the national model to increase the accuracy of land-use change predictions. - GIS-based, spatially explicit model to predict development patterns and land prices that would have existed when one or more land use regulation had been removed in the southern part of the Willamette Valley. - spatially explicit model to examine the causes of sprawl and its socioeconomic consequences.
15	Knowledge Indicator 1d - New tools, models for seafood - traceability and case studies for seafood

16	Knowledge Indicator 4b - Environmental and ecological management (habitat) - awareness of potential problems associated with riparian grazing. - Improved monitoring and management of rangelands and forest lands, including modeling for preservation and expansion of native ungulates in North America and Asia.
17	Knowledge Indicator 4c - Environmental and ecological management (monitoring of pathogens) - chromatophore cells for their use as a living sensor for rapid detection of food- and water- associated pathogenic bacteria and their toxins. - host and geographic range, pathogenesis, taxonomy, modes of transmission, and treatment of infectious and toxicological diseases of importance to wild and cultured fishes, particularly those afflicting fishes in the Pacific Northwest region and how to minimize the impact of these diseases.
18	Knowledge Indicator 5b - Basic information on ecosystem (species assemblages) - ecology of a variety of insect species and the dynamics of multi-hundred species assemblages in forested habitats - SAR11 for investigations aimed at understanding how plankton cells use light dependent proton pumps, and impact the efficiency of carbon cycling in the ocean surface.
19	Knowledge Indicator 5c - Basic information on ecosystem (soils) - fluid movement through soils, - biogeochemical recycling in soils, - carbon and nitrogen cycling in soils, - microbial diversity in soils, - soil-landscape evolution.
20	Action Indicator 1b - Better decision-making, behaviors, and policies (soil management). - Research on carbon and nitrogen cycling will lead to better regional and national nutrient sequestration plans as partial solutions for nutrient contamination and global warming concerns. - Research on microbial diversity will lead to better understandings of changes that occur in soils under different management regimes, of inherent differences in soil microbe diversity, and of the ability of soils to recover from events that affect microbial populations.
21	Action Indicator 1c - Better decision-making, behaviors, and policies (natural resources and ecosystems). - better conservation practices reduce mortalities and promote population recovery of whales - individuals will modify behaviors and practices so that ecosystem functions and processes can be restored. - Policy makers will develop incentives, rules and regulations that prevent further resource damage or encourage ecosystem restoration - the knowledge about atmospheric carbon and carbon sequestered in oceanic waters will enable more accurate models for the global carbon cycle - ecosystem restoration policy decisions based upon the theoretical understanding of processes affecting aquatic and terrestrial organisms and ecosystem function.
22	Action Indicator 1d - Better decision-making, behaviors, and policies (fisheries & seafood). - establish management and conservation/restoration efforts for salmonids, Pacific rockfish, Pacific herring, and shellfish - Better fishery management and ocean policies that are compatible with issues of economics, incentives, communities and ecosystems. - approaches for managing the pink shrimp fishery and the environmental effects of fishing
23	Action Indicator 2b - Improved technologies and practices (seafood and fisheries) - traceability systems for marketing and science research (electronic logbooks). - principles of seafood marketing and trade - fisheries management strategies to encompass detailed knowledge of the dispersal/disease process - Performance of complex microparticle types that provide nutrients to marine larval fish
24	Action Indicator 2c - Improved technologies and practices (ecosystem services) - Research on fluid flows in soils will allow for better waste material containment facility design. - new ecosystem service industries in Oregon that deliver products or manage plant based systems designed for specific environmental problems. - Improved indicators of environmental health as described in the Oregon State of the Environment report.
25	Environmental Changes 2 - ecosystems - Global warming will be addressed in part by carbon sequestration strategies - Soil microbial health will be maintained or improved - Changes in policies will result in sustainable natural resource use or ecosystems restoration

Outcome #1

1. Outcome Measures

Knowledge Indicator 1a - New tools, models for irrigation and water management - new set of tools to help farm operators make better irrigation scheduling decisions, e.g., deficit irrigation, models and web-based tools to schedule irrigation applications to reduce water use and maximize farm profit

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Water resources are becoming more limiting as multiple demands increasing compete for finite and decreasing fresh water resources. Microirrigation has the potential to help growers conserve water.

What has been done

Drip, sprinkler, and furrow irrigation systems are being compared and various irrigation criteria are being tested for their effects on onion yield and grade. Results are being communicated to growers by means of field days, workshops, grower meetings, written and "on line" reports, and published and "on line" extension brochures.

Results

Irrigation scheduling by soil water tension allows growers to use water more precisely. Calibration of soil moisture instruments promotes improved irrigation scheduling with greater precision and confidence. Better use of irrigation systems and irrigation criteria for onions are increasing onion yields and reducing environmental consequences of onion irrigation. Environmental consequences of onion production are less because water and nutrient applications are very close to the actual needs of onion.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources

102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
311	Animal Diseases
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

Knowledge Indicator 2 - Understand impacts - of land use change on water quality and ecosystems by examining land-use policies at the national scale, using land cover and land use maps, and spatially-explicit policy simulations. - of land use change on populations of different wildlife species.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Urbanization presents both opportunities and challenges for farmers and farm supporting sectors on the urban fringe. The emergence of a new customer base has provided farmers new opportunities for higher value crops. Urbanization also presents challenges to farmers. Negative externalities associated with urbanization increase the cost of farming and threaten the viability of the agricultural economy. Conflicts with non-farm neighbors and vandalism, such as destruction of crops and damage to farm equipment, are major concerns of farmers at the urban fringe. Conversely, being part of a large farming community (a cluster) can offer many benefits. It allows a farm to operate more productively in sourcing inputs, and in accessing information, technology, and needed institutions. With urbanization farmers may no longer be able to take advantage of economies of scale in production that come from information sharing and formal and informal

business relationships between neighboring farms. An important question is how urbanization affects the viability of agricultural economies.

What has been done

This study evaluates the effect of urbanization on the viability of farm supporting sectors (i.e., input suppliers, output processors) and on the cost and profitability of agriculture. To achieve this objective, we first develop a theoretical model to analyze the interrelationship between agriculture and its supporting sectors and then examine how the relationship is affected by urbanization. We then conduct an empirical analysis to evaluate the effect of urbanization on local agricultural economies using county-level data from four western states of the United States (Oregon, Washington, Idaho, and California), focusing on the influence on 1) the number of input suppliers, 2) the number of output processors, 3) farmers' production costs, and 4) net farm income.

Results

This study attempts to fill the gaps in the literature by examining the effects of urbanization on the viability of input suppliers and output processors and on the cost and profitability of farming. Urbanization is found to be associated with higher farm production cost, which is consistent with the negative externalities that are posited to accompany urbanization. But, the higher costs of production in urban versus rural localities are outweighed by higher prices for agricultural output and increased off-farm job opportunities. As a result, net farm income is found to increase with urbanization. Our results have an important implication. Urbanization is not necessarily a bad thing for struggling rural communities, particularly when the objective is to increase net farm income. Urbanization may increase farmers' production costs, but it also creates new opportunities for farmers (growing high-value crops, off-farm employment opportunities, etc.). Our results suggest that the benefits of urbanization outweigh the costs, and net farm income increases with urbanization. However, in rural communities that have already experienced a high degree of urbanization, continuing urban sprawl may indeed threaten agriculture as a viable way of living.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Knowledge Indicator 3 - Economic feasibility, best practices - chemical control programs for susceptible cultivars - biological control to combat invasive plant species - stock assessments can be used to evaluate stock status, harvest management policies, and areas of misunderstanding or disagreement between fishery scientists and fishing industry - incentive-based fishery management tools, spatial ocean management approaches, community-based management, and ecosystem-based management. - new approaches for managing the fishery to increase economic benefits. - market-based tools for managing the environmental impacts of fishing

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A number of the same traits that make nursery crops successful also allow some of these species to become naturalized or even invasive. Some states have begun banning some species in an attempt to limit the negative ecological impact that they pose. Common cherry laurel (*P. laurocerasus*) and Portugese cherry laurel (*P. lusitanica*) are rugged plants that fill a number of roles in modern landscapes. Unfortunately, they have both become naturalized in Western Oregon and Washington to the point that they are receiving attention as potentially invasive. Breeding for sterility offers an opportunity to benefit growers by allowing them to continue growing and marketing profitable plants, while also benefiting the environment by reducing the potential of these species to displace native flora.

What has been done

The PI has successfully developed polyploids of common cherry laurel but they have all reverted. Treatments were repeated in larger numbers in 2011. When polyploids are identified they will be grown to reproductive maturity and used in strategic backcrossing to develop sterile forms. Large population of the odd-ploidy progeny will be grown with collaborating growers in order to provide the best opportunity of recovering improved landscape forms. Seed was recovered from interspecific crosses and will be sown following stratification. Findings of some studies were shared with growers in 2010.

Results

Findings are still preliminary.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
604	Marketing and Distribution Practices

Outcome #4

1. Outcome Measures

Knowledge Indicator 4a - Environmental and ecological management (life history, migration) - critical life history and migratory issues, e.g., whether there is genetic variation associated with the variations in juvenile migratory behavior of Chinook and coho salmon within coastal watersheds, if stream-estuary ecotone is important to the survival of coastal coho in Oregon, and larval dispersal and juvenile and adult movement patterns in Pacific rockfish and Pacific herring - location and migration patterns of whales

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Conservation planning often occurs only after a species has been extirpated from portions of its historical range and limited information is available on life history variation prior to extensive development. Inadequate information on a species' migration patterns before and after extensive physical modification of their habitat limits our ability to conserve and manage those species. To address this gap, we provided novel information on the migration behavior of Chinook salmon (*Oncorhynchus tshawytscha*) before and after extirpation of a local population in the upper Columbia River. We provided detailed information on life history variation in this commercially, recreationally, and culturally important species before and after the development of an extensive hydropower system that can aid future management and conservation efforts.

What has been done

We examined ancient otoliths (ear bones) of Chinook salmon to determine the home stream, or natal river, of those individuals and reconstruct aspects of their migration patterns in the upper Columbia River prior to the construction of a large mainstem dam, the Chief Joseph Dam. We also obtained otoliths from modern populations of Chinook salmon immediately downstream of the extirpated population to determine if we can reconstruct aspects of this species' life history before and after extensive hydropower modification of the species' habitat. The direct comparison of individuals from the same geographic region before and after non-indigenous human settlement and hydropower modification provided empirical evidence on life histories prior to widespread human impacts. We based our approach on otolith chemical ($^{87}\text{Sr}:^{86}\text{Sr}$, Sr:Ca) and structural analyses because otoliths provide a chemical record adequate to differentiate between

fresh and marine waters and among freshwater systems and growth structures amenable to robust estimation of individual body size. Our primary study objectives were to (i) estimate the number of and similarity among natal environments and (ii) reconstruct aspects of the life history, including determination of size at freshwater emigration, life history type, and adult body size upon return to fresh water. Additionally, we assessed the archaeological otoliths for evidence of diagenesis, which refers to any chemical or physical change after initial deposition. There can be partial to complete exchange of the original elemental constituents with locally derived sources; extensive diagenesis could remove the original Sr record and lead to an un-interpretable pattern of strontium within the otolith.

We also provided two very well-received presentations (an oral and a poster presentation) to members of the Confederated Tribes of the Colville regarding the use of their tribal artifacts, ancient fish ear bones in this case, to provide historical information on local salmon populations. A peer-reviewed manuscript was published in the Canadian Journal of Fisheries and Aquatic Sciences in 2011.

Results

We generated increased knowledge of juvenile Chinook salmon migration behavior prior to construction of extensive hydropower system on the Columbia River. Specifically, we determined that the ancient individuals displayed life history traits, including size at ocean entrance and adult size at return to fresh water, most similar to the modern population of summer-fall run Chinook salmon. All of the ancient individuals displayed a juvenile migration pattern that is currently evident in only a small proportion of the modern population, which suggests that a reduction of life history diversity is occurring. Overall, our study indicated that there is the potential to maintain aspects of predevelopment Chinook salmon life histories in the Columbia River, and strategies that promote maintenance of that life history diversity may be warranted. Furthermore, we demonstrated the potential of using archaeological collections to provide information relevant to current conservation and management of an important fish species. Such information is integral to ensuring the long-term availability of fisheries resources as well as understanding potential impacts of climate change.

Associated with this project, we trained two academic researchers from Portland State University in the preparation and structural and chemical analysis of biological specimens, including fish otoliths and bone. Both of these researchers are continuing important work on modern and ancient salmon populations in the Pacific Northwest that are relevant to conservation and restoration activities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
311	Animal Diseases
605	Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Knowledge Indicator 5a - Basic information on ecosystem (habitats) - Understand threshold concepts within riparian systems as they relate to channel morphology, water table and plant community dynamics - Greater awareness of watersheds/invasive species/animal behaviors/watershed conditions.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Medusahead is predominant on millions of acres of semi-arid rangeland in the Pacific Northwest. It is extremely competitive, crowding out all other vegetation on infested rangeland, including such undesirable species as cheatgrass or downy brome. Another species, Ventenata, has spread over large areas of rangeland as well. It is particularly difficult to control, appears to thrive in wetter area and is present on the Warm Spring Indian Reservation. Medusahead, ventenata and cheatgrass often out-compete bunch grasses that stabilize the soil and provide feed for cattle and other herbivores. These annual weedy grasses dramatically increase the fuel load creating hotter, more destructive range and forest fires. They also allow soil structure to deteriorate, setting the stage for increased soil erosion.

What has been done

Plots were established during 2008 on the Warm Springs Indian Reservation and near Ashwood, Oregon. Each location included two sites, one where bunchgrasses were still present despite high populations of ventenata (Warm Springs) and medusahead (near Ashwood). A second nearby site was located where few to no bunchgrasses remain due to domination by ventenata and medusahead. These plots are similar to those established in 2007 at South Junction.

Results

At the Warm Springs location residual efficacy for the four herbicides on ventenata the second season following application ranged from 95 percent for Landmark and 90 percent for Matrix, to 60 percent for Journey and Plateau. Stand establishment following the 2009 fall planting of the Landmark and Matrix plots was highest for Sandberg's bluegrass followed by Sherman big bluegrass, smooth brome and intermediate wheatgrass. Very few bluebunch wheatgrass or squirreltail plants were observed.

Bunchgrass stands appeared to be significantly reduced in the Journey and Plateau treated plots from 2009 to 2010. Cattle remained in the plot area from the fall of 2009 until mid summer of 2010. The plot area saw a high level of activity that degraded the site and appeared to significantly reduce the number of established plants from the fall 2008 planting. Bunchgrasses planted in the Landmark and Matrix plots in the fall of 2009 appeared to be largely unaffected by the cattle. This may have been due to their small size during the time the cattle were present, making them inaccessible as feed.

It appears from informal observations at the Warm Springs site that the population of ventenata has spread significantly since plots were established in the fall of 2008. Ventenata was largely in the wetter areas along a draw that drains seasonal water. It is along the edge of this drainage area that the herbicide plus planting plots were placed. Ventenata appears to have spread up into the scabland areas that surround the draw where medusahead has been dominant. It is unclear whether this was an opportunistic expansion due to two wet springs, or a more methodical progression as ventenata expands into areas previously dominated by medusahead or cheatgrass.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
125	Agroforestry
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #6

1. Outcome Measures

Knowledge Indicator 6 - Genetic information - susceptibility of blackberry germplasm - genotypes of *P. violaceum* present in the Pacific Northwest as compared to the genotypes in other regions - structure, function and regulation of the VV G1L proteinase and the role that it plays during the assembly and maturation of infectious progeny virions - role a number of critical proteins play in baculovirus genome replication and processing. - molecular mechanisms of quorum sensing function and consequences of these distinct properties, which will have important implications for the development of antivirulence strategies as well as for the particular role of each signaling system in *P. aeruginosa* group behavior and pathogenesis. - molecular biology of RNA viruses affecting corps, animals and humans, e.g., early stages of viral infection, Trojan horse model, translational enhancer sequences, dicistronic expression. - how the GALLS protein participates in gene transfer to plants and its role in plant transformation - new microorganisms and the mechanisms by which microorganisms acquire and utilize foreign DNA

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Barley is facing a crisis. Acreage has declined to historically low levels and the US is in danger of conceding domestic and world markets for barley, and its value-added products, to competitors from Australia, Canada, and Europe. This will have a substantial negative impact on the US economy and federal, state, and local tax revenue. Acreage decline is due to several factors. In some traditional barley production areas, corn and soybean have become dominant crops due to favorable farm policy, biotechnology, and high levels of investment by the private sector. This has pushed barley acreage into more marginal areas, where drought and heat stress are major production restraints. Throughout the US, climate change is resulting in increased abiotic (e.g., drought, cold) and biotic (e.g., disease, insect) stresses on all crops. Barley is among the most stress tolerant crops, and judicious investment in biotechnology will allow scientists to enhance this innate tolerance in order to maximize productivity, quality, and economic returns.

What has been done

The barley research community used the knowledge gained, and tools developed by, the Regional Barley Gene Mapping Project. The Regional Barley Gene Mapping Project, which supported a directed competitive grant program, funded individual projects throughout the US that provided for significant advances in genomic science, but did not provide a coordinated approach to meet this crisis. Advances in genomic research provided by a previous special grant, and other efforts, provide a unique opportunity to address this crisis through a new research grant. Researchers in Minnesota, North Dakota, Oregon, Washington, and Wisconsin developed a coordinated research plan to apply genomics tools to four research areas that have the greatest potential for success to increase barley production - winter hardiness; drought tolerance; disease resistance; and quality. This research was accomplished by a tight and coordinated network of Land Grant University and ARS scientists with linkages to the private sector.

Results

A vigorous public sector research community, in cooperation with the private sector, has developed a robust set of genomics and molecular breeding tools. These discoveries in basic biology can be extended to practical applications and to other crops. The Regional Barley Gene Mapping Project provided funding to every barley researcher in the United States. These funds, in turn, leveraged nearly every competitive grant awarded for barley research. Most recently, these leveraged grants include the prestigious Barley CAP and Triticeae CAP.

4. Associated Knowledge Areas

KA Code	Knowledge Area
136	Conservation of Biological Diversity
201	Plant Genome, Genetics, and Genetic Mechanisms
311	Animal Diseases
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #7

1. Outcome Measures

Action Indicator 1a - Better decision-making, behaviors, and policies (water and land use). - Researchers investigate, compare, and integrate the environmental and economic impacts of various land-use policies - Research on soil-landscape evolution will allow for use of remote-sensing and modeling techniques to predict the affects of human, biotic and abiotic forces on soil formation and to use this information in soil mapping, land use planning and other activities. - Farmers learn how to use water more efficiently

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Camelina is a short-season annual oil-seed crop in the Brassicaceae family. Camelina may have potential as a rotation crop for crops in the grass family including the cool-season grass seed crops and the small grain cereals. In the Willamette Valley, camelina has an advantage over other potential bioenergy crops in that it does not cross with Brassica spp. vegetable seed crops that are widely grown.

What has been done

Field trials were conducted on stand establishment (date and method of planting), cultivar performance, and nitrogen rate for camelina in the Willamette Valley as part of a regional research effort. Seed yield and oil content of the crops from the management treatments were measured.

Results

Camelina is an unusual crop in that seed yields were symmetrically distributed by planting date with the greatest yields centered about January 1, and lowest seed yields were attained when the planting was done earliest in autumn or latest in the spring. By plotting seed yield data against planting dates, and fitting the combined data to a 2nd order regression function, a symmetrical distribution of camelina seed yields across planting dates was identified. There were no differences in seed yield among planting by drill or broadcast planting methods, nor was there an interaction of planting date and planting method. This means that growers can further reduce the cost of production by broadcasting the seed rather than drilling the crop with a planter, and makes planting in wet weather a better prospect. Several cultivars appeared to be adapted to Willamette Valley conditions and would likely produce economic yields when planted within the suggested planting window and fertilized with at least 60 lbs N/acre.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
112	Watershed Protection and Management
121	Management of Range Resources
125	Agroforestry
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics

Outcome #8

1. Outcome Measures

Action Indicator 2a - Improved technologies and practices (for control of pests and pathogens) - U.S pear and apple industry suppress disease through economical chemical control programs for susceptible cultivars - Novel control approaches to other diseases of plants. - Epidemic modeling at large scales - application of baculovirus technology to a variety of investigations dependent upon the use of this remarkable group of viruses. - assay development and biochemical details of proteolysis

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There has been considerable recent progress regarding genetic recombination by chlamydiae. Our laboratory has participated in this process, and we continue to explore the actual mechanisms of lateral gene transfer in this system.

We are also working to elucidate novel antimicrobial compounds, through interactions with a local biotechnology company.

What has been done

We have spent considerable effort and time exploring how chlamydiae might recombine, and the genomic results of such exchanges. We created a large family of recombinants between different Chlamydia strains, and genome sequenced twelve of these strains. We are currently using these strains to explore phenotypic differences among clinically distinct human pathogenic chlamydiae. We have identified genetic regions of the chlamydial chromosome that correspond to phenotypic differences among these strains. These projects are ongoing, with a variety of possible phenotypes that we can continue to examine.

We have also recently used a high throughput screening procedure to identify and characterize novel antimicrobial agents against Chlamydia and other bacteria. This is exciting work that has been fruitful, as a set of six unique families of antimicrobials have been identified. These projects are being conducted with Siga Research Laboratories and the compounds are currently the property of that company. But, this work has led to the demonstration of a novel mechanism of laboratory-generated antimicrobial resistance in the chlamydial system, via mutation in a protein important in the bacterial general secretory pathway.

Results

Our recent work has been considered the best examples that chlamydial recombination actually occurs in the laboratory. This has been a part of the very recent explosion in mindset change in the chlamydial field, with this historically genetically intractable organism suddenly becoming more and more manipulable. This will lead to major progress with regards to our understanding of how chlamydiae lead to disease in humans and animals.

We anticipate that our antimicrobial discovery work will allow people to examine chlamydial differently in the research laboratory, and hopefully, add tools to the clinical arsenal of antibiotic options for clinicians dealing with the challenge of antimicrobial resistance in bacterial disease.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #9

1. Outcome Measures

Action Indicator 3 - Improved safety - new assays and technology help combat viruses - potential antiviral drugs from rational drug design and high throughput screening efforts designed to develop G1L inhibitors - information about molecular biology of RNA viruses used in designing new approaches for combating pathogenesis by these viruses.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There are many aspects of microbiology that affect the health of humans, the food supply, the environment and natural resources. One is continually reminded of the involvement of bacterial, viral and parasitic agents in both health and disease from articles in both the popular press (reflecting issues of broad societal importance) and in many scientific journals.

What has been done

Our faculty continues to focus on the production of information, as well as the dissemination of knowledge through conferences and peer-reviewed articles and extension activities related to environmental health issues. One particular effort that relates to climate change involves investigations by the Stephen Giovannoni group into the genome evolution and metabolism of the marine bacterium SAR11 and marine carbon cycle as explained by understanding marine bacteria, based on high throughput microbial culturing, proteomics, and metabolomics. The other important focus is student training in research. During this year, our microbiology faculty generated 33 peer-reviewed publications and is training 26 graduate students and 15 undergraduate students in research.

Results

The Giovannoni laboratory has established pure cultures and determined the genomic DNA sequence for several open ocean bacteria. They use metagenomics and oceanographic field work to link laboratory discoveries to natural processes. The team obtained information from phylogenomic comparisons that the SAR11 clade of ubiquitous marine bacteria are closely related to mitochondria and may have been the progenitor of these organelles. These cultures and the information from the genome sequences are allowing widespread research on these bacteria to proceed in laboratories around the world, which are attempting to determine a more

accurate understanding of biological activities in the oceans and under various conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
303	Genetic Improvement of Animals
311	Animal Diseases
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #10

1. Outcome Measures

Economic Changes in food systems - Risk management of fire blight pathogen could lead to larger export markets for U.S. grown pears. - Enhanced fish, shellfish, and whale populations will be of economic value in coastal tourism - Ocean resource management approaches that integrate ecological and economic components and promote sustained economic productivity for the Oregon seafood industry. - Traceability will increase marketing success and generate higher ex-vessel prices and profits for fishermen, processors, and retailers; Traceability will also be used to collect science information to improve science and management. - The adoption of rights based approaches for managing the environmental effects of fishing will improve economic performance of the industry while also protecting marine species, habitats, and ecosystems. - Improvements in marine fish nutrition will result in expansion of marine aquaculture to meet the increased global demand for fish. - The Pacific oyster breeding program will provide significant benefits to this \$3.7 billion dollar industry as well as provide global benefits through its approach to oyster breeding.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This research activity seeks to improve the quality, accuracy, and understanding of the stock assessment procedures and results used in the management of Oregon's fisheries for groundfish so that these fisheries can achieve greater economic benefits. Marine fish resources are an important source of good quality protein that is highly valued by consumers. Furthermore, fishing activities, both recreational and commercial, are vital economic activities for many coastal communities. Recreational anglers in Oregon are estimated to have made 77 thousand fishing trips directed at groundfish species during 2010. Although the value of these trips is not easily quantified, expenditures by anglers in Oregon during 2006 for charter boat fees, travel, meals, and accommodations were estimated to be about \$100 per fishing trip. Hence the expenditures on recreational fishing for groundfish in Oregon, not including expenditures on fishing equipment, would be estimated at almost \$8 million annually. Commercial fishing activities are more easily measured. The economic value of Oregon's commercial landings of groundfish during 2010 was \$31.0 million, with considerable value added during the production of processed fish products. The landed value of all groundfish caught from US West Coast waters during 2010 was \$85 million. To maintain fish harvests that are sustainable in the long term requires careful monitoring of the fish stocks, fishing activities and ocean conditions. These data are used in stock assessments to evaluate the balance between fishery removals and natural stock growth. Stock assessments are technically challenging to conduct and the results can be difficult to explain.

What has been done

During development of a spatially explicit model for simulating multi-species fisheries a previously unreported aspect of the phenomenon known as fishery selectivity was discovered, explored and described in a series of three published journal articles. Fishing activities that are not uniformly distributed in space will, under a broad range of conditions, result in fishery selection that is domed, meaning that older fish are caught less frequently than slightly younger fish. This has important consequences for how stock assessment models are configured and for our understanding of certain reference points used routinely in fishery management for West Coast stocks of groundfish. Other activities during 2011 included publication of a study on the accuracy of data in Oregon trawl logbooks, participation in the activities of the Scientific and Statistical Committee of the on the Pacific Fishery Management Council (PFMC), including the review of new stock assessments for two key groundfish stocks, and providing stock assessment training for Oregon's members of the PFMC.

Results

The results from the research on fishery selectivity have broad implications for the construction of age-structured stock assessments, which typically assume, without verification, that the effects of age-specific fishing mortality can be modeled using simple curves that are time-invariant. The study results provide a theoretical basis for questioning the validity of this conventional assumption. The full consequences of using overly simple models for fishery selectivity have not yet been fully determined but the results from the study of Oregon trawl logbook data indicate gross inconsistencies in some of the data, implying that logbook data may require careful screening to avoid the use of inaccurate and potentially misleading information. The review of the new stock assessments for Dover sole and sablefish resulted in acceptance by the PFMC of these assessments as providing the best available scientific information for the purpose of setting annual catch quotas for the 2013 and 2014 fishing seasons. The catch quota recommended for Dover sole for 2013 remains unchanged from the 25 thousand metric ton catch quota that will be in effect for 2012. However, the catch quota recommended for sablefish for 2013 will decrease by almost 18% from the 6.6 thousand metric ton catch quota that will be in effect for 2012. Stock assessment estimates of current stock status and predictions of future prospects, which are generally conducted on a biennial or less frequent cycle, often exhibit considerable volatility from one cycle to the next. Variability in the ocean environment and in the strength of incoming year-classes of fish, compounded by the extreme uncertainty surrounding estimates of fish abundance,

makes fishery management extremely challenging. The training workshop with Oregon's members of the PFMC provided them with an understanding of some of the potentially confusing technical aspects of groundfish stock assessments, i.e., if stock assessments underestimate the health or productivity of an exploited fish stock, then fishery management agencies may inadvertently set overly restrictive regulations that result in lost fishing opportunities and spill-over of displaced fishing activities, and conversely, if assessments are overly optimistic, harvests may be unsustainably large and result in stock declines and reduced long-term productivity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
201	Plant Genome, Genetics, and Genetic Mechanisms
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #11

1. Outcome Measures

Environmental Changes 1 - food systems - Provide more sustainable approaches for managing plant disease - Restored health and stability to marine food webs - Adoption of rights based approaches for managing the environmental effects of fishing will improve economic performance of the industry while also protecting marine species, habitats, and ecosystems - The pacific oyster breeding program will provide significant benefits to this \$3.7 billion dollar industry as well as provide global benefits through its approach to oyster breeding - Reduce impact of disease on wild and cultured salmonids

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The West Coast oyster industry, whose total economic worth is approximately \$207 million, is facing a serious problem in maintaining a supply of seed from both wild spawns in Willapa Bay and from two of the three major hatcheries. The full cause(s) of high larval mortalities is unknown but appears to be correlated with poor quality seawater supplied from depth, either through upwelling or via hatchery pumping, leading to increased disease pressure and poor shell formation.

What has been done

In 2011, two cohorts of about 100 families each were produced for the oyster selection program (the Molluscan Broodstock Program; MBP). These were planted at commercial test sites in Washington and Oregon. In addition, four "pods" of elite families were produced for industry to use in the future for commercial-scale production of seed.

Results

The oyster broodstock improvement project has resulted in production of large quantities of selected broodstock that are currently being used by commercial hatcheries. Hatcheries and growers that have handled improved oysters report good results. Due to elimination of special research grants from the Federal budget, MBP research funding has been decimated which will greatly impact expansion of this program. The program is currently trying to facilitate the transfer of MBP to industry. However, loss of this research program will reduce the ability of the industry to adapt to future changes in seawater conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
201	Plant Genome, Genetics, and Genetic Mechanisms
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
311	Animal Diseases
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #12

1. Outcome Measures

Societal Changes - more enlightened populace with regard to the value of habitats and conservation.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Urban horticulture is redefining the relationship of people and landscapes. Landscapes provide us with a number of goods and services whose value has not been fully accounted for in land use planning or in our broader market economy. Also, until recently our cities have largely developed alienated from ecological function. As a consequence ecological functions are often degraded in urban environments causing a suite of problems such as urban heat islands, water and air pollution, and diminished biodiversity. There is a growing recognition that re-integrating ecological processes into the built environment can provide cost effective solutions to improving the health and vitality of cities and properly accounting for landscape goods and services may provide powerful incentives to engage in conservation practices. There is, however, a great need for applied research to develop and assess innovative technologies to create societal changes. In addition, limits in our understanding of the functional importance of biological diversity and of the link between biodiversity and ecosystem functions may diminish our ability to design more sustainable horticultural and agricultural food systems.

What has been done

Experiments tested a variety of vegetated rooftop, using elevated platforms without the buildings underneath, to investigate the suitability of plants that might be grown atop city buildings; vegetated roofs can moderate storm water, provide cooling in cities, refresh the air and provide habitat for pollinators and other beneficial insects, says John Lambrinos, a landscape ecologist at OSU. Students in Lambrinos' ecological restoration class created a restoration plan to remove invasive plants and replant native varieties in a number of urban settings. Further, OSU's new Oak Creek Center for Urban Horticulture is helping prepare students for the growing market for landscape design and study. As head of OSU's horticulture department, Anita Azarenko envisioned a place where students could kneel on the ground, get their hands dirty, and satisfy their desire to grow their own food and manage their landscapes.

Results

"The classical view of urban horticulture has been only the aesthetic value of plants, in isolation from nature," Lambrinos said. "But we've come to realize that horticulture is an interaction between plants and people, and many feel that gardening provides spiritual relief. There has been a disconnect in urban areas, and people recognize that it's important to reconnect our everyday lives with nature." More than 40 community gardens have sprouted in Portland, where vegetables grown on large lots help feed the community, and edible landscapes are replacing suburban lawns.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
112	Watershed Protection and Management
121	Management of Range Resources
125	Agroforestry
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics

Outcome #13

1. Outcome Measures

Knowledge Indicator 1b - New tools, models for crop production - Simplified, realistic crop growth models easily applied to variety of soils, climates and irrigation technologies which also help make decisions regarding economic tradeoffs between various decisions or competing goals - weather-based models that indicate when spores are first released in spring and the minimum environmental requirements for infection of leaves. - know which host variables (abundance, heterogeneity, or spatial structure) need to be included in models to make predictions about disease risks, and to determine the relative importance of each to disease spread.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Creating crop suitability maps with GIS/web-based tools can assist land managers to match land use with appropriate crops and cropping/livestock systems and policy makers to develop rational plans for food and energy security. Biological capacity is determined by climate, soil and plant resources and management practices. This capacity can be determined in a highly detailed manner (through high resolution modeling and mapping on a landscape level) and communicated through fundamental education and development of management tools to match use with capacity. Such systems allow growers to manage according to the land's ability to produce (its biological capacity), not according to unsustainable exploitation driven by short-term needs.

What has been done

Traditional approaches to plant species suitability mapping have been based on hand-drawn maps involving a graphic artist and a plant specialist to define general zones of adaptation, using minimum temperature as the primary criterion. Thus, maps have been general representations rather than specific decision-making tools.

A new method based on eco-physiology is being developed with this research project to accurately identify suitability zones for various forage, food, and energy crops and cropping/livestock systems. This method, involving modern spatial analysis modeling and mapping techniques, delineates the environmental limits that define suitability zones. Initial work on this approach addressed mapping grass species suitability zones in the US and PRC. Work in 2011 addressed expanding the crop suitability mapping work from the initial 3 cool-season grass species to additional species including alfalfa and switchgrass. Quantitative tolerance values and functions were developed describing the response of these species to climatic and edaphic conditions in the US and PRC. Team members were expanded to include energy crop and economics expertise.

Results

Agronomic approaches to evaluating the potential for new crop species or cultivars has traditionally involved species and variety trials in various locations, often selected based on convenience of research facilities rather than agro-ecological zones. This project's approach has inverted the traditional process to one that develops detailed spatial maps of crop suitability based on previous research found in research and extension documents and local expert knowledge. Draft suitability maps then provide the basis for validation experiments in zones identified as having different yield and persistence potential. Thus, the problem of extrapolation of research information to areas not covered by research sites is addressed providing greater efficiency of research resource use.

Recent interest in biofuel/energy crops is being addressed with this ecophysiological/spatial mapping approach to more accurately predict the suitability of various species and crop types in meeting US renewable energy goals. The approach is also being used as part of revamping the USDA-RMA crop insurance program.

Alfalfa plantings in China have increased dramatically in an attempt to provide high quality feed for dairy cows. Interest has been expressed by the PRC National Alfalfa Research Program to utilize this approach for selecting alfalfa types and cultivars. If funded and alfalfa fall dormancy types are mapped for their appropriate use areas, this will assist US alfalfa seed producers in marketing their product to the appropriate agro-ecological zones in the US and PRC, since spatial data layers for climate and soils are available for both countries.

4. Associated Knowledge Areas

KA Code	Knowledge Area
215	Biological Control of Pests Affecting Plants

Outcome #14

1. Outcome Measures

Knowledge Indicator 1c - New tools, models for land-use decisions - regional econometric models that reveal the importance of localized factors such as climate and access to commodity markets on private land-use decisions, and incorporate these results into the national model to increase the accuracy of land-use change predictions. - GIS-based, spatially explicit model to predict development patterns and land prices that would have existed when one or more land use regulation had been removed in the southern part of the Willamette Valley. - spatially explicit model to examine the causes of sprawl and its socioeconomic consequences.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Regulation to address the environmental impacts of agriculture could significantly impact the prosperity of small and medium-sized farms and rural communities. Hence, it is necessary to balance the needs of farm families with environmental conservation. We examine an innovative approach that can enhance farm viability and promote conservation on agricultural lands. In this approach farmers incorporate wetlands into their crop rotations by flooding fields for a limited time, draining them, and planting again.

What has been done

Chrisian Langlap, agricultural and resource economist developed a dynamic optimization model and simulation framework which related conservation activities and land use changes to farm profits and water bird habitat to rigorously evaluate wetland rotation programs. The model also allowed comparison of outcomes from wetland rotation programs and traditional agri-environmental programs along various dimensions, including farm profits, wildlife habitat, and cost-effectiveness.

Results

Results will result in:

- (i) Developing an integrated economic-biophysical model of conservation practice and the facilitating its adoption through improved understanding of its effects on farm economic viability;
- (ii) Enhancing understanding of how participation increases market opportunities;
- (iii) Providing insight into the program's impact on the cost of meeting farm prosperity and habitat conservation goals, thus enhancing the efficiency of investment in programs to maintain rural vitality and promote environmental quality;
- (iv) Identifying the allocation of land between crops and wetlands that minimizes agency costs while enhancing farm profitability and wildlife conservation, thereby promoting rural economic development and enhancing rural quality of life.

4. Associated Knowledge Areas

KA Code	Knowledge Area
605	Natural Resource and Environmental Economics

Outcome #15

1. Outcome Measures

Knowledge Indicator 1d - New tools, models for seafood - traceability and case studies for seafood

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This effort seeks to address concerns about hatchery operations and their potential impacts on wild fish stocks. There are numerous and long-standing concerns regarding hatchery operations. These concerns include the spread of disease from hatchery to wild fish, to genetic contamination of local wild stocks by fish released from hatcheries, to direct behavioral competition between wild and hatchery fish for food or habitat, to indirect effects such as attraction of predators and alterations of aquatic communities by hatchery fish.

What has been done

We have conducted a series of experiments at the Oregon Hatchery Research Center using both tank systems and experimental stream systems. Parameters of interest include behavior, genetic, physiology and reproductive performance. We have also conducted a series of radio-telemetry studies of wild and hatchery fish in natural environments where survival, movements

and behavior are the biological traits that are collected.

Results

First, a project, jointly funded by the Pacific Ocean Shelf Tracking Network, showed that as many as 50% of downstream migrating steelhead smolts do not survive to the Pacific Ocean. Virtually all that mortality occurs in the very short estuarine section of coastal rivers. Our data lead to the Oregon Legislature and ODFW allocating funds and hiring personnel to consider predator harassment techniques to reduce this mortality. Our data also showed that there are no significant differences between hatchery and wild steelhead smolts in this regard.

Second, as a result of our studies of population genetics of steelhead in the Alsea River we know that wild stocks persist in the basin, despite extensive stocking of hatchery fish over many years. This has changed the management policy for stocking of hatchery fish and use of wild broodstock. Our results have also influenced management decisions for acclimation and out-planting steelhead in the Alsea River, including extended efforts at the OHRC to monitor returns of hatchery fish.

Third, we showed, among other things, that initial egg size determines growth rate and size for at least 1 year after hatching. This effect will almost certainly extend to life history differences (e.g., steelhead vs rainbow). Egg size varies predictably between hatchery and wild fish (smaller in hatchery fish) and so may account for a number of important differences between hatchery and wild fish.

Fourth, there is considerable pressure from angler groups, local politicians and those interested in restoration of salmon in southern Oregon to use "egg planting" techniques, based on equipment aggressively marketed by a company in Alaska. We have begun testing of the alternative techniques for such procedures, including involvement in a designated study coming from the Speaker of the Oregon Legislature (via ODFW management). We have shown already that direct gravel planting may not be the best procedure in these cases. We are currently involved in planning a multi-year study to address concerns about restoration of southern Oregon coho populations to enhance commercial and recreational angling.

Finally, we have used the experimental stream channels at the OHRC to compare the spawning behavior of Chinook, coho and steelhead. Those studies have allowed us to define the spawning site characteristics of each species, and furthermore to demonstrate that wild and hatchery steelhead do not differ significantly in the characteristics or success of their spawning behavior under those conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
723	Hazards to Human Health and Safety

Outcome #16

1. Outcome Measures

Knowledge Indicator 4b - Environmental and ecological management (habitat) - awareness of potential problems associated with riparian grazing. - Improved monitoring and management of rangelands and forest lands, including modeling for preservation and expansion of native ungulates in North America and Asia.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Agricultural production systems that employ domestic animals are economically important to rural economies that have been hard hit by recent economic events. Unregulated livestock grazing has been implicated in land and stream degradation across the western United States impacting water resources, wildlife resources, and natural ecosystems. Fortunately, managerial strategies can be developed that reduce the negative impacts of grazing while promoting positive effects. We have developed grazing systems that target invasive, exotic plant species such as Russian knapweed, Himalayan blackberry, English ivy, and cheatgrass and shift the competitive advantage back to native plants. These grazing systems simultaneously increase biological diversity and slow the spread of noxious weeds. In order to develop and test these grazing systems, our research employs collaborative planning with stock-growers and ranchers, on-the-ground application of ecological theory, and advanced electronic monitoring technologies. The goal of our research is to work closely with commercial ranching enterprises to develop economically profitable livestock production strategies that are not only sustainable but can improve environmental conditions.

What has been done

We have developed grazing strategies that have been effective in controlling Russian knapweed in meadow ecosystems of eastern Oregon, as well as Himalayan blackberry and English ivy on in western Oregon valleys and foothill systems. Grazing systems developed on our project are being employed by landowners, ranchers, and municipalities to control these weeds. The value of grazing strategies that target biological weakness of invasive plants were recognized by the broader scientific community and we have begun collaborative studies with state and federal researchers in Oregon and other states. This project is also developing monitoring protocols that employ optical and laser technologies to quantify changes in plant composition, cover and density

on rangelands. These techniques are employed to evaluate impacts on target weeds under applied grazing strategies.

Results

This project has greatly expanded our understanding of ecological aspects of targeted grazing by cattle, goats, and sheep. We have found that combinations of grazing treatments applied at specific phenological stages of weeds, or repetitive targeted grazing can effectively control weeds. These strategies reduce the use of herbicides and simultaneously provide forage for domestic animals.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
121	Management of Range Resources
136	Conservation of Biological Diversity

Outcome #17

1. Outcome Measures

Knowledge Indicator 4c - Environmental and ecological management (monitoring of pathogens) - chromatophore cells for their use as a living sensor for rapid detection of food- and water-associated pathogenic bacteria and their toxins. - host and geographic range, pathogenesis, taxonomy, modes of transmission, and treatment of infectious and toxicological diseases of importance to wild and cultured fishes, particularly those afflicting fishes in the Pacific Northwest region and how to minimize the impact of these diseases.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Sod webworms have been observed in low numbers scattered throughout the Kentucky bluegrass seed production area of central Oregon for several years. There has been concern that this and other insects found in Kentucky bluegrass could become more serious pests over time. The grass seed industry has asked that OSU monitor fields to track changes in the insect pest populations over time.

What has been done

More recently this project has focused on sod webworm populations and distribution during since 2005. The strategy has been to use pheromone traps that emit a scent to attract males in order to track the number of the sod webworm moths. This has been followed by sod-sampling to determine the correlation between moth and larval populations. The objective of this research is to determine if pheromone traps can be used as an indicator of which fields will have high populations of larvae in the fall, when control measures are applicable. The number of cutworms collected in pheromone traps has been tracked as well.

Results

Sod webworm numbers and flight timings in central Oregon Kentucky bluegrass fields have been similar over the last three seasons, 2008-2010. In general, sod webworm moths appear in late June and steadily increase in numbers until peak flight in mid to late July, with a significant decline in population the first of August as fields dry down in preparation for open field burning. Cutworm moths peak a few weeks prior to sod webworm peak, generally in early July. There is an option for control of sod webworm by treating adults at peak flight prior to egg-laying, rather than targeting larvae in the fall as has been done historically. If this approach were used, pheromone traps would have a direct influence on the need for treatment rather than being an indicator of potential larvae populations in the fall. There has not been a strong correlation between adult populations in early summer and larval number in the fall. Control of adults is complicated by harvest operations, while application of insecticides in the fall is effective against multiple insect pests.

4. Associated Knowledge Areas

KA Code	Knowledge Area
311	Animal Diseases
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #18

1. Outcome Measures

Knowledge Indicator 5b - Basic information on ecosystem (species assemblages) - ecology of a variety of insect species and the dynamics of multi-hundred species assemblages in forested habitats - SAR11 for investigations aimed at understanding how plankton cells use light dependent proton pumps, and impact the efficiency of carbon cycling in the ocean surface.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The overall objective of the research program is to investigate the interaction between life history and management strategies and to evaluate realized and potential fish restoration efforts using individual physiology, population viability, and community structure as response variables.

What has been done

We conducted field studies in three locations, made behavioral observations of fish in natural environments and fish collections, and collected physiological and reproductive data in the laboratory. In the last year this work has led to the co-authoring a book chapter on the species and the acceptance of one manuscript.

Results

The Nassau grouper project has vastly improved our knowledge of the importance of spawning aggregations to the reproductive success of this species, and is changing actions, conditions, and policies in the public, scientific, and management areas. The results of our work has been made into two short public service announcements, a brochure being used for distribution through Cayman Islands tourist outlets, published in a public consumption SCUBA magazine, is the subject of an upcoming documentary, and is being used by the Cayman Islands Department of Environment to make a decision (required by December 31, 2011) as to the future protection of this species and its spawning aggregations.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity

Outcome #19

1. Outcome Measures

Knowledge Indicator 5c - Basic information on ecosystem (soils) - fluid movement through soils, - biogeochemical recycling in soils, - carbon and nitrogen cycling in soils, - microbial diversity in soils, - soil-landscape evolution.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Knowledge about physical transformations occurring in the vadose zone is crucial for understanding and managing biotic and abiotic processes occurring in Earth's terrestrial critical zones. Because it forms an interface with the atmosphere and sustains plants with water and essential microbiological communities, good stewardship of vadose zone functions should be among the highest priorities of our society. Meanwhile, changing societal food and energy demands, land use and climatic conditions, and introduction of man-made substances are imposing ever greater stresses on the vadose zone. The protection and sustainability of this crucial resource can only be assured through a better understanding of vadose zone processes at different spatio-temporal scales. This requires improvement in instrumentation, numerical modeling, and fundamental understanding of critical processes. Expected outcomes include improved protection of soil and water resources and sustainability in use associated with energy production, water/irrigation management and mineral extraction activities.

What has been done

Conducted fieldwork to investigate salt deposition morphology in naturally cracking soil; conducted laboratory work to investigate the effect of soil heterogeneity on the spatial distribution of salt deposition within a porous media; and mentored three graduate students in laboratory methods, theory and professional development. Events: Presented this year's work to colleagues at the American Geophysical Union (AGU) National Conference. Dissemination: Project work was disseminated to the research community via conference presentations and manuscript publication.

Results

The investigation has led to an advance in the understanding of the temporal evolution of evaporation from a porous media. The first stage of evaporation, which is traditionally understood to consist of a constant evaporation rate driven by atmospheric conditions, was shown instead to exhibit a consistently decreasing evaporation rate when the media is heterogeneous. Heterogeneity was also shown to control the distribution of salt precipitates, with precipitates favoring deposition in the smaller pores, while the coarse pores remained salt free and provided an avenue for vapor transport. During the second stage of evaporation, precipitation internal to the porous media occurs in well-defined bands parallel to the evaporation surface.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships

103	Management of Saline and Sodic Soils and Salinity
136	Conservation of Biological Diversity

Outcome #20

1. Outcome Measures

Action Indicator 1b - Better decision-making, behaviors, and policies (soil management). - Research on carbon and nitrogen cycling will lead to better regional and national nutrient sequestration plans as partial solutions for nutrient contamination and global warming concerns. - Research on microbial diversity will lead to better understandings of changes that occur in soils under different management regimes, of inherent differences in soil microbe diversity, and of the ability of soils to recover from events that affect microbial populations.

Not Reporting on this Outcome Measure

Outcome #21

1. Outcome Measures

Action Indicator 1c - Better decision-making, behaviors, and policies (natural resources and ecosystems). - better conservation practices reduce mortalities and promote population recovery of whales - individuals will modify behaviors and practices so that ecosystem functions and processes can be restored. - Policy makers will develop incentives, rules and regulations that prevent further resource damage or encourage ecosystem restoration - the knowledge about atmospheric carbon and carbon sequestered in oceanic waters will enable more accurate models for the global carbon cycle - ecosystem restoration policy decisions based upon the theoretical understanding of processes affecting aquatic and terrestrial organisms and ecosystem function.

Not Reporting on this Outcome Measure

Outcome #22

1. Outcome Measures

Action Indicator 1d - Better decision-making, behaviors, and policies (fisheries & seafood). - establish management and conservation/restoration efforts for salmonids, Pacific rockfish, Pacific herring, and shellfish - Better fishery management and ocean policies that are compatible with issues of economics, incentives, communities and ecosystems. - approaches for managing the pink shrimp fishery and the environmental effects of fishing

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Columbia River spring-run Chinook salmon (*Oncorhynchus tshawytscha*) abundance has declined dramatically since the early 1900s. Although early marine residence is considered a critical period for juvenile salmon, specific survival mechanisms are often unidentified and may vary by species or life stage. A greater understanding of the mechanisms regulating survival is important for conservation and management of this species. For example, we cannot determine the appropriate management or restoration actions if we do not understand the mechanisms of mortality. Therefore, to elucidate mechanisms of early marine survival, we tested key hypotheses regulating early marine survival. We evaluated the "bigger-is-better" and the "growth-mortality" hypothesis, which posits that size and growth rate are important for future abundance. We also tested the "match-mismatch" hypothesis to determine whether early marine growth was related to indices related to regional productivity, including spring transition timing and copepod community composition.

What has been done

We evaluated these hypotheses using data on an important stock of Chinook salmon in the Columbia River, i.e., the mid-upper Columbia River spring run. We generated estimates of individual size at ocean entry and capture, marine growth rate, early marine migration rate, and emigration timing across eight years by combining data from ocean cruises and genetic stock assignments with chemical and structural analyses of otoliths (fish ear bones). Using data from ocean surveys completed between 1998 and 2008, we determined that juvenile body size after ~30 d marine residence and early marine growth rate were strongly and positively related to future adult returns whereas size at marine entry was not. Furthermore, we determined that juvenile body size after initial marine residence was greater when a certain prey community was dominant (i.e., lipid-rich copepods). Although future adult abundance was not related to the timing of juvenile entry into marine waters, we determined that juveniles migrated more slowly when their growth rates were higher, potentially altering their migration behavior based on foraging conditions. Overall, processes during early ocean residence appear to play a larger role in determining future population size than those at marine entry.

A peer-reviewed manuscript was accepted for publication in the Marine Ecology Progress Series in 2011 (to be published in 2012). We also provided several oral presentations of this work to state and federal scientists as well as managers.

Results

We generated increased knowledge of factors regulating survival of juvenile Chinook salmon during early marine residence. We were able to separate two key periods in the life history of an important Chinook salmon stock (marine entry and one month after marine entry). This allowed us to quantitatively evaluate the concept that size and timing at marine entry are key determinants of early marine survival. We found little evidence to support this long-standing concept. We found only weak evidence that the size and timing of marine entry influenced subsequent survival. Rather, we found the ocean conditions and growth rate during early marine residence were strong predictors of future survival and adult returns. This information is integral to establishing realistic

recovery and management plans for Columbia River stocks, several of which are listed under the Endangered Species Act. The full recovery of salmon, and other endangered fish species, is necessary if any sustainable harvest is to occur in the future. Furthermore, a greater understanding of the mechanisms that regulate survival and productivity of these culturally and economically important species is needed to predict the impact of projected changes in local and regional climate.

Associated with this project, we trained two federal scientists at the USFWS based in Washington State in the chemical analysis of fish otoliths. These researchers are working on several species of managed fishes within Washington State and are using these techniques to address important management questions associated with migration history and habitat use.

4. Associated Knowledge Areas

KA Code	Knowledge Area
112	Watershed Protection and Management
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
605	Natural Resource and Environmental Economics

Outcome #23

1. Outcome Measures

Action Indicator 2b - Improved technologies and practices (seafood and fisheries) - traceability systems for marketing and science research (electronic logbooks). - principles of seafood marketing and trade - fisheries management strategies to encompass detailed knowledge of the dispersal/disease process - Performance of complex microparticle types that provide nutrients to marine larval fish

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A hindrance to the development marine fish aquaculture is the lack of adequate diets for the larval marine fish. One strategy for overcoming this obstacle is the development of microparticulate

diets for marine fish larvae.

What has been done

Digestion of wax beads by rotifers has been demonstrated using fluorescent stains. Feeding studies have been carried out in which rotifers have been fed on encapsulated vitamins and then the enriched rotifers have been fed to larvae of Pacific cod and Sheepshead minnow (our lab's experimental species). No beneficial effects have been observed by feeding fish larvae on vitamin-enriched rotifers but other types of enrichment are planned.

Results

Development of microparticulate diets for enriching prey species or for directly feeding to marine fish larvae is still at a research-scale. We are collaborating with the Alaskan NMFS group at HMSC and Hubbs SeaWorld, California, on projects to expand the scope of this approach.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
136	Conservation of Biological Diversity
302	Nutrient Utilization in Animals
311	Animal Diseases
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

Outcome #24

1. Outcome Measures

Action Indicator 2c - Improved technologies and practices (ecosystem services) - Research on fluid flows in soils will allow for better waste material containment facility design. - new ecosystem service industries in Oregon that deliver products or manage plant based systems designed for specific environmental problems. - Improved indicators of environmental health as described in the Oregon State of the Environment report.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Influence of habitat changes on animal populations is a focus of wildlife management and conservation biology. Study of habitat affinities of species, dynamics of populations in natural and manipulated habitats, and reproductive success of populations across landscapes help natural resource managers understand consequences of habitat management.

What has been done

We measured abundances of birds with several techniques, including point counts, spotmapping, and radiotracking to measure home ranges. We also collected invertebrates under different agricultural practices. Ecosystem condition was assessed in several ways under this subprogram. First, we collected population size, survival, reproductive success and other demographic parameters for species of interest. The parameters served as surrogates for terrestrial vertebrates within ecosystem types. Second, we measured changes in landscape metrics (patch size, patch distribution, etc.) and vegetation condition at the ecological unit level over time.

Results

Our research on the effect of livestock grazing intensity's effect on biodiversity and ecosystem function has expanded our knowledge of the consequences of different grazing regimes on diversity and community composition of plants, invertebrates, birds, food web dynamics, and pollinations services. This information is directly useful to livestock producers and resource managers in developing sustainable grazing practices that minimize negative ecological effects and maximize economic return to the producers. Producers, managers and environmental nonprofit groups are now collaborating to modify grazing and habitat management tactics for the benefit of livestock and wildlife productivity in the Zumwalt Prairie of northeastern Oregon.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
103	Management of Saline and Sodic Soils and Salinity
112	Watershed Protection and Management

Outcome #25

1. Outcome Measures

Environmental Changes 2 - ecosystems - Global warming will be addressed in part by carbon sequestration strategies - Soil microbial health will be maintained or improved - Changes in policies will result in sustainable natural resource use or ecosystems restoration

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

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 # 3

1. Name of the Planned Program

Global Food Security and Hunger

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%	
121	Management of Range Resources			5%	
202	Plant Genetic Resources			5%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			5%	
206	Basic Plant Biology			5%	
216	Integrated Pest Management Systems			10%	
301	Reproductive Performance of Animals			5%	
302	Nutrient Utilization in Animals			5%	
307	Animal Management Systems			5%	
501	New and Improved Food Processing Technologies			5%	
502	New and Improved Food Products			5%	
511	New and Improved Non-Food Products and Processes			5%	
601	Economics of Agricultural Production and Farm Management			5%	
602	Business Management, Finance, and Taxation			5%	
603	Market Economics			5%	
607	Consumer Economics			5%	
803	Sociological and Technological Change Affecting Individuals, Families, and Communities			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Extension	Research
------------------	-----------------

Year: 2011	1862	1890	1862	1890
	Plan	2.0	0.0	35.0
Actual Paid Professional	0.0	0.0	156.2	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	1841330	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	11411607	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	11813099	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.

In addition, a broad coalition of agricultural, environmental and food groups has coalesced around the need for a single, integrated center for sustainable agriculture and food systems information, research, and education. Over the past decade, the Oregon Agricultural Experiment Station has been building core expertise systematically across the range of agriculture disciplines. The creation of an Oregon Sustainable Agriculture and Food Systems Research, Education and Outreach Center will allow existing and newly acquired expertise from strategic investments to be mobilized in a targeted, coordinated, systematic response tailored to these emerging needs. The center will coordinate its activities with and through the various departments, Extension offices, and Agricultural Research Stations. In addition it will coordinate resources and efforts with the Institute for Natural Resources, the Institute for Water and Watersheds, and

the Rural Studies Program. This resource center will be web-based and will draw on contributions from many state and federal agencies, non-profit organizations, certifiers, and others as needed. Outcomes include more economically and ecologically sustainable farms and ranches; a more resilient rural economy; stronger bonds between rural, urban, and periurban residents; and a healthier environment for all Oregonians.

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

2. Brief description of the target audience

- Professional peers and scientific communities, extension faculty, veterinarians, vaccine producers
- State commodity commissions, grower groups, packers, crop consultants
- Natural resource industry clientele &ndash growers, field representatives, grower co-ops and partnerships, processors and handlers, export companies, importing companies
- County, state and federal agencies &ndash 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?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	5000	68000	140	0

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

Patent Applications Submitted

Year: 2011
 Actual: 4

Patents listed

International Patent Application PCT/US11/52593 (Donald Danforth Plant Science Center and Oregon State University) ?Metabolic control of seed germination? (filed 09/21/11)

U.S. Provisional Patent Application No. 61/385149 (Nonogaki H, Beachy R.N.) ?Metabolic control of seed germination? (filed 09/21/10)

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	40	65	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- DEVELOP BETTER UNDERSTANDING OF BASIC PHYSIOLOGY OF PLANTS AND ANIMALS...Indicator 1- Environmental response by plants o Evaluate protein supplement of cool versus warm season forage o understand responses to environmental signals, germination, growth and development pathways

Year	Actual
2011	2

Output #2

Output Measure

- DEVELOP BETTER UNDERSTANDING OF BASIC PHYSIOLOGY OF PLANTS AND ANIMALS ...Indicator 2 - Animal reproductive factors o Identify factors affecting reproduction, e.g., physiological constraints limiting gamete viability, differentiation and outgrowth of endodermal cells from the bovine inner cell mass during the formation of extraembryonic endoderm, the relationship and interactions between the immune and reproductive systems with regard to establishment and maintenance of pregnancy.

Year	Actual
2011	2

Output #3

Output Measure

- CARRY OUT STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS...Indicator 1- Bacteria And Viruses And Other Microorganisms
 - o Obtain insights to evolutionary histories of microbes and plants, e.g, nitrifying bacteria within microbial communities and the unique niches of different species of nitrifying bacteria,
 - o Identify differences and similarities among microorganisms in mono- and co-cultures.

Year	Actual
2011	1

Output #4

Output Measure

- CARRY OUT STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS...Indicator 2 - Genetic diversity and function
 - o Identify novel and previously unknown genes, microarray analysis of genes
 - o Determine the role of specific genes and model metabolism
 - o Identify co-regulated gene sets by their function.
 - o Characterize genetic diversity in economically important crop plants,
 - o Further understand the interaction of antagonistic signaling pathways

Year	Actual
2011	1

Output #5

Output Measure

- CARRY OUT STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS...Indicator 3 - Disease resistance and higher tolerances
 - o Carry out molecular breeding in adapted germplasm
 - o Understand disease resistance, defense pathways
 - o Develop transgenic lines of higher tolerances, e.g., freezing, morphology and yields

Year	Actual
2011	2

Output #6

Output Measure

- CARRY OUT STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS...Indicator 4 - Reproduction factors
 - o Know expression patterns and identity of cells expressing suppressors of cytokine signaling genes, and how these genes are regulated in reproductive tissues
 - o Describe effects of the reproductive hormones on gene expression and cell function
 - o Understand genetic load present in economically significant populations of poultry based upon the identification of embryonic failures (e.g., in Coturnix quail)

Year	Actual
2011	2

Output #7

Output Measure

- BREEDING PROGRAMS THAT RESULT IN DESIRABLE TRAITS, CULTIVARS AND VARIETIES...Indicator - improved traits.
 - o Improved breeding lines and new varieties for barley, meadowfoam, potato, wheat (for general public and/or licensed release and special market opportunities)
 - o Improved crop quality including wheat and potato starches and proteins, oil quality and quantity in meadowfoam/canola/mustard/camellina and of glucosinolates
 - o Improved germplasm for year-round marketing.
 - o Alkaline tolerant poplar tree varieties for saw log production on poor and sloping soils with the aid of drip irrigation.
 - o Improved horticultural crops to meet the needs of industry, e.g., hazelnut, beans, snap pea, tomato, apples, broccoli, organic lines

Year	Actual
2011	2

Output #8

Output Measure

- DEVELOP IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS...Indicator 1 - animal reproductive success rates
 - o Develop improved, surviving offspring and appropriate calving dates,
 - o Reduce lambing production inputs (e.g., remove those of high mortality risk) and improve weaned lamb weight
 - o Synchronize forage and carcass data for calf and cow management

Year	Actual
2011	2

Output #9

Output Measure

- DEVELOP IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS...Indicator 2 - nutrition, feeding and forage relationships.
 - o Evaluate grazing distribution and use of riparian pastures
 - o Analyze forest fuel reduction/burning and stocking rate effects on cattle diets in mixed conifer rangelands
 - o Identify influence of season on cattle resource selection on mixed conifer rangelands
 - o Investigate influence of early weaning on cattle distribution and use of late season mixed conifer forests
 - o Evaluate influence of overstory management on understory forage quality of stocking rates

Year	Actual
2011	2

Output #10

Output Measure

- DEVELOP IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS...Indicator 3 - inputs for plant systems. Dryland crops
 - * Strategies for efficient use of soil nitrate and the other available N sources, nitrogen management
 - * Improved crop management recommendations for nutrients, temperature, moisture and other abiotic stresses, plant growth regulators, attack by other organisms
 - * Nutrient management strategies, e.g., for soft white wheat grown in

conservation tillage systems * Potential alternative crops for cereal-based crop rotations; best management practices for alternative crops * A comprehensive understanding of the morphological, physiological and/or genetic basis for plant responses in studied management systems Irrigated crops * Efficient irrigations systems, e.g., subsurface drip irrigation or different bed conformation works with potatoes, automated systems that use soil moisture monitoring to override fixed schedule drip irrigation systems when the soil was too wet * Environmental improvements such as avoiding leaching water and nitrate to groundwater. * Improved nutrient applications Horticultural crops * Precision management systems in vineyards, with nutrition component * Improved production efficiency knowledge and practices, such as new berry cultivars, new rootstocks, grafted stock, cold hardiness, disease resistance, chemical control of pests; nutrient budget recommendations, improved weed management, water use, off-season production methods, water conservation and recycling, soil quality parameters, post-harvest management, and identify alternative crops for pest and weed management * Best management practices for new varieties Small farms. * Improved practices in small farms.

Year	Actual
2011	4

Output #11

Output Measure

- UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS TO GROWERS AND PEERS, Indicator 1 - pest management systems * Pest management systems * Weed management with improved herbicides and cultural management * Optimum inputs and agronomically compatible weed management in alternate crops * Biology of yellow nutsedge under local conditions * Decay management programs appropriate to various producer objectives, e.g., efficacy of individual treatments for control of postharvest decay of pear fruit, and quantify and compare the efficacy of treatment programs composed of diverse, multiple control tactics. * Decay risk prediction models for use in orchards and packinghouses * Fumigants used at reduced rates in combination with other nematicides * Crop management systems for suppression of CRKN using suppressive rotation crops, green manure crops and reduced nematicide use * Technologies for efficient application of viral vectors in grapevine.

Year	Actual
2011	1

Output #12

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS TO GROWERS AND PEERS, Indicator 2 - disease resistance * Uncover disease resistance gene evolution in plants and compare evolutionary histories * Develop and release wheat cultivars with improved capacity to resist or tolerate infections by plant-pathogenic fungi and plant-parasitic nematodes * Innovations that mitigate the detrimental effect of Verticillium wilt, probably the most limiting disease of potato in the Treasure Valley * Understand physiological basis of plant disease resistance and susceptibility

Year	Actual
2011	1

Output #13

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS TO GROWERS AND PEERS, Indicator 3 - herbicide identification and resistance * Release new crop varieties with herbicide resistance. * Identify herbicides that can be safely and efficaciously used in different crops * Control downy brome and other weeds through extracts from broadleaf plants (natural herbicides) * Evaluate new herbicide candidates and non-chemical cultural practices under field conditions for weed control effectiveness, crop safety, and soil persistence

Year	Actual
2011	2

Output #14

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS TO GROWERS AND PEERS, Indicator 4 - pathogen and pest biology * Develop basic knowledge of pests by conducting pest biology trials at lab, growth chamber, greenhouse, small plot and/or field scale levels; control of slugs, symphilids, crane flies, cereal leaf beetle; native and invasive grassy and broadleaf weeds including wild oat, brome spp., jointed goatgrass, annual bluegrass, and clover broomrape, Sudden oak death, orchardgrass, choke pathogens, cereal leaf beetle * Understand species complex and fungicide sensitivity

Year	Actual
2011	1

Output #15

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY...Indicator 1 - erosion control experiments o Conduct large plot studies in commercial wheat fields to develop season-long chemical fallow management systems and compare chemical fallow treatments with conventional tilled summer.

Year	Actual
2011	1

Output #16

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY Indicator 2 - animal effects o Analyze competition between deer, elk, and cattle in grazing impacts o Develop more economical and environmentally sustainable dairy and beef production systems that meet new environmental requirements

Year	Actual
2011	1

Output #17

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY...Indicator 3 - green management practices for horticultural crops
 - o Develop green or organic practices for industry, such as plants adapted to specific sites and specific environmental purposes, ecological orchard systems, organic cover crops
 - o Model the spread of an invasive species making use of genomics (microarray, sequencing) and ecological (field/greenhouse experiments) data.

Year	Actual
2011	1

Output #18

Output Measure

- PROVIDE ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...Indicator 1 - land use management analyses.
 - o Assess land ownership fragmentation and economic impacts
 - o Develop ranch economic models
 - o Develop framework to integrate economic, social, and ecological aspects of rangeland sustainability
 - o Evaluate use of rangeland website
 - o Identify policy alternatives for fire and fire surrogate management

Year	Actual
2011	2

Output #19

Output Measure

- PROVIDE ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...Indicator 2 - markets and trade analyses
 - o Provide information to producer groups on factors shaping global markets.
 - o Use model to show key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade.
 - o Show productivity-convergence effects resulting from product trade and foreign direct investment (channels of international knowledge flow and rate of productivity convergence)

Year	Actual
2011	0

Output #20

Output Measure

- PROVIDE ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...Indicator 3 - profitability and productivity studies
 - o Productivity factors to measure technological strength of U.S. agriculture and processed food industries
 - o Studies of community based micro processing centers for agricultural products

Year	Actual
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2011 1

Output #21

Output Measure

- DEVELOP AND ENHANCE VOLUNTEER PROGRAMS FOR BROADER APPLICATION OF RESEARCH AND EXTENSION INFORMATION
 - o Reach Master Gardeners (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
2011	1

Output #22

Output Measure

- DEVELOP DISTANCE and OTHER EDUCATION OUTLETS TO FURTHER REACH CLIENTELE.
 - 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
2011	1

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	KNOWLEDGE, Indicator 1 - horticultural plant production management systems. * Growers improve their production systems to remain competitive: precision horticulture, mineral nutrition, new varieties, new cultural practices, innovations, pest control, and organic systems and fundamental aspects of data analysis
2	KNOWLEDGE, Indicator 2 - animal reproductive biology and management * improved fertility in dairy cattle * reduced uterine infections * management factors that influence loss of potential lambs in commercial ewes
3	KNOWLEDGE, Indicator 3 - forage and nutrient management * workshops and other forms of teaching provided on issues related to grazing, manure management, and production systems. * Beef industry will understand forage quality dynamics for dominant forage species in Oregon, * Beef industry will understand how management practices can synchronize the relationship between forage nutrient supply and cow nutrient requirements, how pre-weaning and post-weaning calf management practices influence lifetime productivity of the calf and carcass quality and how feedstuffs can influence the health and physiological stress of the calf.
4	KNOWLEDGE, Indicator 4 - plant breeding for plant attributes. * Growers learn about new cultivars with novel attributes and greatest potential for production in the Pacific Northwest; variety trials published online; Examples: Rotational crop cultivars, Varieties released (with Plant Variety Protection coverage) for general public and/or licensed release * Regulation of embryo maturation in cereals. * Researchers determine sets of genes involved in critical processes, e.g., functions of nitrifiers, including genes involved in mutualistic growth between ammonia and nitrite oxidizers, genes involved in Fe metabolism, and genes involved in autotrophy and lithotrophy.
5	KNOWLEDGE, Indicator 5 - pest management * Basic pest biology information, * new pesticides registered * Growers become aware of pest management processes, including level of management required, risks associated with this pest as it becomes established, * Fumigants used at reduced rates in combination with other nematicides are likely to be the optimum management strategies for control of CRKN.
6	KNOWLEDGE, Indicator 6 - economic studies * Producer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade.
7	Action Indicator 1 - Adoption of new varieties o reduce yield losses and expenses, o rejuvenate orchards o achieve better productivity and efficiency: o provide environmental benefits (less fungicide applications, etc.), o effectively compete on world market with new varieties 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	Action Indicator 2 - Improved animal fertility and genetic stock 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	ACTION Indicator 3 - animal management tools used by private sector * Beef producers improve their economic competitive advantage and improve the ecological sustainability of production systems. * manure management
10	Action Indicator 4 - 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

	<p>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.</p>
<p>11</p>	<p>Action Indicator 5 - 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.</p>
<p>12</p>	<p>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.</p>
<p>13</p>	<p>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,</p>

	<p>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.</p>
<p>14</p>	<p>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 competitive 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.</p>
<p>15</p>	<p>KNOWLEDGE, Indicator 1b - landscape management systems. * Professional turf/landscape managers, nursery retailers, gardeners, and people associated with restoration/conservation projects will learn about sustainable gardening practices (eg. fertilizers, water, and pest</p>

	management including organic), turf management, horticulture and aboriculture principles and practices, streamside gardening, native plants, invasive species, fire prevention, methods to minimize water runoff and use, wildlife enhancement, conservation and stewardship, and add value and beauty.
16	KNOWLEDGE, Indicator 1c - dryland production management systems. * 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	KNOWLEDGE, Indicator 1d - irrigated production management systems. * Growers and the public sector are made aware that environmentally friendly drip and micro sprinkler irrigation systems produce increased crop yield and crop quality and that less nitrogen is required when crops are irrigated than with furrow and regular sprinkler irrigation
18	KNOWLEDGE, Indicator 1e - marketing approaches * Improved marketing approaches for local markets and community food systems.
19	KNOWLEDGE, Indicator 2b - animal reproductive genetics. * genetic causes of early embryonic failures, * developmental biology of the early bovine embryo * factors affecting establishment of extraembryonic endoderm * sire genotype effects on embryonic loss * understanding genetic basis for fertility in male poultry including sperm cell function
20	KNOWLEDGE, Indicator 4b - plant attributes for health. * Antioxidant effects of various carotenoids and flavonoids, and impact of flavonoids on antioxidant effect * Stakeholders learn about human health benefits, disease resistance, and breeding for organic systems of vegetables.
21	KNOWLEDGE, Indicator 5a - weed control * factors affecting herbicide activity * herbicides registered, * natural herbicides to control weeds in organic and/or no-till wheat production, * improved weed control in no-till fallow systems, including optimum inputs
22	KNOWLEDGE, Indicator 5c - disease biology, control and resistance * Facilitate future planned activities in functional genomics and provide a more robust sampling of the Pleosporales for comparative genomic studies by the fungal research community. * Efficacy of various orchard, postharvest, and storage methods for control of postharvest decay of pear * Molecular mechanisms responsible for closterovirus reproduction and transport in plants and develop model to predict risk * Functions of the GLRaV-2 proteases in virus reproduction and spread, as well as characterize mechanisms of BYV Hsp70h interactions with actin cytoskeleton and targeting to plasmodesmata; approaches to engineering GLRaV-2 gene expression vectors. * Elucidate the underlying molecular mechanisms of pathogenicity (virulence) and disease susceptibility (compatibility) and disease development. * Technologies for efficient application of viral vectors in grapevine. * Disease resistance discoveries, including gene evolution, plant lines * Information for the development of resistant wheat germplasm to tan spot. * relationships between disease susceptibility and disease resistance. Characterize genes involved in Victoria Blight Disease susceptibility, and uncovered
23	KNOWLEDGE, Indicator 6b - trade * We expect to show that international trade will be an important vehicle by which adaptations can be made to global climate change. * Researchers will uncover key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade. * Policy makers will understand that climate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade. * Numerical estimates will be provided regarding how climate change will affect crop prices, production costs, and the economic welfare of producers, consumers, and society at large.
24	KNOWLEDGE, Indicator 6c - community education. * Ways to integrate agricultural education into high school curriculums

25	ACTION Indicator 3b - plant management tools used by private and public sector * 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. * 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.
26	ACTION Indicator 3c - post harvest tools used by private sector * 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.
27	ACTION Indicator 3d - land and invasive species management tools used by private and public sector * Land management protocols will be used in public land management policy decisions. * Understand pollen flow mechanisms between wheat and its wild relative jointed goatgrass

Outcome #1

1. Outcome Measures

KNOWLEDGE, Indicator 1 - horticultural plant production management systems. * Growers improve their production systems to remain competitive: precision horticulture, mineral nutrition, new varieties, new cultural practices, innovations, pest control, and organic systems and fundamental aspects of data analysis

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Professionals in commercial viticulture and enology seek to improve their farming methods to produce better quality fruit for wine production. With Oregon's cool climate grape production dominating the commercial industry, there are needs to better understand vine balance, canopy management, adequate cropping levels, vine nutrition needs, and better disease management for

high quality winegrape production which is not addressed by much of the research conducted on warm climate grape cultivars in California, Australia and elsewhere. Furthermore, many vineyard managers are faced with restricted budgets and are encouraged to seek out farming certifications (sustainable, organic, etc), which requires them to identify better management practices to meet those needs. Through research and Extension, the OSU Viticulture program works to provide new and relevant information for the industry to meet their needs.

What has been done

An applied viticulture research and Extension program has been developed for discovering and delivering information to wine grape growers in Oregon and the region regarding best management practices that will enhance the health, productivity and economic sustainability of their vineyards. On-farm research trials, field meetings, workshops/seminars and written publications were created, developed and delivered to address the needs of the industry (both beginning and advanced). Research trials in canopy management, vine balance, vine nutrition and disease management resulted in data generated for better understanding of vine physiology and vineyard management for the state and region.

Results

As a result of research conducted on canopy management practices from 2007-2011, growers have begun to implement earlier and more intense leaf removal in the fruiting zone of grapevines. This has led to a better management of disease and reduced losses due to Botrytis bunch rot in the two very difficult seasons of 2010 and 2011. Various grape growers are also starting to consider different pruning methods as a result of research and Extension efforts conducted in the OSU Viticulture Program. This will allow them to save on labor over time.

Research discussion forums have been active during the past few years (workshops, colloquiums, informal technical groups formed), and as a result, more industry members are conducting their own on-farm trials to determine what works best for them. There has been an increase in readership of publications and attendance at all workshop/programs offered by the OSU Viticulture Extension Program. As we provide more information on grape yields, fruit set, and vine size, more industry members are asking about this information and making steps toward considering new methods and decision-making in the vineyard than they have in the past. It is still difficult for the grape growers to develop different types of metrics for grape contracts, but the conversations have started, and grape growers are trying to inform winemakers about what quality means in the vineyard.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #2

1. Outcome Measures

KNOWLEDGE, Indicator 2 - animal reproductive biology and management * improved fertility in dairy cattle * reduced uterine infections * management factors that influence loss of potential lambs in commercial ewes

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The value-added services associated with processing, distributing, and marketing meat, milk, and fiber from sheep amount to a combined contribution of several billion dollars annually to American agriculture and the overall economy. However, costs of production in the U.S. are greater than other major sheep producing countries and imported lamb now represents over 40% of the U.S. market. Per capita consumption of lamb continues to decline. New technology can be applied to improve efficiency and to compete more effectively in a world-wide market. Research results benefit the sheep industry and consumers by increasing profitability and improving product quality. A viable sheep industry can contribute to sustainable agricultural practices and provide economic stability to rural communities. It is expected that sheep producers will use breed resources more effectively to improve reproductive efficiency and produce nutritious, lean lamb. Experimental results from this committee will provide guidelines for the appropriate use of breeds. Increased use of hair breeds of sheep in easy-care, low-input production systems is an expected impact of research done by this committee. Experimental results will provide information that can be published in industry magazines. Extension efforts will work directly with stakeholders to transfer technology at industry meetings. Information will also be published on departmental Web site.

What has been done

Polypay ewes were compared with Dorper ewes, a hair breed, for improved reproductive efficiency, evaluation and development of easy-care sheep breeds. Ewes from both breeds were pasture lambled and productivity evaluated with minimum inputs of labor and management.

Results

Changing the lambing season to a time when ewes are able to lamb outdoors, rather than confined to a shed or barn, will reduce labor inputs. It appears that breed of dam does not affect

productivity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
121	Management of Range Resources
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #3

1. Outcome Measures

KNOWLEDGE, Indicator 3 - forage and nutrient management * workshops and other forms of teaching provided on issues related to grazing, manure management, and production systems. * Beef industry will understand forage quality dynamics for dominant forage species in Oregon, * Beef industry will understand how management practices can synchronize the relationship between forage nutrient supply and cow nutrient requirements, how pre-weaning and post-weaning calf management practices influence lifetime productivity of the calf and carcass quality 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Livestock production is a high-risk enterprise, with feed costs underlying much of the uncertainty for producers. Fluctuations in the cost of inputs and the availability of public grazing land have eliminated some livestock operators and put many more at risk of losing their businesses. Furthermore, producers relying on public land allotments are faced with increased conflicts with other public land uses, loss of forage due to wildfires and the following two year rest period, increased levels of invasive weeds, reductions in AUMs, and other regulations. This project focuses its efforts on management-intensive grazing as a key component of sustainable livestock production systems for the western U.S.

What has been done

Data from the September 2008 and 2009 planting dates have been analyzed and compiled for forage Brassica plants. These preliminary data have been presented to producers and peers at extension programs and professional meetings, published as an abstract and a proceedings paper in the Western Section of the American Society of Animal Science joint annual meeting, presented as a poster at two professional meetings, and published in the OSU Beef Research Report and OSU Beef Research Field Day Report. The study was repeated and results are currently being compiled and summarized, including an economic analysis. In addition in the spring of 2010, a legume inter-seeding trial was initiated to look at the feasibility of improving the quality of existing grass stands for pasture and hay. The trial was planted on land owned by a cooperating producer in the spring, harvested once, and monitored in 2010. The trial results have been provided to livestock producers in Klamath County. Project faculty presented information on forage quality and interpreting forage quality results at several extension meetings; the audiences were varied and included hay growers, college students, and small and large scale livestock producers. Began a Livestock and Forage Bytes blog to keep livestock and forage producer informed with research and extension information related to livestock and forage production.

Results

Producers, researchers, and extension agents learned about the potential uses of brassica as forage, through publications and presentations. In addition two local producers and one in Northeast Oregon requested information and planted brassicas for forage use. Another research project was spun from this work to look at uses in other areas of Oregon.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
121	Management of Range Resources
302	Nutrient Utilization in Animals
307	Animal Management Systems

Outcome #4

1. Outcome Measures

KNOWLEDGE, Indicator 4 - plant breeding for plant attributes. * Growers learn about new cultivars with novel attributes and greatest potential for production in the Pacific Northwest; variety trials published online; Examples: Rotational crop cultivars, Varieties released (with Plant Variety Protection coverage) for general public and/or licensed release * Regulation of embryo maturation in cereals. * Researchers determine sets of genes involved in critical processes, e.g., functions of nitrifiers, including genes involved in mutualistic growth between ammonia and nitrite oxidizers, genes involved in Fe metabolism, and genes involved in autotrophy and lithotrophy.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Basic and applied research was performed on the biology of seeds, which directly contributes to agriculture, and hence, the quality of our life. Seeds provide 70% of world food, and therefore, the improvement of their yields and nutritive values is a critical issue in agriculture. With the world population exceeding 7 billion, efficient production of seeds as food is becoming even more important. Continuous modification of seed crops is essential to solve existing world hunger and poverty and to be prepared for higher demands for food in the future. In the modern agricultural systems, the importance of seeds as a genetic delivery system is only increasing. Seed companies stack elite genetic traits, which have been developed from breeding programs, in seeds. Therefore, germination of seeds and their vigor are also important targets for improvement. The seed biology project focused mainly on the mechanism of seed dormancy and germination, and developed the foundation of technologies to promote or suppress germination. Promotion of germination is important for F-1 hybrid vegetable production and other crops, while the suppression of germination is also crucial to avoid precocious germination problems, such as pre-harvest sprouting from wheat grains, which could happen more under recent unstable climate and cause a significant economical losses. The technology is being applied to a biofuel crop.

What has been done

Transgenic Arabidopsis plants were developed to permit conditional expression of a gene encoding 9-cis-epoxycarotenoid dioxygenases 6 (NCED6), a rate-limiting enzyme in abscisic acid (ABA) biosynthesis. Induction of NCED6 during seed imbibition increased ABA levels more than 20 fold and was sufficient to prevent germination. Germination suppression was prevented by fluridone, an inhibitor of ABA biosynthesis. In another study, induction of the NCED6 gene in transgenic seeds of non-dormant mutants tt3 and tt4 re-established seed dormancy. Furthermore, inducing expression of NCED6 during seed development suppressed vivipary, precocious germination of developing seeds.

Results

Full understanding of mechanisms that control seed dormancy and germination, especially the mechanisms of hormonal regulation, remains elusive. While it has been proposed that translational control plays a predominant role in germination, other studies suggest the importance of specific gene expression patterns in imbibed seeds. The results from the seed biology project focusing on the role of ABA biosynthesis gene revealed that a single transcriptional change in one of the rate-limiting (most critical) genes is sufficient to induce seed dormancy, and that expression of a hormone metabolism gene in seeds can be a sole determinant of dormancy. Furthermore, this study opened the possibility to develop a robust

technology to suppress or promote seed germination through engineering pathways of hormone metabolism. Seed dormancy is problematic when growers need to germinate seeds for agricultural production. However, it is also necessary to maintain seed dormancy under certain circumstances in agricultural production. For example, precocious germination from developing seeds on the maternal plant occurs due to the lack of dormancy and causes serious problems in agriculture. A well-known example is preharvest sprouting (called PHS) from developing wheat grains during production in fields. PHS is a serious problem in wheat production. This precocious germination dramatically reduces the quality of final products, which causes substantial financial losses for wheat growers and affects food supply in our society. Technology development resulting from this project will provide solutions to these agricultural problems.

4. Associated Knowledge Areas

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

Outcome #5

1. Outcome Measures

KNOWLEDGE, Indicator 5 - pest management * Basic pest biology information, * new pesticides registered * Growers become aware of pest management processes, including level of management required, risks associated with this pest as it becomes established, * Fumigants used at reduced rates in combination with other nematicides are likely to be the optimum management strategies for control of CRKN.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Insects have close relationships with crops being produced in Oregon which include diverse grasses and rotational crops, many of which are raised for seed production. Their impacts are

either negative when they cause damage, or positive when they serve as beneficial insects either as pollinators or as natural enemies. Insects and related organisms such as slugs can also serve as vectors for plant diseases. The goal of the research was to study the biology of the pests and beneficial insects to develop management strategies for suppression of the pest species while preserving and promoting the beneficial species. Damage caused by insect pests can occur either above ground or below and hence appropriate strategies are required for each pest. Also, while insecticides are effective for some pests, others cannot be managed by the existing insecticides and alternative tactics are required for their management. Pollinators are critical to crop production and their preservation in field and horticultural crops is critical for ensuring good yield in seed crops in Oregon.

What has been done

Seed production in orchardgrass seed crops in Oregon is limited due to the presence of an endophytic pathogen that causes choke disease. Fungal spermatia that are transferred between opposite mating types for fertilization are known to be vectored by a fly species. Studies at OSU indicated that slug species feed on the fungus and hence they may also serve as vectors. Laboratory studies were thus conducted to determine the roles of slugs in fertilization of the fungus and spread of choke disease. A work group meeting was organized to which researchers and extension personnel at OSU, USDA, growers and industry personnel were invited for identifying future research directions for choke management.

Seed production in red clover crops is affected by a subterranean pest, the clover crown borer. Lab and field studies were conducted to evaluate the impacts of insecticides and natural enemies for suppression of the pest.

Laboratory studies were also conducted to determine the negative impacts of pesticides on bumble bees that pollinate red clover seed crops. In addition, pathogens present in bumble bees which affect their abundance and availability for crop pollination were also examined.

Results

Studies in orchardgrass revealed the presence of not one but three species of slugs associated with the endophytic fungus. The three species differed in the extent to which they were involved in fertilization of the fungus and spread of conidia that lead to new plants being infested. However, besides, slugs and flies, water splash from rain also has the potential to fertilize the fungus. Hence, management strategies aimed at suppression of slugs are not expected to provide adequate control of the choke disease fungus. Based on discussions at the work group meeting, identification of varieties with resistance has the greatest potential for choke disease management in Oregon.

Studies on the clover crown borer indicated that of the four insecticides that were evaluated, none exhibited significant pest mortality in the field. Under laboratory conditions, of two insect pathogens that were evaluated, one, *Metarhizium*, has potential for killing adults and merits further investigation.

Responses of queens and worker bumble bees to pesticide residues indicated variation within the same class of the pesticides, and even to the same pesticide, and underscored the need for caution when pesticides are applied to crops that provide foraging resources for queen and worker bumble bees. Even reduced-risk insecticides and fungicides which are believed to be relatively harmless, showed negative impacts, and these need to be considered when decisions are made on application of pesticides. Bumble bee populations were also observed to be affected by a diversity of pathogens including *Sphaerulaia bombi*, *Nosema bombi*, other

microorganisms and a conopid parasitoid.

The studies addressed development of sustainable food systems as the research was aimed at increasing yield in forage crops and protection of bees that are key pollinators of crops that serve as food for humans and livestock.

4. Associated Knowledge Areas

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

Outcome #6

1. Outcome Measures

KNOWLEDGE, Indicator 6 - economic studies * 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The project has sought to analyze the factors contributing to changing global trade patterns in agriculture and processed food industries, with emphasis on technological change and trade costs. Measuring trade costs has been limited because of lack of time series data on applied tariffs as well as systematic cross-country information on transport costs and logistics. Moreover, a national measure of trade cost does not appreciate the large number of and diverse U.S. regions through which trade in agriculture and processed food occurs.

What has been done

Over the past year, this project has focused on measuring region-level trade costs faced by U.S. agricultural and processed food industries.

Results

This research has contributed to improved understanding of factors limiting U.S. trade in agriculture and food at a regional level. For instance, bilateral trade costs between U.S. - China has significantly declined during the past decade especially for the west coast states relative to those on the east coast of the United States. Similarly, the Great Lakes region faces relatively lower bilateral trade costs with Canada, while Texas or Arizona have lower trade costs with Mexico. Such variations in trade costs among regions contribute to differential responses by U.S. agricultural and food producers and exporters to changes in global demand and trade policy. Thus, regional economic development depends on alleviating high trade costs faced by several U.S. regions in accessing global markets.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management
603	Market Economics
607	Consumer Economics
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #7

1. Outcome Measures

Action Indicator 1 - Adoption of new varieties o reduce yield losses and expenses, o rejuvenate orchards o achieve better productivity and efficiency: o provide environmental benefits (less fungicide applications, etc.), o effectively compete on world market with new varieties 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Potatoes are a highly desirable crop, but have high production costs (\$3000/a). Disease pressure in traditional potato production areas can be high. Typically, adoption of new varieties expands

more rapidly if accepted by processors versus fresh market distributors. Grocery retailers can be slow to accept new russet varieties. An acre of potatoes in the Klamath Basin requires 1.75 acre feet of water per year.

What has been done

USDA Agricultural Research Service, U of Idaho, Washington State U and OSU developed the variety Classic Russet. Data showed Classic Russet gives growers a 50-75 hundredweight (cwt) per acre increase in yield over Russet Norkotah. The average price per cwt to the grower is currently \$7.75. This new variety has the added advantage of a 10% reduction in input costs and water usage. It does not require nearly as much nitrogen as other popular russet varieties and is more tolerant of certain soil borne pathogens.

Results

Classic Russet meets fresh market quality standards with reduced input costs and irrigation. For this reason it has generated interest among producers. Seven Klamath Basin growers have adopted this new variety out of the Tri-state potato breeding program in 2011. This rate of adoption is quite rapid compared to historical usage patterns. If adoption of this variety continues at the current rate, it could replace 30% of the 8,000 acres of fresh market russet potatoes produced in the Klamath Basin. The aggregate savings in inputs to Klamath Basin growers would be $(30\% * 8,000 \text{ acres} * [\$3,000 \text{ per acre} * .9]) = \6.48 M per year . An increase in gross return to the grower solely based on yield improvements would be $[50 \text{ cwt} * \$7.75 * 30\% * 8,000 \text{ acres}] = \1.16 M per year . Water savings would be $(30\% * 8,000 \text{ acres} * [1.75 \text{ acre feet} * .9]) = 3,780 \text{ acre feet of water per year}$. An acre foot of water is equivalent to 325,850 gallons. 3,780 acre feet of water is enough to provision almost 10,000 households (indoor and outdoor water use) for a full year.

4. Associated Knowledge Areas

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

Outcome #8

1. Outcome Measures

Action Indicator 2 - Improved animal fertility and genetic stock of 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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Two of the three major commercial oyster hatcheries are using Mulluscan Broodstock Program broodstock to produce large numbers of seed for the West Coast industry and foreign markets. Reduced seed production from commercial hatcheries due to poor water "quality", coupled with lack of commercial set in Willapa Bay, have resulted in a lack of adequate seed for commercial oyster farmers on the West Coast.

What has been done

Larvae from crosses among selected inbred lines (e.g. Adam x Eve) are reported to perform better than larvae from unselected "wild" broodstock under stressful hatchery conditions associated with upwelling events. Very favorable reports have been received from growers receiving seed from progeny derived from MBP-selected broodstock. New stocks of Pacific and Kumamoto oysters that were derived from oysters imported from the Ariake Sea, southern Japan, have been released to industry for use as broodstock. The new Pacific stocks will hopefully perform better in warmer conditions, such as those found in Puget Sound, California and Mexico. Anecdotal accounts from Mexico indicate that survival of progeny from the new Pacific stocks is greater than from existing West Coast stocks. Incorporation of the new Kumamoto stocks into the West Coast broodstock population will overcome issues associated with inbreeding of existing Kumamoto stocks. Preliminary results indicate that the new Kumamoto broodstock are comparable in shell shape to West Coast stocks. Trials are underway to compare growth and yield characteristics of the new Kumamoto stocks with those of West Coast stocks.

Results

Large quantities of broodstock have been sold to industry since 2009 and the proceeds used to support the repository. MBP has also worked with industry to develop a broodstock amplification and management plan whereby the hatcheries amplify selected families for future use as broodstock. Four "pods" were produced in each of 2010 and 2011 and another four are planned in 2012. These "pods" can be crossed without concern for inbreeding and yet it will be possible to maintain genetic diversity for at least 12 years into the future.

A service contract was developed between Oregon State University and a private company, Austin Creek Inc., located in Netarts Bay, Oregon, to distribute and sell MBP broodstock to commercial hatcheries. This transition program will hopefully result in a permanent transfer of Broodstock activities to the private sector, as harsh declines in federal and state funding support over the past two years are drastically reducing broodstock research and outreach activities.

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

ACTION Indicator 3 - animal management tools used by private sector * Beef producers improve their economic competitive advantage and improve the ecological sustainability of production systems. * manure management

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Surviving as a rancher in Oregon means finding a way to add value to the product. High costs associated with ranching, including fuel prices, may be a breaking point, despite increasing demand for beef in the U.S. and abroad. "Last year was the first time since 1947 that more beef was exported from the U.S. than imported," says John Williams, staff chair of OSU Extension Service in Wallowa County. "We should be doing pretty well, but our costs often outpace sales. We need better infrastructure and the ability to capture new markets." Other important challenges facing niche market producers take place off the grazing grounds. Closure of packing plants, a lack of small processing facilities, and a growing list of regulations face niche market cattle operations throughout the Pacific Northwest, says Lauren Gwin, a resource economics research associate at OSU. In the last three decades, there has been a steady decline in large and small meat processing facilities across much of the West both from insufficient year-round demand for their services and communities' prohibitions of their presence. Although beef cattle and forages make up the number one agricultural commodity in Oregon (with farmgate sales of \$709 million in 2010), Oregon isn't great year-round cattle country in regards to available feed, says Mueller. OSU research is focusing on how to help producers succeed in the market.

What has been done

Markets and infrastructure are in many ways related. In Oregon, developing new markets means developing "branded beef," says David Bohnert, an OSU ruminant nutritionist and beef cattle specialist at the Eastern Oregon Agricultural Research Center in Burns. Branded beef is sold under a certain description, such as natural, organic, or grass-fed, or more specifically under business names such as Painted Hills Natural Beef and Country Natural. The transition from traditional ranching operations to those that respond to demands for new, value-added products is not easy, according to Chad Mueller, an OSU researcher focused on beef cattle systems from conception to consumption. For people used to eating corn-finished beef, taste is something that they find lacking in some of the leaner branded products as fat is also related to taste. "To be competitive and to give consumers what they want, we have to take advantage of what we have," says Mueller, who is studying the genetics of marbling in beef cattle. It is possible to select for hereditary traits that result in more marbled, intramuscular fat deposits. Increased marbling is usually related to improved flavor and increased economic potential.

Results

"There is definite growth in natural, organic, grass-finished, and branded products," says Bohnert. "It's a challenging way of ranching, but it's attractive because of the associated premium price. If our ranchers can get into these markets they can make it profitable, but it's not for everybody. Right now maybe five percent of beef operations in the state target the niche markets." "The consumers we're hearing from really want beef from the niche markets," says Lea Ann Kinman, the manager of OSU's Clark Meat Center, an on-campus facility where students learn livestock anatomy and butchery, and where the public can purchase OSU-raised beef and other meats. She sees a shift in consumer demand toward grass-finished. "We see a high level of concern for the welfare of the animal. Consumers want to know more about how the cattle were cared for prior to harvest."

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
121	Management of Range Resources
302	Nutrient Utilization in Animals
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #10

1. Outcome Measures

Action Indicator 4 - 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

We wish to create a robust national network of organic vegetable breeders working collaboratively with each other and regional growers to benefit the organic community with improved vegetable varieties that are adapted to organic systems combined with disease resistance, nutritional and flavor quality, and contemporary productivity traits crucial to modern markets. We will focus on four hubs in the Northern US because of the similarities of our growing environments. Five crops that span a growing season were selected that integrate grower needs and plant breeding expertise: pea, broccoli, sweet corn, carrots and winter squash. Variety trialing and evaluation of material at various stages of development will provide key information regarding adaptability and will be ideal for soliciting regional participant grower input regarding their evaluation of the suitability of the vegetables to their needs and guidance for further improvement toward cultivar development. This engagement will take the form of trialing material at various stages of development along with existing varieties as well as engaging in participatory breeding.

What has been done

We are creating a robust national network of organic vegetable breeders working collaboratively with each other and regional growers to develop improved, adapted varieties. We will focus on four hubs in the Northern US because of the similarities of our growing environments. Five crops that span a growing season were selected that integrate grower needs and plant breeding expertise: pea, broccoli, sweet corn, carrots and winter squash. Variety trials and evaluations at various stages of development will provide key information regarding adaptability. This will be ideal for soliciting regional grower input regarding suitability of the vegetables for their needs and yield guidance for further improvement of cultivars. Data collection protocols were revised in 2011 to acquire useful information while minimizing visits to field sites. Seed used in variety trials was acquired by Cornell and distributed to regional sites. Each region had a farmers' choice trial: cabbage (WI), tomato (NY), beets (WA), and peppers (OR). The broccoli breeding program was conducted at 3 PNW sites with 2 farmers participating. Four OP populations were entered in trials. Sweet corn breeding at UW progressed with cycle 3 advanced in Chile and MN. Carrot breeding in WA advanced with selfs made in a winter population in 2010. S1 seed was planted in the field in fall and roots dug in spring were returned to the greenhouse. In the pea breeding program, BC1F1 populations were selected for stringlessness at Cornell. Three advanced lines from OSU were evaluated in regional variety trials in 2010. Winter squash breeding at Cornell focused on a new hybrid butternut which is also being dehybridizing to release as an OP targeted to organic

growers. A prototype variety trial database is in the final stages of testing with a call for trial results as part of the NOVIC website launch.

Results

Overall, the variety trialing project was successful in identifying certified organic sources and evaluations from the trials and interest generated may stimulate organic production of seed currently only available from convention production. In the Oregon regional meetings, we asked the following: "will you make changes to your variety selections this season based on NOVIC results?" and we received positive answers from about 63% of respondents. Many farmers who attended the WA NOVIC field day intended to change the varieties of beet and winter squash they grew based on the variety trial results. We received requests for breeding material (mostly broccoli and squash) from organic and conventional seed companies. Seed companies, producers, and consumers have attended our field days and presentations and thus have increased knowledge of breeding and trialing that is being done, and varieties that work in organic systems. We have been invited to engage in variety trialing collaboration efforts with seed companies and have received strong interest and involvement from independent seed growers and breeders.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
121	Management of Range Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
511	New and Improved Non-Food Products and Processes
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #11

1. Outcome Measures

Action Indicator 5 - 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our current research is focused on measurement of trade costs, which refer to all factors limiting the movement of goods and services across countries, including handling and transportation costs, tariffs, and other barriers. We have sought to analyze the factors contributing to changing global trade patterns in agriculture and processed food industries, with emphasis on technological change and trade costs.

What has been done

Measuring trade costs has been limited because of lack of time series data on applied tariffs as well as systematic cross-country information on transport costs and logistics. Moreover, a national measure of trade cost does not appreciate the large number of and diverse U.S. regions through which trade in agriculture and processed food occurs. Over the past year, this project has focused on measuring region-level trade costs faced by U.S. agricultural and processed food industries.

Results

This research has contributed to improved understanding of factors limiting U.S. trade in agriculture and food at a regional level. For instance, bilateral trade costs between U.S. - China has significantly declined during the past decade especially for the west coast states relative to those on the east coast of the United States. Similarly, the Great Lakes region faces relatively lower bilateral trade costs with Canada, while Texas or Arizona have lower trade costs with Mexico. Such variations in trade costs among regions contribute to differential responses by U.S. agricultural and food producers and exporters to changes in global demand and trade policy. Thus, regional economic development depends on alleviating high trade costs faced by several U.S. regions in accessing global markets.

4. Associated Knowledge Areas

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

- 607 Consumer Economics
- 803 Sociological and Technological Change Affecting Individuals, Families, and Communities

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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Endophytic fungi and cool-season grasses (tall fescue, perennial rye, and fine fescues) have a symbiotic relationship. While the grass nurtures the fungus, the fungus produces alkaloids that provide beneficial qualities to the grass, including vigor, drought-tolerance, nematode and insect resistance, and successful competitiveness against weeds.

These endophytes, however, produce additional alkaloids (principally ergovaline and lolitrem B) that are toxic to livestock when infected forage is ingested in large amounts. Symptoms of endophyte toxicosis include weight loss; decline in body condition; abnormal function of thermoregulation leading to hyperthermia, increased respiration rates, excessive salivation; lower pregnancy rates; and reduced milk production, bringing lower calf weight and less sales revenue. Nationwide losses to livestock producers have been estimated at \$1 billion/year.

The Willamette Valley produces 65-70% of the world's supply of grass seed, with net revenue to the state estimated at over \$580 million in 2008, garnering the ranking of the 3rd largest agricultural commodity in the state. Research in this project focuses on studying the metabolism and ultimate disposition of these plant toxins in livestock species, so that strategies can be developed to treat, or even eliminate, the repercussions of these toxins. Specifically, our research aims to identify and isolate ruminal microbe species that are capable of degrading endophyte toxins. The ultimate goal is to develop a probiotic? a dietary supplement containing beneficial microbes? that can be fed to livestock so that they then can consume endophyte-infected forages without succumbing to the deleterious effects of their toxins.

What has been done

The digestive responses and degradation of ergovaline and production of lysergic acid in the rumen of sheep offered endophyte-infected tall fescue straw at two ergovaline levels were investigated. The appearance of lysergic acid in the feces, urine, and ruminal fluid is likely due to microbial degradation of ergovaline in the rumen and further breakdown in the lower digestive tract.

Alternative sources for microorganisms which can degrade ergot alkaloids were investigated, including the anaerobic gut of the earthworm, *Eisenia fetida*. We performed comparative microbial and biochemical analyses between the prokaryotic populations within the gut of earthworms given two varieties of grass seeds with either 0 or 10,000 ppb ergovaline content.

A case report involving four dairies in the Willamette Valley, Oregon which experienced reproductive problems associated with a large, previously unidentified peak eluting at five minutes in a standard ergovaline HPLC assay of perennial ryegrass silage fed to those animals was published. We offered rationales for elucidation of the structure of this compound, with the closest starting point comprising a m.w. of 566? a fructofuranosyl-(2-1)-O-beta-D-fructofuranoside derivative of 6,7-secoergoline from *Claviceps fusiformis*.

Two new primer sets based on the *rpoB* gene were designed and evaluated with bovine and ovine rumen samples. The primers amplified a large number of clones belonging to phylum Proteobacteria, providing a useful insight into the microbial structure of the rumen; the study also suggests that the bovine rumen is more diverse than the ovine rumen.

Results

Our research guides safe administration of endophyte-infected forage to livestock throughout the lifespan of various species, including horses, cattle and sheep. Recommended feeding regimens and threshold of toxicity levels are given on our website (<http://oregonstate.edu/endophyte-lab/>), through interactions with extension agents and in peer-reviewed literature publications. Future research will focus on defining these toxicity parameters for camels of the Middle East and other

animals that the hay export market is currently targeting in forage sales. Field burning was previously the most economically efficient way for grass seed farmers to dispose of the masses of residue remaining after the seed harvest. However, due to the environmental and social hazards created by burning, farmers have gradually phased out this method of disposal. Uses have been developed for the straw residue, so that it has been turned into a valuable, marketable product in the form of baled straw; in 2006, straw sales amounted to \$110 million. Meanwhile, field burning emissions have been reduced to about 5% of the levels seen before the phase-out began. An unexpected side effect of this otherwise win-win situation has been the toxic effects on cattle, sheep, camels and other livestock if fed large amounts of high level endophyte-infected straw. This project addresses that problem.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
121	Management of Range Resources
202	Plant Genetic Resources
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
302	Nutrient Utilization in Animals
307	Animal Management Systems
601	Economics of Agricultural Production and Farm Management

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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The cleanup of ordinance contamination on military ranges has the potential to be the largest environmental cleanup ever implemented in the United States. EPA has estimated that over 700,000 cubic yards of soil and 10 billion gallons of groundwater require treatment at a cost of \$14 - 30 billion. TNT and RDX are the primary contaminants at these sites, along with dinitrotoluenes (DNT) and other nitro substituted explosives. TNT, RDX, their metabolites, and related compounds represent environmental hazards because they exhibit considerable toxicity to humans, dogs, rats, fish, algae, and microorganisms.

The overall strategy of "Phyto-Ruminal-Bioremediation" involves using cool season grasses to remove TNT from contaminated soils then using sheep with TNT- and RDX-degrading ruminal microbes to graze the grasses and convert the metabolites into non-toxic digestible nutrients in the sheep rumen. Our research focuses on concerns the mechanism by which munitions are biotransformed to amines, which are then assimilated back into amino acids by bacteria in the rumen. Ruminants are nutritionally rate-limited in nitrogen and amines and possess enzymes to assimilate nitrogen-containing compounds. This new engineering approach (grasses and sheep) could be the solution for munitions cleanup in many contaminated sites throughout the world.

The long term objective is to encapsulate these ruminal microbes so they may be seeded into indigenous ruminant or pseudo-ruminants species, i.e., deer and rabbits, respectively. This innovative technology will provide a cost effective method to remediate contaminated soils.

What has been done

We investigated the fate of [14C]-TNT in ruminating sheep to determine the utility of ruminant animals as a portion of the bioremediation process. Plasma radioactivity peaked within 1 h of dosing and was depleted within 18 h. Approximately 76% of the radiocarbon was excreted in feces, 17% in urine, with 5% being retained in the gastrointestinal tract and 1% retained in tissues. Parent TNT and metabolites were not detected in excreta. This study demonstrated that TNT reduction within the ruminant gastrointestinal tract leads to substantial immobilization of residues to organic matter, a fate similar to TNT in other strongly reducing environments.

RDX incubated in whole ovine rumen fluid was nearly eliminated within 4 h. Whole ovine rumen fluid was then inoculated to select for archaeal and bacterial organisms capable of RDX biotransformation. Phylogenetic analysis revealed similar homologies to eight different bacterial and one archaeal genera classified under the phyla Firmicutes, Actinobacteria, and Euryarchaeota. Further, *Sporanaerobacter acetigenes* was identified in the consortia as the only organism able to completely transform RDX.

We studied the fate and uptake of [14C]-TNT from soil into orchardgrass (*Dactylis glomerata*), perennial ryegrass (*Lolium perenne*), and tall fescue (*Festuca arundinacea*) over one year in a greenhouse-controlled environment. Continual uptake of TNT into grass blades was observed over the one year period, with a total accumulation of 1.3%, 0.9%, and 0.8% of the initial soil [14C]-TNT dose for orchard grass, perennial ryegrass, and tall fescue, respectively. All [14C]-TNT residue in plant material was incorporated as bound residue.

Results

Our demonstration of both cool-season grass uptake and ruminal degradation of explosives provides the background information and confirmation to make phyto-ruminal-bioremediation of munitions a reality. The next step in our research program is to perform a field demonstration of this remediation strategy, planting grasses on contaminated land and allowing ruminant species to graze the grass, all-the-while measuring uptake by the grasses and remediation by the ruminants (using cannulated animals). This remediation strategy has become attractive to other nations as well, who are entertaining the possibility of using their own native grasses and ruminant livestock to achieve their clean-up goals. The cleanup of ordinance contamination on military ranges has to potential to be the largest environmental cleanup ever implemented in the United States. EPA has estimated that over 700,000 cubic yards of soil and 10 billion gallons of groundwater require treatment at a cost of \$14 - 30 billion. Groundwater and soil contamination from military exercises, unexploded ordnances and improper storage/disposal at munitions manufacturing and handling facilities pose a serious threat to public health and dictate the need for a large, efficient environmental clean-up program. 2,4,6-Trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) are the primary contaminants at these sites, along with dinitrotoluenes (DNTs) and other nitro-substituted explosives (i.e. HMX, tetryl and C4). These compounds and their metabolites represent environmental hazards, as they exhibit considerable toxicity to terrestrial and aquatic organisms, including humans.

The long-established practice for removing nitroaromatics from contaminated soil has been through extensive excavation and subsequent incineration. While effective, this method is not very practical from a logistical or economic perspective. Ex situ slurry anaerobic/aerobic treatment or composting are effective in forming strongly bound munitions residues, but are also quite expensive compared to in situ processes. Alternatively, in situ bioremediation technologies are implemented on site, have few health and environmental precautions to consider, and are less expensive relative to other procedures. The overall goal of this project, therefore, is to investigate a novel paradigm for cost-effective remediation of munitions such as TNT and RDX found in contaminated sites using plants and anaerobic microbes from ruminants: phyto-ruminal bioremediation.

If this research is successfully implemented, the social consequences will be far-reaching, including: restoring contaminated lands to their native state so that local flora and fauna can once again thrive; safeguarding the health of humans and animals that depend on areas currently contaminated with munitions; clean-up of soil and groundwater in areas previously used for agriculture so that it may once again be returned to this use and provide a means of sustenance and profitability for the people that depend on that land.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

602	Business Management, Finance, and Taxation
603	Market Economics
607	Consumer Economics
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

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 competitive 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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Kentucky bluegrass seed fields in central Oregon, Hermiston and the dryland areas of eastern Washington use surface applied nitrogen. Volatile nitrogen loss as ammonia is an economic and environmental concern.

What has been done

The three production areas have diverse characteristics from high elevation (central Oregon), low elevation (lower Columbia Basin), and rolling terrain (eastern Washington). Differences in winter temperatures and production practices make for different risks for nitrogen loss. Soil characteristics and residue management also vary between regions as well as within regions. All three production areas receive their primary application as topdress in mid to late fall. The objective of this study was to quantify as pounds per acre ammonia volatilization from urea, Agrotain-coated urea, solution 32, CAN 27 and ammonium nitrate applied to the soil surface in the fall under commercial field conditions. Ammonia volatilization losses were measured with a modified passive flux method (Wood et al., 2000), which consists of a rotating ten foot tall masts placed at the center of each 100 ft diameter circular plot. Nitrogen loss due to ammonium volatilization was highest with urea followed by solution 32. Agrotain-coated urea, CAN 27 and ammonium nitrate provided similar low levels of volatilization.

Results

First year data from the ammonia volatilization project indicate a reduction of 15 to 35 lbs N/acre using Agrotain-coated urea compared to urea in fall-applied, broadcast application in Kentucky bluegrass. Initial conservative calculations indicate a savings in excess of \$100K to central Oregon grass growers. Based on the initial results of this study, Agrotain is being added to urea-based fertilizers applied to winter wheat. It was previously thought that temperatures were too low that time of year for any significant volatilization. Estimates related to wheat indicate another \$100K savings, for a total savings in excess of \$200K annually for these two crops alone.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management
602	Business Management, Finance, and Taxation

603	Market Economics
607	Consumer Economics
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #15

1. Outcome Measures

KNOWLEDGE, Indicator 1b - landscape management systems. * Professional turf/landscape managers, nursery retailers, gardeners, and people associated with restoration/conservation projects will learn about sustainable gardening practices (eg. fertilizers, water, and pest management including organic), turf management, horticulture and aboriculture principles and practices, streamside gardening, native plants, invasive species, fire prevention, methods to minimize water runoff and use, wildlife enhancement, conservation and stewardship, and add value and beauty.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Phytophthora species cause the most important diseases of nursery crops nationwide. Commercial greenhouses have relied on chemical fumigants and drenches to control soilborne pathogens between cropping cycles, but increasing restrictions on the use of these materials is forcing growers to explore other ways to manage diseases. In previous work, we have documented several sources of contamination in nurseries such as contaminated gravel substrates, reused pots, and irrigation water. In this work, we will test sustainable management practices to minimize the risk of infection from these sources.

What has been done

Ten horticultural nurseries were investigated for the frequency of Phytophthora contamination in each of three Critical Control Points in the production process: used containers, irrigation water, and gravel underlying container yards. Five of the nurseries were participants in a nursery certification program, the Grower-Assisted Inspection Program (GAIP), sponsored by the Oregon Dept. of Agriculture, and five nurseries were not (non-GAIP). The frequency of contamination was determined by baiting of soil and water samples collected in fall and spring. Parke investigated non-chemical alternatives to fumigation including removal and replacement of substrate, in situ pasteurization, solarization, and solarization followed by soil incorporation of the biocontrol agents

SoilGard and RootShield.

Results

Overall, there were no significant differences in the frequency of contamination between GAIP and non-GAIP nurseries. The timing of water sampling appears to be very important, with significantly greater recovery of Phytophthora in fall as compared to spring. Used pots and gravel were a source of Phytophthora in several nurseries, and irrigation water was contaminated in most nurseries that did not treat their water, including two of the GAIP nurseries. Several of the nurseries adopted best management practices to curtail their Phytophthora contamination problems as a result of our study. Because of our findings, the Oregon Dept. of Agriculture will require that nurseries participating in GAIP must disinfest recycled irrigation water. Solarization for 6 weeks during the summer was not adequate for killing inoculum of Thielaviopsis basicola, Rhizoctonia solani, or Pythium irregulare buried 4" beneath the soil surface, but solarization did reduce damping-off disease in soil bioassays. SoilGard 12G appeared to give some improvement in root quality and plant health. Additional research is proposed to document the effectiveness of solarization and biocontrol amendments under controlled greenhouse conditions in Oregon.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
602	Business Management, Finance, and Taxation

Outcome #16

1. Outcome Measures

KNOWLEDGE, Indicator 1c - dryland production management systems. * 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Beginning and established smaller-scale farmers require resource materials for continued sustainability. OSU Extension lacked easy-to-read and understand publications that provide the essential message in an attractive, easily understood format, while providing additional resources to those seeking additional information.

What has been done

A multi-agency team of resource managers located in Central Oregon and the mid-Columbia region was formed. Working with the Department of Extension & Experiment Station Communications (EESC), a number of publications, under the series name "Living on the Land," have been developed to address immediate information needs for this audience. The publications are a maximum of two pages in length, and include ample photos, and tables, plus links to additional information. EESC's contribution to the series success has been the unique feature of a podcast version of each publication. To date, topics have included pasture and livestock essentials, winter livestock care, and manure management. Forthcoming topics are predator management, and soil and water conservation practices. The topics will expand to other sustainable agriculture topics as needs are identified and teams are assembled. The publications are suitable for the entire state, rather than specific regions.

Results

To date we have created:

EC 1634-E Living on the Land: Pasture and Livestock Essentials

EC 1635-E Living on the Land: Winter Livestock Care

EC 1637-E Living on the Land: Managing Manure

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management

Outcome #17

1. Outcome Measures

KNOWLEDGE, Indicator 1d - irrigated production management systems. * Growers and the public sector are made aware that environmentally friendly drip and micro sprinkler irrigation systems produce increased crop yield and crop quality and that less nitrogen is required when crops are irrigated 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Water resources are becoming more limiting as multiple demands increasing compete for finite and decreasing fresh water resources. Microirrigation has the potential to help growers conserve water.

What has been done

Drip, sprinkler, and furrow irrigation systems are being compared and various irrigation criteria are being tested for their effects. Tensiometers, granular matrix sensors (GMS), hybrid sensors, thermocouple psychrometer readings, and capacitance probes are being compared and calibrated. Irrigation scheduling instruments that measure soil water tension (SWT) irrigation criteria are being calibrated and compared. The project will develop grower-appropriate scheduling products. Irrigation criteria is being examined for seed production of 20 native perennial plant species that the US Forest Service and BLM have determined would be highly desirable for rangeland restoration. Each species is being grown under SDI in replicated plots with three irrigation treatments (0, 100, and 200 mm/yr total irrigation) repeated over years.

Results

Irrigation scheduling by soil water tension allows growers to use water more precisely. Calibration of soil moisture instruments promotes improved irrigation scheduling with greater precision and confidence. Better use of irrigation systems and irrigation criteria are expected to increase yields and reduce environmental consequences of irrigation.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #18

1. Outcome Measures

KNOWLEDGE, Indicator 1e - marketing approaches * 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Oregon Farm Explorer (<http://oregonexplorer.info/farm>) maps Oregon's rural and urban connections through an exploration of farms and markets using a variety of data collections, mapping tools, stories and other resources.

What has been done

The Oregon Farm Explorer (<http://oregonexplorer.info/farm>) maps Oregon's rural and urban connections through an exploration of farms and markets using a variety of data collections, mapping tools, stories and other resources. The Oregon Farm Explorer was developed as a collaborative effort of the OSU Libraries, Oregon University System's Institute for Natural Resources and the OSU College of Agricultural Sciences.

Results

The Oregon Farm Explorer presents a wonderful opportunity to learn about the bountiful food produced in Oregon, said Anita Azarenko, head of OSU's Department of Horticulture, including what is raised here, where it is produced, and where to find it. The site allows visitors to find local, fresh, farm-grown produce, meats and cheeses with the Farmers' Market Finder and its interactive maps, as well as to learn about agricultural and horticultural crops and the livestock and dairy industries that support Oregon's economy. The site highlights the Oregon Century Farm & Ranch Program and can trace the spread of agriculture through the establishment of farms and ranches. A specially designed viewer maps farms and ranches that have received century and sesquicentennial awards, and provides detailed information by county.

4. Associated Knowledge Areas

KA Code	Knowledge Area
601	Economics of Agricultural Production and Farm Management

603	Market Economics
607	Consumer Economics

Outcome #19

1. Outcome Measures

KNOWLEDGE, Indicator 2b - animal reproductive genetics. * genetic causes of early embryonic failures, * developmental biology of the early bovine embryo * factors affecting establishment of extraembryonic endoderm * sire genotype effects on embryonic loss * understanding genetic basis for fertility in male poultry including sperm cell function

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Research was directed towards two goals: (1) a gene-based, quantitative definition for semen quality, and (2) a method for storing poultry sperm based upon bio-energetic theory. To date, semen quality in domestic species at large is understood in terms of a variety of variables such as volume and sperm cell concentration. Consequently, though it is generally understood what semen quality is, semen quality has been described rather than defined. In contrast, research by animal reproductive geneticist, Fred Menino, has shown that poultry semen quality can be defined in a quantitative manner, i.e. the number of mobile sperm produced per gram testis per day. Moreover, sperm mobility is subject to genetic selection. The analysis of sperm mobility has afforded two wholly unexpected outcomes: (1) understanding the mechanism enabling in vivo sperm storage, and (2) an experimental approach that will likely enable vitro sperm storage based upon bioenergetic theory. In summary, issues addressed stem from original discovery, reflect cutting-edge poultry science, and as such will lead to industry application.

What has been done

The majority of experiments performed during 2011 pertained to NIFA award number 2011-67015-20035 entitled "A gene-based, quantitative definition for semen quality." Work was completed relative to each of the award's three specific aims. In regard to the first aim, a high-throughput method was validated for estimating daily sperm production within the rooster's testis. This method was used to evaluate phenotypic variation within and between experimental lines. Roosters within these lines are characterized by low and high sperm mobility. In brief, daily sperm production is a variable required for estimation of deferent duct transit time, and transit time was, on average, a day longer within the low sperm mobility line. In addition, an

intermediate phenotype was generated in a breeding experiment in which experimental lines were crossed. In regard to the second specific aim, replicate testis transcriptomes per line were generated in collaboration with Co-PDs at the University of Arkansas and the University of Arizona. In regard to the third aim, one of two proposed experiments addressing gene x environment interaction was completed. The experimental outcome reinforced the notion that sperm mobility phenotype fundamentally arises from genetic causes as opposed to environmental factors encountered by cockerels during sexual maturation. Experiments related to in vitro sperm storage demonstrated the utility of potassium-based media in the context of inactivating and reactivating motile sperm by manipulating mitochondrial Ca²⁺ cycling.

Results

The estimation of daily sperm production from a large sample of roosters represents a fundamental technical advance towards the grant's overall goal. Historically, daily sperm production has been estimated by homogenizing testes and counting homogenization-resistant sperm nuclei with a hemacytometer. This technique is effective but inordinately tedious. It also employs an infinitesimal volume of the homogenate. In contrast, the new technique uses 5 to 15% of the testis homogenate, depending upon testis size. In turn, the rapid and accurate estimation of daily sperm production enabled estimation of deferent duct transit time. Sperm mobility phenotype appears to be the interaction of a genetic predisposition and a circumstance experienced by sperm after they leave the testis. When sperm cell proteomes were compared between lines, the enzymes within the entire glycolytic pathway were downregulated within the low sperm mobility line. Likewise, deferent duct transit time was greater in this line relative to the high sperm mobility line. Note that the deferent duct is the principal excurrent duct within the rooster's reproductive tract and thus holds the bulk of a rooster's extragonadal sperm reserve. In review, experimental outcomes during the review period will fully enable chicken semen quality to be defined in terms of a single, quantitative variable. This will be a fundamental advancement in poultry science, for male fertility is a function of sperm mobility phenotype and variables affecting phenotype - which are genetic in nature - are now being elucidated. In summary, the first outcome was a novel conceptual advance that enables semen production to be understood in terms of systems biology.

The second outcome was an invitation to speak at the corporate headquarters of Cobb-Vantress, Inc. in Siloam Springs, Arkansas (airfare paid by Cobb-Vantress). This company is the largest primary breeder of meat-type chickens in the U.S. and is owned by Tyson Foods. A 2-h seminar was presented on December 6, 2011 entitled "A Prospectus for Semen Preservation." Senior geneticists, the VP for Research & Development, and the Director of Intellectual Property & Technology Development for Tyson Foods were in attendance. Based upon an immediate need to preserve and transport semen from pedigree line roosters, they may be in touch.

The third outcome was an invitation to apply for a grant within the Translational Genomics for Improved Fertility of Animals program area within NIFA's Food Safety challenge area. The invitation was received on December 12, 2011 as an email from Mark Mirando, National Program Leader. The first draft of the proposal was written prior to December 31, 2011. Research to be proposed logically follows on-going NIFA-funded research. In other words, timely execution of federally funded experimentation afforded critical preliminary data for a grant proposal pertinent to one of NIFA's five new challenge areas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals

Outcome #20

1. Outcome Measures

KNOWLEDGE, Indicator 4b - plant attributes for health. * Antioxidant effects of various carotenoids and flavonoids, and impact of flavonoids on antioxidant effect * Stakeholders learn about human health benefits, disease resistance, and breeding for organic systems of vegetables.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There is a great need to develop organic production systems for processed and fresh blackberry that maximize plant growth, yield, fruit quality, and food safety; and to provide healthy and nutritious food.

What has been done

Using commercial storage practices, fruit qualities and bioactive compounds in fresh Obsidian and Triple Crown organic blackberries associated with different organic planting and management systems were evaluated during postharvest refrigeration storage.

Results

New knowledge on the impact of different organic production systems on the quality and storability of fresh organic blackberries was developed. Such information will be valuable for optimizing the most practical organic agricultural production system. Information on the storage and processing effects on the quality and nutraceutical benefits of blackberries can be used by processors to develop better procedures for retaining the nutraceutical components of berries and by consumers to better understand potential health benefits of the various products.

4. Associated Knowledge Areas

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

Outcome #21

1. Outcome Measures

KNOWLEDGE, Indicator 5a - weed control * factors affecting herbicide activity * herbicides registered, * natural herbicides to control weeds in organic and/or no-till wheat production, * improved weed control in no-till fallow systems, including optimum inputs

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Weeds are the most ubiquitous pests found in agricultural fields. Insects and pathogens can be more specific to a particular crop whereas weeds are more widespread. Weeds compete with crops for the same resources and cause loss of crop quantity and quality. The research in the weed science program concentrates on identifying weed management strategies for agronomic crops in Oregon. Italian ryegrass and annual bluegrass are two of the major weeds in crops in Western Oregon. Herbicide resistance in both of these species increases the cost and difficulty for control of these species. We have identified populations with resistance to most of the herbicides available to control them. We have Italian ryegrass populations with resistance to Roundup and Rely, resistance to Roundup, Velpar, and Oust, or resistance to Define, Zidua and Select. When populations have resistance to multiple herbicides, it is difficult for growers to choose an appropriate control measure. Carbon seeding is used for perennial grasses grown for seed. The carbon will protect the crop seedlings from injury from the herbicide used for weed control. However, annual bluegrass has evolved resistance to the most commonly used herbicides for carbon seeding.

What has been done

Field, greenhouse and laboratory studies were conducted for the management of the herbicide resistant populations. We studied the mechanisms responsible for resistance and the biology and genetics related to the resistance in order to help predict the spread of resistance under field conditions. We evaluated herbicide options for control of the resistant populations.

Results

In 2011, the program evaluated both chemical and nonchemical control tactics for control of Italian ryegrass and annual bluegrass. We identified herbicides that will effectively control resistant Italian ryegrass and annual bluegrass populations and are working with the

manufacturers of these products to obtain labels for use in Oregon.

4. Associated Knowledge Areas

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

Outcome #22

1. Outcome Measures

KNOWLEDGE, Indicator 5c - disease biology, control and resistance * Facilitate future planned activities in functional genomics and provide a more robust sampling of the Pleosporales for comparative genomic studies by the fungal research community. * Efficacy of various orchard, postharvest, and storage methods for control of postharvest decay of pear * Molecular mechanisms responsible for closterovirus reproduction and transport in plants and develop model to predict risk * Functions of the GLRaV-2 proteases in virus reproduction and spread, as well as characterize mechanisms of BYV Hsp70h interactions with actin cytoskeleton and targeting to plasmodesmata; approaches to engineering GLRaV-2 gene expression vectors. * Elucidate the underlying molecular mechanisms of pathogenicity (virulence) and disease susceptibility (compatibility) and disease development. * Technologies for efficient application of viral vectors in grapevine. * Disease resistance discoveries, including gene evolution, plant lines * Information for the development of resistant wheat germplasm to tan spot. * relationships between disease susceptibility and disease resistance. Characterize genes involved in Victoria Blight Disease susceptibility, and uncovered

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Oregon produces 99% of US commercial hazelnuts, with farmgate sales at \$60-75 million. Oregon hazelnuts attract a premium price for the large size of the nuts compared to all other production areas globally. PNW acreage (OR, WA, BC) increased from 1905 until 1970 when

Eastern Filbert Blight (EFB) was documented in Washington State. Since then, acreage has declined, with production outside of Oregon's Willamette Valley almost non-existent. EFB is a fungal disease endemic to the eastern US. Chemical control of EFB costs about \$160 per acre per year. Growers incur an additional \$150 per acre per year to scout and remove infected branches from fully established orchards. Infected trees gradually die. In the meantime, their yield can be dramatically reduced. Oregon has lost some 1600 acres of about 30,000 acres of hazelnuts to EFB in the past decade. Currently, more than 70% of Oregon orchards are infected, or are in close proximity to diseased orchards.

What has been done

The goal of this project is to develop disease-resistant hazelnut varieties, adapted to production conditions both within and outside of the Pacific Northwest, such as the US Midwest, and providing growers with an additional enterprise, biofuel biomass, for increased farm sustainability. The Gasaway gene confers resistance to EFB; it is now fully mapped and characterized, although work continues to refine our understanding of its function in hazelnut. Selections from the hazelnut breeding program, fully resistant to EFB, are crossed with susceptible cultivars; resultant crosses not resistant to EFB are dropped from the breeding program. The resistant seedlings are evaluated according to the quality of their nuts and adaptability to climatic conditions across the US.

Results

EFB resistant Jefferson, a cultivar valued for its large nuts, is being readily adopted by growers. About 5,000 acres have been planted since its release in 2010. These are the first new orchards to be planted since 1970. Continued research will address the need to uncover a broader base of sources of resistance and concerns about breakdown of resistance, lending durable, long-term sustainability to this industry. This work has saved a specialty crop industry in the United States. Further, hazelnuts provide an alternative enterprise to the Willamette Valley's grass seed growers, who continue to suffer from stagnant markets since the fall of the housing market in 2008. In a fully establishment orchard, EFB resistant trees return \$1,940 per acre over cash costs to the grower, as compared to -\$3,014 for the EFB susceptible planting, a difference in cumulative cash flow of \$4,954 per acre.

4. Associated Knowledge Areas

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

Outcome #23

1. Outcome Measures

KNOWLEDGE, Indicator 6b - trade * We expect to show that international trade will be an important vehicle by which adaptations can be made to global climate change. * Researchers will uncover key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade. * Policy makers will understand that climate change will be related to changes in comparative advantage in international crop production, and in turn the

pattern and volume of trade. * Numerical estimates will be provided regarding how climate change will affect crop prices, production costs, and the economic welfare of producers, consumers, and society at large.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Climate change could impact agricultural production and trade

What has been done

Present research focuses on the role of natural resources, especially land and water, in world agricultural production and trade, and how this system will be affected by potential shocks associated with climate change. The relationship between international trade and natural resources was conceptualized in a model that ties together resource endowments, agricultural productivity, geography, and other key determinants of trade. Since last year’s report, Jeff Reimer wrote two new papers on international trade in agricultural products in terms of how it relates to natural resources and, in particular, water. The focus is on understanding how future changes in climate, as well as natural existing variability, influence how crop decisions are made, how patterns of commodity trade will adjust in response, and how producers and consumers will be affected.

Results

The study has contributed to improved understanding of the mechanisms at the international level by which crop agriculture must adapt to new climate possibilities. The project provides evidence that openness to international trade can offer another margin of adjustment to a key problem associated with climate change. Countries use their relations with each other to alleviate the effects of a shock to their natural resource endowment. When impacts are too big for one country to handle by itself in isolation, some new trade flows start up, while others shut down.

4. Associated Knowledge Areas

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

803 Sociological and Technological Change Affecting Individuals, Families, and Communities

Outcome #24

1. Outcome Measures

KNOWLEDGE, Indicator 6c - community education. * Ways to integrate agricultural education into high school curriculums

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

A new program at Oregon State University aims to help agricultural sciences and forestry students succeed in the workplace, and show employers that these OSU graduates are top-notch employees. "We heard feedback from employers that our graduates have impeccable technical skills, but that most job-seekers would benefit from additional development in soft-skill areas," said Kellie Strawn, the director of the new program, which is run by the College of Agricultural Sciences.

What has been done

The program, called Leadership Academy, got under way this past year with 10 students. Over the course of the year, participants will sharpen their ability to lead, think critically, communicate and work in a team. Participants, who are selected after submitting an application and being interviewed, must meet regularly with a faculty mentor, develop personal goals, hold leadership roles on campus and in the community, and attend a biweekly campus seminar. They do not receive credit for participating in the academy but they do receive a small stipend. At present, the program is only for students in the Agricultural Sciences and Forestry colleges.

Results

The academy's hallmark is the one-on-one mentoring component. It was the main draw for Tom Griffin, an environmental and economic policy major who plans to attend law school next year. His mentor is Sonny Ramaswamy, the dean of the College of Agricultural Sciences.

"The opportunity to network with a faculty member is going to help tremendously with making industry connections," said Griffin, who will intern for a congressman winter term. Jonathan Velez, general agriculture professor, hopes to double the number of academy students next year and

eventually offer it to 50 to 60 students a year.

4. Associated Knowledge Areas

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

Outcome #25

1. Outcome Measures

1ACTION Indicator 3b - plant management tools used by private and public sector * 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. * 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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

With \$150 million in gross farm sales in 2010, spuds are Oregon's sixth most important agricultural commodity. Silvia Rondon's first day on the job was a baptism of fire. It was 2005 and she was sitting at her desk at OSU's Hermiston Agricultural Research and Extension Center when a potato grower knocked on her door. He rattled off a list of problems he wanted her to tackle?among them, tuberworms. An outbreak of the potato-burrowing insect was wreaking havoc in Oregon and Washington and worried growers wanted to know what to do.

"We didn't have many answers," said Rondon. That's because the pest wasn't thought to exist in Oregon until just a few years earlier.

What has been done

Rondon set about trying to wrap her head around these pests. She and colleagues from OSU and other states trapped and counted them, doused them with water, buried them under soil, eyeballed them under microscopes, and gathered their DNA. They identified resistant potato

germplasm, tested hundreds of chemicals, and even hunted down an old specimen housed in OSU's insect collection.

Results

The research and extension project team discovered that the tuberworms in Oregon and Washington were genetically different from those in the central and eastern parts of the U.S. Ominously, that means the insect has adapted to cold Northwest winters and may be here to stay. "The numbers may not be as high as they were back in 2004, but we will have tuberworms year after year," Rondon said.

In her lab, Rondon incubated speck-size tuberworm eggs and determined that young tuberworms can survive temperatures as low as 41° F. In field trials she found that pupae can endure more than 90 days of exposure to extreme winter conditions. Rondon and colleagues have learned a lot and shared what they've discovered with growers. Rondon's article "The Potato Tuberworm: A Literature Review of Its Biology, Ecology, and Control" published in the American Journal of Potato Research was the most downloaded article in 2011.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
205	Plant Management Systems
216	Integrated Pest Management Systems

Outcome #26

1. Outcome Measures

ACTION Indicator 3c - post harvest tools used by private sector * 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
------	--------

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Several species of pathogenic fungi infect pears through small wounds in the fruit surface which occur during harvest. The subsequent colonization and decay of fruit during cold storage result in significant economic losses to producers and wastage of fruit, threatening the sustainability of the pear system. Fungicides registered for postharvest application during fruit packing can be effective in protecting fruit wounds from fungal infection. However, in commercial production districts a large volume of fruit is harvested in a relatively short period of time, requiring a delay up to several months before all fruit are fungicide treated and packed. Thus for a large portion of the stored crop, postharvest fungicide application may of limited effectiveness. The objective of this project is to evaluate decay management strategies that will mitigate the consequences of delayed application of postharvest fungicides.

What has been done

Randomized, replicated factorial plots were organized in a mature Bosc pear orchard at the Oregon State University Southern Oregon Research and Extension Center. Trees were either treated with a series of calcium chloride foliar applications in mid-summer, or received no supplemental calcium. Within each calcium treatment, trees were treated one week before harvest with one of three candidate pre-harvest fungicides, or no fungicide treatment. Harvested fruit were artificially wounded and treated with a postharvest fungicide (fludioxonil) applied as a line spray, at 0, 3, 6, or 9 weeks after harvest. Before and after postharvest treatments, the fruit were stored -0.5°C. Decay incidence was evaluated at 14 weeks after harvest. In a companion experiment, fruit with and without calcium and pre-harvest fungicide treatments were treated with fludioxonil as an individual bin drench (15 liters of solution per 454 kg of fruit, 0.3 g fludioxonil per liter) in the orchard immediately after harvest.

Results

Postharvest fungicide treatment was highly effective when applied immediately after harvest, moderately effective at three weeks after harvest, and was largely ineffective when applied six or more weeks after harvest. Orchard applications of calcium chloride in summer and pre-harvest fungicide applications each reduced the rate of increase in postharvest decay incidence with delay in application of postharvest fludioxonil. Mitigation of the consequences of delayed application of fludioxonil was best achieved by the sequential treatment of summer calcium chloride followed by pre-harvest fungicide. The sequential treatment was highly effective in reducing decay regardless of timing of application of postharvest fludioxonil. Application of fludioxonil as an in-orchard individual drench treatment was intermediate in effectiveness. Regardless of orchard calcium or pre-harvest fungicide treatment, the individual bin drench provided decay control at a level equivalent to a postharvest line spray treatment applied between three and six weeks after harvest. Pear industry personnel responsible for field and postharvest crop management have been informed of the findings of this research. Many pear producers have introduced orchard calcium treatments and/or pre-harvest fungicide applications into their postharvest decay management programs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
216	Integrated Pest Management Systems

Outcome #27

1. Outcome Measures

ACTION Indicator 3d - land and invasive species management tools used by private and public sector * Land management protocols will be used in public land management policy decisions. * Understand pollen flow mechanisms between wheat and its wild relative jointed goatgrass

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Walla Walla Valley IPPC Weathernet (VleW) maintains an informational network of real time data easily accessible to growers through the Internet and is housed on the OSU Extension Website for Umatilla County (<http://extension.oregonstate.edu/umatilla/mf/index.php>). Seventeen ADCON weather stations distributed throughout the Valley record environmental data, which are used by the IPPC to model the development of several pests and diseases using accredited pest and disease models. This information is essential for precise timing of insecticide and fungicide applications.

What has been done

The Walla Walla Valley Integrated Plant Protection Center maintains an informational network of real time data easily accessible to growers through the Internet. IPPC worked with the National Resources Conservation Service (NRCS) to bring weather stations to the Valley through grower workshops and publicizing EQIP funding. Seventeen ADCON weather stations distributed throughout the Valley record environmental data, which are used by the IPPC to model the development of several pests and diseases using accredited pest and disease models. This Weathernet (VleW) site is hosted on the OSU Milton Freewater Extension website under the link <http://pnwpest.org/MF>. Workshops are given twice a year at the Blue Mountain Community College, helping growers become familiar with the website and Weathernet. In addition more than 15 "house calls" have been made to individual growers to help familiarize them with the VleW Program. Growers are actively encouraged to participate in setting model parameters, including timing of flowering and fruit set. This helps ensure "buy in" and participation from the growers.

Results

This program has enabled accurate modeling of insect and disease life cycles on an individual crop basis and is extremely site specific. Accurate predictions throughout the Valley has enabled

use of alternative "soft" chemicals. Spray records have shown that growers now use horticultural oils, Rimon (ovicide) and Delegate (larvacide) extensively. Also fewer full cover sprays are being applied to the orchards and on average less than two full cover sprays of organophosphate are applied each growing season to the orchards, compared to more than five full organophosphate cover sprays on average in the past.

At least 32 growers have been trained in person either as walk-ins at the office or through field visits to their homes. An IRB-approved grower survey found that grower acceptance and usage was currently at 93% (of the 2554 acres of fruit orchards farmed in the Valley, at least 2385 acres were currently being farmed using the VleW Program).

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
121	Management of Range Resources
202	Plant Genetic Resources
205	Plant Management Systems
216	Integrated Pest Management Systems
601	Economics of Agricultural Production and Farm Management
803	Sociological and Technological Change Affecting Individuals, Families, and Communities

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

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 # 4

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
133	Pollution Prevention and Mitigation			5%	
204	Plant Product Quality and Utility (Preharvest)			5%	
306	Environmental Stress in Animals			5%	
308	Improved Animal Products (Before Harvest)			5%	
311	Animal Diseases			5%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			5%	
501	New and Improved Food Processing Technologies			10%	
502	New and Improved Food Products			10%	
602	Business Management, Finance, and Taxation			5%	
603	Market Economics			5%	
606	International Trade and Development			5%	
607	Consumer Economics			5%	
702	Requirements and Function of Nutrients and Other Food Components			5%	
703	Nutrition Education and Behavior			5%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			5%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			5%	
723	Hazards to Human Health and Safety			5%	
724	Healthy Lifestyle			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	15.0	0.0
Actual Paid Professional	0.0	0.0	83.0	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	881478	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	7179767	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	10283098	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?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	1000	4000	250	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	1	96	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS Indicator: number of experiments or tests - experiments to reduce percentage of mortality to enhance hatchability in poultry - tests to identify a marker of immunity in livestock

Year	Actual
2011	1

Output #2

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH Indicator 1 ...Numbers of nutrients/minerals - increase health-enhancing nutrients in novel product development - number of mineral supplementation developed to reduce the incidence of cancer

Year	Actual
2011	1

Output #3

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN and ENVIRONMENTAL/ECOLOGICAL HEALTH Indicator 1 ...Agricultural/Environmental chemical analyses - 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 - assess risk factors for the development of various cancers by DNA damage and compromising DNA repair mechanisms. - 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 - refine agrichemical risk assessment for aquatic insects to include life history and behavior - develop, refine, improve quantitative procedures that improve our ability to assess the risks that pest management practices pose to beneficial invertebrates.

Year	Actual
2011	5

Output #4

Output Measure

- ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS Indicator 1 - market analyses - provide food industry with better understanding of market conditions and marketing strategies - develop demand and firm strategies (FIC) - analyze food consumption and import demand in the Pacific Rim and other international markets

Year	Actual
2011	0

Output #5

Output Measure

- ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS Indicator 2 - consumer studies - establish survey tool and data to describe current consumer buying and consumption habits - determine relationship of lifestyle to taste and consumer acceptance. - evaluate integrated research and extension activities between food scientists and business strategists

Year	Actual
2011	2

Output #6

Output Measure

- TECHNOLOGY, MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS REGARDING FOOD PRODUCTS Indicator 1 - food quality attributes - determine quality attributes of Northwest fruits, vegetables, cereals, seafood, and beverages

Year	Actual
------	--------

2011 4

Output #7

Output Measure

- TECHNOLOGY, MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS REGARDING FOOD PRODUCTS Indicator 2 - value added products - develop value-added products through a systematic product development strategy

Year	Actual
2011	1

Output #8

Output Measure

- TECHNOLOGY, MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS REGARDING FOOD PRODUCTS Indicator 3 - food technology - determine best use of innovative or emerging processing methods, e.g., high pressure processing, laser technology, and radio frequency identification tags.

Year	Actual
2011	3

Output #9

Output Measure

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

Year	Actual
2011	29

V(G). State Defined Outcomes**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Knowledge Indicator 2a - Characterize and model toxins arising from food production and processing (analytical methods and tools) * New analytical methods and biomarkers to cost-effectively identify and track agricultural chemicals and other contaminants through time and space * Develop transgenic lines of zebrafish for response to toxicants * Identify agents, mechanisms of action, and dose response for reducing fetal risk from toxic chemicals * Model system to evaluate dioxin toxicity to humans and characterize specific responsive genes to toxicants
2	Knowledge Indicator 3 - Methods to improve Animal Health production systems - improve maternal diet through understanding of fundamental relationships between maternal diet, fatty acid metabolism and egg hatchability - develop technological strategy to enhance the efficacy of vaccination programs in livestock - develop a diagnostic method to assess immune health of livestock
3	Knowledge Indicator 4... Improved knowledge of consumer and market conditions and factors that affect business survival - 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
4	Action Indicator - 2. Percentage health risks reduced - Markers for oxidative stress and DNA integrity lead to novel approaches for identifying biomarkers of zinc deficiency in humans. - Zinc supplementation will be an effective strategy in limiting the incidence of prostate cancer - Effective dietary intervention strategies are broadly applied to reduce obesity - Modulate maternal diet to reduce the risk to the fetus from toxic chemicals
5	Action Indicator - 3. 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.
6	Action Indicator - 4. Improved animal husbandry - 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
7	Action Indicator - 5. Improved competitiveness of Pacific Northwest food businesses. - 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
8	Action Indicator - 6. Informed policy-making and management - Policy makers will develop food processing regulations that prevent incidences of food-borne illnesses. - Improved decision-making/policy on regulation of PAH in aquatic ecosystems. - Public health recommendations reduce the burden of prostate cancer.
9	Action Indicator - 7. Protection of natural environment from agricultural chemicals - Reduce the fate of agricultural chemicals in remote aquatic ecosystems - Improve policies or regulation of pesticides
10	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.
11	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.
12	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.
13	Knowledge Indicator 1 - Understanding Human Health and Nutrition (nutrition) * Identify new risk factors in prostate cancer and offer novel dietary modifications to reduce the incidence of prostate cancer * Knowledge of the mechanisms behind the health benefits of fruits and vegetables.
14	Knowledge Indicator 2 b- Characterize and model toxins arising from food production and processing (effects and extent) * 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
15	Knowledge Indicator 2 c- Characterize and model toxins arising from food production and processing (mechanisms) * Examine mechanisms that underlie the immune suppression * Identify role of human AhR polymorphisms and role of Arnt in mediating and relieving dioxin toxicity
16	Knowledge Indicator 2d - 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.

Outcome #1

1. Outcome Measures

Knowledge Indicator 2a - Characterize and model toxins arising from food production and processing (analytical methods and tools) * New analytical methods and biomarkers to cost-effectively identify and track agricultural chemicals and other contaminants through time and space * Develop transgenic lines of zebrafish for response to toxicants * Identify agents, mechanisms of action, and dose response for reducing fetal risk from toxic chemicals * Model system to evaluate dioxin toxicity to humans and characterize specific responsive genes to toxicants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Organophosphates are a class of pesticides that are widely utilized in agriculture, although their uses have been significantly declining in North America as a result of the implementation of the Food Quality Protection Act. Although the uses of organophosphates are declining over the past 10 years, a growing number of epidemiological studies have been conducted during this time period that have suggested associations between these pesticides and health effects ranging from developmental delays, cognitive dysfunction, and other health problems among children and adults. Many of these studies have used dialkyl phosphates as biomarkers of exposure to organophosphates.

What has been done

In 2011, an invited review article was published in the peer-reviewed journal *Clinical Toxicology*. The manuscript addresses an important current area of research, specifically the use of biomarkers of exposure to organophosphate pesticides in epidemiological studies. This review article summarizes the current understanding of the validity of these biomarkers of exposure to organophosphates.

Results

An extensive review and summary of the scientific literature identified numerous problems associated with the use of dialkyl phosphates as biomarkers. These include the observation that these non-toxic chemicals are normally found on fruits, vegetables, and other commodities that have been previously treated with organophosphates. For this reason, the measurement of dialkyl phosphates in the human body does not necessarily indicate exposure to organophosphates, but rather they measure exposure to the non-toxic chemicals that organophosphates degrade into after they are used in the environment. Other important limitations to the use of dialkyl phosphates as biomarkers include a wide amount of variation in the daily excretion of these chemicals from the human body. Most epidemiological studies have relied on a single measurement of these chemicals from human subjects as a means of assessing exposure to organophosphates. The article concludes that the science of exposure assessment is not advancing, and that there are more accurate and evidence-based methods to assess human exposure to organophosphates from the diet as well as other pathways of exposure in the environment. This article was recently featured as a "Paper of the Month" in the November, 2011 issue of *Current Awareness in Clinical Toxicology*, which is a monthly summary of relevant scientific publications that is published by the American Academy of Clinical Toxicology.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
723	Hazards to Human Health and Safety

Outcome #2

1. Outcome Measures

Knowledge Indicator 3 - Methods to improve Animal Health production systems - improve maternal diet through understanding of fundamental relationships between maternal diet, fatty acid metabolism and egg hatchability - develop technological strategy to enhance the efficacy of vaccination programs in livestock - develop a diagnostic method to assess immune health of livestock

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Stressors can be highly detrimental to well-being and productivity of beef cattle. Therefore, developing methods to quantify stress, and also how to prevent it, will benefit animals and producers.

What has been done

Studies were conducted to develop methods to quantify stress in beef cattle under common management scenarios, and also strategies to alleviate the detrimental effects of stress on cattle productivity. The results of all experiments conducted within this program were immediately available to the public via extension media, which can be found at the Beef Cattle Sciences Website (<http://beefcattle.ans.oregonstate.edu>). The results were also presented at scientific meetings.

Results

Study results demonstrate that stressful situations can stimulate inflammatory reactions in beef cattle, and feeding ingredients rich in essential fatty acids (omega-3 and omega-6) to stressed cattle is an alternative to prevent such inflammatory responses.

Sample research findings:

* Corticotrophin-release hormone (CRH) at 0.1 µg/kg of BW increased circulating concentrations of cortisol, and stimulated the acute-phase response in halter-trained beef steers.

* Excitable temperament is detrimental to reproductive performance of B. taurus beef cows, independently of BCS and breeding system.

Further, this effect can be associated, at least in part, with increased plasma cortisol concentrations of cows with excitable temperament.

* PUFA (polyunsaturated fatty acids) supplementation during preconditioning 30 d prior to shipping to the feedyard had detrimental effects on feed intake, but reduced plasma concentrations of TNF-α following transportation, and improved feedlot performance and carcass quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases

Outcome #3

1. Outcome Measures

Knowledge Indicator 4... Improved knowledge of consumer and market conditions and factors that affect business survival - 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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The U.S. Center for Disease Control and Prevention estimates that each year in the U.S., foodborne diseases sicken roughly one in six people (or 48 million) and kill 3,000. Salmonella alone racks up \$365 million in direct medical costs each year. Hoping to decrease these numbers, the federal government gave safe food a seat at the table when it passed the FDA Food Safety Modernization Act in 2011. The law shifts the focus of federal regulators more toward preventing contamination instead of merely responding to it.

What has been done

To address the problem, the U.S. Department of Agriculture awarded OSU \$400,000 to help inspectors and manufacturers of specialty products learn how to ensure food safety. As part of that effort, Zhao and her OSU colleagues developed a course on campus for people who aspire to make specialty fruit and vegetable products. They crammed three terms of science into three days, with hands-on activities at OSU's food processing plant.

Results

Zhao teaches a variety of classes for processors, including one for businesses that produce acidified and low-acid foods. The FDA requires that these companies have a supervisor on site who has passed such a course. Nearly 90 people attended this year's course at OSU, including employees from Ocean Spray, Starbucks, and Harry and David. They were joined by fellow students such as Rhonda Zathan, a grandmother from Camas Valley who wants to sell her pineapple-jalapeño sauce, and James Hall, a sauté chef in Portland who wants to turn his "Crazy Juice" hot sauce into a moneymaker.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
502	New and Improved Food Products
602	Business Management, Finance, and Taxation
603	Market Economics
606	International Trade and Development
607	Consumer Economics
703	Nutrition Education and Behavior
724	Healthy Lifestyle

Outcome #4

1. Outcome Measures

Action Indicator - 2. Percentage health risks reduced - Markers for oxidative stress and DNA integrity lead to novel approaches for identifying biomarkers of zinc deficiency in humans. - Zinc supplementation will be an effective strategy in limiting the incidence of prostate cancer - Effective dietary intervention strategies are broadly applied to reduce obesity - Modulate maternal diet to reduce the risk to the fetus from toxic chemicals

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Dysregulation of cellular redox homeostasis has been linked to the pathogenesis of many chronic and inflammatory diseases as well as to degenerative changes occurring in the course of aging. For example, oxidant stress has been implicated in cardiovascular diseases, diabetes, cancer and neurodegenerative diseases. One of the consequences of oxidative stress is the non-enzymatic modification of proteins by reactive species, reactive species, termed commonly as reactive oxygen species (ROS) and/or reactive nitrogen species (RNS), lipid peroxidation products and reducing carbohydrates. Irreversible oxidative modifications of proteins may lead to dysfunctional proteins, compromised protein degradation and accumulation of insoluble proteins. In addition, protein thiolation and S-nitrosylation are examples of reversible protein modifications with roles in oxidative stress response and signaling.

What has been done

We develop mass spectrometry (MS)-based bioanalysis methods to identify, characterize and quantify oxidatively modified proteins and other biomolecules with relevance to redox biology in cellular systems and diverse bodily fluids. We predict that MS-based biomarkers will play significant roles for monitoring the oxidant status in healthy and diseased human subjects, including those with obesity-related health problems, as well as for monitoring disease development, progression and intervention strategies in personalized medicine.

Results

We predict that MS-based biomarkers will play significant roles for monitoring the oxidant status in healthy and diseased human subjects, including those with obesity-related health problems, as well as for monitoring disease development, progression and intervention strategies in personalized medicine. This will lead to increased knowledge of the role of oxidative stress in human diseases.

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 #5**1. Outcome Measures**

Action Indicator - 3. 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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement**Issue (Who cares and Why)**

Increased acid is an aid in food preservation. Acidity is measured as pH on a scale from 0 to 14, where the lower the pH, the higher the acidity. Food with a pH above 4.6 is considered to be low-acid and can harbor spores of the bacteria *Clostridium botulinum*. These spores are not destroyed in boiling water, even though the bacterium itself is destroyed, and they can grow into new bacteria which produce a toxin that is often fatal, paralyzing muscles and shutting down your respiratory system. Low-acid foods with added acid to bring the pH below 4.6 can be processed in boiling water and safely stored at room temperature.

What has been done

During an inspection, OSU's food safety specialist, Mark Daeschel, reviews a written step-by-step description of how the product was processed. After a product gets his seal of approval, he writes a green-light letter to the FDA. If the product doesn't pass, Daeschel explains how the processor could fix the problem.

Results

Daeschel is recognized by the Food & Drug Administration as an expert in evaluating the safety of acidified foods (like salad dressings and pickles) or low-acid canned foods (like beans and corn). Federal regulations require commercial processors of such foods to have authorities like Daeschel scrutinize their products and processing methods. Daeschel, who has testified as an expert witness in food safety litigation cases involving Odwalla juice and Jack in the Box burgers, is the expert to whom state and federal agencies refer people when they inquire about thermally processing acidified foods. He evaluated more than 200 products last year, the most ever in a single year, and about three-quarters of them passed on their first inspection. The most common was barbecue sauce.

4. Associated Knowledge Areas

KA Code	Knowledge Area
204	Plant Product Quality and Utility (Preharvest)
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
501	New and Improved Food Processing Technologies
702	Requirements and Function of Nutrients and Other Food Components
703	Nutrition Education and Behavior
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #6

1. Outcome Measures

Action Indicator - 4. Improved animal husbandry - 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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Poor hatchability and chick mortality during the first two weeks of life remains a problem for the broiler industry. Without any significant disease, mortality in the first week post-hatch is 4-5%, i.e. over 0.48 billion chicks do not survive the first week post-hatch, emphasizing the need for early intervention. Despite this significant problem in broiler production, there are currently no effective means to improve quality and first week survival of chicks because the etiological aspects and underlying mechanism(s) that influence chick quality and early post-hatch health are largely

unknown. Because pre and the early post-hatch period is a major determinant of neonatal survival and bird performance, investigating factors that can modulate health and survival during pre and early post-hatch will greatly enhance the efficiency of US broiler production. The long-term goals of this research are to understand essential fatty acid metabolism in pre- and post-hatch chicks so as to enhance chick growth, health and viability.

What has been done

Early access to n-3 essential fatty acids either through in ovo method (hatching egg) or through post-hatch (within 5hr of hatching) feeding is investigated. The early exposure of n-3 fatty acids is obtained through in ovo method (enriching hatching eggs) or providing chick starter diets high in n-3 fatty within 5 hr of hatching. Blood and tissue samples were collected from chicks at different stages of growth and changes in fatty acid composition and patterns of cytokine production, inflammatory protein or gene expression was examined. Our data shows that early access to n-3 fatty acids influence the progeny tissue n-6 and n-3 fatty acids and modifies the expression of genes related to lipid metabolism and affects the expression of cyclooxygenase-2 protein upon challenge.

Results

Modulating egg yolk n-3 fatty acids through maternal diet led to enhancement of n-3 fatty acids with a concomitant reduction in arachidonic acid in progeny chick tissues. Tissue enrichment of n-3 fatty acids affected the proinflammatory eicosanoid and cytokine production in progeny chicks. In addition, it was observed that early access to n-3 PUFA affects lipid metabolism and the expression of COX-2 protein. These results indicate that early exposure to essential n-3 fatty acids can have long lasting effect on broilers. Results demonstrating the role of maternal fatty acid in modulating the progeny eicosanoid and cytokine generation may have practical applications. Broiler birds are raised commercially for 5-6 weeks. Under commercial conditions, mortality during the first 2 weeks of growth is around 5% and this remains a problem for the broiler industry. In addition, metabolic disorders and heart-related conditions are the major cause of mortalities and morbidities in broiler birds and have been reported in birds as early as 3 days of age. Considering the role of eicosanoids in the pathobiology of various inflammatory conditions, early access to n-3 fatty acids is of importance in enhancing chick health. This research will have important practical implications for improving bird health and productivity and will bring increased economic returns to the \$38 billion US poultry industry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
306	Environmental Stress in Animals
308	Improved Animal Products (Before Harvest)
311	Animal Diseases

Outcome #7

1. Outcome Measures

Action Indicator - 5. Improved competitiveness of Pacific Northwest food businesses. - 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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Optimization of surimi yield through understandings and characterization of fish myofibrillar proteins: in the Pacific Northwest, surimi seafood is typically prepared from lower-value fish stocks including Pacific whiting or Alaskan pollock, and its texture and color mimic lobster, crab and other shellfish. Fluctuations in price and consumer demand drive the need to lower production costs and to improve the yields from the surimi process. Recent research studies have been focused on the thermal stability of fish myofibrillar proteins.

What has been done

Research studies were conducted to maximize the value of surimi proteins by understanding the thermal stability of fish species (cold water fish vs. warm water fish). A new area of research has been initiated to utilize fish proteins as a fat blocker for fried seafood products.

Results

As a result of research and transfer of knowledge to the industry (for example, via OSU's annual Surimi School) surimi prepared from low-grade fish is being utilized more efficiently during production. With an increased optimization of fish proteins based on optimum chopping conditions per fish species, the manufacturers of surimi seafood now use a lesser amount of surimi, but still obtain equal performance in the finished seafood product. This current research has made various efforts to maximize the value of surimi proteins by understanding the thermal stability of fish species as affected by various comminution conditions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
602	Business Management, Finance, and Taxation
603	Market Economics
606	International Trade and Development
607	Consumer Economics

Outcome #8

1. Outcome Measures

Action Indicator - 6. Informed policy-making and management - Policy makers will develop food processing regulations that prevent incidences of food-borne illnesses. - Improved decision-making/policy on regulation of PAH in aquatic ecosystems. - Public health recommendations reduce the burden of prostate cancer.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Seafood may contain human pathogens and be a vehicle for foodborne illnesses. Among the pathogens commonly associated with seafood, *Vibrio parahaemolyticus* is recognized the leading cause of human gastroenteritis associated with seafood consumption in the U.S. The Centers for Disease Control and Prevention (CDC) estimated that 4,500 cases of *V. parahaemolyticus* infection occur each year in the U.S. Numerous outbreaks of *V. parahaemolyticus* infection linked to raw oyster consumption have been documented in the U.S. Recently, the CDC reported a 78% increase in the incidence of *Vibrio*-associated infections in 2006 from the 1996-1998 baselines.

What has been done

Research studies are underway to investigate new technologies to reduce pathogens in seafoods, including: 1) validation of high pressure processing for inactivating *Vibrio parahaemolyticus* in Pacific oysters (*Crassostrea gigas*); 2) application of probiotics in the oyster depuration process for reducing *Vibrio* contamination; 3) evaluation of antimicrobial activities of tea polyphenols against *Vibrio*; 4) low-temperature post-harvest processing for decontaminating *Vibrio* in oysters; and 5) studying the mechanism of high pressure processing on inactivating *Vibrio*.

Results

Development of post-harvest processes to eliminate pathogens in seafood, particularly *V. parahaemolyticus* in oysters, will minimize illnesses associated with seafood consumption. Application of these research findings and innovative technologies will enable the seafood industry to control microbial pathogens in seafood processing plants and finished products.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #9

1. Outcome Measures

Action Indicator - 7. Protection of natural environment from agricultural chemicals - 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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

White mold, i.e., *S. sclerotiorum* (Ss) is a serious disease of snap beans. *Coniothyrium minitans* (Cm) is a mycoparasite of Ss and commercially available as Contans (www.prophyta.com). Cm parasitizes sclerotia at 50 - 68°F. Contans has been applied at 2-6 lb/A before or at planting. The goal of this project was to evaluate efficacy of a 1.5 lb application after bean harvest on Cm and Ss dynamics and disease severity in subsequent bean crops. Root rot of sweet corn can reduce yield by half. Many cover crop suppress root rot to some degree. Oat has been most consistently suppressive but immobilizes nitrogen (N). Vetch grown in mixture with oats can supply N and thereby reduce N immobilization by the oats. The goal of this project was to determine if vetch/oat mixtures can deliver N and improve yield.

What has been done

Contans Experiment: Fall applications of Contans to flailed crop residues on the soil surface generated biocontrol epidemics over 12 mos; Cm from the initial Contans application colonized sclerotia and those colonized sclerotia oozed spores from pycnidia throughout the winter which splashed and generated new infections. Six mos after a November Contans application to diseased residues, Cm colonization of sclerotia was 47% in Cm+ compared to 3% in Cm- fields;

mean sclerotial viability in Cm+ and Cm- fields was 67 and 98%. Susceptible (91G) and moderately resistant (6230) beans planted 7 mos after application exhibited 23 and 7.5% foliar disease severity in the Cm- fields, and 7 and 1% in the Cm+ fields. Pod mold incidence in 91G and 6230 was 17 and 11% in the Cm-, and 7 and 3% in the Cm+ fields. Ten mos after application, viability in Cm+ and Cm- fields was 8.5 and 74%; 22 mos after, sclerotial viability was 5 and 22%. Low rate Contans applications reduced sclerotial viability by 32 and 77% at 7 and 22 mos after application and reduced subsequent bean crop disease severity.

Cover Crop Experiment: All cover crop treatments except Monida oat/vetch suppressed root rot but single species cover crops were more suppressive than mixtures. Vetch and the oat/vetch mixtures mineralized nitrogen immediately after incorporation. Growing oat and vetch in a mixture overcomes N immobilization of oats. There were no significant differences in corn yield.

Results

We have shown that low rate Contans applications, alone or in combination with a moderately resistant bean variety, can reduce white mold incidence on snap beans to a commercially viable level. Farmers and agricultural professionals have learned about Coniothyrium and Sclerotinia sclerotiorum biology and ecology. Seed professionals have been encouraging seed growers to use Contans to control white mold in overwintering seed crops, as they are prone to white mold due to the long wet winter conditions in which they grow. Seed growers are starting to use Contans to control white mold. Gathering Together Farm is now applying Contans to all fields to control white mold in a wide variety of fresh market and seed crops. The adoption of Contans for white mold management in conventional production could reduce the quantity of conventional fungicides used, which would protect human and other organism health. In addition, a low rate of Contans would cost \$20-30 per acre, compared to more than \$100 per acre for a two spray fungicide program. The effective use of Contans on diversified organic vegetable farms, in which many crops are impacted to some degree, would be significant, potentially increasing marketable yields by more than 10% across many crops. The effective use of Contans on high value seed crops could increase marketable yields by as much as 50%, but this has not yet been documented. We will have a better idea of the impact of Contans in the next few years. Growers cover crop with oat/vetch mixtures to improve corn yield and quality.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
306	Environmental Stress in Animals
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #10

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 gauge 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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

High costs associated with ranching, including fuel prices, may be a breaking point for many ranchers, despite an increasing demand for beef in the U.S. and abroad. Better infrastructure and the ability to capture new markets may be critical tactics to industry survival. Lea Ann Kinman, the manager of OSU's Clark Meat Center, an on-campus facility where students learn livestock anatomy and butchery, sees a shift in consumer demand toward grass-finished. "The consumers we're hearing from really want beef from the niche markets," says Kinman. "We see a high level of concern for the welfare of the animal. Consumers want to know more about how the cattle were cared for prior to harvest."

"Last year was the first time since 1947 that more beef was exported from the U.S. than imported," says Williams. "We should be doing pretty well, but our costs often outpace sales. We need better infrastructure and the ability to capture new markets." Most people have been raised eating corn-finished beef, says Lea Ann Kinman, the manager of OSU's Clark Meat Center, an on-campus facility where students learn livestock anatomy and butchery, and where the public can purchase OSU-raised beef and other meats. She sees a shift in consumer demand toward grass-finished.

"The consumers we're hearing from really want beef from the niche markets," says Kinman. "We see a high level of concern for the welfare of the animal. Consumers want to know more about how the cattle were cared for prior to harvest."

The transition from traditional ranching operations to those that respond to demands for new, value-added products is not easy, according to Chad Mueller, an OSU researcher focused on beef cattle systems from conception to consumption.

What has been done

The transition from traditional ranching operations to those that respond to demands for new, value-added products is not easy. Markets and infrastructure are in many ways related. In Oregon, developing new markets means developing "branded beef." Branded beef is sold under a certain description, such as natural, organic, or grass-fed, or more specifically under business names such as Painted Hills Natural Beef and Country Natural.

Results

"There is definite growth in natural, organic, grass-finished, and branded products," says Dave Bohnert, an OSU ruminant nutritionist and beef cattle specialist at the Eastern Oregon Agricultural Experiment Station. "It's a challenging way of ranching, but it's attractive because of the associated premium price. If our ranchers can get into these markets they can make it profitable, but it's not for everybody. Right now maybe five percent of beef operations in the state target the niche markets." However, such products are growing in visibility in regional supermarket chains and are used in marketing by a number of food chains in the region.

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
606	International Trade and Development
607	Consumer Economics

Outcome #11

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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Barley is an important component of heart-healthy whole grain diets because it supplies beta-glucan. All current barley varieties with high beta-glucan are spring habit, and these varieties have waxy starch. Fall-sown varieties have agronomic advantages but must have low temperature tolerance (LTT). Vernalization sensitivity (VS) is associated with higher levels of LTT.

What has been done

To rapidly develop fall-sown varieties with LTT and higher grain beta-glucan, we used marker-assisted selection (MAS) at the WX and VRN-H2 loci. The MAS-derived lines, together with unrelated non-waxy germplasm developed via phenotypic selection (PS) were used for genome-wide association mapping (GW-AM). The panel was phenotyped for grain beta-glucan, LTT and VS. It was genotyped with 3072 single nucleotide polymorphisms (SNPs) and allele-specific primers. Marker-assisted selection fixed target alleles at both loci but only one of the target phenotypes (higher beta-glucan percentage) was achieved. Continued segregation for VS and LTT is attributable to (i) incomplete information about VRN-H1 at the outset of the project and (ii) unexpected allelic variation at VRN-H3 with a large effect on VS and LTT.

Results

This new information contributes to the body of knowledge regarding barley nutritional and physiological properties and will be essential in developing fall-sown food barley varieties. Additional research will be necessary to establish the functional basis of the associations. Genome-wide association mapping can be a more efficient QTL detection tool than biparental QTL mapping because it can be applied directly to any array of breeding germplasm segregating for the trait of interest. However, unless perfect markers based on functional polymorphisms of determinant genes are used, follow-up research may be necessary to characterize favorable alleles.

Additionally, we have developed barley varieties that will benefit farmers and consumers. Streaker will be released in 2012 and the WinCrisp series in 2013.

4. Associated Knowledge Areas

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

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

Outcome #12

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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

There was an unprecedented effort by the Beijing municipal government to improve air quality for the 2008 Beijing Olympics. A wide range of combustion sources, including vehicles, trucks, factories, and coal combustion for power generation, were controlled leading up to the Olympics, with the most stringent combustion source control measures occurring during the Olympic period (August 8-24, 2008). From July 20-August 7, 2008, traffic was reduced, with license plates ending in even (odd) numbers allowed on the roads on even (odd) numbered calendar days, construction sites were closed, and the operation of coal fired power plants were strictly limited. From August 8-24, 2008 (the Olympic period), additional restrictions on coal-combustion were implemented. From August 25-September 20, 2008 the source control measures were less strictly implemented. The significant effort to reduce combustion emissions in Beijing during the Olympic period provided a unique opportunity to study the particulate matter with diameter less than 2.5 um (PM2.5)-bound polycyclic aromatic hydrocarbon (PAH), nitro-PAH (NPAH) and oxy-PAH (OPAH) concentrations, as well as the associated toxicity, in correspondence with the implementation and removal of source control measures. Particulate matter and black carbon emissions from China have been implicated in global climate change.

What has been done

The objectives of this study were to: 1) measure the PM_{2.5}-bound PAH, NPAH, and OPAH concentrations and toxicity in Beijing before, during, and after the Olympics; 2) characterize the influence of photochemistry on the formation of NPAH and OPAH; and 3) assess the influence of sources and source control measures on the PM_{2.5}-bound PAH, NPAH, and OPAH concentrations and, in turn, mutagenicity and potential for DNA damage. We also measured the black carbon concentrations on the PM_{2.5}, collected at a sampling site that was located on the roof of the 7-story Geology Building on the Peking University (PKU) campus, about 25 meters above ground. Sixty-three PM_{2.5} samples were collected over 24 h periods (~1500 m³ of air) from July 28 to September 3, 2008 and from September 13 to October 7, 2008. The PM_{2.5} samples were extracted with dichloromethane and the PAH, NPAH, and OPAH were measured by gas chromatographic mass spectrometry. The mutagenicity of these same extracts were measured in the Ames assay and potential for DNA damage was measured with the Comet Assay.

Significant reductions in BC (45%), OC (31%), MW < 300 PAH (26% - 73%), MW 302 PAH (22% - 77%), NPAH (15% - 68%) and OPAH (25% - 53%) concentrations were measured during the source control and Olympic periods. However, the mutagenicity of the PM_{2.5} was significantly reduced only during the Olympic period. The PAH, NPAH, and OPAH composition of the PM_{2.5} was similar throughout the study, suggesting similar sources during the different periods. During the source control period, the parent PAH concentrations were correlated with NO, CO, and SO₂ concentrations, indicating that these PAHs were associated with both local and regional emissions. However, the NPAH and OPAH concentrations were only correlated with the NO concentrations, indicating that the NPAH and OPAH were primarily associated with local emissions. The relatively high 2-nitrofluoranthene/1-nitropyrene ratio (25 - 46) and 2-nitrofluoranthene/2-nitropyrene ratio (3.4 - 4.8), suggested a predominance of photochemical formation of NPAHs through OH-radical-initiated reactions in the atmosphere.

Results

On average, the sumNPAH and sumOPAH concentrations were 8% of the parent PAH concentrations, while the direct-acting mutagenicity (due to the NPAH and OPAH) was 200% higher than the indirect-acting mutagenicity (due to the PAH). This suggests that NPAH and OPAH make up a significant portion of the overall mutagenicity of PM_{2.5} in Beijing. In addition, we used the relative potency factor approach to estimate the benzo[a]pyrene equivalent (BaP_{eq}) concentration of 17 carcinogenic PAHs before, during and after the 2008 Beijing Olympics on PM_{2.5}. Using a point-estimate approach, the lifetime excess inhalation cancer risk due to exposure to the 17 carcinogenic PAHs was estimated to range from 6.5 to 518 per million people for the source control period concentrations and from 12.2 to 964 per million people for the non-source control period concentrations. This corresponded to a 46% reduction in inhalation cancer risk and indicated that the cancer risk posed by PAH exposure in Beijing air, as well as air in other Chinese megacities, can be greatly reduced by effective source control strategies. In addition, the total excess inhalation cancer risk would be underestimated by 23% if the 5 MW 302 PAHs were not included in the estimate. This indicates the importance of including these high molecular weight PAHs in future assessments both in China and in the U.S. In addition, our black carbon measurements provide insight into emissions from China and have possible implications for global climate change.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation

306	Environmental Stress in Animals
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

Outcome #13

1. Outcome Measures

Knowledge Indicator 1 - Understanding Human Health and Nutrition (nutrition) * Identify new risk factors in prostate cancer and offer novel dietary modifications to reduce the incidence of prostate cancer * Knowledge of the mechanisms behind the health benefits of fruits and vegetables.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Prostate cancer remains a very significant contributor to the morbidity and mortality of U.S. men. Increased vegetable intake has long been associated with decreases in prostate cancer risk. However, mechanisms for chemoprevention are unclear. This research is significant because nutritional strategies that decrease oxidative stress, decrease DNA damage and/or target aberrant epigenetic alterations, such as acetylation, in prostate cancer have the potential to dramatically reduce the incidence of prostate cancer, reduce health care costs associated with prostate cancer, and improve the quality of life of thousands of American men.

What has been done

We have found that sulforaphane, a phytochemical derived from broccoli, inhibits prostate cancer cell growth in vitro and in rodent models of prostate cancer.

Results

The protection mechanism appears to be related to targeting epigenetics and histone deacetylases. Moreover, the effects of sulforaphane is specific to cancer cells, not normal cells. Bioavailability studies in humans show that absorption of sulforaphane is higher from broccoli sprouts as a whole food than broccoli supplements.

This work will form the basis for future work and larger trials to identify effective dietary intervention strategies that are broadly applicable nutrition recommendations and will significantly reduce the burden of prostate cancer. With this research we hope to identify new risk factors in prostate cancer and offer novel dietary modifications to reduce the incidence of prostate cancer, establish low dietary zinc as risk factor for DNA damage and cancer risk and other chronic diseases, establish low cruciferous vegetable intake as a risk factor for the development of prostate cancer by altering histone modifications and cell proliferation pathways and gain knowledge of the mechanisms behind the health benefits of zinc and cruciferous vegetables. Obesity is also a major risk factor for prostate cancer and the proposed research may impact this susceptible population.

Specific outcomes:

- Gain knowledge on new risk factors in prostate cancer and offer novel dietary modifications to reduce the incidence of prostate cancer
- Establish low dietary zinc as risk factor for DNA damage and cancer risk.
- Establish low cruciferous vegetable intake as a risk factor for the development of prostate cancer by altering histone modifications and cell proliferation pathways.
- Gain knowledge of the mechanisms behind the health benefits of zinc and cruciferous vegetables

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 #14

1. Outcome Measures

Knowledge Indicator 2 b- Characterize and model toxins arising from food production and processing (effects and extent) * 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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Quantification of trace levels of emerging contaminants, including androgenic steroids, in municipal wastewater and fluorochemicals in landfill leachates pose analytical challenges. While advances in high pressure liquid chromatography/tandem mass spectrometry LC-MS/MS has improved analysis, efforts are needed to identify limitations to the approach. Efforts also need to be directed at a more complete understanding and control over the factors that control the analytical performance of direct large volume injections for environmental applications of LC-MS/MS.

What has been done

A new method was developed for the analysis of natural and synthetic androgenic steroids and their selected metabolites in aquatic environmental matrices using direct large-volume injection (LVI) high performance liquid chromatography-tandem mass spectrometry (Backe et al. 2011). Method accuracy, precision, and detection limits were determined and the method was demonstrated on a series of 1-hr composite wastewater influent samples collected over a day with the purpose of assessing temporal profiles of androgen loads in wastewater. Several androgenic steroids were detected in the sample series at concentrations up to 290 ng/L and loads up to 535 mg. Boldenone, a synthetic androgen, had a temporal profile that was strongly correlated to testosterone, a natural human androgen, suggesting its source may be endogenous. Twenty four fluorochemicals were quantified in complex heterogeneous landfill leachates recovered from municipal refuse using an analytical method based on solid-phase extraction, dispersive-carbon sorbent cleanup, and liquid chromatography/tandem mass spectrometry (Huset et al. 2011). The method was applied to six landfill leachates from four locations in the U.S. with as well as to a leachate generated by a laboratory bioreactor containing residential refuse. All seven leachates had the common characteristic that short-chain (C4-C7) carboxylates or sulfonates were greater in abundance than their respective longer-chain homologs (C8). Concentrations of individual fluorochemicals reaching levels up to 2,800 ng L⁻¹ were found, which indicates that landfills can act as point source of these chemicals to the environment. Illicit drug use is a largely hidden phenomenon and population measures are notoriously problematic. Reliable and valid data for local, regional and national public health and other interventions are needed. To address this need, we examined temporal trends within and across weeks in methamphetamine in a single location in order to inform a sampling plan for understanding long-term trends in MA use based on sampling raw influent to waste water treatment plants (Chiaia et al. 2011). The measured concentrations in wastewater were used to estimate the total mass of methamphetamine consumed. Results from this community in a region with high levels of methamphetamine use indicate that levels do not differ significantly between weekdays and weekend and that the potential contribution of legal sales of the mass of methamphetamine consumed ranges from 3-8%. The time-honored convention of concentrating aqueous samples by solid-phase extraction (SPE) was challenged in our manuscript (Buseti et al. 2011) by illustrating the increasingly wide spread use of LVI liquid chromatography-mass spectrometry for the determination of traces of polar organic contaminants in environmental samples. In this critical review, we define LVI and find that LVI is easier to set up compared to SPE, as it only requires small hardware modifications to existing autosamplers. In our review, we discussed 1) the history and development of various forms of LVI, 2) the critical factors that one needs to consider when creating and optimizing LVI methods and 3) example applications that demonstrate the range of environmental matrices, to which LVI is applicable such as drinking water, groundwater and surface water including seawater as well as wastewater.

Results

The development of large-volume injection technology for LC/MS applications will likely to have an impact on laboratory practices around the state and nationally by offering a sensitive way to analyze for environmental contaminants that minimizes the exposure of laboratory personnel to hazardous chemicals, reduces the cost of analysis by decreasing the time required for analysis and solvent consumption, and decreases the time required for analysis. The review article by Buseti et al. will be published in the 10th Anniversary Edition of the journal Analytical and Bioanalytical chemistry and is likely to receive wide readership. We continue to improve our understanding of large volume injection chromatography and to expand the number of applications in the environmental arena. By contributing to this area, we expect to see an increasing number of applications on large volume chromatography and a decreased dependence on solid phase extraction.

4. Associated Knowledge Areas

KA Code	Knowledge Area
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #15

1. Outcome Measures

Knowledge Indicator 2 c- Characterize and model toxins arising from food production and processing (mechanisms) * Examine mechanisms that underlie the immune suppression * Identify role of human AhR polymorphisms and role of Arnt in mediating and relieving dioxin toxicity

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Autoimmune and allergic diseases afflict millions of people worldwide. Unfortunately, current therapies involving immunosuppressive drugs are often inadequate or associated with many undesirable side effects. One exciting new biological approach to treat these immune-mediated diseases is focused on enhancing the development of immunoregulatory T cells (Tregs) that potentially suppress immune responses. The discovery of a novel approach to induce Tregs is important and timely.

The Kerkvliet laboratory was the first to describe the Ah receptor (AhR) as a ligand-activated transcription factor that induces CD4+Tregs, a finding that emanated from immunotoxicity studies on 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), a widespread environmental contaminant (TCDD) with potent immunosuppressive effect. Subsequent studies have shown that activation of AhR by TCDD prevents the development of several different types of autoimmune disease as well as allergic responses in mouse models via the induction of Tregs. Beyond TCDD, there are many other chemicals, including several that are naturally occurring in our food supply, that also activate the AhR. Our goals are to a) characterize novel compounds that potentially activate AhR to induce Tregs, and b) identify potential new drugs as well as bioactive dietary compounds. We hypothesize that susceptibility to autoimmune and allergic diseases could be modified by diet, depending on the presence or absence of natural compounds that activate the AhR.

What has been done

The Kerkvliet and Kolluri laboratories have collaborated during the past two years to screen over 15,000 chemicals in a small molecule library for compounds that activate AhR. For positive hits, secondary screening criteria were employed to reveal compounds with highest probability to induce Tregs in vivo. Our screening process was a success and we were extremely fortunate to discover a lead compound (AHRL3) that activates the AhR to induce Tregs by a mechanism that appears to be identical to TCDD. However, unlike TCDD, AHRL3 is rapidly metabolized, with pharmacokinetics that are favorable for drug development. Recently, using a graft-vs-host model of immune-mediated disease, we have shown that daily treatment of mice with AHRL3, like TCDD, suppresses the GVH response without associated toxicity.

Results

We have identified and characterized a novel AhR ligand that induces regulatory T cells (Tregs) and is a potent suppressor of the transplant rejection response. This compound, or a modified analog, holds promise for development as a novel treatment of immune-mediated diseases, including allergies and autoimmune diseases. These studies also provide the framework for future studies to evaluate the hypothesis that susceptibility to autoimmune and allergic diseases can be modified by diet, depending on the presence or absence of natural compounds that activate the AhR.

4. Associated Knowledge Areas

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

Outcome #16

1. Outcome Measures

Knowledge Indicator 2d - 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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As the nanomaterial engineering revolution proceeds, the number and significance of their applications are only paralleled by the growing gap in our knowledge of how these materials interact with living systems. Mounting data is demonstrating that a small yet relevant fraction of these materials possess concerning toxic potential. It is critical at this juncture in nanotechnology research and development to identify the specific physical and chemical properties that elicit adverse biological outcomes from exposure. Nanotoxicology centers on the unknown and unforeseen consequences that may result from nanomaterial exposure due to the unique properties that may cause them to adversely impact living systems. Currently, vast toxicological data gaps exist regarding the risks associated with nanomaterial exposure, and the principal characteristics that may be predictive of nanomaterial interactions with biological systems have yet to be identified due to this lack of information. Thus, rapid testing strategies are immediately necessary to identify the specific features of nanomaterials that result in toxicity in order to mitigate risks from exposure and define structure-property relationships that can be used to predict nanomaterial hazard in lieu of empirical data.

What has been done

Research by Stacey Harper utilizes an integrative approach to strategically target structure-activity relationships by leveraging nanomaterial characterization and toxicity data using informatics. The goal is to identify the principal features that govern nanomaterial-biological interactions and define key drivers for nanomaterial toxicity. Her overall objective is to determine the relative influence that size, shape and surface chemistry have on uptake, effects and mechanism of toxicity. Harper, recipient of a five-year, \$1.9 million award as an Outstanding New Environmental Scientist from the National Institute of Environmental Health Sciences (NIEHS), used her knowledge gained from in vivo evaluations of over 200 nanomaterials to define preliminary structure-activity relationships showing that uptake, effects and mechanism(s) of

toxicity are dependent on nanomaterial size, shape and surface chemistry. Working hypotheses based on this preliminary data will be further tested across material classes to assess how broadly applicable these relationships are. Refined structure-property relationships will be elucidated from data on nanomaterial characterization, toxicological evaluations, uptake, biodistribution, pathway analysis, cell death assays and molecular investigations using the Nanomaterial-Biological Interactions (NBI) knowledge base at OSU. This information can be used as a basis for nanotechnology risk management decisions and to establish design rules for biocompatible medical applications.

Results

First, it is critical to establish and validate assays for defining which inherent physicochemical properties are relevant or predictive of biological impacts. Given the enormous diversity of nanomaterials and their dynamic nature when in complex media, these assays need to be highly predictive as well as time- and cost-effective. The embryonic zebrafish, a recently-established rapid in vivo model for human health and disease, are being used in our studies to define dose-responses from exposure for nanomaterial formulations. Nanocrystalline cellulose (NCC), produced in collaboration with John Simonsen (Wood Science and Engineering, OSU) is being used as a model platform to formally test predicted relationships within an iterative testing framework. NCC was selected due to its future commercial importance, potential for novel biomedical applications, and the ease with which it can be modified structurally and chemically to suite our testing scheme. Our long-term research goal is to identify and broadly disseminate the mathematical and theoretical relationships between inherent nanomaterial properties and their behavior in complex systems. The rationale is that if we can define the inherent features that govern nanomaterial fate and biological interactions, that information can be used as a basis for nanotechnology risk management decisions and to establish design rules for biocompatible medical applications. Upon completion of recently funded studies, we expect to: i) fill critical information gaps by providing primary data on nanomaterial characterization, fate and biological impact, ii) provide validated assays for rapidly determining nanomaterial characteristics and testing for biological impact, iii) identify the chain of molecular events that lead to a toxic outcome in zebrafish exposed to environmentally relevant nanomaterial concentrations, and iv) deliver an unbiased information platform to delineate which nanomaterial features, or combination of features, modify toxic potential. Such information will have a positive impact and advance the fields of nanomedicine, nanotoxicology, and nanotechnology by reducing the need to empirically test every nanomaterial formulation, providing information on the structural elements that can be modified to minimize inherent nanomaterial toxicity, enhancing community resources for dissemination of important information on nanomaterials, and finally providing new tools for risk assessors to protect humans and the environment from potentially harmful exposures.

4. Associated Knowledge Areas

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

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Childhood Obesity

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
610	Domestic Policy Analysis			20%	
802	Human Development and Family Well-Being			80%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.1	0.0	0.1	0.0
Actual Paid Professional	0.0	0.0	1.6	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	43237	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	150684	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	45740	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.

- determine factors that drive the decisions of educated rural householders to move to an urban locality (fueling "brain drain") through surveys
- examine factors to explain why low human capital people are attracted to rural places or otherwise reluctant (or unable) to leave them (thru surveys)

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?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	600	2500	200	0

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

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	21	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- OTHER SCHOLARLY ACHIEVEMENTS: panel, awards, presentations

Year	Actual
2011	18

Output #2

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH AND COMMUNITIES.
 Indicator...Rural health and communities models a) Develop and test econometric and other models about human capital in rural places * One model will examine the factors that lead highly educated householders to migrate from rural to urban places. * A second model will investigate the determinants of rural residential choice among householders with low educational attainment. b) Compile most comprehensive data set on low-income rural family well being available in the U.S. and conduct analyses of community contextual data c) Develop conceptual models to 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

Year	Actual
------	--------

2011

3

Output #3

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH Indicator ...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

2011

5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Knowledge...Improved understanding about rural human capital: a) understand why people are more likely to be poor if they live in a nonmetropolitan than in a metropolitan area - provide evidence on the degree to which the disproportionate poverty in nonmetro areas is explained by low social and economic opportunities in rural communities or a sorting into rural places of people with low human capital. b) inform local and state policy discussion about rural brain drain and outmigration
2	Knowledge...Models developed and refined: a) Econometric models will explain the sorting of people with low human capital into rural places. b) 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	Trained scholars and extension educators
4	Action...Improved strategies in rural policies for - rural family and community welfare - local community vitality - anti-poverty - combinations of human-capital and community-strengthening policies that are most likely to reduce nonmetro poverty and its unfavorable consequences. - maximize physical activity and physical and mental health of rural youth and adults
5	Knowledge...Improved outreach, education, and professional practice in serving the needs of rural low-income families - improved well-being and functioning of rural low-income families - programmatic interventions that reduce the physical inactivity and promotes well-being of lower-income and ethnic minority youth across rural America
6	Action...Affect governmental decisions about rural areas - service cuts and revenue alternatives - reallocations of service responsibilities among state and local governments - revenue sharing formulas
7	Change...Improved well-being of lower-income and ethnic minority youth across rural America
8	Knowledge Indicator...Understanding Human Health and Nutrition (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
9	Action...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.

Outcome #1

1. Outcome Measures

Knowledge...Improved understanding about rural human capital: a) understand why people are more likely to be poor if they live in a nonmetropolitan than in a metropolitan area - provide evidence on the degree to which the disproportionate poverty in nonmetro areas is explained by low social and economic opportunities in rural communities or a sorting into rural places of people with low human capital. b) inform local and state policy discussion about rural brain drain and outmigration

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Urbanization presents both opportunities and challenges for farmers and farm supporting sectors on the urban fringe. The emergence of a new customer base has provided farmers new opportunities for higher value crops. Urbanization also presents challenges to farmers. Negative externalities associated with urbanization increase the cost of farming and threaten the viability of the agricultural economy. Conflicts with non-farm neighbors and vandalism, such as destruction of crops and damage to farm equipment, are major concerns of farmers at the urban fringe. Conversely, being part of a large farming community (a cluster) can offer many benefits. It allows a farm to operate more productively in sourcing inputs, and in accessing information, technology, and needed institutions. With urbanization, farmers may no longer be able to take advantage of economies of scale in production that come from information sharing and formal and informal business relationships between neighboring farms. An important question is how urbanization affects the viability of agricultural economies.

What has been done

This study evaluates the effect of urbanization on the viability of farm supporting sectors (i.e., input suppliers, output processors) and on the cost and profitability of agriculture. To achieve this objective, we first develop a theoretical model to analyze the interrelationship between agriculture and its supporting sectors and then examine how the relationship is affected by urbanization. We then conduct an empirical analysis to evaluate the effect of urbanization on local agricultural economies using county-level data from four western states of the United States (Oregon, Washington, Idaho, and California), focusing on the influence on 1) the number of input suppliers, 2) the number of output processors, 3) farmers' production costs, and 4) net farm income.

Results

This study attempts to fill the gaps in the literature by examining the effects of urbanization on the viability of input suppliers and output processors and on the cost and profitability of farming. The number of input suppliers and the number of output processors are found to increase with urbanization initially, but decrease when urbanization reaches a certain level. There are threshold effects for the urbanization variables, which, once reached, are associated with a rapid decline in the number of input suppliers and output processors; but the thresholds are well beyond the ranges of developed land and population density in the four Western States counties. Urbanization is found to be associated with higher farm production cost, which is consistent with the negative externalities that are posited to accompany urbanization. But, the higher costs of production in urban versus rural localities are outweighed by higher prices for agricultural output and increased off-farm job opportunities. As a result, net farm income is found to increase with urbanization.

Our results have an important implication. Urbanization is not necessarily a bad thing for struggling rural communities, particularly when the objective is to increase net farm income. Urbanization may increase farmers' production costs, but it also creates new opportunities for farmers (growing high-value crops, off-farm employment opportunities, etc.). Our results suggest that the benefits of urbanization outweigh the costs, and net farm income increases with urbanization. However, in rural communities that have already experienced a high degree of urbanization, continuing urban sprawl may indeed threaten agriculture as a viable way of living.

The results of this study can assist policy makers and local agricultural leaders in assessing the likely economic impacts of an increase in the speed at which farmland is converted to urban development and other non-farm uses. Land retirement programs, such as the Conservation Reserve Program (CRP), effectively reduce the amount of harvested cropland or working farmland. Such a program can reduce the number of input suppliers and output processors, particularly in areas experiencing rapid loss of farmland to urbanization. Such a program could also have a significant impact on farm production costs and net returns. In addition to the direct effects on farm production costs and net returns, land retirement programs can also affect farm production costs and net returns through their impacts on agricultural infrastructure. In contrast to the cropland retirement programs, land use policies that aim at slowing down urbanization and farmland loss, such as exclusive farm use zoning and development impact fees, can reduce the degradation of agricultural infrastructure and the cost of farming, although such policies may not necessarily increase net farm income.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
802	Human Development and Family Well-Being

Outcome #2

1. Outcome Measures

Knowledge...Models developed and refined: a) Econometric models will explain the sorting of people with low human capital into rural places. b) 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Factors that contribute to food insecurity and low levels of physical activity, especially among youth living in rural communities, may result in increased rates of childhood obesity. As a result, many communities have turned to youth gardens as an intervention strategy for educating young people about environmental sciences, nutrition, and healthy behaviors. Youth gardens may improve knowledge of nutritional practices, and enhance consumption of fresh fruits and vegetables, although little research has been done. Less is known about the impact of engaging older high-risk adolescents and young adults in garden programs designed to increase access to healthier foods and opportunities to obtain job skills and business experience.

What has been done

The researchers also received NIH funding in 2010 to help bring together university researchers, low-income youth transitioning to adulthood, and members of faith-based communities in two Oregon towns in a project designed to: a) provide training, employment, and improve health outcomes for vulnerable youth, b) offer opportunities for adults from faith-based congregations to address issues of social injustice, and, c) build community partnerships leading to a sustainable youth garden entrepreneurship program. The project takes advantage of existing faith-based garden space and interfaith outreach collaborations to provide opportunities for vulnerable youth. Low-income youth (age 16-25) have partnered with adult volunteers in Sweet Home and Corvallis in Oregon to build organic gardens. Gardens were planted and produce is being harvested and marketed locally. Youth are paid a summer research incentive and participation in the project for two years is encouraged. Youth and adults have jointly collaborated in developing the Community Based Research aspect of the study. Baseline data have been collected, and short interviews evaluating initial perceptions about the project are completed. The progress of each garden is being documented in photos, field notes, individual journals, and garden artwork. To date the

project has baseline measurements of physical and mental health including BMI, CES-D Depression Measure, Self-Esteem Index, the Positive Youth Development Index, 3-Day Physical Activity Record, 3-Day Food Diary. A second wave of data will be collected near the end of the summer allowing for short-term longitudinal comparisons. Most youth plan to continue their participation in 2012.

Results

In Year-2 of the project, youth, mentors, and project personnel from both communities will jointly design and carry out an activity intended to present findings and encourage development of faith community/youth garden collaborations in other areas of the state.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
802	Human Development and Family Well-Being

Outcome #3

1. Outcome Measures

Trained scholars and extension educators

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	15

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Youth are at risk for obesity due to food insecurity and low levels of physical activity.

What has been done

Outreach and training efforts are being planned for the upcoming project year:
?Training opportunities for Participant Scholar, National Institute on Minority Health and Health Disparities (NIMHD)
2nd Translational Health Disparities Course. This two-week intensive course brings together scholars from around the world and provides participants with specialized instruction on the concepts, principles, methods, and applications of health disparities science, practice, and policy.

?In the summer of 2012, OSU will host a conference led by youth gardeners, to teach members from faith communities or other organizations how to develop collaborative youth-adult garden projects. We believe that this model might prove an effective way of engaging vulnerable youth, especially in small rural communities where land may be more readily available, in partnerships with caring adults. In the coming months we will be jointly working on planning the conference including writing a conference grant proposal, developing publicity materials and a manual.

Results

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
802	Human Development and Family Well-Being

Outcome #4

1. Outcome Measures

Action...Improved strategies in rural policies for - rural family and community welfare - local community vitality - anti-poverty - combinations of human-capital and community-strengthening policies that are most likely to reduce nonmetro poverty and its unfavorable consequences. - maximize physical activity and physical and mental health of rural youth and adults

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Regulation to address the environmental impacts of agriculture could significantly impact the prosperity of small and medium-sized farms and rural communities. Hence, it is necessary to balance the needs of farm families with environmental conservation. We examine an innovative approach that can enhance farm viability and promote conservation on agricultural lands. In this approach farmers incorporate wetlands into their crop rotations by flooding fields for a limited time, draining them, and planting again.

What has been done

We developed a dynamic optimization model and simulation framework which relates conservation activities and land use changes to farm profits and water bird habitat to rigorously

evaluate wetland rotation programs. The model also allows us to compare outcomes from wetland rotation programs and traditional agri-environmental programs along various dimensions, including farm profits, wildlife habitat, and cost-effectiveness.

Results

We are:

- (i) Developing an integrated economic-biophysical model of this conservation practice and facilitating its adoption through improved understanding of its effects on farm economic viability;
- (ii) Enhancing understanding of how participation increases market opportunities; (iii) Providing insight into the program's impact on the cost of meeting farm prosperity and habitat conservation goals, thus enhancing the efficiency of investment in programs to maintain rural vitality and promote environmental quality; (iv) Identifying the allocation of land between crops and wetlands that minimizes agency costs while enhancing farm profitability and wildlife conservation, thereby promoting rural economic development and enhancing rural quality of life.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
802	Human Development and Family Well-Being

Outcome #5

1. Outcome Measures

Knowledge...Improved outreach, education, and professional practice in serving the needs of rural low-income families - improved well-being and functioning of rural low-income families - 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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Obesity is a critical concern and drives research related to diet intake, exercise and weight control. Healthy eating is a broader concept that encompasses the ability to determine and choose healthy foods, that is one part of the control of obesity. The concept of balancing food

intake on a daily basis, with the regular consumption of foods that meet both nutrient density and energy density is more difficult. Much of the public is challenged both in understanding as well as implementing the concept of healthy eating, which contributes to obesity and many related maladies.

What has been done

The project team:

*Conducted focus groups with Hispanic and Non-Hispanic whites parents of pre-adolescent children asking about factors that motivate parents to have rules for their children's eating behavior and keeping calcium rich healthy foods available in the home.

*Conducted survey research that queries college students regarding their perception of healthy foods and the availability of healthy foods on campus.

*Compared selected healthy food intakes between Hispanic and Asian immigrants to identify changes in eating patterns that could be related to nativity as a measure of acculturation.

Results

The project has resulted in increased knowledge about the factors that influence families to choose healthy foods; the project is moving toward development of messages and campaigns to motivate parents to provide healthy food choices in the home.  

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
802	Human Development and Family Well-Being

Outcome #6

1. Outcome Measures

Action...Affect governmental decisions about rural areas - service cuts and revenue alternatives - reallocations of service responsibilities among state and local governments - revenue sharing formulas

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Small communities worry about whether there is a critical mass of population below which the community may not survive. Many community development programs of the U.S. Department of Agriculture specify a maximum qualifying population, which ranges from 10,000 to 50,000 people. So far, to the best of our knowledge, no study has systematically investigated the existence of the critical population mass for small communities, nor is there empirical evidence for the specification of the cutoff population levels for community development programs. We address these issues in this research.

What has been done

We built a geocoded database consisting of community-level social, economic and demographic data of Oregon communities. Regression analysis is conducted. We find that such a critical mass of population mass that worries many small communities does not exist based on statistical evidence in Oregon. Our results support the use of community population thresholds as a qualifying condition for the participation in government grant and loan programs and the targeting of community development programs to smaller communities.

Results

Our research generates new knowledge regarding community population change. It quantitatively distinguishes small, medium and large communities in Oregon and show how their population changes are affected by different factors, like education, public services, local tax and the competition among neighboring communities. These knowledge help community leaders to direct their limited time and socio-economic resources to the factors that will significantly affect the growth of their communities.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
802	Human Development and Family Well-Being

Outcome #7

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 Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
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3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This research addresses energy balance and the dietary and physical activity adaptations that are required to help kids, families and communities achieve their healthy lifestyle goals. The research team is very interested in what they can do to help children, young adults, and adults prevent health issues related to chronic disease, while achieving and maintaining a healthy weight without dieting but being physically active. They are also interested in the effect of parents modeling healthy lifestyle behaviors, especially healthy eating and physical activity, and how much of this is incorporated into the norms of the family. The project team is also working nationally to get a better integration of the energy balance message into the training of future and current professionals working with communities (e.g. Extension Faculty) and into government education programs for low-income families and schools.

What has been done

The team has attempted to 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 interventions in ways that will be most effective for specific groups and subgroups and identify key parent-child relationships that contribute to childhood overweight and resiliency in various populations. The team and multi-state collaborators began to close out the project during the Fall of 2011 and to write a new multistate project to begin in 2012. The multistate group is working together to submit a research article titled, "Field assessment for obesity prevention in children and parents: Anthropometrics, physical activity, fitness and metabolic parameters" for the Journal of Nutrition Education and Behavior. The group also worked to put together a proposal for a presentation of this work at the Annual Meeting of the Society for Nutrition Education in 2012.

Results

Project results included:

- * New or improved obesity intervention strategies in the community setting
- * Identified 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
- * Markers and strategies will become the standards of methods and measurement of childhood overweight and resiliency
- * Advances in the study of obesity
- * Controlled growth in the rate of obesity and osteoporosis among youth

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
802	Human Development and Family Well-Being

Outcome #8

1. Outcome Measures

Knowledge Indicator...Understanding Human Health and Nutrition (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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our research suggests that changes in both diet composition and level of physical activity are important to reverse risk factors for chronic disease in individuals who are overweight or obese. Over 60% of adult Americans are currently overweight or obese (Body Mass Index [BMI]>25 kg/m²); we must identify ways to slow this trend, especially in our children and youth. This research addressed the importance of teaching women to make changes in their own health behaviors that become part of their lifestyle, and then model these healthy behaviors in the home to improve the health of the family. Weight loss is very difficult for most women to achieve and it is even more difficult to keep the weight off once it is lost. Helping women address weight issues and chronic disease risk factors before they become obese and/or are diagnosed with a chronic disease will aid in improving the health of Oregon families and the US population.

What has been done

We have attempted to 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 interventions in ways that will be most effective for specific groups and subgroups.

Results

Our research has identified:

- * New or improved obesity intervention strategies in the community setting
- * 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

4. Associated Knowledge Areas

KA Code	Knowledge Area
802	Human Development and Family Well-Being

Outcome #9

1. Outcome Measures

Action...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
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Health issues result from factors contributing to food insecurity and limited physical activity, especially among youth living in rural communities. To reduce rates of obesity and improve physical activity in children, many communities have turned to youth gardens as an intervention strategy for educating young people about environmental sciences, nutrition, and healthy behaviors. Youth gardens may improve knowledge of nutritional practices, and enhance consumption of fresh fruits and vegetables. Additionally, engaging older high-risk adolescents and young adults in garden programs designed to increase access to healthier foods may produce opportunities for them to obtain job skills and business experience.

What has been done

The researchers also received NIH funding in 2010 to help bring together university researchers, low-income youth transitioning to adulthood, and members of faith-based communities in two Oregon towns in a project designed to: a) provide training, employment, and improve health

outcomes for vulnerable youth, b) offer opportunities for adults from faith-based congregations to address issues of social injustice, and, c) build community partnerships leading to a sustainable youth garden entrepreneurship program. The project takes advantage of existing faith-based garden space and interfaith outreach collaborations to provide opportunities for vulnerable youth. Low-income youth (age 16-25) have partnered with adult volunteers in Sweet Home and Corvallis in Oregon to build organic gardens. Gardens were planted and produce is being harvested and marketed locally. Youth are paid a summer research incentive and participation in the project for two years is encouraged. Youth and adults have jointly collaborated in developing the Community Based Research aspect of the study. Baseline data have been collected, and short interviews evaluating initial perceptions about the project are completed. The progress of each garden is being documented in photos, field notes, individual journals, and garden artwork. To date the project has baseline measurements of physical and mental health including BMI, CES-D Depression Measure, Self-Esteem Index, the Positive Youth Development Index, 3-Day Physical Activity Record, 3-Day Food Diary. A second wave of data will be collected near the end of the summer allowing for short-term longitudinal comparisons. Most youth plan to continue their participation in 2012.

Results

There is evidence that some of the youth are developing new social capital, particularly in Sweet Home. One youth is now volunteering to provide childcare for a parenting support group at the Methodist Church that hosts the garden, and another young woman has been hired by a church member to water his garden. Frequently, staff are told positive stories about the youth gardeners when talking with members of the congregation or neighbors, and enthusiasm from the youth remains high. Youth regularly attend the free Manna dinner at the church in Sweet Home after they have finished gardening, and they plan to begin volunteering to help to prepare and serve the Manna meal. Youth in both gardens are currently developing outreach plans to distribute information about the project to their local communities.

The Corvallis gardeners are planning a fall harvest party targeting low-income members of the community to offer them the opportunity to purchase organically grown produce for significantly reduced prices. Local newspapers have highlighted both garden projects. We have designed and produced marketing/team-building materials with unique logos for project participants including water bottles and project binders, and are in the process of have tee-shirts with logos designed by a youth from each garden.

A conference led by the youth gardeners is planned for the summer of 2012 to teach members from faith communities or other organizations how to develop collaborative youth-adult garden projects. The researchers believe that this model is an effective way of engaging vulnerable youth, especially in small rural communities where land may be more readily available, in partnerships with caring adults. In the coming months we will be jointly working on planning the conference including writing a conference grant proposal, developing publicity materials and a manual.

4. Associated Knowledge Areas

KA Code	Knowledge Area
610	Domestic Policy Analysis
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

{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 # 6

1. Name of the Planned Program

Excellence in Water and Watersheds: Advance understanding and effective management of water, wate

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%	
111	Conservation and Efficient Use of Water			10%	
112	Watershed Protection and Management			10%	
132	Weather and Climate			10%	
133	Pollution Prevention and Mitigation			10%	
403	Waste Disposal, Recycling, and Reuse			10%	
404	Instrumentation and Control Systems			10%	
405	Drainage and Irrigation Systems and Facilities			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: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	2.0	0.0
Actual Paid Professional	0.0	0.0	15.0	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	93771	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	791115	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	1646249	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research is often carried out at field sites which are related to a specific project. Field sites with short- and long-term instrument deployment are located in all four corners of Oregon, as well as Washington State, Kansas and Canada.

We will develop and use novel soil-water instrumentation. Passive measurement of spatially distributed soil temperature can allow for estimation of the energy consumption of evapotranspiration and soil water flux. Beyond passive reporting of temperature, the use of actively heated fiber optics for the observation of subsurface water movement and water content via a heat pulse offer new research opportunities. Continuous temporal and spatial measurement at various scales will be validated and incorporated into new models and measurement tools. Improved spatial statistics is an aspect affecting remote sensing experiments and measurements, particularly related to soil moisture.

We will update and expand the reference evapotranspiration data currently available for Oregon. We expect to develop references for short and tall crops, disease and weed free, shaded and not short of water scenarios. We will compare estimates to recently available data from AGRIMET stations to validate estimating methods. We will consolidate meteorological data and develop a database in support of this effort. Information will be used to update Extension publications (both hard copy and online) to allow better information accessibility and wider range of applications. The effort is also applicable for long term agricultural and water resources planning.

Technological advances have made possible the development of a hydrologic model capable of simulating the interactions and processes between surface water and groundwater. Results of model simulation will help in the decision making process by producing a water budget analysis and an easy visualization of several management scenarios, e.g., no surface recharge from the irrigation canals.

Field observations of physical and biological processes and functions, benthic macroinvertebrate community, numerical and statistical models play critical roles in understanding the driving principles of watershed and river ecosystems and linkages. In addition, the use of laboratory flumes for simulating sediment and channel changes are a "safe" and controlled way to experiment with or predict outcomes of river management activities.

Watershed and river basin scale resource simulation models and decision tools will be used to examine coupled natural and human systems and trajectories of change under alternative future scenarios.

- Conduct Research Experiments.

- Construct Research Facilities.- Monitor and evaluate
- Conduct Workshops, meetings.
- Deliver Services.
- Develop Products, Curriculum, Resources.
- Provide Training.
- Assessments.
- Partnering.

2. Brief description of the target audience

The audience includes typical citizens in urban settings through extension outreach, those responsible for agricultural production through extension outreach and workshops, the engineering profession through publication of results in professional journals, and undergraduate and graduate students through presentation of project descriptions and results in a classroom setting.

3. How was eXtension used?

{No Data Entered}

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	400	600	0	0

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

Patent Applications Submitted

Year: 2011
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	17	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY: Indicator Type 1...Document natural processes and responses to anthropogenically-influenced conditions: a) Understand feedbacks between plants, soil hydraulic processes and atmospheric boundary layer development - Selker b) Evaluate dynamics and variability in fish and benthic macroinvertebrate communities - Tullos c) Investigate biotic-abiotic interactions and responses to disturbance in aquatic environments, both historically and in response to events or management - Tullos

Year	Actual
2011	1

Output #2

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY: Indicator - Type 2...Develop instrumentation and apply instrumentation systems (monitor, survey, collect data) to test hypotheses and events: a) Monitor soil moisture content and soil hydraulic properties at various scales related to 1) landscape subsurface hydrology 2) snow accumulation and ablation 3) upscaling from point to pixel - Selker; b) Monitor response to dam removal - Tullos

Year	Actual
2011	1

Output #3

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY: Indicators - Type 3...Develop models and reference data: (soil) a) Evaluate predictive power soil moisture and soil hydraulic models - Selker b) Evaluate evapotranspiration estimating methods for state-wide water resource management - Cuenca

Year	Actual
2011	1

Output #4

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY: Indicators - Type 3b....Develop models and reference data: (streams/rivers) c) Investigate aquifer recharge project design to enhance stream habitat and increase available water resources, examine management scenarios (5) Cuenca and Selker d) Investigate biotic-abiotic interactions and responses to disturbance in aquatic environments relative to river management strategies

(5) - Tullos

Year	Actual
2011	2

Output #5

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY:
Indicators - Type 3c....Develop models and reference data: (watershed) e) Examine coupled natural and human systems through watershed scale and river basin scale water resource simulation models and decision tools (whole system, vegetation, ecosystem services models) - Bolte and Cuenca f) Understand human elements in natural resources management (human surveys, analyses of landscape actors and social institutions) and conduct multiagent and adaptive management modeling - Bolte and Cuenca

Year	Actual
2011	2

Output #6

Output Measure

- OTHER SCHOLARLY EXCELLENCE: participation on professional boards and committees, as well as science panels, and receipt of awards

Year	Actual
2011	10

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Knowledge Indicators - Type 1...People provided information: - Informed decision-makers and citizenry - Better informed extension faculty - Better informed watershed councils and irrigation managers - Better informed agricultural producers - Trained scholars and peers
2	Knowledge Indicators - Type 2a - better understanding about water resource systems (and soil) * interconnectivity of soil and water resources
3	Knowledge Indicators - Type 3 Better tools and models, e.g., flumes, continuous data probes, revised models, coupled models
4	Action/Application Indicators - Type 1 Decision-makers use resource allocation or management tools e.g., Revised Oregon Irrigation Water Requirements Guide, websites
5	Action/Application Indicators - Type 2 Improved irrigation water management
6	Condition Indicators - Type 1 - Environmental a) Improved water availability and quality b) Improved watershed hydrology
7	Knowledge Indicators - Type 2b - better understanding about water resource systems (organisms) * aquatic species habitat and survival,
8	Knowledge Indicators - Type 2c - better understanding about water resource systems (management) * effects of management strategies

Outcome #1

1. Outcome Measures

Knowledge Indicators - Type 1...People provided information: - Informed decision-makers and citizenry - Better informed extension faculty - Better informed watershed councils and irrigation managers - Better informed agricultural producers - Trained scholars and peers

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The natural resource professions are attractive to people from rural backgrounds. Consequently, many of them are time-, place-, and situation-bound and cannot come to a University for advanced professional development at the BS and MS levels. Oregon State offers a unique opportunity that allows these individuals to overcome their constraints and complete degrees through Ecampus.

What has been done

The department responded to this need by developing courses for online students. As the number of courses increased, a minor in Fisheries and Wildlife was offered. Ultimately, it made sense to expand the offerings to a full online major in the fall 2009. Advising and administrative staff were added as needed to support the demand for online hours. A Professional Science Master in Fisheries in Wildlife Administration will be offered online; the first cohort of students will be accepted in the spring of 2012. Since fall 2010, we have developed and coordinated 61 internships for Ecampus students including two international experiences. These internships are extremely important for online students in assisting them with developing professional skills and developing contacts within the profession.

Results

The new FW major offered online had 100 majors within six months. Four hundred sixty majors have been admitted since the start of the program; currently 378 online students are being advised by three full-time advisors, one online internship coordinator, plus a half-time support staffperson. A quarter-time coordinator manages the many administrative tasks associated with the program. These 4.25+ of FTE provide modest economic stimulus locally, and are very real impacts for the individuals filling those positions. Online students are from 48 of the 50 states, two foreign countries and five U.S. military overseas bases. Almost 40% of these students already

have a college degree. Seventy-two students are pursuing a Fisheries and Wildlife minor online. Four students have completed graduate certificates in Fisheries Management online and we anticipate seven more to finish this term. Few universities can meet our 60% employment rate with state or federal agencies for their natural resources graduates.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities
902	Administration of Projects and Programs

Outcome #2

1. Outcome Measures

Knowledge Indicators - Type 2a - better understanding about water resource systems (and soil) *
interconnectivity of soil and water resources

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Water resources are becoming more limiting as multiple demands increasing compete for finite and decreasing fresh water resources. Microirrigation has the potential to help growers conserve water. This project will help define options where Microirrigation can feasibly be substituted for conventional irrigation systems that are wasteful of water. The completion of the objectives of this project will directly help growers design, manage and maintain Microirrigation systems for various

crops.

What has been done

Compare irrigation scheduling technologies and develop grower-appropriate scheduling products. The response of corn lily (*Veratrum californicum*) to soil water tension (SWT) irrigation criteria is being studied. Corn lily is being grown with automated drip irrigation at SWT criteria of 5, 10, 20, 30, 40 kPa (4 replicates each) at both 2,150 and 4,900 feet elevation in Oregon and Idaho, respectively. Irrigation criteria is being examined for seed production of 20 native perennial plant species that the US Forest Service and BLM have determined would be highly desirable for rangeland restoration. Each species is being grown under SDI in replicated plots with three irrigation treatments (0, 100, and 200 mm/yr total irrigation) repeated over years. Irrigation scheduling instruments that measure SWT are being calibrated in a hanging, weighing lysimeter in a controlled temperature growth chamber through wetting and drying cycles at different temperatures. Tensiometers, granular matrix sensors (GMS), hybrid sensors, thermocouple psychrometer readings, and capacitance probes are being compared and calibrated. Irrigation scheduling instruments that measure SWT are being calibrated in coarse sand in a crop production field with variable temperature through wetting and drying cycles created by irrigation events. Tensiometers, GMS, and capacitance probes are being compared and calibrated. Various GMS installation methods potentially appropriate for sand are being tested. Irrigation scheduling instruments that measure SWT are being calibrated in heavy clay in a crop production field with variable temperature through wetting and drying cycles created by irrigation events. Tensiometers, GMS, and capacitance probes are being compared and calibrated. Various GMS installation methods potentially appropriate for clay are being tested. Results of A-E above are being communicated to growers by means of field days, workshops, grower meetings, written and "on line" reports, and published and "on line" extension brochures. Drip, sprinkler, and furrow irrigation systems are being compared and various irrigation criteria are being tested for their effects on onion yield and grade. Results are being communicated to growers by means of field days, workshops, grower meetings, written and "on line" reports, and published and "on line" extension brochures.

Results

Irrigation scheduling by soil water tension allows growers to use water more precisely. Calibration of soil moisture instruments promotes improved irrigation scheduling with greater precision and confidence. Better use of irrigation systems and irrigation criteria for onions are increasing onion yields and reducing environmental consequences of onion irrigation. Environmental consequences of onion production are less because water and nutrient applications are very close to the actual needs of onion.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities
902	Administration of Projects and Programs

Outcome #3

1. Outcome Measures

Knowledge Indicators - Type 3 Better tools and models, e.g., flumes, continuous data probes, revised models, coupled models

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This work investigates responses of abiotic and biotic components of river systems to management actions, with an emphasis on dam removal and dam operations. The PI's lab has successfully solicited funding for studying the removal of seven dams and barriers in Oregon.

What has been done

We have made observations of the ecology and physical characteristics of the Calapooia River, Rogue River, Sprague River, and Oak Creek to describe responses of the channel to barrier removal. Observations include channel bathymetry, substrate, velocities, streamflow, woody debris, vegetation, benthic macroinvertebrates, and fish. Data have been used to link biotic and abiotic responses, to model system behavior, and to investigate monitoring approaches. While our research on dam operations research is still developing, research assistants are developing operations and hydrodynamic models for the Santiam River, the Sacramento River, and the Willamette River.

Results

In short, this project has led to improved understanding of and new models for predicting sediment processing with small and medium barrier removals, new partnerships with agencies and organizations, support for watershed councils and engineering consultants for project design, and investigation of the adequacy of current and alternative approaches to dam operations. Several additional manuscripts are in preparation, and several more are expected as the dam operations research progresses.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities
902	Administration of Projects and Programs

Outcome #4

1. Outcome Measures

Action/Application Indicators - Type 1 Decision-makers use resource allocation or management tools e.g., Revised Oregon Irrigation Water Requirements Guide, websites

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This project focuses on improving our understanding of how biophysical systems, management actions, and socio-economic influences interact to affect sustainability in a variety of landscapes. We highlight two here: understanding dynamics of fire-prone landscapes under climate change, and futures assessments in two urbanizing areas in Puget Sound. The first effort integrates social and ecological sciences to study a fire-prone landscape in central Oregon that includes private, state, federal, and tribal lands. We are developing a rich representation of social network influences on actor decision-making in this landscape, and coupling that with models of vegetation dynamics, fire, and habitat to identify policies and strategies for achieving landscape management goals. The second study involves two systems in Puget Sound. The Envision Skagit 2060 project seeks to develop and implement a broadly-supported, 50-year plan to protect the Skagit and Samish River watersheds' many environmental values, maintain highly productive

natural resource industries, and accommodate population growth in livable, walkable, and economically vibrant communities. A similar project is underway in Kitsap County, WA.

What has been done

We have implemented a series of simulation models, spatial datasets, and decision tools to assess future trajectories of change in each of these systems. We have implemented a mixed multi-agent/conventional simulation and decision tool, Envision, in these regions and worked with stakeholders to articulate drivers of future scenarios or change, and simulated those future trajectories.

Results

Efforts have resulted in:

- 1) Inclusion of Envision alternative futures modeling in planning processing in Kitsap County WA and Skagit County WA.
- 2) Development of new simulation models for fire and land use interactions, vegetative succession, and carbon storage in the Willamette Valley, OR.
- 3) Development of a new course with 20 undergraduate and graduate students focused on understanding climate change impacts and policies.
- 4) Training of 3 graduate students and 3 post-doctoral researchers in simulation and analysis of coupled natural/human systems.

Our efforts in alternatives futures analyses in Puget Sound are demonstrating how different policies around growth management and planning might impact land use pattern and ecosystem services in that region. Similarly our efforts in the Willamette Valley and Central Oregon region are demonstrating the impacts of policy alternative around growth and development and forest and fire management impact land use pattern evolution, fuels build up, and ecosystem function in those areas.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
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132	Weather and Climate
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities
902	Administration of Projects and Programs

Outcome #5

1. Outcome Measures

Action/Application Indicators - Type 2 Improved irrigation water management

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Groundwater in northeastern Malheur County has become contaminated with nitrate from crop production. Faculty at the Malheur Experiment Station in eastern Oregon sought options where growers could make nitrogen (N) fertilizer use more efficient.

What has been done

Many nitrogen fertilization options were tested on sugar beets, potatoes, wheat and onions. Nitrogen rates could be reduced for furrow- and drip-irrigated onion. Nitrogen rates were tested for furrow- and sprinkler-irrigated potato. Drip, sprinkler and furrow irrigation were compared for onion and potato production. Forty commercial fields were used for multiple demonstration strips with different reduced N fertilizer inputs, including zero applied nitrogen. Sugarbeets followed various rotation crops with different N fertilizer regimes, and were evaluated for yield, sugar content, nitrate, total N and the leaves were evaluated for N content and soil was evaluated available N at harvest and N mineralization.

Results

Growers modified N fertilizer practices using less N and more efficient N timing. Growers have greatly reduced fall N applications, which have been proved to be of low efficiency and greatly subject to leaching losses. Growers have adopted split N applications during the growing season to get more efficient use of N. We demonstrated that onions grown under drip irrigation had improved yield and quality with lower inputs of water and N fertilizer, hence lower chemical input costs and lower potential for N leaching. Results of onion trials have been widely adopted by growers locally and in other production regions. Many growers are substituting sprinkler irrigation for surface flood irrigation on crops other than onion. Groundwater nitrate contamination is decreasing.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #6

1. Outcome Measures

Condition Indicators - Type 1 - Environmental a) Improved water availability and quality b) Improved watershed hydrology

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Our research is being used in a variety of capacities to influence wetland ecosystem function and biological values for wetland dependent organisms. Specifically, research on wetlands created via the federal government's Wetland Reserve Program is being used by the Pacific Coast Joint Venture to prepare a conservation plan for ducks wintering in the Willamette Valley of western Oregon and the Lower Columbia River Valley of Oregon and Washington. We also outline one approach that is useful for assessing the effectiveness of wetland restoration and management activities. This effort is directly relevant to the NIFA Challenge Areas: Climate Change and Sustainable Food Systems.

What has been done

We used a combination of correlative and experimental approaches (e.g., enclosure experiments) to address a range of issues related to conservation planning for wintering waterfowl. We used controlled feeding trials to expand our understanding of the nutritional quality of foods for wild birds and expanded on that basic research to explore the role waterfowl play in the dispersal of both native and exotic plant seeds.

Results

Recently completed work on aquatic invertebrate community composition in seasonal wetlands in agricultural landscapes in the Willamette Valley has identified taxa that may be useful in

developing a wetland assessment technique for these habitats. Research on winter habitat use and movements of Sandhill Cranes in California developed strategies for effectively restoring and managing wetland habitats for cranes, assessing the risk of human activities in areas managed for cranes, and defined the spatial scale at which cranes use the landscape during winter, which helped conservation planners define connectivity of isolated basin wetlands in the context of crane winter habitat needs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
403	Waste Disposal, Recycling, and Reuse
404	Instrumentation and Control Systems
405	Drainage and Irrigation Systems and Facilities

Outcome #7

1. Outcome Measures

Knowledge Indicators - Type 2b - better understanding about water resource systems (organisms) * aquatic species habitat and survival,

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

This project has focused on studies of river and stream restoration projects throughout Oregon including the Willamette and Umatilla River basins and its stream network and assessment of the response of these ecosystems to restoration practices and is relevant to the NIFA Challenge Areas of Climate Change and Sustainable Food Systems. Our work involves effectiveness monitoring of restoration projects using aquatic macroinvertebrate community and trait composition as tools.

What has been done

We mapped thermal refuges along the entire length of the Willamette River, providing the first spatial framework for cold water habitats in the Willamette River. We created the SLICES framework for the Willamette River floodplain, which the state of Oregon and the federal Habitat Technical Team now use for prioritizing restoration actions in the mainstem Willamette River. The online pdfs are available to the public as a basis for designing floodplain and river restoration (<http://ise.uoregon.edu/slices/Main.html> , Hulse et al. 2010). We monitored macroinvertebrate communities responses to restoration projects using aquatic and trait composition as tools. We collected amphibians in restored and unrestored areas to compare response to agricultural practices and restoration practices. We also conducted laboratory experiments on behavioral responses of aquatic organisms to invasive organisms.

Results

Cooperators have used our data to develop the anchor habitats framework for the Willamette Special Investment Partnership. We provided information on fish communities, thermal habitats, and floodplain characteristics to the Willamette Partnership, watershed councils, Cascade Pacific RC&D, McKenzie River Trust, Greenbelt Land Trust, and Willamette Riverkeepers to assist in developing conservation and restoration actions. Our data have been used in the development of seven major restoration projects: 1) Green Island, 2) Blue Ruin Island, 3) Harkens Lake, 4) Waggle/Stellmacher Oxbow, 5) Bowers Rock, 6) Luckiamute Landing, and 7) Willamette Mission. We have worked with NGOs and land owners in public meetings to identify links to additional conservation incentives (CSP, CREP, Wetland Reserves, tax incentives) and potential conservation payments.

Our results have provided important knowledge on the effectiveness of USDA CREP buffers on small streams and tribal conservation easements along a large river. Our results indicate that, in both cases, buffers have small, but observable, impacts on river reach quality and that greater efforts are needed that involve increasing the size and spatial extent of buffers in eastern Oregon. Our work also involves studying the impact of water withdrawals for irrigated agriculture in eastern Oregon rivers. Information from this project has helped inform water and fisheries managers of the potential benefits of proposed water management strategies designed to increase summer flows. Our work indicates that improved flow alone will accrue only small benefits to river reach quality and that habitat improvements will also be necessary to improve the quality of impacted river reaches. Finally, we are also conducting field work to examine the relationships between buffer type (herbaceous and woody) and stream intermittency on the macroinvertebrate productivity of headwater streams.

We have found that aquatic organisms in Oregon respond positively to restoration efforts and that the invasion of biological organisms compromises this response. When conservation practices are implemented within agricultural landscapes, freshwater streams and ponds have a higher diversity of amphibians, fish, and macroinvertebrates than habitats within watersheds with no conservation practices (i.e. no-tillage practices and buffers). Biological invasions, however, can impede habitat restoration efforts. We found that invasive crayfish in southern Oregon freshwater streams negatively impacts native Signal crayfish by outcompeting them for resources. We determined that bullfrog populations can be controlled by manipulating hydroperiods in these freshwater ponds. We also found that these invasive frogs do not behaviorally respond with appropriate antipredator strategies to native amphibian salamanders, potentially allowing for a biotic control of bullfrog invasions in salamander occupied habitats.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
112	Watershed Protection and Management

Outcome #8

1. Outcome Measures

Knowledge Indicators - Type 2c - better understanding about water resource systems (management) * effects of management strategies

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

To investigate new methods of monitoring complex agro-hydrologic systems we have developed an entirely new line of methods based on fiber optic temperature sensing. Using this method we can measure temperature, soil moisture, soil water flux, groundwater upwelling in streams and atmospheric turbulence at spatial resolution of 25 cm along transects of up to 2,500m, resulting in up to 10,000 simultaneous measurements. We are also developing wireless networked sensors which can report all micro-meteorological parameters, soil moisture, and other sensor readings (e.g., load cells). We are addressing:

- 1.Irrigation optimization management in field crops with distributed fiber optics
- 2.Precision water management in container nurseries with wireless sensors
- 3.Aquifer recharge and recovery for habitat and agricultural water supply based on simulation and measurement
- 4.Stream habitat status and restoration efficacy based on continuous distributed temperature sensing.
- 5.Impact of soil structure and swelling on runoff and infiltration
- 6.Use of hybrid Poplar trees for waste water treatment
- 7.Use of wetlands with permeable lower boundaries for hyporheic recharge for stream restoration.

What has been done

- 1.Irrigation optimization management in field crops with distributed fiber optics: Heatable fiber optic cables have been installed in Hermiston Oregon, Madrid, Spain, and Oklahoma City,

Oklahoma where we are perfecting the soil moisture measurement for agricultural applications. These efforts are supported by parallel laboratory calibration efforts.

2.Precision water management in container nurseries with wireless sensors: A network of wireless sensing systems was installed in a commercial nursery in Newberg Oregon. These data are being compare to the performance metrics to develop a real-time, low-cost precision irrigation control system for container nurseries.

3.Aquifer recharge and recovery for habitat and agricultural water supply based on simulation and measurement: Three-dimensional unsaturated-saturated modeling (HYDRUS-3D) with analytical models to develop a predictive framework to identify the relationship between size, vadose zone properties, and net recharge for aquifer storage and recovery projects in the Walla Walla basin. These results are being combined with large-scale (100 km² three dimensional basin models to provide a planning tool for this community. Results presented December 2010.

4.Stream habitat status and restoration efficacy based on continuous distributed temperature sensing: Observations have been made in 5 2-km reaches of the Walla Walla, Middle Fork John Day, and Big Boulder rivers using fiber optic temperature sensing. Each reach has been modeled with the stream temperature model "Heat Source" to provide a validated, comprehensive, physically based representation of these streams for use by collaborating fisheries and wildlife management colleagues.

Results

CTEMPS. In water resources management, inability to obtain precise measurement of soil moisture and soil water flux across a landscape have been huge impediment to understanding and managing water resources. The methods we have developed have resulted in the emergence of a new branch of scientific experiments making use of the fiber optic method for observations. We have been overwhelmed by interest in these efforts, and lead us to propose the establishment of a National Center to extend these methods beyond our laboratories. In 2009 we received funds from the National Science Foundation to establish the Center for Transformative Environmental Monitoring Systems (CTEMPS.org), which has now enabled over 20 teams to use this method. We provide instrumentation, technical support, and assistance in the field to help teams to successfully make use of this powerful method.

STREAM MONITORING. We participate in the Middle Fork John Day, Walla Walla, and Big Boulder Creek restoration efforts. We have strongly influenced the approach, location, and kind of restoration undertaken on these sites.

NOVEL METHODS FOR SOIL PHYSICAL MONITORING. We have developed real-time methods of observing the dynamics of crack openings in soils under natural conditions which allows understanding of these complex dynamic systems in varied settings.

NURSERY MANAGEMENT. We have demonstrated the use of wireless sensors providing rich, real-time data on irrigation status of nursery crops. These have traditionally be highly over-irrigated, and with this method should be able to be more exactly managed, reducing both water and nutrient application, as well as reducing pests.

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
404	Instrumentation and Control Systems
902	Administration of Projects and Programs

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}