2009 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, four of which are closely aligned with NIFA's Strategic Goals: Global Food Security and Hunger; Sustainable Energy; Climate Change; and Food Safety. The additional two include Rural Communities and Water and Watersheds. The following are highlights from four of these Planned Programs.

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 agricultural education, 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. Greenhouse and nursery crops are the leading commodity crop in Oregon, worth $877 million in 2008. Researchers in the Horticultural Department have developed a Best Management Practices program for greenhouses and nurseries to prevent the spread of Phytophthora ramorum, a disease that devastates nursery stocks and can compromise food crops. The Oregon Department of Agriculture has used the results from this research to start a pilot program with 23 participating nurseries.

Sustainable Energy

OAES faculty fromthe Department of Biological and Ecological Engineering continue to make strides in production of bioproducts, biofuels and biohydrogen from sunlight and agricultural and cellulosic feedstocks. This year, the PIs put their focus on modeling production systems. Biosolar production of hydrogen from water has great potential, but much is still not known about the constraints of the production system. Flux balance analysis, a mathematical modeling approach, was used to examine the effect of different cell growth parameters on H2 production under a variety of simulated conditions. The model provides insights into the mechanisms of H2 production.

Climate Change

A major focus of this program is conservation, restoration and management of fish and wildlife populations, and improving our understanding of ecosystems and the effects of climate. Investigators are exploring various methods to assess and improve management of anadromous fisheries stocks, including Pacific salmon. Since 2006, some of these stocks have decreased to a fraction of what they once were. A collaboration with agencies and trade groups has produced Project CROOS (Collaborative Research on Oregon Ocean Salmon). This partnership focused on improving management of weak salmon stocks by using "real time" genetic information to identify stock structure and migration patterns base on fine scale spatial and temporal information. The project will also provide information on the suite of life strategies in the salmonid genetic code that may enable stocks to respond to different climatic conditions. Thus far, the project has helped to retain more than 170 fishing and fishing related jobs and more than a $1 million in exvessel revenue. Ongoing workshops train fisherman to use best practices and electronic kiosks in Portland grocery stores trace the capture, handling and processing of individual fish from the boat to the market for consumers, in addition to providing information on salmonid stocks.

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. Conventional food safety methods often cannot detect bacterial toxicity. Researchers in the Department of Microbiology discovered that the pigment cells of Siamese fighting fish, Betta splendens, act as a natural alarm -- a "biosensor" -- signaling the presence of toxin-producing bacteria that contaminate food or drinking water. Characterization of the specific interactions between chromatophore cells and food associated pathogenic bacteria revealed it is the toxic behavior of the pathogenic bacteria that induces a response in the chromatophore cell based biosensor. This will help limit food-borne illnesses and spare lives while potentially saving companies millions in unnecessary recalls.

Obesity

Currently, projects that address the issue of obesity are included in the program areas of Global Food Security and

Hunger, Rural Commuities, and Food Safety. For example, a Rural Communities project is examining the relationship between US farm subsidies, rates of obesity and medical expenditures. Preliminary findings suggest that subsidies decrease commodity prices, which in turn leads to a reduction in retail food prices, which are correlated to increased Body Mass Index and increases in medical expenditures. A new Obesity program will be included in our FY11 Plan of Work update.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	43.1	0.0	143.6	0.0
Actual	0.0	0.0	268.0	0.0

II. Merit Review Process

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

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

2. Brief Explanation

{No Data Entered}

III. Stakeholder Input

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

- Use of media to announce public meetings and listening sessions
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey of the general public
- Survey specifically with non-traditional groups
- Survey specifically with non-traditional individuals
- Survey of selected individuals from the general public
- Other (town halls, blogs, Facebook, live interviews/Q&A)

Brief explanation.

We have provided social networking approaches to encourage real-time engagement and open opportunities for participation.

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

1. Method to identify individuals and groups

- Use Advisory Committees
- Use Internal Focus Groups
- Use External Focus Groups
- Open Listening Sessions
- Needs Assessments
- Use Surveys

Brief explanation.

{NO DATA ENTERED}

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.

{NO DATA ENTERED}

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.

{NO DATA ENTERED}

Brief Explanation of what you learned from your Stakeholders

Stakeholders inside and outside the College of Agricultural Sciences contributed ideas and suggestions that have shaped a plan for restructuring the College, a mandate of our institution. The plan proposes structural and programmatic change throughout the organization to better position the College for a future with a predicted small

state-supported "footprint." Discussions over the next several months among internal and external stakeholders will help refine the design. While most of our stakeholders have said they understand the need for us to be creative at addressing our budget challenges, they also hope that we will be creative in meeting their local needs as well.

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	3197483	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	2449562	0
Actual Matching	0	0	26827550	0
Actual All Other	0	0	50253067	0
Total Actual Expended	0	0	79530179	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from				
Carryover	0	0	318438	0

V. Planned Program Table of Content

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			40%	
511	New and Improved Non-Food Products and Processes			40%	
609	Economic Theory and Methods			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.1	0.0
Actual	0.0	0.0	15.5	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	89850	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	984036	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	2323094	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, data analyses, assessments
- conduct workshops, provide training

- partner

2. Brief description of the target audience

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

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	600	6000	60	60
Actual	600	6000	60	60

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

Year: 2009
Plan: 2
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	1	10	
Actual	1	22	23

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	Target	Actual
2009	1	15

Output #2

Output Measure

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

Year	Target	Actual
2009	2	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	Target	Actual
2009	1	2

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 d) examine coordination between public and private sector and the mix of public-good and private-good inventions e) test assumptions about basic research's influence on downstream applications and product development f) understand role and influence of intellectual property regimes on innovation

Year	Target	Actual
2009	4	4

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 - Type2 ... 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.
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	Knowledge Indicators - Type 4...Productivity information a) understand reverse impact of downstream on upstream research b) understand where to distribute investments on basic-to-applied research continuum and in which fields or subfields to focus
5	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
6	Action Indicators - Type 2...economic activity in rural areas a) bioenergy facilities are located close to potential feedstocks to generate additional economic activity
7	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

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	Quantitative Target	Actual
2009	1	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Development of environmentally benign and sustainable technologies is a critical need. Increasing use of renewables for producing fuels and industrial products necessitates a systematic approach for utilization of renewable biomaterials. Bioresources such as cereal grains, agricultural residue, animal waste, municipal waste and other byproducts from food and feed industries can be utilized for value added processing.

What has been done
* grass straw samples have been analyzed for C5 and C6 sugars, lignin, ash and moisture contents
* algae strains were tested in 1 L photobioreactors for nitrogen and phosphorous removal from synthetic waste water.
* Steam explosion process for several different feedstocks has been conducted.
* Chemostat setup to test yeast adaptation to C5sugars was completed - A collaborative project with Trilium Fiberfuels, a cellulosic ethanol start-up company.

Results
Information on a life cycle analysis (LCA) for algae biodiesel production has been developed and is being published in a peer journal.
The lead investigator has developed an educational webpage on biofuels: http://stl.bee.oregonstate.edu/Biofuels_pachyderm/index.html.

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 - Type2 ... 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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Improving the power output of microbial fuel cells and microbial electrochemical cells. 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.

What has been done
Nanomaterials have received much attention from researchers in the context of microbiology due to their unique physical, electrical, and chemical properties, which facilitate the study of interactions between bacteria and surfaces. Anode surfaces were modified using nanotechnology and changes in power output measured. Microarray analysis of organisms growing on the nanomodifed anodes was performed to help elucidate the mechanisms of enhanced power output.

Results
The current generation of microbial electrochemical systems is affected by the properties of anodes. Au and Pd nanoparticle decorated graphite electrode were developed and evaluated in a newly designed multi-anode microbial electrolysis cell (MEC). The anodes decorated with Au nanoparticles produced current densities up to 20-fold higher than plain graphite anodes by Shewanella oneidensis MR-1, while those of Pd-decorated anodes with similar morphologies was 0.5-1.5 times higher than the control. Significant positive linear regression was obtained between current densities and the size, including average Feret's diameter and average area, of the particles, while the circularity of the particles showed negative correlation with current densities. On the contrary, no significant linear correlation between the current density and the density of the particles, including area fraction and particle counts was evident. The results demonstrated that nano-decoration can greatly enhance the performance of microbial anodes, while the chemical composition, size and shape of the nanoparticles determined the extent of the enhancement.
Shewanella oneidensis MR-1 is an important model microorganism for metabolic studies of the effects of different environmental factors because of its diverse respiratory capabilities. Nanoparticle modified graphite disks were

used as anodes to investigate the effects of nanostructures on the performance S. oneidensis MR-1 in microbial electrolysis cells (MECs.) Results demonstrated that current densities produced with Fe nanoparticle decorated anodes were up to 6.7-fold higher than plain graphite anodes; whole genome microarray analysis of the gene expression showed that of the total of 4295 genes, 188 genes were up-regulated and 204 genes were down-regulated more than two-fold in response to the nanostructured anodes. The majority of differentially regulated genes were related to electron transport. In particular, a number of genes encoding formate dehydrogenase family proteins (fdhD and fdhE) were up-regulated more than 4-fold in response to the nanostructured anodes, suggesting that these genes possibly play critical roles in current density enhancement. These results indicate that nanomodification of MEC anode structure causes significant changes in the expression level of certain genes, which may in turn contribute to the enhanced performance of MECs observed.

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	Quantitative Target	Actual
2009	2	6

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Biosolar production of hydrogen (H2) from water has great appeal as an environmentally sustainable, long-term solution to energy needs. The major feedstocks (sunlight and water) are abundant and widely distributed, and quantities of biosolar H2 that could be produced far exceed current and projected global energy requirements. The metabolic engineering of Synechocystis sp. PCC 6803 strains with the capability of consistent, high-yield biosolar production of H2 requires the continued development of comprehensive mathematical models describing the metabolism underlying H2 production.

What has been done
Flux balance analysis, a mathematical modeling approach, was used to examine the effect of different cell growth parameters on H2 production in Synechocystis sp. PCC 6803 under a variety of simulated conditions. This multi-compartment network model incorporates a detailed description of photosynthetic and fermentative electron transport and central carbon metabolism. The model was used to provide insights into the mechanisms of H2

production in Synechocystis sp. PCC 6803.

Results
Model outcomes provide insights into the structure and function of elements of the photosynthetic and respiratory electron transfer chain, including terminal oxidases located in the plasma and thylakoid membranes, and H2 metabolism in Synechocystis. Photoautotrophic H2 production capabilities were found to be within the range reported for other photosynthetic microorganisms. Maximal H2 production studies identify several reactions including photorespiration as potential factors impacting H2 synthesis.

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 #4

1. Outcome Measures

Knowledge Indicators - Type 4...Productivity information a) understand reverse impact of downstream on upstream research b) understand where to distribute investments on basic-to-applied research continuum and in which fields or subfields to focus

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal of this project is to improve the understanding of the sources and measurement of productivity and technology change, with application to agricultural, agribusiness, resource, and bioresearch industries. Productivity growth is the principal source of comparative advantage and long-run growth. This principle applies equally well to the agricultural and rural economies, including their input supply, farming, and manufacturing/distribution components. Examining the types and sources of productivity change is therefore a worthwhile research goal in its own right, strongly complementing trade comparative advantage studies and other investigations in the Oregon Agricultural Experiment Station.

What has been done
The PI is currently developing production models for the joint production of good and bad outputs, and adopting them as tools in performance measurement.

Results
New methods of measuring productivity change and applying to U.S. agricultural and related industries are in

progress.

4. Associated Knowledge Areas

KA Code	Knowledge Area
609	Economic Theory and Methods

Outcome #5

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 #6

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 #7

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Energy and water are two critical issues that have to be addressed for sustainable development in the world. Biofuels production from algae is one of the long term sustainable alternatives for meeting the liquid transportation fuel needs. Increasing fresh water scarcity around the world due to depleting ground water aquifers, changing surface water flows, population pressures and large scale biofuel crop production necessitate holistic solutions

that address both water and energy issues. Large quantities of waste water produced in cities have organic and inorganic nutrients and therefore requires treatment before discharge into natural streams. In addition, waste water is often contaminated with heavy metals that require additional treatment before discharge. Challenges for large scale production of algae biofuels are in harvesting and processing of algae biomass. Our collaborative research is focused for a better understanding of algae, development of energy efficient process technologies and using algae for treatment of waste waters and heavy metal sequestration.

What has been done

Specific projects are to:
1. Develop efficient photobioreactors for algae production.
2. Develop novel recovery systems for harvesting and processing algae to produce biodiesel.
3. Understand the mechanisms in algae for lipid and starch accumulation using metabolic engineering approaches.
4. Develop control systems for automated management of algal cultures.
5. Integrate waste water processing with the algae production to reduce production costs.

Results

Green algae is presently being commercialized as a potential source of lipids and carbohydrates, to produce bio-fuels and bio-products. Genomic and biochemical information have previously been used to re-construct the metabolic network of the green algae, C. reinhardtii. The re-constructed network consists of 458 metabolites and 484 metabolic reactions (reversible and irreversible) organized into three metabolically active compartments representing the chloroplast, mitochondrion and cytosolic spaces. Model parameters will be determined through biochemical analyses of the lipid and starch content and other metabolic inputs and outputs. Linear programming will be used to study the behavior of the model organism under simulated growth conditions- including autotrophic, heterotrophic and mixotrophic growth. This reconstruction will lead to the identification of metabolic and biochemical factors affecting the spectrum of carbohydrates and lipids in wild-type and mutant gene knockout strains of C. reinhardtii and can be used to guide the engineering of new strains for lipid and carbohydrate 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

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 and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

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

G4-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			1%	
102	Soil, Plant, Water, Nutrient Relationships			1%	
111	Conservation and Efficient Use of Water			1%	
112	Watershed Protection and Management			46%	
132	Weather and Climate			1%	
133	Pollution Prevention and Mitigation			1%	
403	Waste Disposal, Recycling, and Reuse			1%	
404	Instrumentation and Control Systems			1%	
405	Drainage and Irrigation Systems and Facilities			46%	
902	Administration of Projects and Programs			1%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.5	0.0	2.2	0.0
Actual	0.0	0.0	11.2	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	22549	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	246952	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1481931	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 form 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.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	200	300	50	100
Actual	200	100	50	100

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

Year: 2009
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	2	
Actual	0	8	8

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 anthropogenitically-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	Target	Actual
2009	2	2

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	Target	Actual
2009	1	4

Output #3

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY: Indicators - Type 3....Develop models and reference data: a) Evaluate predictive power soil moisture and soil hydraulic models - Selker b) Evaluate evapotranspiration estimating methods for state-wide water resource management - Cuenca 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 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	Target	Actual
2009	4	6

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 2 Better understanding about water resource systems for allocation of water resources, e.g., interconnectivity of soil and water resources, aquatic species habitat and survival, effects of management strategies
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 Resource allocation tools for decision-makers e.g., Revised Oregon Irrigation Water Requirements Guide, websites
5	Action/Application Indicators - Type 2 Improved irrigation water management
6	Condition Indicators - Type 1 Improved water availability and quality Improved watershed hydrology

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	Quantitative Target	Actual
2009	20	20

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Hydrologic instrumentation is undergoing a transformative shift in its ability to concurrently measure scales from centimeters to kilometers [e.g., Selker et al., 2006]. Training is needed to rapidly distribute and incorporate these advances in the Earth and hydrologic sciences,

What has been done
The Center for for Transformative Environmental Monitoring Programs (CTEMPS) began in mid-2009. It provides short- and intermediate-term project access to five field-deployable DTS systems that can be shipped directly to project sites. CTEMPS also offers 1-day and week-long courses on distributed temperature sensing and wireless autonomous sensing. In addition, researchers and their students are visit the University of Nevada, Reno and the Oregon State University for "hands-on" training prior to instrument delivery. The first one-day course was offered in December 2009.

Results
The CTEMPS equipment represents a significant resource to the hydrologic and earth sciences community. The quality of the data collected by this resource is such that it will be of interest to investigators for many years. In order to encourage the use of the data by others and thereby make the facility of more value to the community, it is the CTEMPS policy that all data collected by instruments be provided to the Center in ODM format so that they can be accessed by other interested investigators after a proprietary period of 2 years.

CTEMPs, working with industry, also will make extended resolution (spatial and temporal) DTS systems available to address the most demanding applications of this technology. CTEMPs anticipates that in early 2010 it will make available to the research community a DTS with 0.25 meter spatial and 1 second temporal scale capability which would be four times better spatial resolution and 10 times better temporal resolution than currently available instruments

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 2 Better understanding about water resource systems for allocation of water resources, e.g., interconnectivity of soil and water resources, aquatic species habitat and survival, effects of management strategies

Not Reporting on this Outcome Measure

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	Quantitative Target	Actual
2009	3	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
More precise hydrologic measurements facilitate efficient, cost-effective environmental solutions, such as well-targeted restoration efforts. Applications of this work may result in improved salmon habitat, more accurate flood warnings, better estimates of water runoff and recharge, safer wastewater disposal, and effective groundwater protection

What has been done
Using a cable plow developed in the lab, hundreds of meters of fiber-optic cables that allow resolution every 1 meter along 10,000 meter cables are being laid at several depths in Oregon, with proposed installations at the USDA Reynolds Creek Experimental Watershed, crossing from valley bottoms to windward and leeward hill crest slopes. A new method is being developed, using the DTS to measure the thermal response of soils to a short burst of energy to measures soil water content and soil heat flux dynamics.

Results
Cables near the surface of the soil precisely reveal the location of snow cover due to its blanketing effect on winter soils. Supplementing the cable-computer system are satellite remote sensors that map fractional snow covered areas and provide snow water equivalencies, manual measurements (neutron probes and snow depth probes), distributed sensor stations (using the SensorScope platform), and remotely sensed parameters collected by truck-, airplane-, and satellite-mounted sensors. The entire system will be integrated into a web-published database. If the system proves successful and leads to widespread implementation, much costly flood damage may be avoided through an improved warning system, as well as possibly indicating ways to improve dam management.

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 Resource allocation tools for decision-makers e.g., Revised Oregon Irrigation Water Requirements Guide, websites

Not Reporting on this Outcome Measure

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	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Conventional irrigation management applies water sufficient to maximize crop yields, without regard for the associated costs of water and energy. In contrast, this work presents a new irrigation paradigm--to maximize net returns to water (economically optimum irrigation management). Although the new optimization paradigm is applicable in all circumstances, it is particularly relevant when and where water supplies are limited.

What has been done
Managing irrigation to maximize net economic benefits is inherently more challenging than traditional irrigation management in that it generally implies some degree of deficit irrigation, and, therefore, involves a very different approach to planning and scheduling irrigation applications. This project developed practical analytical tools for determining optimum irrigation strategies tailored to the specific circumstances of client farmers.

Results
Soon into the project, results began attracting considerable interest in using the analytical tools under real-world conditions. This project will benefit the bottom line for Oregon farms in two ways: Reduce excess water use (and its associated costs) and help farmers identify the most profitable strategies when water supplies are limited.

* Reducing over-irrigation. One estimate of the total annual costs of irrigation in Oregon is on the order of $500 million/year. Irrigation consumes about 80% of all stream and river diversions and uses approximately 1.7 terawatt hours of electricity annually. Field observations show that farmers often over-irrigate by substantial amounts; more than 20% excess water use is common. Estimates of the costs of over-irrigation in Lane County and parts of the Columbia Basin suggest that applying 20% excess water to a single irrigated field can easily costs the farmer $50 to $140/acre/year for energy, labor, nitrogen leaching and yield reductions.

There were over 2.9 million acres harvested in Oregon in 2007, counting grains, hay and forage, grass and legume seed, field crops, tree fruit and nuts, small fruit and berries, vegetable and truck crops, and specialty products. Assuming that one-third of this harvested acreage is irrigated and one-fifth of the irrigated acreage (around 19,333 acres/year) is already, or will soon be, under the new irrigation paradigm, savings to the Oregon farmers adopting the new system would, conservatively, amount to $9.6 million/year (using the $50/acre, the lowest of the range mentioned above). As more farmers adopt the new irrigation paradigm, their savings on irrigation costs will increase.

* Optimizing use of limited water. Economically optimum irrigation strategies could increase net farm income on the order of 5% to 10% and by more when water supplies are limited. These expected economic benefits will increase as water costs rise and water becomes less plentiful. It is widely perceived that Oregon (along with the rest of the world) will face increasing competition for water. As that competition drives up the costs of irrigation and reduces the supply of readily available water, most irrigated agriculture will have to shift from conventional, yield-oriented irrigation management to profit-oriented strategies. In light of that prospect, this project should be seen as a long-lead (ten-year) effort to position Oregon to make the most effective and profitable use of irrigation water.

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 Improved water availability and quality Improved watershed hydrology

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)

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

FA2-Sustaining Rural Communities

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			1%	
802	Human Development and Family Well-Being			98%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures			1%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	0.8	0.0	1.9	0.0
Actual	0.0	0.0	1.7	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	8609	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	94285	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	108507	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.

We will carry out chemical and thermal analyses of agricultural products to determine chemical constitution and physical features for insulation and allergic sensitivity.

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.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	100	100000	0	0
Actual	100	10000	0	0

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

Year: 2009
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	10	
Actual	0	20	20

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- OTHER SCHOLARLY ACHIEVEMENTS: panel, awards, presentations

Year	Target	Actual
2009	6	2

Output #2

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH AND COMMUNITIES. Examine rural health and communities through development and testing of econometric and other models and the compilation and analysis of data on communities, families and individuals: a) Develop 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	Target	Actual
2009	2	2

Output #3

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH AND COMMUNITIES. Examine rural health and communities through development and testing of environmentally friendly agricultural products for textiles a) Conduct laboratory experiments to characterize and assess the fibers' chemical, physical and performance properties that are relevant to textile thermal insulation applications.

Year	Target	Actual

2009	4	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	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	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	Demonstrate that poplar seed hair fibers possess properties are suitable for textile thermal insulation applications. - high-end bulk thermal insulation material
4	Trained scholars and extension educators
5	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
6	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
7	Affect governmental decisions about rural areas - service cuts and revenue alternatives - reallocations of service responsibilities among state and local governments - revenue sharing formulas
8	Value-added use of poplar seed fibers (e.g., for insulating textiles) will benefit the environment and increase total utilization of this resource
9	Improved well-being of lower-income and ethnic minority youth across rural America
10	Use of poplar seed fibers will positively impact the poplar industry and provide environmentally friendly textiles

Outcome #1

1. Outcome Measures

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	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The PI seeks to understand how social support and other factors shape parent confidence among rural low-income Mexican immigrant mothers living in newly settled as compared to more established destinations.

What has been done
The PI and a graduate student used a mixed methods approach to examine the relationships between parenting support and community context (newly settled versus established destinations for Mexican immigrant families) and the mother's feelings of confidence in her own parenting.

Results
Quantitative analyses revealed that parenting support was more strongly related to parent confidence for mothers living in newly settled, rather than established destinations. Qualitative analysis of targeted subsamples both supported quantitative findings and demonstrated that assimilation, transnational motherhood (having children both in the US and in Mexico), childhood risk (e.g. poverty, deprivation and harsh parenting practices), and source of social support were also relevant factors. A manuscript is being revised for publication.

4. Associated Knowledge Areas

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

Outcome #2

1. Outcome Measures

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	Quantitative Target	Actual
2009	1	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Current research focus on two questions: a) do social support and other factors shape parent confidence among rural low-income Mexican immigrant mothers living in newly settled as compared to more established destinations and 2) why do rural low-income families from some of the more prosperous states sampled have persistently higher rates of food insecurity than similar families from less prosperous states?

What has been done
a) Sarah Feeney, an HDFS student completed her master's thesis by using a mixed methods approach to examine the relationships between parenting support and community context (newly settled versus established destinations for Mexican immigrant families) and the mother's feelings of confidence in her own parenting.

b) A mixed methods analysis of the longitudinal data revealed that families living in states with persistently high rates of food insecurity did not have lower median incomes or life satisfaction, but they did experience higher material hardship and greater housing costs than did families in food secure states.

Results
Results of both studies indicate place influences on health and familty skills. Under study a) Quantitative analyses revealed that parenting support was more strongly related to parent confidence for mothers living in newly settled, rather than established destinations. Qualitative analysis of targeted subsamples both supported quantitative findings and demonstrated that assimilation, transnational motherhood (having children both in the US and in Mexico), childhood risk (e.g. poverty, deprivation and harsh parenting practices), and source of social support were also relevant factors.

Under study b) Families in food insecure states used high-risk consumption reduction strategies to cope with their food insecurity, whereas families in food secure states employed more positive use of their human capital.

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Demonstrate that poplar seed hair fibers possess properties are suitable for textile thermal insulation applications. - high-end bulk thermal insulation material

Not Reporting on this Outcome Measure

Outcome #4

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	Quantitative Target	Actual
2009	3	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural subsidies lead to a higher consumption of calorie dense, nutritionally vacant foods which leads to higher rates of obesity and higher medical expenditures.

What has been done
Empirically estimate via elasticity analysis the extent to which agriculture subsidies decrease commodity prices; lower commodity prices in turn lead to a reduction in retail food prices; and a decrease in retail food prices leads to increases in BMI and increases in medical expenditures.

Results
Specifically, we find that medical expenditures are .072 to .116 percent higher and pharmaceutical expenditures are .126 to .203 percent higher than they would otherwise be without US farm subsidies.

Results were disseminated at the American Public Health Association Meeting and through an academic paper under review "The Twisted Path from Farm Subsidies to Health Care Expenditures" Under review Journal of Public Health Policy. Two research studies exploring young adult food choice and factors influencing eating behaviors, including behaviors associated with consumption of calcium rich foods resulted in two successfully defended M.S. degrees.

4. Associated Knowledge Areas

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

804 Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

Outcome #5

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #6

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #7

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #8

1. **Outcome Measures**

Value-added use of poplar seed fibers (e.g., for insulating textiles) will benefit the environment and increase total utilization of this resource

Not Reporting on this Outcome Measure

Outcome #9

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #10

1. **Outcome Measures**

Use of poplar seed fibers will positively impact the poplar industry and provide environmentally friendly textiles

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

Evaluation Results

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 4

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			4%	
111	Conservation and Efficient Use of Water			8%	
121	Management of Range Resources			4%	
202	Plant Genetic Resources			8%	
204	Plant Product Quality and Utility (Preharvest)			5%	
205	Plant Management Systems			9%	
206	Basic Plant Biology			5%	
216	Integrated Pest Management Systems			9%	
301	Reproductive Performance of Animals			3%	
302	Nutrient Utilization in Animals			3%	
307	Animal Management Systems			5%	
501	New and Improved Food Processing Technologies			1%	
502	New and Improved Food Products			1%	
511	New and Improved Non-Food Products and Processes			3%	
601	Economics of Agricultural Production and Farm Management			9%	
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			8%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	35.7	0.0	76.1	0.0
Actual	0.0	0.0	105.0	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	1119083	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	12256175	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	20579312	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
Provide Training
Provide Demonstrations
Provide Counseling
Assessments
Work with Media
Partnering
Facilitating

2. Brief description of the target audience

- Professional peers and scientific communities, extension faculty, veterinarians, vaccine producers

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

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	35415	7265775	740	1100
Actual	35415	500000	750	1200

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

Year: 2009
Plan: 5
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	4	150	
Actual	0	108	108

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 o Evaluate protein supplement of cool versus warm season forage o understand responses to environmental signals, germination, growth and development pathways

Year	Target	Actual

2009	2	2

Output #2

Output Measure

- DEVELOP BETTER UNDERSTANDING OF BASIC PHYSIOLOGY OF PLANTS AND ANIMALS ...Indicator 2 - Reproduction 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	Target	Actual
2009	2	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	Target	Actual
2009	2	3

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	Target	Actual
2009	3	3

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	Target	Actual
2009	2	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	Target	Actual
2009	3	3

Output #7

Output Measure

- DEVELOP BREEDING PROGRAMS THAT RESULT IN DESIRABLE TRAITS, CULTIVARS AND VARIETIES...Indicator - improved traits. o Improve breeding programs for barley, meadowfoam, potato, wheat and release new varieties for general public and/or licensed release o Crop quality work include studies on malt barleys, super soft white wheats, modified wheat starches and proteins, modified potato starches and proteins, assessment of oil quality and quantity in meadowfoam and of glucosinolates in meadowfoam meal, cultivar testing of canola and mustard o Develop onion germplasm for year-round marketing. o OSU and ARS breeding program partnership develops at least one varietal selection for potato adaptation to the Treasure Valley - selections at the Malheur Experiment Station, including colored flesh potato varieties, may have special market opportunities. o Develop alkaline tolerant poplar tree varieties for saw log production on poor and sloping soils with the aid of drip irrigation. o Develop improved horticultural crops to meet the needs of industry, e.g., hazelnut, beans, snap pea, tomato, apples, broccoli, organic lines

Year	Target	Actual
2009	5	5

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	Target	Actual
2009	0	3

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	Target	Actual
2009	1	1

Output #10

Output Measure

- DEVELOP IMPROVED ANIMAL AND PLANT PRODUCTION SYSTEMS...Indicator 3 - inputs for plant systems. o Nutrient and crop management extension recommendations o Improved nitrogen management strategies for soft white wheat o Improved nutrient recommendations for soft white wheat grown in conservation tillage systems and for potential alternative cereal crops o Develop a comprehensive understanding of the morphological, physiological and/or genetic basis for plant responses in studied management systems to nutrients, temperature, moisture and other abiotic stresses, plant growth regulators, attack by other organisms o Develop and promote strategies for efficient use of soil nitrate and the other available N sources, nitrogen management, growth regulators, abiotic stresses, o Develop

precision management systems in vineyards, with nutrition component o Develop 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, avoiding leaching water and nitrate to groundwater. o Make known to horticulture practitioners a variety of 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 o Identify suitable alternative crops for wheat-based crop rotations; determination of best management practices for alternative crops o Develop information on best management practices for new varieties o Establish statewide small farms extension program with new positions.

Year	Target	Actual
2009	8	5

Output #11

Output Measure

- Output Measure 5 - PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS TO GROWERS AND PEERS Indicator 1 - management systems o Create, improve or evaluate pest management systems for commodity groups, and provide weed management with improved herbicides and cultural management o Identify optimum inputs and agronomically compatible weed management in alternate crops o Gain knowledge about the biology of yellow nutsedge under local conditions o Quantify the 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. o Develop decay management programs appropriate to various producer objectives. o Design crop management systems for suppression of CRKN using suppressive rotation crops, green manure crops and reduced nematicide use o Knowledge that fumigants used at reduced rates in combination with other nematicides are likely to be the optimum management strategies for control of CRKN. o Develop technologies for efficient application of viral vectors in grapevine. o Develop decay risk prediction models for use in orchards and packinghouses

Year	Target	Actual
2009	4	4

Output #12

Output Measure

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

Year	Target	Actual
2009	1	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 o Work with plant breeding and genetics colleagues to release new crop varieties with herbicide resistance. o Identify herbicides that can be safely and efficaciously used in different crops o Control of downy brome and other

weeds through extracts from broadleaf plants (natural herbicides) o Evaluate new herbicide candidates and non-chemical cultural practices under field conditions for weed control effectiveness, crop safety, and soil persistence under eastern Oregon dryland conditions.

Year	Target	Actual
2009	5	5

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 o 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 o Better understand species complex and fungicide sensitivity

Year	Target	Actual
2009	5	5

Output #15

Output Measure

- Output Measure 6 - 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	Target	Actual
2009	1	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	Target	Actual
2009	2	2

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	Target	Actual
2009	3	3

Output #18

Output Measure

- Output Measure 7 - 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	Target	Actual
2009	4	4

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	Target	Actual
2009	2	2

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 Use total factor productivity to measure technological strength of U.S. agriculture and processed food industries o Complete feasibility study of community based micro processing centers for agricultural products

Year	Target	Actual
2009	2	3

Output #21

Output Measure

- Output Measure 8 - DEVELOP AND ENHANCE VOLUNTEER PROGRAMS FOR BROADER APPLICATION OF RESEARCH AND EXTENSION INFORMATION o Reach Master Gardners (new, past, and current) through MG training programs and materials, websites, and other distance education programs o Refine OSU Urban and Community Horticulture Website to reach new audiences.

Year	Target	Actual
2009	200	200

Output #22

Output Measure

- Output Measure 9 - 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	Target	Actual

2009	0	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Knowledge Indicator - plant production management systems. oGrowers are provided information that will improve their production systems: issues related to precision horticulture, mineral nutrition, and fundamental aspects of data analysis; new cultural practices, innovations, pest control, and organic systems to remain competitive; marketing approaches for local markets and community food systems. oProducers, NRCS, conservation districts and environmental agencies learn about whole farm nutrient management. oBasic agronomic practices for commercially promising alternative crops under reduced tillage systems. oProfessional 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. oGrowers 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	Knowledge Indicator - animal reproductive biology and genetics. oalternatives that are more sustainable in terms of economics and ecology. ogenetic causes of early embryonic failures, developmental biology of the early bovine embryo and factors affecting establishment of extraembryonic endoderm onew means to improve fertility in dairy cattle and to reduce uterine infections osire genotype effects on embryonic loss and of management factors that influence loss of potential lambs in commercial ewes osperm cell function and a conceptual basis for understanding a genetic basis for fertility in male poultry
3	Knowledge Indicator - forage and nutrient management oExtension Specialists produce workshops and other forms of teaching on issues related to grazing, manure management, and cropping systems. oBeef industry will understand forage quality dynamics for dominant forage species in Oregon, 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 - plant breeding and plant attributes. oGrowers 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 oRegulation of embryo maturation in cereals. oAntioxidant effects of various carotenoids and flavonoids, and impact of flavonoids on antioxidant effect oStakeholders learn about human health benefits, disease resistance, and breeding for organic systems of vegetables. oResearchers determine sets of genes involved in processes critical to the 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 - pest, disease and weed control and resistance in plants oBasic pest biology information, new pesticides/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 oGrowers become aware of pest management processes, including level of management required, risks associated with this pest as it becomes established, factors affecting herbicide activity oDisease resistance discoveries, including gene evolution, plant lines oUnderstand pollen flow mechanisms between wheat and its wild relative jointed goatgrass

	o oElucidate the underlying molecular mechanisms of pathogenicity (virulence) and disease susceptibility (compatibility) and disease development. oFacilitate future planned activities in functional genomics and provide a more robust sampling of the Pleosporales for comparative genomic studies by the fungal research community. oInformation for the development of resistant wheat germplasm to tan spot. oFunctions 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. oMolecular mechanisms responsible for closterovirus reproduction and transport in plants and develop model to predict risk oTechnologies for efficient application of viral vectors in grapevine. oCharacterize genes involved in Victoria Blight Disease susceptibility, and uncovered relationships between disease susceptibility and disease resistance. oFumigants used at reduced rates in combination with other nematicides are likely to be the optimum management strategies for control of CRKN. oEfficacy of various orchard, postharvest, and storage methods for control of postharvest decay of pear
6	Knowledge Indicator - community education and economic studies. oWays to integrate agricultural education into high school curriculums oProducer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade. oWe expect to show that international trade will be an important vehicle by which adaptations can be made to global climate change. oResearchers will uncover key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade. oPolicy 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. oNumerical 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.
7	Action Indicator - Adoption of new varietals oreduce yield losses and expenses, orejuvenate orchards oachieve better productivity and efficiency: oprovide environmental benefits (less fungicide applications, etc.), oeffectively compete on world market with new varieties oCommercial 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 - Improved fertility and genetic stock oProducers and animal health professionals improve fertility and prevent uterine infections in dairy cattle from implementing every-day on-farm practices. oIndustry stores sperm cells with minimal loss of function for use as a commodity and for long-term maintenance of genetic stock
9	Action Indicator - alternative management tools used by private and public sector oBeef producers improve their economic competitive advantage and improve the ecological sustainability of production systems. oLand management protocols will be used in public land management policy decisions. oEnd users adopt new pesticide and pest management systems and strategies for working with invasive pests oProfitable alternative cereal crops for dryland cropping systems in the PNW oFarmers will more strategically plan for crop production and manure management. oInteraction 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. oGreen manure crops in combination with reduced nematicide use is likely to be successful, particularly for short season potato crops. CRKN may be managed with crop rotation sequences, including green manure crops, which suppress nematode populations so that no or minimal nematicides are necessary. oDistrict-specific control programs will reduce usage of fungicides with low efficacy and emphasize

	integrated control practices. oGrowers, 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. oDetermine packinghouse water system contamination by fungal pathogens. Commercial service lab can apply PCR technology to maintain sanitation determine most effective fungicides for each species. oCustomized decay control program for each unique pathogen complex.
10	Action Indicator - conservation strategies adopted oConservation 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. oGrowers 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 oGrowers 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. oGeneration of the viral vectors for grapevine disease control and functional genomics vectors have a potential for replacing current strategies of using chemical fungicides and bactericides with viral biocontrol strategies.
11	Action Indicator - improved agricultural economies oThe 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). oDomestic policymaking and multilateral trade negotiations will mitigate effects of climate change in reduction of trade barriers and subsidies. oClimate change will be related to changes in comparative advantage in international crop production, and in turn the pattern and volume of trade. This information will be important in the context of domestic policymaking and multilateral trade negotiations as it pertains to reduction of trade barriers and subsidies.
12	Change Indicator - Ecological / Environmental oLandscapes 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. oFood/farm systems reduce surface and/or groundwater or other pollution in the environment, while improving nutrient and water budgets, and organic production systems. oNew reduced risk, environmentally safer pest control tools will be available that are target pest specific will facilitate the implementation of IPM programs. oEnvironmental 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. oBetter 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. oenhance the nation's natural resource base and environment by revealing cost-effective means to control plant diseases and reduce the need for pesticides. oBiocontrols 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. oImproved soil, water, and crop management practices and strategies that protect Oregon resources oManagement 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. oStrategies for avoiding invasive pests will be in place oPlant disease resistance will lower the amount of pesticide use, resulting in a more healthful environment

and reduced exposure of humans to hazardous chemicals.

13	Change Indicator - Societal oSocial 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. oSocial 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. oSocial 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. oSocial change will improve economic stability of families and quality of life with improved cropping systems. oWorker 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. oIncreased opportunities for rural community marketers and processors will be developed; oPublic health will be improved through the use of crops with improved nutritional value oSustainable and economically viable wheat and dryland cropping industry for vibrant rural economy in eastern Oregon oThe public has access to an ongoing research data base that allows for natural resource/land management decisions to have a fundamental basis in science.
14	Change Indicator - Economic oThe 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. oEconomic 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. oProfitability 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. oProfitability 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. oProfitability 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. oProfitability 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. oAgricultural producers will realize greater economic return in their cropping enterprises; Plant nutrient and other production input use will be optimized oProducers maximize the control of postharvest decay within the various production and marketing objectives of producers. oBiocontrols 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. oHigher-value niche markets will be established oBeef producers in the Intermountain and Great Basin areas remain completive on a regional, national, and global basis. oProducers 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. oBetter 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.
oIntense selection reduces needs for assistance in pasture lambing conditions.
oEconomic viability of farmers markets will be enhanced
oAgricultural producers will realize greater economic return in their enterprises;
oIncreased 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.

Outcome #1

1. Outcome Measures

Knowledge Indicator - plant production management systems. o Growers are provided information that will improve their production systems: issues related to precision horticulture, mineral nutrition, and fundamental aspects of data analysis; new cultural practices, innovations, pest control, and organic systems to remain competitive; marketing approaches for local markets and community food systems. o Producers, NRCS, conservation districts and environmental agencies learn about whole farm nutrient management. o Basic agronomic practices for commercially promising alternative crops under reduced tillage systems. o 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. o 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	Quantitative Target	Actual
2009	5	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Greenhouse and nursery crops, worth $877 million in 2008, are the leading agricultural commodity in Oregon. Most of the crop is exported out of state, but the finding of Phytophthora ramorum in nursery plants has resulted in strict regulation of the plant trade. P. ramorum is a quarantined pathogen that can be carried by nursery plants as they are shipped to other states or countries. Contaminated nurseries must destroy infested plants and they often face financial ruin as a result. P. ramorum is responsible for sudden oak death, a devastating forest disease that has killed over one million trees in California since the mid-1990s. Because it can infect over 100 plant species, there is great concern that movement of P. ramorum with shipped nursery plants could jeopardize forests, human and food landscapes throughout much of the U.S.

What has been done
In cooperation with USDA-ARS Horticultural Crops Research Laboratory, the PI developed a systems approach to detect sources of all Phytophthora species in nurseries. Recycled irrigation water, re-used pots, and infested gravel beds were the most common sources of Phytophthora contamination. The data provided the scientific basis for

developing Best Management Practices to prevent Phytophthora contamination. The research team also helped create a free, online course in English and Spanish to train nursery growers about Phytophthora biology, symptoms, and disease management.

Results
The Oregon Department of Agriculture developed a pilot program with 23 participating nurseries based on the results. Nurseries that participate in the program must pass the online course and agree to comply with Best Management Practices that address the common sources of contamination. The systems approach could readily be broadened to include additional pathogens and pests. Such an approach has significant potential in identifying sources of contamination, targeting mitigation strategies, providing a scientific basis for development of Best Management Practices, and providing an improved strategy for reducing spread of pests and diseases with nursery stock. Modification of nursery management practices will add to production costs. For example, irrigation water may need treatment to eliminate the pathogen, and additional labor may be required to monitor plants for disease symptoms. However, nurseries that participate in this program may also benefit from marketing advantages that promote clean nursery stock production systems.

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

Outcome #2

1. Outcome Measures

Knowledge Indicator - animal reproductive biology and genetics. o alternatives that are more sustainable in terms of economics and ecology. o genetic causes of early embryonic failures, developmental biology of the early bovine embryo and factors affecting establishment of extraembryonic endoderm o new means to improve fertility in dairy cattle and to reduce uterine infections o sire genotype effects on embryonic loss and of management factors that influence loss of potential lambs in commercial ewes o sperm cell function and a conceptual basis for understanding a genetic basis for fertility in male poultry

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	3	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Identifying critical factors involved in the establishment of extraembryonic endoderm may provide insights into aberrant mechanisms predisposing the early bovine embryo to pregnancy loss due to abnormal development and/or implantation failure.

What has been done
Factors affecting differentiation and outgrowth of bovine endodermal cells from the inner cell mass (ICM) during the formation of extraembryonic endoderm were investigated. Normally, several types of cells migrate by binding to activator receptors, specifically urokinase-type plasminogen activator receptor (uPAR) acts an integrin. The PA inhibitor, PAI-1, competes with uPAR and inhibits cellular migration. Experiments were conducted to evaluate the effects of PAI-1 on this process and the reversibility, if any, of the PAI-1 effect. Inner cell masses (ICM) were isolated from bovine blastocysts using an immunosurgical procedure and then cultured in medium containing PAI-1. Areas of cellular outgrowth and numbers of cells in the outgrowths were recorded. At the end of the culture, conditioned medium was recovered and analyzed for PA.

Results
Concentrations of 33 and 330 g/ml PAI-1 in the culture medium eliminated PA activity and significantly suppressed the numbers of cells leaving the ICM and forming a mat of cellular outgrowth. ICM and outgrowth areas were also reduced in medium containing PAI-1. Experiments were also conducted to evaluate the reversibility of the PAI-1 effect. ICMs were cultured in PAI-1 for 96 h, recovered from the microdrops, washed and cultured for an additional 96 h in microdrops containing 0 g/ml PAI-1. Transferring ICMs to 0 g/ml PAI-1 stimulated ICM and outgrowth areas and numbers of cells in the outgrowths suggesting that inhibition of endodermal cell migration by PAI-1 is reversible. Collectively, these data suggest bovine endodermal cells utilize uPAR to bind vitronectin during their departure from the ICM and formation of extraembryonic endoderm. Furthermore, endodermal cell migration can be modulated by PAI-1 where its presence inhibits and absence stimulates cell movements. These results will help cattle breeders reduce costs associated with lost

4. Associated Knowledge Areas

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

Outcome #3

1. Outcome Measures

Knowledge Indicator - forage and nutrient management o Extension Specialists produce workshops and other forms of teaching on issues related to grazing, manure management, and cropping systems. o Beef industry will understand forage quality dynamics for dominant forage species in Oregon, 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	Quantitative Target	Actual
2009	4	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There has been much speculation about the difference between organic and conventional dairy farms. It is a commonly held belief that organic farms are unable to produce the same amount of milk. Also, it is believed that organic farms have more disease outbreaks. The researchers in this program seek to quantify production and incidence of disease at both farm models.

What has been done
In cooperation with Cornell University and University of Wisconsin-Madison, researchers aim to find correlations between management practices, incidences of diseases and the amount of milk produced. They'll then use the data to develop recommendations for keeping dairy cows healthy while optimizing income and the quality of the milk. This data is lacking. Researchers will spend the next two years visiting each farm to make observations, review farm records and administer a questionnaire. During the visits, they'll see how many cows are pregnant, check for lameness, measure their body fat, and rate the cleanliness of the cows' udders. Additionally, they'll collect milk samples so they can count bacteria and screen for common infectious diseases. In particular, they'll look for mastitis, a costly infection of the mammary gland. Furthermore, during the 60 days before and after each visit, farmers will be asked to collect and submit data about diseases their cows may have and their economic impact on their business.

Results
Research is ongoing.

"There's a lot of speculation about the difference between organic and conventional dairy farms," Investigator Gamroth said. "We always automatically say if you're organic you won't be able to produce as much milk. I'm not sure that's true. We need to put some real numbers on that. Also, some conventional dairy farms think that if you're organic, disease is going to be a problem. We don't know that for sure. So we want to find out what's true and what's not," Gamroth added.

This study will provide objective information for farmers, agencies, and the general public.

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 - plant breeding and plant attributes. o 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 o Regulation of embryo maturation in cereals. o Antioxidant effects of various carotenoids and flavonoids, and impact of flavonoids on antioxidant effect o Stakeholders learn about human health benefits, disease resistance, and

breeding for organic systems of vegetables. o Researchers determine sets of genes involved in processes critical to the 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	Quantitative Target	Actual
2009	5	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Approximately 18,500 acres of green beans (Phaseolus vulgaris) are grown for canning and freezing annually in the Willamette Valley. Processors prefer bush Blue Lake (BBL) types because of their high yields (6 T/A compared to 3.5 T/A in the Midwest) and their superior quality, flavor, and processing characteristics. Since 1980, the dominant BBL variety has been 'Oregon 91G' because of its stable yields and processing attributes. The industry faces difficulties with field production, including root rot and white mold pathogens. To compete with green beans produced in other regions of the U.S., greater efficiency in harvest and in the processing plant needs to be achieved. BBL beans have weak stems and branches that let pods lay on the soil. This can lead to misshapen and moldy pods that reduce processing efficiency. White mold (caused by Sclerotinia sclerotiorum) is a particularly serious problem for growers because an incidence of >3% moldy pods will cause the processor to reject the truck load. Historically, growers have controlled this disease in their fields using fungicide treatments, but the cheapest, most effective fungicides have been withdrawn from the market by the EPA because of human health concerns. Currently available "softer" fungicides are more expensive, and must be applied more frequently and with greater precision in both time and space. Genetic resistance to white mold has been identified, but is controlled by many genes with small individual effects, making the breeding effort more difficult. The best sources of resistance reside in a related species, the scarlet runner bean (P. coccineus).

What has been done
A long-term breeding effort on BBL beans has had as its objectives: 1) improving processing quality and efficiency, 2) incorporating upright architecture into the BBL background, and 3) breeding for white mold resistance. To address objectives 1) and 2), the researchers have produced a linkage map based on molecular markers, and have mapped quantitative trait loci (QTL) associated with growth habit and processing characteristics. Breeding lines have been selected with more upright growth habit resulting in the release of OSU 5630 and the development of the advanced breeding line OSU 6443. Breeding for white mold resistance has been addressed using a two-pronged approach. As a long-term strategy, P. coccineus accessions with the highest levels of white mold resistance were identified and used to create backcross inbred populations in a BBL background. These populations were characterized for resistance through field and greenhouse trials and were subjected to molecular marker analysis. To date, three QTL for resistance have been identified. A second approach has been to use QTL for white mold resistance identified in the P. vulgaris accessions G122 and NY6020. G122 has a major QTL located on linkage group B7 whereas NY6020's major QTL is on B8. Using a combination of selectable markers and phenotypic selection for white mold resistance, the PI pyramided both QTL into a BBL background.

Results
Newly developed varieties with higher yields and better quality, are increasing grower revenues. OSU 5630 is gradually displacing 'Oregon 91G', and is now being grown on about 1/3 of the acreage in the Willamette Valley. Estimated revenue to processors from this variety is estimated to be about $7.3 million per year. OSU 5630 has about a 1 T/A yield advantage over 'Oregon 91G' as well as better processing quality, which means returns are

significantly higher. With OSU 5630, growers are grossing approximately $80 per acre more than with 'Oregon 91G'. The initial reports on OSU 6443 are favorable, and if this line is released could result in an increase of average yields of about 0.5 T/A over OSU 5630. Averaging three new varieties over several production years shows an increased gross return of almost $80/acre. As growers of some 18,500 acres in Oregon gradually replace older varieties with new ones, they will eventually be ahead in gross sales by almost $15 million/year (18,500 acres * $80/acre).

An unforeseen insight obtained from mapping efforts has been a new understanding of genetic relatedness of BBL types to other green beans. BBL and Midwestern green beans have different alleles at the phaseolin locus, and show genetic complementation for the snap bean syndrome. The phaseolin locus is a marker of center of domestication (S phaseolin types come from the Mesoamerican, and T phaseolin types come from the Andean center of domestication). As such, BBL green beans are Mesoamerican in origin while most Midwest green beans are Andean. Taken together, these results indicate that green beans were derived more than once from dry beans and that different genes controlling the green bean syndrome were fixed in different backgrounds. Green bean breeders have known for some time that BBL beans did not combine well with other green beans, but did not know why. These findings have been communicated to other public and private snap bean breeders who, when crossing to BBL types, now use breeding methods that favor keeping trait complexes intact.

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

Outcome #5

1. Outcome Measures

Knowledge Indicator - pest, disease and weed control and resistance in plants o Basic pest biology information, new pesticides/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 o Growers become aware of pest management processes, including level of management required, risks associated with this pest as it becomes established, factors affecting herbicide activity o Disease resistance discoveries, including gene evolution, plant lines o Understand pollen flow mechanisms between wheat and its wild relative jointed goatgrass o o Elucidate the underlying molecular mechanisms of pathogenicity (virulence) and disease susceptibility (compatibility) and disease development. o 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. o Information for the development of resistant wheat germplasm to tan spot. o 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. o Molecular mechanisms responsible for closterovirus reproduction and transport in plants and develop model to predict risk o Technologies for efficient application of viral vectors in grapevine. o Characterize genes involved in Victoria Blight Disease susceptibility, and uncovered relationships between disease susceptibility and disease resistance. o Fumigants used at reduced rates in combination with other nematicides are likely to be the optimum management strategies for control of CRKN. o Efficacy of various orchard, postharvest, and storage methods for control of postharvest decay of pear

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	5	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Eriophyid mites cause extensive crop losses in cool-climate wine grape regions. The grapevine rust mite Calepitrimerus vitis has a free-living lifestyle during the growing season and is usually found on leaves and young shoot surfaces. It is believed that these mites cause economic damage and extensive crop losses to vines in Australian, Swiss, Hungarian, French, Italian and United States (Pacific Northwest) vineyards. Damage most likely is caused by surviving overwintering (deutogyne) C. vitis populations during the early spring. In Oregon and other parts of the world, high (above 8 mites per shoot) mite numbers in the spring were associated with leaf and shoot distortions, retarded growth in emerging green tissue, and crop losses, and are described as short shoot syndrome (SSS). Bud break failure along with yield losses were correlated with C. vitis infestations in California, South Africa and Australia. It is suspected that early feeding of deutogyne mites on rapidly-developing vine tissues within young buds cause mite-associated damage symptoms.

What has been done
The researchers studied mite incidence and damage in order to determine the symptoms and relationship between mite incidence and damage. They also determined developmental parameters for C. vitis in Oregon along with grapevine growth stages in order to better understand the biology and connection to grapevine damage. This information helps wine grape producers to accurately time mite treatments to the vulnerable stage of this species.

Results
The researchers clearly described the syndrome known to grape growers in Oregon as Short Shoot Syndrome (SSS). By correct description and diagnosis, they were able to link C. vitis and Col. vitis to Restricted Shoot Growth symptoms. Similar symptoms referred to as Short Shoot Syndrome are for the first time linked to C. vitis incidence in the sampled Oregon vineyards and confirm the relationship between SSS and C. vitis incidence first reported in Australian vineyards. Damage caused by feeding of C. vitis on young developing tissue appears to be responsible for SSS and its season-long consequences in Oregon vineyards. Through this work we now better understand the seasonal phenology of C. vitis on grapevines by observing mite development and fecundity under controlled and field conditions.
Seasonal observations of grapevine phenology, mite pest populations, symptoms due to leaf infestations, and seasonal crop loss data was used to determine periods during the season when damage occurs and when mite populations are more susceptible to control. This information helps growers to more adequate time sprays and dramatically reduces crop losses due to mite infection. It is believed that optimal mite control is dependent on two factors. First, pest mite populations must come in contact with pesticides and this is enabled when bud tissue becomes less tightly packed during the wooly bud stage allowing for movement of mites out of the bud area and pesticides into these areas. Second, mite activity and movement to exposed plant parts start to take place during early spring. Treatments targeted at exposed and active pest mite populations should result in lower in-season establishment and targeted sprays mid season should decrease potential over-wintering populations. It is estimated that there were annual savings of approx. $500,000 statewide due to improved management techniques. These figures are obtained by calculating an approx. 0.5% crop savings due to improved monitoring, modeling and control due to increased knowledge, and extension.
The statewide survey of eriophyid mite incidence conducted by this project shows that approximately 33% of all vineyards had crop losses due to mite-related SSS. These losses can range from 5% to 100% in a specific block. For a conservative estimate of the economic loss experienced by Oregon growers from mite-related SSS, assume

that the statewide overall loss was 2.5% of the crop. (While the lowest damage found was a 5% loss, some vineyards experienced no loss. But recall that Oregon's three largest wine grape counties, Yamhill, Polk, and Washington, showed SSS and eriophyid mite incidence on between 40% to 50% of the sampled materials.) Gross sales for the 2007 wine grape crop totaled $55.6 million; 2.5% of this loss would amount to $1.39 million annually. If from the recommendations of this project, mites are treated at precisely the right time, these losses can be more than halved. Then, if more money is invested to optimize control of the pest, savings would be even more dramatic. Thus, the economic net benefits to Oregon horticultural growers from this and other work reported here, could average at least $1 million/year.

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 - community education and economic studies. o Ways to integrate agricultural education into high school curriculums o Producer groups learn about factors shaping global markets and productivity-convergence effects on US agricultural and processed food production and trade. o We expect to show that international trade will be an important vehicle by which adaptations can be made to global climate change. o Researchers will uncover key relationships that tie climate change to the distribution of crop yields, comparative advantage, geography, and international trade. o 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. o 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	Quantitative Target	Actual
2009	3	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Agriculture and processed food industries in the United States and Oregon have played an important role in past and current economic growth and development. In recent years, demands on agriculture and processed food industries have become multidimensional in nature. In addition to providing cheaper food to consumers, these industries have been asked to provide better stewardship for natural resources and the environment, and improved food quality, variety and safety. Simultaneously, these industries have faced increasing global competition evidenced in their declining trade balance, increased multinational activity within US borders and an uncertain credit environment. Thus, the need for economic input in policy and business decisions affecting the comparative advantage of US agriculture and processed food industries, and more specifically, their Pacific Northwest

counterparts continues to be important. Productivity growth is the principal source of comparative advantage and long-run growth. This principle applies equally well to the agricultural and rural economies, including their input supply, farming, and manufacturing/distribution components. The primary objective of this research is to analyze the comparative advantage of US agricultural and food industries and their counterparts in Oregon, with important reference to the interaction between productivity growth and comparative advantage.

What has been done
This research examines the role of public sector in alleviating the likely market failures in aiding productivity growth, conserving natural resources and the environment, and opening global markets for US products. The researchers analyze the nature and effect of trade costs, that is, any barrier that hinders the ability of businesses to easily export and import products across national borders. The activities involve developing an economic models and datasets that can demonstrate how trade liberalization and other changes in trade costs have affected the prospects and possibilities for agricultural producers and consumers. These models will allow us to test hypotheses about trade costs and make predictions about how trade costs affect U.S. exports and the future location of agricultural production and patterns of trade.

Results
The modeling and data analysis thus far has resulted in a number of professional outputs including presentations at national and international conferences and journal articles. Research is ongoing.

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 - Adoption of new varietals 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	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Beginning in 1998, common corn smut (Ustilago maydis) has been a severe problem with production of sweet corn in the Columbia Basin, resulting in serious economic losses to the processing industry.

What has been done
A series of trials evaluating commercial cultivars for resistance to natural infection to common smut has been initiated. To date, 126 cultivars have been tested in replicated field trials. A field day is held to present the results each year and the cumulative results over the trial life to growers, fieldmen, seedsmen, consultants, and processors. A written report is submitted to the Oregon Processed Vegetable Commission, major seed producers, and sweet corn processors. Oral presentations have been made to the International Sweet Corn Development Association, the Pacific Northwest Vegetable Association, the Oregon Processed Vegetable Commission, and the Hermiston Farm Fair.

Results
The industry has changed cultivars to those demonstrated to be less susceptible than the two which accounted for more than 80% of the acreage planted 10 years ago. Those susceptible cultivars now account for less than 10% of the acreage, which has reduced the incidence of disease from approximately 45% in 1999 to less than 20% in 2009, reducing losses and increasing returns to the industry.

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 - Improved 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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Cystic ovarian disease (COD) is a serious reproductive problem for dairy producers because the prolonged postpartum interval associated with this disease reduces production efficiency and increases costs.

What has been done

COD predominates as an anovulatory follicular structure that contributes to an extended calving interval. Typically during ovulation, the follicle wall is broken down by extracellular matrix-degrading proteases which include enzymes of the plasminogen activator (PA)-plasmin system. Physiologic regulation of PA activity is effected by PA inhibitors-1 and -2 (PAI-1 and PAI-2). Abnormally high concentrations of follicular PAI could interfere with ovulation because PA activity would be suppressed and may contribute to the anovulatory follicular cyst pathology. To ascertain if PAI-1 is associated with COD, a survey of plasma PAI-1 concentrations was conducted at the Oregon State University Dairy Center of cows diagnosed with follicular cysts and cows with no history of cysts.

Results
This research identified a plasma marker for cows susceptible to this COD disorder that should enable producers to identify and cull these females in a timely fashion, thereby reducing costs associated with management of COD. Cows in the cystic group had higher plasma PAI-1 activities compared to cows in the non-cystic group.

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 - alternative management tools used by private and public sector o Beef producers improve their economic competitive advantage and improve the ecological sustainability of production systems. o Land management protocols will be used in public land management policy decisions. o End users adopt new pesticide and pest management systems and strategies for working with invasive pests o Profitable alternative cereal crops for dryland cropping systems in the PNW o Farmers will more strategically plan for crop production and manure management. o 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. o Green manure crops in combination with reduced nematicide use is likely to be successful, particularly for short season potato crops. CRKN may be managed with crop rotation sequences, including green manure crops, which suppress nematode populations so that no or minimal nematicides are necessary. o District-specific control programs will reduce usage of fungicides with low efficacy and emphasize integrated control practices. o 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. o 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. o 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	Quantitative Target	Actual
2009	2	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New herbicides being advertised and marketed in the Pacific Northwest for use in wheat need to be evaluated for effectiveness and environmental suitability in this region.

What has been done
Several herbicides including pyroxsulam and flucarbazone were tested under eastern Oregon dryland wheat cropping environment. Furthermore, we investigated the efficacy of meadowfoam (Limnanthes alba, an oilseed crop grown in western Oregon) seed meal (MSM) on the control of downy brome (Bromus tectorum), the prominent grassy weed in wheat cropping systems of the PNW. MSM after oil extraction contains 2-4% of glucolimnanthin, a glucosinolate. We also investigated the effect of fermentation of the seed meal on its chemical composition and the effect of the altered composition on downy brome seed germination. Reports and presentations were distributed to stakeholder groups.

Results
Appropriate uses for pyroxsulam are being adopted by PNW wheat producers. The ineffectiveness of flucarbazone for control of downy brome, a major weed of wheat, has been communicated to stakeholders. Additionally, there are new possibilities for the refinement of glucosinolate-containing seed meals, e.g., MSM, for use as bioherbicides in (organic) farming and horticulture.

The work of this project has, for over a decade, been increasing efficiency of herbicide use and reducing losses from weed competition in wheat in the north central region of Oregon (Wasco, Sherman, Gilliam, Morrow, Umatilla, and Wheeler counties), as well as in Union County. As a result, wheat farmers, along with Columbia Basin farmers in Washington, are enjoying an average 1% yield increase for winter wheat. An additional improvement in wheat quality is resulting from the use of a newly developed herbicide-resistant wheat. Using 2005 figures, the region (including Union County) had 745,600 acres in wheat, yielding an average of 57 bu/acre, sold at $3.50/bu. A 1% yield increase and, say, one-half of another 1% for quality increase translates to an estimated $2.2 million/year more in sales revenue. Using 2009 figures, the increase in sales revenue would be nearly double that amount.

4. Associated Knowledge Areas

KA Code	Knowledge Area
111	Conservation and Efficient Use of Water
121	Management of Range Resources
202	Plant Genetic Resources
204	Plant Product Quality and Utility (Preharvest)
205	Plant Management Systems
206	Basic Plant Biology
216	Integrated Pest Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
307	Animal Management Systems
511	New and Improved Non-Food Products and Processes
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 #10

1. Outcome Measures

Action Indicator - 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	Quantitative Target	Actual
2009	1	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The rate of soil loss from surface furrow irrigation in northeastern Malheur County is high. Irrigation-induced erosion is contaminating surface water with sediment, E. coli, and phosphorus. The researchers seek to find irrigation methods and other cultural practices to reduce irrigation-induced erosion. Since the predominant surface furrow irrigation methods make inefficient use of water and fertilizer, more efficient irrigation practices are needed to protect surface water, improve crop yield and quality, and improve input utilization.

What has been done
Drip, sprinkler and furrow irrigation were compared for onion and potato production. Many trials tested polyacrylamide (PAM), straw mulch, and surge irrigation to reduce soil and bacteria losses. Many partners helped make the trials successful. Demonstrations of filter strips and sedimentation ponds have been conducted.

Results
The team 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. 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 in northeast Malheur County. Growers have adopted sprinkler irrigation systems, PAM, sedimentation ponds, and pump-back systems to reduce sediment, bacteria, and phosphorus losses to streams and reservoirs. Straw mulch and PAM substantially reduced irrigation-induced erosion by 90 to 95 percent. Growers are banding together to replace open canals and drain ditches and construct large piping projects to make sprinkler irrigation system conversions feasible.

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 - 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	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Economics and marketing research in this program has two primary roles. The first is to examine how marketing activities and product characteristics affect demand for processed foods and agricultural commodities. Findings from this research help producers and processors, commodity commissions, and others evaluate strategies to increase demand for their products. The second role is assessment of new industry strategies and conditions. A PI on this project conducted a study to explore the bottleneck in meat processing and livestock slaughter in the Pacific Northwest.

What has been done
The PI conducted a processor/producer study of conditions at various slaughterhouses and explored the possibility of reinstituting state livestock inspections.

Results

The survey findings were presented to industry and published in an Extension Report. Based on the findings, the meat processing industry has moved forward to request consideration of state inspection. A variety of stakeholders are working together to overcome the obstacles faced by the meat processing industry, such as rising transportation costs and overbooked processing facilities. Producers were sufficiently motivated to propose a per head fee to help the state fund the inspection process.

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 - 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	Quantitative Target	Actual
2009	0	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Properly accounting for the ecosystem services provided by agricultural land may provide powerful market-based incentives and income for farmers to manage these services. To make these schemes work, however, there need more accessible and easier to use tools for quantifying the value of these services.

What has been done
The research team has designed a distributed computing framework for calculating ecosystem service credits. Farmers interact with this framework through a web-based user interface similar to Google maps.

Results
The team have previewed the tool to several interested parties including the Oregon Department of Environmental Quality and Clean Water Services. They have presented papers describing the tool design at the 2009 annual meeting of the Ecological Society of America and an invited talk at the 2009 annual meeting of the American Fisheries Society. In these papers they demonstrate a general approach and framework for other researchers to construct similar tools for other ecosystem service values.

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 - 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 Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Potato production and consumption in the US have been declining for the past 10 years. This is due, in part, to a shift in markets at the national and international levels, changes in life style, but also to the perception that potatoes are not healthy. Growers, processors, and retailers are re-claiming the health benefits of potatoes and there is great interest (also by the consumers) in improving the health and nutritional properties of potatoes.

What has been done
The Pacific Northwest 'Tri-State' Potato Variety Development Program initiated a breeding effort in 2000 directed towards breeding specialty/gourmet potatoes with value-added including increased nutrition and health benefits. Oregon State University and USDA/ARS (Prosser, WA) took the lead in the effort and the other Tri-State members joined. The process included the following steps: identification and evaluation of parental clones, crossing, multi-year and multi-environment selections and testing (yield, quality, biotic and abiotic stresses, and chemical composition), cultivar releases, Plant Variety Protection (PVP), and generation of Foundation Seed (pre-nuclear minitubers and in vitro plantlets).

Results
Several specialty/gourmet potato clones have been released. A couple of examples in which OSU took the lead include: Purple Pelisse, a purple skin purple flesh fingerling with total antioxidant capacity three times higher than the traditional russet potatoes and Red Sunset, a red skin white flesh potato with total iron content two times higher than the traditional russet potatoes. Purple Pelisse was exclusively sub-licensed (in a competitive way) to a southern-Oregon based potato cooperative, Klamath Basin Fresh Direct, with the goal of maximizing promotion and marketing efforts to introduce this unusual potato in the market place. Nationwide, Tri-State selections and released varieties are currently produced on approximately 16,000 acres of certified seed which represents about 15% of all domestic seed supplies. This acreage has the potential to plant approximately 240,000 acres of commercial potatoes nationwide with an estimated value of $840 million in farm gate value - excluding added value from processing. Those values are likely to increase in the near future thanks, in part, to the release of new value-added clones.

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Annual ryegrass seed production systems have changed significantly from the time when open field burning and no-till planting was a common and important practice in Oregon's Willamette Valley. In recent years, only about 20% of the acreage has been open field burned. Today, a majority of the acreage is managed with conventional

tillage and planting systems. However, the cost of tillage is expensive; thus, alternative no-till and volunteer systems are being used. These systems offer a way to reduce tillage and fuel expenses, and reduce concerns about dust and air quality.

What has been done
A long-term annual ryegrass cropping systems study established in the fall 2005 was continued with the objective to expand nonthermal residue management production options for seed growers. Replicated trials are evaluating chopping the full straw for surface composting as a low-cost alternative to traditional plowing and cultivation for seedbed preparation. Research is also underway to evaluate row-spraying to control the volunteer stand density in the full-straw production option.

Results
This study is designed to evaluate the long-term economics of these various cropping systems in a continuous annual ryegrass monoculture over multiple years. Preliminary results after four years demonstrate that alternating a conventional tillage system with a no-till or volunteer system of production can provide seed yields comparable to continuous conventional tillage, but at a lower cost of production. Continuous no-till production has been a challenge, primarily to slug damage due to the lack of tillage in combination with a delayed planting date. In the volunteer system, plots that were row-sprayed yielded on average 285 lb/acre more than the volunteer solid stand. We estimate that a conventional tillage-volunteer stand cropping system is being used on approxiamtley 10% of the annual ryegrass acreage at this time with additional adoption likely with the additional reduction in field burning allowances.

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

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 and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

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

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			6%	
204	Plant Product Quality and Utility (Preharvest)			5%	
306	Environmental Stress in Animals			5%	
308	Improved Animal Products (Before Harvest)			1%	
311	Animal Diseases			1%	
314	Toxic Chemicals, Poisonous Plants, Naturally Occurring Toxins, and Other Hazards Affecting Animals			9%	
501	New and Improved Food Processing Technologies			1%	
502	New and Improved Food Products			6%	
602	Business Management, Finance, and Taxation			4%	
603	Market Economics			4%	
606	International Trade and Development			4%	
607	Consumer Economics			4%	
702	Requirements and Function of Nutrients and Other Food Components			4%	
703	Nutrition Education and Behavior			9%	
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			9%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			7%	
723	Hazards to Human Health and Safety			12%	
724	Healthy Lifestyle			9%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	3.8	0.0	24.0	0.0
Actual	0.0	0.0	62.5	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	635024	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	6954767	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	11858076	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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. Assessments 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.

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	8950	26700	750	5000
Actual	8950	26700	750	5000

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

Patent Applications Submitted

Year: 2009
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total

Plan	0	80	
Actual	0	58	58

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- DEVELOP 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	Target	Actual
2009	2	0

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	Target	Actual
2009	1	0

Output #3

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH Indicator 2 ...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	Target	Actual
2009	4	0

Output #4

Output Measure

- EFFECTS ON AND PROTECTION OF HUMAN HEALTH and OF ENVIRONMENTAL HEALTH AND ECOLOGY 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	Target	Actual
2009	3	0

Output #5

Output Measure

- PROVIDE 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	Target	Actual
2009	3	0

Output #6

Output Measure

- PROVIDE 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	Target	Actual
2009	1	0

Output #7

Output Measure

- PROVIDE 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 and vegetables

Year	Target	Actual
2009	4	0

Output #8

Output Measure

- PROVIDE 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	Target	Actual
2009	3	0

Output #9

Output Measure

- PROVIDE 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	Target	Actual
2009	2	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Knowledge Indicator 1... Understanding Human Health and Nutrition -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 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. -Identify strategies (message, pricing, foods) that will increase choosing healthful food choices among adolescents and young adults -Develop Distance and Extension education methods to disseminate information regarding food safety, food processing, value-added foods and products, food packaging, and bioproducts.
2	Knowledge Indicator 2... Characterize and model toxins arising from food production and processing -New analytical methods and biomarkers to cost-effectively identify and track agricultural chemicals and other contaminants through time and space -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 -Examine mechanisms that underlie the immune suppression -Model system to evaluate dioxin toxicity to humans and characterize specific responsive genes to toxicants -Identify role of human AhR polymorphisms and role of Arnt in mediating and relieving dioxin toxicity -Identify agents, mechanisms of action, and dose response for reducing fetal risk from toxic chemicals -Develop transgenic lines of zebrafish for response to toxicants -Evaluate effects of aging on bioavailability of agricultural contaminants -Provide technical training and resources to agricultural and regulatory stakeholders on ecotoxicology of pesticides and integrated pest, nutrient, and water management.
3	Knowledge Indicator3... 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
4	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
5	Action - 1. 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.

6	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
7	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.
8	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
9	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
10	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.
11	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
12	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.
13	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.
14	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.

15	Knowledge Indicator 5...Effects on and protection of human health -Better understanding of biosensors used to test food products.

Outcome #1

1. Outcome Measures

Knowledge Indicator 1... Understanding Human Health and Nutrition - 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 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. - Identify strategies (message, pricing, foods) that will increase choosing healthful food choices among adolescents and young adults - Develop Distance and Extension education methods to disseminate information regarding food safety, food processing, value-added foods and products, food packaging, and bioproducts.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	5	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Agricultural subsidies lead to a higher consumption of calorie dense, nutritionally vacant foods which leads to higher rates of obesity and higher medical expenditures.

What has been done
Empirically estimate via elasticity analysis the extent to which agriculture subsidies decrease commodity prices; lower commodity prices in turn lead to a reduction in retail food prices; and a decrease in retail food prices leads to increases in BMI and increases in medical expenditures.

Results
Specifically, we find that medical expenditures are .072 to .116 percent higher and pharmaceutical expenditures are .126 to .203 percent higher than they would otherwise be without US farm subsidies. Dissemination of results to the American Public Health Association Meeting and academic paper under review and "The Twisted Path from Farm Subsidies to Health Care Expenditures" article is under review for Journal of Public Health Policy

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products

703	Nutrition Education and Behavior
723	Hazards to Human Health and Safety
724	Healthy Lifestyle

Outcome #2

1. Outcome Measures

Knowledge Indicator 2... Characterize and model toxins arising from food production and processing - New analytical methods and biomarkers to cost-effectively identify and track agricultural chemicals and other contaminants through time and space - 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 - Examine mechanisms that underlie the immune suppression - Model system to evaluate dioxin toxicity to humans and characterize specific responsive genes to toxicants - Identify role of human AhR polymorphisms and role of Arnt in mediating and relieving dioxin toxicity - Identify agents, mechanisms of action, and dose response for reducing fetal risk from toxic chemicals - Develop transgenic lines of zebrafish for response to toxicants - Evaluate effects of aging on bioavailability of agricultural contaminants - 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	Quantitative Target	Actual
2009	8	96

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Drug abuse is a major problem in Oregon and other states that affects public health. In particular the abuse of methamphetamine has hit Oregon hard. Although actual production of methamphetamine has decline in Oregon, the levels of abuse remain high and trafficking from Mexico to Canada goes through Oregon. Current methods for obtaining hard data on illicit drugs are limited and potentially biased. For example, methods including self-reporting are likely to underestimate numbers of illicit drug users and mortality data are biased toward the more lethal drugs while emergency room reports and poison control center calls decline with time. In addition, the geographic coverage of current surveillance methods is limited.

What has been done
In collaboration with the Associated of Clean Water Agencies (ACWA), Oregon Department of Human Services, a statewide campaign was conducted to demonstrate the capability of using data on illicit drugs including methamphetamine, cocaine, and ecstasy in the wastewater of individual communities. On Tuesday March 2008, 96 wastewater treatment plants around of the state of Oregon, which represented ~65% of the state's population, voluntarily sent samples of their wastewater influent to researchers at Oregon State University. The samples were quantitatively analyzed in order to report each community's average drugs load (mg/person/day), which takes dilution and each community's population into account. Statistical analyses indicated that cocaine use is more prevalent in urban areas with 92% of the communities testing positive for cocaine. Methamphetamine was present in the wastewater from all communities. Ecstasy was found in only 50% of the participating communities with higher use in urban areas over rural areas.

Results
For this project, innovative analytical approaches were developed to simultaneously analyze the trace levels of illicit drugs and their metabolites in raw wastewater. The scientific community at large benefits from this development due to the publication of the work in a peer-reviewed journal, which has already received 4 citations by groups other than this one. In addition, the statewide study was published in the journal Addiction and is a demonstration of the power of the technology for mapping illicit drug use over large geographic areas.
In addition, the researchers achieved improved communication with stakeholders in the state of Oregon including ACWA, which is a non-profit professional association of Oregon's wastewater treatment plants, storm water management, and associated professionals. This organization, which has 120 members statewide, has as its goal the protection and enhancement of water quality in the state of Oregon. ACWA worked with us to recruit the participants. In addition, the Oregon Department of Human Services also collaborated by providing information on the illicit drugs of interest associated with public health concerns in Oregon. The enhanced communication took the form of including stakeholders in the study design and on the disseminating research results to the public and to participating communities. The study received wide interest and media attention from around the state. The story was picked up by a magazine published by the Water Environment Foundation whose members are interested in water quality, management of water resources, water protection, and water and wastewater treatment.

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 #3

1. Outcome Measures

Knowledge Indicator3... 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	Quantitative Target	Actual
2009	2	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
In the U.S., a major proportion of dietary fat is of animal origin. It is of considerable importance to the animal food industry to produce animal products that are health-enhancing and wholesome.

What has been done
Research on incorporating n-3 PUFA and CLA into poultry foods has been conducted.

Results
Published results have indicated that incorporation of n-3 PUFA and CLA in eggs is equal or higher than that reported in marine (n-3 PUFA) or ruminant-derived foods (CLA). Lipid oxidation and deterioration in product quality are major problems with PUFA-modified foods. Collaborating with Dr. M. Traber (Linus Pauling Institute), the PI was the first to report that tocopherol supplementation may be needed to reduce lipid peroxidation in CLA-modified eggs.

4. Associated Knowledge Areas

KA Code	Knowledge Area
308	Improved Animal Products (Before Harvest)
311	Animal Diseases
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components

Outcome #4

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	Quantitative Target	Actual
2009	3	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Improved understanding of markets and market strategies promises to enhance the competitiveness and success of Oregon and U.S. food processors and producers. Analysis of international and domestic food demand and firm strategies as affected by economic conditions, technological change, and demographic characteristics contribute to this needed market understanding.

What has been done
Firm and market behavior and relationships are examined using econometric and other statistical and analytical techniques. Appropriate data are being acquired or developed to test hypotheses about firm and consumer

behavior in economic markets. By measuring consumer and buyer valuation of product characteristics and qualities, the study helps food processors and agribusinesses (and the growers behind them) improve their marketing efforts, for example, by evaluating the effectiveness of their promotional programs and helping determine future marketing strategies.

Results
While it is not possible to quantify the economic outcomes of the several and diverse projects conducted, a few practical examples will illustrate the importance of such marketing research:

Determining whether potential organic food customers are motivated mostly by environmental or health concerns helps marketers design appropriate advertising.

The research on French fry value-by-length is giving Oregon processors a competitive edge in marketing their product.

The wine study of value-by-characteristic gives wine sellers needed information on what product characteristics to emphasize in marketing their product to restaurants.

The state inspection program report will assist producer groups and legislators in evaluating new strategies to improve the sustainability of the livestock industry.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
602	Business Management, Finance, and Taxation
603	Market Economics
606	International Trade and Development
607	Consumer Economics
724	Healthy Lifestyle

Outcome #5

1. Outcome Measures

Action - 1. 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.

Not Reporting on this Outcome Measure

Outcome #6

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	Quantitative Target	Actual
2009	0	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Through the modulation of the maternal diet, the PI seeks to reduce the risk of the fetus to toxic chemicals capable of crossing the placenta.

What has been done
The PI identified agents, mechanisms of action, and dose response for reducing fetal risk from toxic chemicals.

Results
The PI found that supplementation of the maternal diet with indole-3-carbinol (I3C) during pregnancy and nursing can have a marked effect on the risk of her offspring for developing cancer in later life has potential human health significance. I3C is found in cabbage, Brussels' sprouts, cauliflower, kale and other cruciferous vegetables and has shown to be effective against cancer in other models. I3C is also available as a dietary supplement. Characterizing the developmental stage of the fetus/infant that is most susceptible to carcinogens to which the mother is exposed can now help in designing the most effective chemoprevention protocols.

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 #7

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	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Consumers are seeking longer-lasting and healthier food products.

What has been done
Researchers conducted laboratory experiments on lingcod fillets by dipping them into an edible, protective coating enriched with fish oil. The liquid coating contained chitosan, which comes from crustacean shells and can be made into film for food wrapping to keep out bacteria and fungi and prolong storage life. After the coating was applied, some fillets were refrigerated for three weeks while others were frozen for three months.

Results
This study found that the coating tripled the omega-3 fatty acids in the refrigerated and frozen fish when compared against the uncoated fish. Omega-3 fatty acids are essential nutrients, and research suggests that increasing them may have a number of health benefits. The U.S. Food and Drug Administration says specific ones may reduce the risk of coronary heart disease. In addition to increasing the omega-3 levels in the lingcod, the OSU study also found that the coating reduced lipid oxidation, which causes rancidity, in the refrigerated and frozen samples when compared with the uncoated fillets. The coating also kept the fish moister than the uncoated samples as the frozen ones were thawing. Additionally, the coating delayed the growth of microorganisms in the fresh fillets, and it prevented their growth in the frozen ones. These findings will lengthen shelf life of these fish products. The coating did not affect the color of the fillets.

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 #8

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 Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Metabolic and cardiovascular disorders are major cause of mortality and morbidity in meat-type chickens in the U.S.

What has been done
The PI used a metabolic approach to investigate metabolic and cardiovascular disorders in order to find ways to alleviate them through diet.

Results
The researchers demonstrated that maternal dietary lipids have significant effects on inflammatory responses during growth in broiler birds. Results from this research have led to the hypothesis that fatty acid perturbations during development are important determinants of metabolic or cardiovascular pathologies in the progeny.

4. Associated Knowledge Areas

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

Outcome #9

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	Quantitative Target	Actual
2009	0	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
New and existing businesses that develop food products need to ensure these products pass safety standards. Federal regulations require commercial processors of acidified foods or low-acid foods to have a process authority scrutinize their products and processing methods.

What has been done
The PI is a process authority, someone whom the U.S. Food and Drug Authority recognizes as an expert in evaluating the safety of acidified foods or low-acid canned foods. He makes sure the products are sealed properly. He also reviews a written description of how they were processed, such as pressure-cooked or boiled. He then fills out an FDA form that asks for temperature and maximum equilibrium pH. In the case of jams and jellies he dabs a spoonful onto a refractometer to make sure they contain at least 65 percent sugar to qualify as such foods. Addtionally, he'll check for harmful bacteria like E. coli, salmonella and listeria.

Results
Of the approximately 150 products the PI reviewed last year, about 80 percent passed on their first inspection. This service helps Pacific Northwest food businesses become more competitive.

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 #10

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 Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Exposure to dioxins, including 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), causes a wide array of toxicities, which are mostly considered to be mediated through the inappropriate activation of the aryl hydrocarbon receptor (AHR) signaling pathway. This regeneration study is laying a path to developing strategies for human tissue regeneration following disease or injury.

What has been done
The PI conducted comparative toxicogenomic analysis on both adult and larval fins.

Results
The PI has begun to discover the mechanism by which dioxin exposure interacts with organisms and disrupts normal biology. Results revealed that both adult and larval fins respond to TCDD during regeneration with misexpression of R-Spondin1, a novel ligand for the Wnt coreceptor. It was demonstrated for the first time that inhibition of regeneration by TCDD is mediated by misinduction of RSpondin1. Collectively, these results indicate that inappropriate regulation of R-Spondin/LRP6 is absolutely required for TCDD to inhibit fin regeneration. It was also demonstrated that molecular modeling can predict and identify novel ligands for the AHR. The PI is now in a position to use the developed computer model to identify new ligands that may pose a risk to human and in the environment.

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 #11

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	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pesticides represent a broad class of agricultural chemicals that can have adverse environmental impacts and pose health risks to both children and adults. Opportunities for human exposure to pesticides exist in many environments including the home, the workplace, rights-of-way, from their use in agriculture, and public health uses (including vector control). There is a current need for improved surveillance of pesticide exposures, using data that can effectively be relied upon to communicate relevant findings on a regional (statewide) basis and to reduce the risk of adverse impacts on health. Sources of data that combine temporal and spatial information could be of significant utility in the assessment and communication of findings to local public health agencies, and could provide opportunities for primary, secondary, and tertiary prevention. Sources of data that cover wide geographic areas would be particularly useful, as they enhance the inclusion of rural and underserved populations.

What has been done
In collaboration with a Regional Poison Control Center, spatial and temporal data on unintentional pesticide exposures were analyzed for the time period 2001-2005. From these data, the PI identified the zip code and county of the caller, the location where the exposure occurred, the pesticide(s) involved in the exposure incident, and the medical outcome (no effect, minor, moderate, major effects, death). The researcher sought to determine whether there are significant regional differences in the location where serious health outcomes occur from pesticide exposures in Oregon. Data analysis used temporal and spatial scan statistics, which have been previously used in epidemiological studies of cancer and infectious diseases, but only recently have been applied to the study of poisoning incidents. The analysis identified a significant geographic clustering of serious pesticide poisoning incidents occurring in two adjacent counties (one rural and one urban). Individuals living in these geographic were twice as likely to report a serious pesticide exposure incident (moderate, major, and fatality outcomes) in comparison to people living elsewhere in Oregon. The results of these analyses also identified specific classes of pesticides that were more frequently associated with serious outcomes.

Results
This project used innovative research methods (geographic information systems and spatial scan statistics) to improve the understanding of where serious pesticide exposure incidents occur throughout the State of Oregon. The scientific community benefits from this research, as the methods used in this investigation could be easily implemented in other regions of the country. A manuscript describing the methods, results, and conclusions of this study was peer-reviewed and accepted for publication in the journal Clinical Toxicology. In addition to the scientific community, there are other important stakeholders who benefit from this research. In the past year, the preliminary results of this project were communicated at a meeting of the Oregon Pesticide Analytical and Response Center (PARC), a multi-agency panel of regulatory, enforcement, and public health officials who have responsibilities relating to pesticide use in Oregon. A more detailed discussion of this project, including methods and plans for future applications and collaborative interventions, will take place in the coming year. The results of this project present opportunities for primary prevention, including targeting resources and pesticide education efforts towards geographic locations where the need is greatest. The results of this project also present opportunities for secondary prevention, which would include educational interventions for health care facilities in geographic regions where serious pesticide exposure incidents are more likely to occur. When physicians are better prepared to respond to serious pesticide exposure incidents, the risks of further injury to exposure victims

will be reduced. The effectiveness of targeted interventions in reducing disparities in pesticide exposure risks and outcomes will be monitored in the future, using the same innovative research methods described in the current report.

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 #12

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #13

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #14

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #15

1. Outcome Measures

Knowledge Indicator 5...Effects on and protection of human health -Better understanding of biosensors used to test food products.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	{No Data Entered}	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Conventional food safety testing methods, which are based on a specific sequence of DNA or type of protein bacteria produce, cannot directly assess bacterial toxicity, thus there is great potential for a chromatophore cell based biosensor to assist the food industry, particularly those sectors plagued with recalls due to missed bacterial contamination.

What has been done
Through laboratory experiments, the PI discovered that the pigment cells of Siamese fighting fish, Betta splendens, act as a natural alarm -- a "biosensor" -- signaling the presence of toxin-producing bacteria that contaminate food or drinking water.

Results
A chromatophore cell based biosensor, composed of erythrophore cells from Siamese Fighting Fish, detects food and water associated pathogenic bacteria including, Salmonella enteritidis, Salmonella typhimurium, Bacillus cereus, Clostridium perfringens, Clostridium botulinum and Escherichia coli 0157:H7. A chromatophore cell based biosensor, composed of melanophore cells from Chinook salmon, detects fish bacterial pathogens, including, Aeromonas salmonicida, Carnobacterium piscicola, Flavobacterium psychrophilum and Yersinia rucker. Characterization of the specific interactions between chromatophore cells and food associated pathogenic bacteria revealed it is the toxic behavior of the pathogenic bacteria that induces a response in the chromatophore cell based biosensor. This will help limit food-borne illnesses and spare lives while potentially saving companies millions in unnecessary recalls.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
723	Hazards to Human Health and Safety

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 and Data Collection)

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)

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

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			8%	
102	Soil, Plant, Water, Nutrient Relationships			6%	
103	Management of Saline and Sodic Soils and Salinity			5%	
112	Watershed Protection and Management			9%	
121	Management of Range Resources			5%	
125	Agroforestry			2%	
135	Aquatic and Terrestrial Wildlife			8%	
136	Conservation of Biological Diversity			8%	
201	Plant Genome, Genetics, and Genetic Mechanisms			7%	
212	Pathogens and Nematodes Affecting Plants			6%	
215	Biological Control of Pests Affecting Plants			6%	
302	Nutrient Utilization in Animals			2%	
303	Genetic Improvement of Animals			2%	
311	Animal Diseases			5%	
604	Marketing and Distribution Practices			2%	
605	Natural Resource and Environmental Economics			8%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			5%	
723	Hazards to Human Health and Safety			6%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of professional FTE/SYs expended this Program

Year: 2009	Extension		Research	
	1862	1890	1862	1890
Plan	1.6	0.0	31.1	0.0
Actual	0.0	0.0	72.9	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	574447	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	6291335	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	13902147	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

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

General public and those in natural resource-based communities, including ranchers and fishermen.

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.

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

V(E). Planned Program (Outputs)

1. Standard output measures

2009	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	32850	97500	1260	41050
Actual	32850	97500	1260	41050

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

Year: 2009
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2009	Extension	Research	Total
Plan	0	76	
Actual	0	140	140

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- EFFECTS ON AND PROTECTION OF ENVIRONMENTAL HEALTH AND ECOLOGY - Indicator ...ecological studies - compare information gained through life history information synthesis, molecular genetic laboratory analyses, otolith elemental and isotopic analyses to evaluate fish life history variations and migration behaviors (Miller) - characterize for marine resource managers seasonal distributions of endangered great whales and characterize their year-round critical habitats (Mate) - fluxes of energy and mass in soils - how abiotic and biotic factors influence 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 - functional groups and a functional group key for meadow riparian systems - riparian relationships and issues associated with livestock grazaing - 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	Target	Actual
2009	32	32

Output #2

Output Measure

- PROVIDE ADDITIONAL UNDERSTANDING FOR PLANT AND ANIMAL PROTECTION FROM DISEASES AND PESTS - experiments to determine control of diseases and pests: - 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. - harm reduced from invasive plant species like ragwort or purple loosestrife, through biological control - host abundance, heterogeneity, and spatial structure influence on the spatiotemporal spread of disease. - does increased focus size speeds 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 - characteristics of and changes due to zebrafish and salmonid diseases - 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	Target	Actual
2009	15	15

Output #3

Output Measure

- CARRY OUT STUDIES TO DECIPHER GENOMES, GENETICS AND MECHANISMS OF PLANTS AND ANIMALS - 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) - develop selective breeding program, repository, and resource center for various desirable traits of Pacific oysters (Langdon) - identify aspects of biology and biotechnology of viruses and bacteria that affect human health - identify characteristics of food and water systems

Year	Target	Actual
2009	2	10

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	Target	Actual
2009	2	2

Output #5

Output Measure

- PROVIDE TECHNICAL, ECONOMIC AND MARKETING MODELS AND ANALYSES THAT INFORM DECISION-MAKERS, INDUSTRY, AND PEERS...Indicator - develop models. - to assess changes in policies that influence supply and cost of water in agricultural and non-agricultural uses - to assess market mechanisms governing water and private land-use decisions - for riparian zones that incorporate different ecological processes than upland models (sate-and-transition models) - characterize sagegrouse habitat, e.g., a new and simplier 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. - 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	Target	Actual
2009	17	17

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	Target	Actual
2009	10500	10500

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Knowledge Indicator 1 - New tools, models -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 i -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 -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. -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. . -traceability and case studies for seafood
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 4 - Environmental and ecological management -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 -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. -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.
5	Knowledge Indicator 5 - Basic information on ecosystem -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. -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. -fluid movement though soils, -biogeochemical recycling in soils, -carbon and nitrogen cycling in soils, -microbial diversity in soils, -soil-landscape evolution.
6	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
7	Action Indicator 1 - Better decision-making, behaviors, and policies. -Researchers investigate, compare, and integrate the environmental and economic impacts of various land-use policies -Farmers learn how to use water more efficiently -Changes in behavior, practices, decision-making, policies with respect to invasive species and biological control -establish management and conservation/restoration efforts for salmonids, Pacific rockfish, Pacific herring, and shellfish -better conservation practices, reduce mortalities, and promote population recovery of whales -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 -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. -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. -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.
8	Action Indicator 2 - Improved technologies and practices -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

-Performance of complex microparticle types that provide nutrients to marine larval fish
-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
-Research on fluid flows in soils will allow for better waste material containment facility design.
-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
-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.

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 -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 -Provide more sustainable approaches for managing plant disease. -Restored health and stability to marine food webs -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. -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 -Nuclear and other waste storage will be safer. -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 resources use or restoration of ecosystems with positive impacts on social, economic, and environmental conditions.
12	Societal Changes -more enlightened populace with regard to the value of habitats and conservation.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	8	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The goal is to determine if disease spread and effects of landscape variables are similar at different climatic, spatial and temporal scales.

What has been done
This is being addressed in a number of ways. First, in wheat stripe rust experiments, the researchers are comparing the spatiotemporal spread of disease scaled as absolute distance (meters) in comparison to when scaled as focus widths to determine if epidemics can be scaled to initial focus size. The most rigorous comparisons were those in which all dimensions of plots, initial foci and distance between sampling points were scale up by a factor of four. The team is investigating in these experiments scaling by the proportion of susceptible plants present per unit distance. Landscape variables in the wheat stripe rust experiments are being compared with larger-scale data obtained by our collaborators for the spread of soybean rust in the mid-western and eastern U.S. The team also developed a simple model to describe accelerating velocities of epidemics caused by pathogens with 'fat-tailed' dispersal kernels. The model assumes decline of inoculum over distance by an inverse power law, and thus is scale invariant. The model was applied to diseases caused by pathogens that are wind-dispersed or vectored by birds: the within-season spread of a plant disease at spatial scales of <100 m in experimental plots, historical plant disease epidemics at the continental scale, the unexpectedly rapid spread of West Nile virus across North America, and the transcontinental spread of avian influenza strain H5N1 in Eurasia and Africa.

Results

Epidemics were highly similar when scaled by focus and this result has been very consistent over data sets. The researchers also found a very good relationship when scaling by the number of susceptible plants per unit distance for the first data set analyzed, though it is less clear if this relationship will be as consistent as that for effect of focus size discussed above. When applying the model of disease spread to empirical data sets, the position of the epidemic front advanced exponentially with time and epidemic velocity increased linearly with distance in all cases. Regression slopes varied over a relatively narrow range among data sets. Estimates of the inverse power law exponent for dispersal that would be required to attain the rates of disease spread observed in the field also varied relatively little (1.74-2.36), despite more than a five-fold range of spatial scale among the data sets.

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	Quantitative Target	Actual
2009	0	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
How can policymakers encourage firms to reduce environmental violations and to do more than regulations require?

What has been done
The study examined why some firms violate environmental regulatory standards while others exceed them. Data from a recent survey that 689 businesses in Oregon answered were used in the analysis.

Results
The investigator found that a business is more likely to "over-comply" with environmental regulations if its senior management believes in protecting the environment and that it makes financial sense in the long term. "The results suggest that a narrow strategy to promote environmental over-compliance may not fare well," Professor Wu said. "For example, offering technical and financial assistance to reduce compliance costs may be offset if these policies reduce competitive pressures. It's apparent that policymakers must avoid a one-size-fits-all approach and be innovative when designing environmental policies."

"It's surprising that management's attitude toward environmental stewardship plays such a large role," Wu said. "Historically, economists believe that profit drives business decisions, but we've found that management's attitude affects a firm's decision about its compliance level. This doesn't mean, however, that profits don't play a role.

"It's also surprising that executives are willing to think beyond next quarter's earnings and spend money to adopt some environmental policies that might not benefit the company until perhaps much later."

Other key findings of the study are:

* Pressures from consumers, investors and interest groups have no statistically significant impact on a firm's decision to violate or comply with environmental regulations. However, facilities that make products that are sold directly to consumers or offer services directly to them are less likely to violate the regulations.

* Competitive market forces are significant factors in deterring environmental violations. These forces include investing in cleaner products to differentiate them from another company's, improving environmental performance to keep up with competitors, and being environmentally responsible to reduce employee turnover and increase productivity.

* Costs and risks associated with environmentally friendly practices increase the probability of environmental violations and decrease the likelihood of environmental over-compliance. These costs and risks include high upfront investments, high day-to-day costs, uncertain future benefits, and downtime and delivery interruptions during implementation.

* Smaller firms (ones with annual revenue of no more than $5 million) and publicly traded companies are more likely to violate environmental standards than companies that are bigger and privately owned.

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	Quantitative Target	Actual
2009	6	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There is a need for improved control of fire blight of pear and apple. Integrated biological and chemical control shows great promise as a means of controlling blight.

What has been done
Three major objectives were undertaken. The first concerned development of integrated biological and chemical control programs for fire blight. The second concerned suppression of fire blight with a high frequency biological program designed to allow for fruit export to the European organic markets. The third objective was concerned with rapid and early detection of the fire blight pathogen using the molecular technology, loop-mediated isothermal amplification (LAMP).

Results
The PIs speculate that an integrated biological and chemical control approach reduces pathogen establishment, then suppresses pathogen growth rate, which allows flowers to progress through their natural developmental stages from highly susceptible to less susceptible before the pathogen attains a sufficient population size for infection. Integrated biological and chemical control can be practiced currently with registered products, and in the experiments, was also highly effective when a biological agent preceded the experimental chemical material, kasugamycin. Under current US National Organic Program regulations, antibiotics (streptomycin and oxytetracycline) are permitted on pome fruits for control of fire blight, but they are not permitted for European Union (EU) organic fruit markets. Using EU allowable materials, it was found that increasing the frequency of applications (e.g., from twice to four times) improved fire blight suppression in both apple and pear. Moreover, it was found that lime sulfur, which is used as a bloom thinner in organic apple production, also provides some suppression of fire blight. Future efforts will focus on integrating the timing of biological treatments with lime sulfur treatments, in both low frequency and high frequency biocontrol programs. LAMP-based scouting has potential to contribute to management of fire blight of pear and apple by informing orchardists when and where the pathogen is active prior to an infection event. LAMP is a simple DNA amplification technology that does not require special equipment (i.e., a thermocycler and electrophoresis rig are not required). In surveys of commercial pear and apple orchards located in CA, OR, WA and UT, LAMP detected the fire blight pathogen in flowers sampled from four of nine orchards in 2008 and 18 of 27 orchards in spring 2009. In general, fire blight occurred in those

orchards in which the pathogen was detected early (19 0f 20), and did not occur when the pathogen was not found (12 of 14).

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
201	Plant Genome, Genetics, and Genetic Mechanisms
212	Pathogens and Nematodes Affecting Plants
215	Biological Control of Pests Affecting Plants
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

Knowledge Indicator 4 - Environmental and ecological management - 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 - 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. - 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	Quantitative Target	Actual
2009	1	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Human reliance on marine resources in the United States and most of the rest of the world continues to grow, while efforts to manage and protect these resources encounter increasingly difficult challenges, including, for example, a changing climate and a higher demand for extraction. Management structures are almost necessarily based on only a limited understanding of what a particular marine species requires to successfully live, grow, and reproduce. This, in turn, is due to the time and resources needed to gather sufficient information on any single species to make the best management decisions with the ability to adaptively respond to changes within that species and the environmental conditions it encounters. To address this informational gap, this project examines aspects of the life history of certain individual fish species. A species' life history includes characteristics, such as, how long it lives, how often it reproduces, how many offspring it has, and its migration patterns. While genetic tools

provide valuable information over evolutionary time scales (1000s of years) and large ecosystems. However, human society and natural changes can affect populations over much shorter, ecological time scales (10s of years). Thus, different tools are needed to provide the information relevant to establishing management strategies and practices across much shorter time frames.

What has been done

Pacific salmon display a tremendous amount of life history variation, that is, they have found many ways to "make a living." Managing for diversity is a challenge that could lead to negative economic impacts, and, over time, some diversity is lost. However, not accounting for and maintaining diverse ways that a species "makes a living" can negatively affect the ability of populations to maintain themselves. Informed trade-offs are required to maintain sustainable fisheries and their associated coastal communities. By providing information on the life history diversity (i.e., who makes a living doing what in a population) can contribute to determining which tradeoffs have the greatest likelihood of success.

To illustrate the complications encountered in studying just one species, consider that Chinook salmon juveniles migrate to the ocean in either their first or their second year of life depending on the conditions in their freshwater and marine environments. But the time and size at which they enter the ocean significantly affects their survival rate. The project is examining the variation in the size and timing of ocean migration of juveniles to better understand how their migration patterns interact with freshwater and marine conditions and influence their survival to reproduction.

Results

If there is relatively little exchange of individual fish among populations each year, the potential impact of harvest on that population is much greater than on populations that receive members from a wide geographic area each year. Also, in some cases, management actions can promote a certain fish behavior. It is possible that some important aspects of a species' life history are not supported by current management practices.

This research demonstrated that some assumptions about management actions for Chinook salmon were not being met. There is evidence that maintaining a diversity of behaviors may be what allows a population to maintain itself over time and climatic conditions. (In some ways, this concept is similar to diversifying an investment portfolio to maintain a certain level of resources during times of economic hardship.) Therefore, this project works to measure and highlight the variation that is occurring within managed populations to have a better understanding of how management practices may be affecting that diversity.

This study's approach promises to provide the more intricate detail needed to guide more effective protection actions.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
121	Management of Range Resources
125	Agroforestry
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
303	Genetic Improvement of Animals
311	Animal Diseases

605 Natural Resource and Environmental Economics

Outcome #5

1. Outcome Measures

Knowledge Indicator 5 - Basic information on ecosystem - 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. - 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. - fluid movement though 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	Quantitative Target	Actual
2009	10	5

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
It has been said that soil is the great regulator of our atmosphere and has been, in fact, looked at throughout this past decade for its role in vapor transport, carbon sequestration, nitrogen exchange, and many other processes. But, one arena that has been heretofore ignored is earth fractures, e.g., soil cracks that are open to the atmosphere, and the effect these have on atmospheric dynamics. Historically, fractures have been studied merely as participants in aquifer recharge providing contamination routes during periods of infiltration or as drying avenues of the soil profile leading to plant drought stress. By and large, their role in atmospheric gas exchange has been overlooked.

What has been done
During the past four years the PI has been investigating the role that soil cracks have on mass and energy transport between the vadose zone and the Earth's atmospheric boundary layer through theoretical, laboratory and field work.

Results
We have found that cracks can play a profound role in enhancing vapor exchange. In brief, the presence of only one isolated fracture per square meter of land surface is capable of exhaling an additional 0.5-2 times the amount of vapor normally evaporated from the soil surface in one day. How does this mechanism work? In one word, convection. The sun's heating of the Earth's surface propagates into the soil profile so slowly that at night warm air deep inside cracks becomes less dense than atmospheric air. When the atmosphere cools at dusk, air within the crack is warmer and convects much like the overturning of lake water in winter. Venting of warm, moist air from the crack and entrainment of cool, relatively dry atmospheric air continues unabated until dawn. In brief, fractures breath at night, as opposed to the soil surface that exhales during the day. And, peak exhalation from fractures occurs in winter rather than summer. These factors mean that the role of cracks changes four important features of soil-atmosphere exchange: magnitude; depth of source material; diurnal timing; and seasonal timing. The understanding of this mechanism and having characterized its role in vapor exchange, opens the door to other investigations, such as its impact on the exchange of other critical atmospheric gases, on microbial activity

within soil, and on the control of soil salinization in agricultural fields. This is a valuable direction for future soil-atmosphere scientific research.

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
201	Plant Genome, Genetics, and Genetic Mechanisms

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	Quantitative Target	Actual
2009	12	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
High mortalities of oysters frequently occur in summer resulting in millions of dollars of lost harvests. The USDA-funded Molluscan Broodstock Program was initiated in 1996 to genetically improve yields of the Pacific oyster by improving their survival and growth.

What has been done
The Hatfield Marine Science Center is developing superior oyster broodstock that will help the Oregon and other

West Coast oyster hatcheries increase production and have oyster lines that better survival during warmer summer temperatures. Several parental inbred lines of high-performing MBP families (Adam and Eve) were released to two commercial hatcheries. The hatcheries produced eyed-larvae that were then sold to nursery operators and growers.

Results
The hatcheries and nurseries reported excellent survival and growth of oyster larvae and seed compared with larvae from non-selected broodstock. The spat have been planted and their performance in grow-out will be monitored.

The U.S. West Coast oyster production has an annual dockside value of $68 million. Faster-growing oysters from selected broodstock could increase this value by 10%, or $6.8 million/year. Also, genetic improvement is likely to be cumulative over generations, resulting in increased production value year after year. Product quality could also improve--i.e., better tasting, better appearing oysters. Faster-growing oysters will mean more rapid production cycles, and, in turn, better economic use of grounds and other facilities. And with shorter production cycles, production costs would decrease. Also, as a result of the oyster broodstock project, oyster exports to Asia and shipments to the U.S. East Coast may increase, benefiting Oregon's economy.

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 1 - Better decision-making, behaviors, and policies. - Researchers investigate, compare, and integrate the environmental and economic impacts of various land-use policies - Farmers learn how to use water more efficiently - Changes in behavior, practices, decision-making, policies with respect to invasive species and biological control - establish management and conservation/restoration efforts for salmonids, Pacific rockfish, Pacific herring, and shellfish - better conservation practices, reduce mortalities, and promote population recovery of whales - 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 - 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. - 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. - 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.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	2	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Policies regarding differences between hatchery and wild fish have been contentious in the past. Scientists seek to discover more information about the physiological differences between hatchery and wild fish so that policy makers may be better informed about the issue.

What has been done
The research team has led a number of research projects at the Oregon Hatchery Center, directed to investigate the mechangisms of the differences in behavior between hatchery and wild salmon. The PIs also participate in the full rante of collaborative research projects at the ORHC. These range from detailed studies of molecular genetics to investigations of the impacts of climate change, food webs and early development of salmon.

Results
Results of this collaboration have established the critical nature of coastal estuaries as the primary location for smolt mortality. The results from this study will refine the monitoring programs of Oregon Department of Fish and Wildlife and other agencies for interpreting freshwater and marine survival of coastal salmon and steelhead populations and ultimately policy decisions. Results from research studies at the OHRC are regularly published in a variety fo scientific journals and monographs and continue to change the understanding of the mechansims producing differences between hatchery and wild fish.

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 2 - Improved technologies and practices - 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 - Performance of complex microparticle types that provide nutrients to marine larval fish - 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 - Research on fluid flows in soils will allow for better waste material containment facility design. - 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 - 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	Quantitative Target	Actual
2009	3	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Since 2006, some Pacific salmon stocks have decreased to only a fraction of their normal population, resulting in large area closures, significant harvest reductions, and declarations of "Salmon Disasters" by the West Coast Governors and NOAA. Economic impacts have totaled more than $300 million to businesses and communities that depend on healthy salmon runs.

What has been done
The Oregon Salmon Commission, the National Marine Fisheries Service, the Oregon Department of Fish and Wildlife, the Community Seafood Initiative, and Oregon State University's Coastal Oregon Marine Experiment Station formed a partnership to find solutions to the "salmon disaster." Titled Project CROOS (Collaborative Research on Oregon Ocean Salmon) the partners focused on improving management of weak salmon stocks by using "real time" genetic information to identify stock structure and migration patterns base on fine scale spatial and temporal information. Combined with oceanographic data, this information will be used to direct fishermen to areas with proportionately higher levels of healthy stocks, avoid areas of weak stocks, and reduce the need for costly coast wide fishery closures. Over the last three years, CROOS has worked with more than 150 salmon fishermen and have piloted new concepts in science, technology, and data sharing that have enabled fishermen to harvest over 10,000 salmon while also logging location, time, oceanographic conditions, and tissue samples for analysis. This data has been mapped and analyzed and the CROOS Group is developing information support systems including electronic data loggers, data storage and distribution systems, bar coded tags, kiosks, and interactive websites to improve marketing and management (www.PacificFishTrax.com).

Results
The project has helped to retain more than 170 fishing and fishing related jobs and more than a $1 million in exvessel revenue. Workshops have helped train over two hundred fishermen in research protocols and project findings. Almost 10,000 fish have been marketed using project bar codes that assist the marketplace in tracking

product and the location and timing of the harvest. More than $15,000 of product has been sold through test pilot electronic kiosks in Portland area retail stores that link consumers directly with product information. ProjectCROOS and PacificFishTrax have become brand names to support science and seafood marketing consistent with creating a broader community interested in local sustainable fisheries. A "real time" fishery information system is being completed that will fundamentally change management approaches for developing, transmitting, storing, and sharing fishery information.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife
302	Nutrient Utilization in Animals
604	Marketing and Distribution Practices
605	Natural Resource and Environmental Economics
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	Quantitative Target	Actual
2009	1	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Bacterial cell-to-cell signaling, termed quorum sensing, has emerged as a new field in microbiology. Individual bacteria use chemical signals to communicate with each other and coordinate group activities. The best understood signaling system employs diffusable acyl-homoserine lactone (acyl-HSL) molecules that are made by an acyl-HSL synthase and are bound by a cognate receptor that acts as a transcriptional activator. There are now over 70 known examples of such components in bacterial species. The opportunistic human pathogen Pseudomonas aeruginosa serves as a model system to study quorum sensing gene regulation. It employs two complete acyl-HSL signaling systems and one orphan receptor to control the expression of large, overlapping sets of target genes (Fig. 1). In addition to its function as a global regulator of gene expression, quorum sensing in P. aeruginosa is also important for virulence and the formation of biofilms, surface-associated bacterial communities, which have been implicated in chronic persistent infection. As such, quorum sensing has become an important target for antimicrobial and antibiofilm strategies.

What has been done

The PI investigates the molecular mechanisms of quorum sensing gene regulation in Pseudomonas aeruginosa, including the identity of target genes, promoter specificity, quorum signal binding, integration of quorum sensing

into cellular physiology, and the role of the two quorum sensing systems for group behavior. He is also interested in the evolution of cooperative traits and the ecological context of cell-cell signaling in bacteria. He has begun to explore this aspect by characterizing defectors that do not engage in social behavior. In P. aeruginosa, such cheaters emerge in the form of lasR mutants that cease production of extracellular quorum-controlled factors and take advantage of their production by the group.

Results
Results from these projects contribute to the understanding of bacterial diversity in chronic infection, and contribute to the understanding of the molecular mechanisms governing communication and virulence gene regualtionin the bacterial pathogen P. aeruginosa.

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 - 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 Condition Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2009	0	2

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

The Pacific oyster industry on the West Coast, U.S. was established about 100 years ago. The oyster is the most important cultured marine species on the West coast with an estimated annual dock-side value of $85 million. The industry mainly depends on either production of larvae from commercial hatcheries or capture of wild seed from Willapa Bay, Washington. Recently, there appears to have been a change on oceanographic conditions that has resulted in a lack of natural oyster seed supplies in Willapa Bay and greatly reduced production of oyster larvae from some major commercial hatcheries. This lack of sufficient larvae has resulted in many oyster growers not being able to plant enough seed to sustain long-term production.

What has been done

The research hatchery at the Hatfield Marine Science Center (HMSC), Newport, first noticed deterioration in water quality in 2005 that adversely affected an oyster breeding program. (the USDA/NIFA funded Molluscan Broodstock Program). A multi-phase seawater treatment system was developed and installed to improve water quality. In 2007, one of the three major hatcheries on the West coast, the Whiskey Creek Hatchery (WCH) located at Netarts Bay, Oregon, reported major problems in rearing larvae. In early 2008, the seawater treatment system developed at HMSC was installed at WCH and a series of bioassays were conducted at HMSC in order to discover additional water-treatment methods to restore water quality. In spring 2009, a proposal was funded by the Washington Department of Fisheries and Wildlife to monitor water quality at WCH and Willapa Bay (co-PI's Dan Cheney, Alan Barton, Burke Hales, Alan Trimble).

Results

The multi-phase water treatment system installed at WCH improved water quality in the first 6 months of 2008; however, strong upwelling events after July 2008 resulted in high larval mortalities. In addition, for the fourth and fifth years running, there was no natural set of wild seed in Willapa Bay in 2008 and 2009. Water chemistry analyses in 2009 indicated that the presence of upwelled water, characterized by low pH values (<7.9) and high concentrations of dissolved carbon dioxide, was correlated with high larval mortalities. However, in the afternoons during upwelling events, photosynthesis by estuarine plants reduced concentrations of dissolved carbon dioxide and raised the pH, resulting in improved water quality for larval rearing. Bioassays conducted at HMSC indicated that oyster larvae are very sensitive to seawater super-saturated with air (as measured by oxygen concentrations), supporting the hypothesis that high concentrations of dissolved carbon dioxide during upwelling events were responsible for poor larval performance. The hatchery at HMSC and WCH have implemented procedures to reduce concentrations of dissolved carbon dioxide in oyster larval cultures during upwelling events and future projected increases in ocean acidification resulting from elevated atmospheric concentrations of carbon dioxide. These measures should help ensure long-term hatchery supplies of larvae for the West Coast oyster industry.

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 - Provide more sustainable approaches for managing plant disease. - Restored health and stability to marine food webs - 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. - 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 - Nuclear and other waste storage will be safer. - 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 resources use or restoration of ecosystems with positive impacts on social, economic, and environmental conditions.

Not Reporting on this Outcome Measure

Outcome #12

1. Outcome Measures

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

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.)
- null

Brief Explanation

{No Data Entered}

V(I). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Case Study
- Comparisons between program participants (individuals, group, organizations) and non-participants

- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}