

2008 Washington State University Research Plan of Work

I. Plan Overview

1. Brief Summary about Plan Of Work

The goal of the Washington State University Agricultural Research Center (ARC), the Agricultural Experiment Station of the State of Washington, is to promote research beneficial to the citizens of Washington. The ARC recognizes its unique land-grant research mission to the people of Washington and their increasing global involvement. The ARC provides leadership in discovering and accessing knowledge through high-quality research that contributes to the safe, abundant food and fiber supply; promotes the well-being of individuals, families, and communities; enhances sustainability of agricultural and economic systems; and promotes stewardship of natural resources and ecological systems.

In Washington, the agricultural system is very diverse and includes over 300 crops. Washington is rich in natural resources and is graced with great scenic beauty. Agriculture remains the largest business in Washington, maintaining high levels of exports of agricultural crops, particularly to the Pacific Rim countries. Washington is known for its apples, wheat, livestock, milk and milk products, and horticultural industries. Although most of the farmland of the state is found in Central and Eastern Washington, the majority of the population of the state remains on the west side of the Cascade Mountains in a corridor roughly following Interstate highway 5 from the Canadian border south to Vancouver, Washington. Western Washington is home to an extraordinarily diverse agriculture in an expanding urban environment in which local food systems have become quite important.

A number of years ago, as a result of diminishing legislative monetary support to the University, the Agricultural Research Center chose to narrow the focus of its research to the food system of Washington and the needs of the stakeholders in this system. As a result of this focus, we find ourselves examining both conventional and organic agricultural production systems with regard to economic and environmental sustainability. We are maintaining a strong emphasis on basic sciences and are translating our findings into practical applications. Recently, we added important programs in viticulture and enology because Washington has the second largest wine industry in the country---a growing topic of research.

In parallel, new buildings are being constructed in our precinct of the campus to house the integrated biotechnology aspects of our program. A new emphasis in horticultural genomics has been put in place. As a result of emphasis on water-conservation in the west for multiple uses, including crops, we find our economists critically examining the various aspects of water use and conservation. The biological systems engineers are working on precision systems for the delivery of that water most beneficially to produce not only the best outcome for the farmers, but to preserve the land. Integrated pest management is emphasized. The millions of tons of biomass generated by our agricultural enterprises and the commitment to create a bioeconomy in Washington State have resulted in an increased effort to develop technologies and processes to convert a wide range of Washington-based biomass feedstocks to products and fuels. We hope to capitalize on many aspects of the Washington agricultural system to benefit our stakeholders, to increase rural vitality, and to preserve our abundant natural resources.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	479.9	0.0
2009	0.0	0.0	479.9	0.0
2010	0.0	0.0	479.9	0.0
2011	0.0	0.0	479.9	0.0
2012	0.0	0.0	479.9	0.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- Expert Peer Review
- Other (individual external peer reviewers from within or without the university)

2. Brief Explanation

Agricultural Research Center (ARC) projects are written by individual faculty members and are submitted first to their department chairs. The department chair reviews the submission and ascertains whether the topic of the research is consistent with departmental and College goals and sends the individual ARC project out for internal and external review. The reviewers are asked whether the research is current and will advance the field of study. They are invited to offer suggestions for improvement and to identify the strongest and weakest points of the proposal. After comments are received from the reviewers, the chair assembles the commentary and submits it to the faculty member. The faculty member then revises the project and the Chair submits the project to the Agricultural Research Center where it is reviewed by either the Director or the Associate Director. After that final review, it is sent on to the USDA-CSREES for review by the respective National Program Leader. When approval is final, the project is entered into our database and into the CRIS system.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

The merit review process of ARC projects (which involves internal and external peer review) along with the collective input from our stakeholders plus the CSREES guidelines, and the WSU College of Agricultural, Human and Natural Resource Sciences strategic plan, and benchmarks inform us of the issues of strategic importance. Our review and approval process remains sensitive to the critical issues.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

We have attempted to address the needs of underserved groups by having a diverse Advisory Council. There are also ARC research projects that touch on the needs of minority groups. The Department of Community and Rural Sociology monitors the changing social dynamics in WA due to the influx of Hispanic populations. The Food and Environmental Quality Laboratory (FEQL) has been monitoring cholinesterase levels in orchard workers, who are mainly members of minority groups. More of the outreach to minority groups is described in the WSU Extension Plan of Work.

3. How will the planned programs describe the expected outcomes and impacts?

ARC projects are three years in duration in accordance with the wishes of the Washington Legislature. Although there may be results during the first year of a project, it would be more likely that the outcomes would occur later, perhaps even during the extension of the project. The projects are reviewed to see whether the objectives are worthy and will lead to results and whether they are in accordance with the College plan and will fulfill the benchmarks within the department and College.

4. How will the planned programs result in improved program effectiveness and/or efficiency?

Although the research arm of CAHNRS, the Agricultural Research Center, and the WSU Extension are in separate colleges, efforts are made to collaborate on programs. Sometimes this is achieved by faculty members having split appointments in both research and extension. The work of a number of programs is accomplished by persons with dual appointments (research/extension).

IV. Stakeholder Input

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

- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to traditional stakeholder groups
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder groups

Brief explanation.

The College of Agricultural, Human and Natural Resource Sciences (CAHNRS) has an advisory council which meets two to three times annually to review the programs of the College, and in so doing, comments on the research being performed in the Agricultural Research Center. The Advisory Council has a broad and diverse membership of recognized leaders and currently includes twenty persons from various segments of our stakeholder group including: agribusiness – supply marketing and finance, the Alumni Association, youth and family organizations, farm labor, the wine industry (viticulture and enology), students, farmers, organic agriculture, 4-H and youth programs, the apparel sector, the Native American tribes, the Washington Department of Agriculture, the Department of Natural Resources, cattlemen, the lumber industry, counties, community colleges and the chemical industries (serving the farmers). The purpose of the advisory committee is to assist the Dean and Directors in identifying and developing broad-based programs and priorities to promote excellence within the College. A second purpose is to communicate with clientele groups so that there is active support for the budget and programs of the college; and so that appropriate interest groups will advocate for the College in the Legislature. The group also periodically examines short-term issues facing the College. We also ensure a broad geographical representation from across the State. Members serve three-year terms. A new structure for the Advisory Council is now under consideration, but its exact makeup is not known at this time. An update on this portion of the Plan of Work will be made next year.

In addition to receiving advice from the members of the Advisory Council, the dean and directors routinely attend many commodity commission meetings and are in close touch with members of those industries. Advisory groups are attached to the Wine Advisory Committee, the Food and Environmental Quality Laboratory and the Center for Sustaining Agriculture and Natural Resources. We hold research reviews for the majority of our federal and state initiative projects at which the stakeholders may critique the work and make suggestions for future endeavors. We are also involved in annual research reviews with many of our state's commodity commissions. We are connected to the organic and sustainable agriculture movement by attendance at meeting of the Washington Sustainable Food and Farming Network. This year and in past years we have held public listening sessions around the state concerning our new initiative to the State Legislature. The CAHNRS maintains several Research and Extension Centers across the state, (Puyallup, Mt. Vernon, Wenatchee, Prosser) where the faculty and staff work very closely with clientele on specific regional problems. The Centers are visible reminders of the presence of the WSU Agricultural Research Center and CAHNRS. The Departments within the College maintain their own advisory committees and thus receive feedback about their respective research disciplines.

2(A). A brief statement of the process that will be 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 External Focus Groups
- Open Listening Sessions
- Use Advisory Committees
- Use Internal Focus Groups

Brief explanation.

We use our Advisory Committee as described in the previous paragraph plus internal and external focus groups. Recently, we have been holding open listening sessions to gain input for the new initiative to the Legislature. It is important to identify the stakeholder concerns, and the listening sessions have been particularly valuable in the past and also in the present.

2(B). A brief statement of the process that will be 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 invited selected individuals from the general public
- Meeting specifically with non-traditional individuals
- Meeting with traditional Stakeholder groups
- Meeting specifically with non-traditional groups
- Meeting with traditional Stakeholder individuals

Brief explanation

The Advisory Committee (described previously) which derives from a broad base is part of the process of collecting stakeholder

input. The dean, associate deans, director and associate director routinely travel throughout the state and in doing so meet with both traditional and non-traditional stakeholders. Our system of Research and Extension Centers in addition to the presence of our WSU Extension Partners in every county of the State enable wide traditional and non-traditional input to be heard and assessed and incorporated into our plans..

3. A statement of how the input will be considered

- To Set Priorities
- To Identify Emerging Issues
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans

Brief explanation.

The input of our stakeholders is taken into careful consideration because we are concerned about the relationship of the outcomes of our research to the welfare of the citizens of Washington (our primary stakeholders).

V. Planned Program Table of Content

S. NO.	PROGRAM NAME
1	Institute of Biological Chemistry
2	Program in Agricultural Animal Health
3	Program in Animal Science
4	Program in Biological Systems Engineering
5	Program in Community and Rural Sociology
6	Program in Crop Genetics and Breeding
7	Program in Economic Sciences
8	Program in Entomology
9	Program in Environmental Horticulture
10	Program in Food Science and Human Nutrition
11	Program in Fruit and Vegetable Development, Production and Management
12	Program in Natural Resource Sciences
13	Program in Plant Pathology
14	Program in Statistics
15	Program in Sustainable Crop and Soil Management
16	Program in the Post Harvest Quality of Fruits and Vegetables
17	The IMPACT Center
18	Western Regional Plant Introduction Station (W-006)
19	Wood Materials Engineering Laboratory

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Institute of Biological Chemistry

2. Brief summary about Planned Program

The Institute of Biological Chemistry's mission is to conduct research in plant species, with the overall goal to both understand how plants "work" and how they can be most effectively utilized for the good of humanity and the environment. Topic areas include: helping decipher the plant genome (as well as of bacterial systems involved in nitrogen fixation); determining how specific plant biochemical pathways can be modified to improve wood and fiber quality, and to provide modified plants more suitable for bioenergy/biofuel products; establishing how the efficiency of photosynthesis can be improved and thus to increase plant productivity; identifying how plants can optimally form various nutritional components (e.g. edible carbohydrates and proteins), as well as numerous specialty plant products (oils, flavors, fragrances, dietary supplements, cancer preventative substances), as well as how plants defend themselves against opportunistic pathogens. The Institute of Biological Chemistry plans to continue and expand its presence in these areas as a truly internationally recognized program. A rapidly emerging emphasis, which will be a new focus, is to increase our knowledge of how the various plant enzymes and proteins confer their biological functions via structural biology studies.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 201 18% Plant Genome, Genetics, and Genetic Mechanisms
- 202 2% Plant Genetic Resources
- 203 19% Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 3% Plant Product Quality and Utility (Preharvest)
- 205 4% Plant Management Systems
- 206 34% Basic Plant Biology
- 211 8% Insects, Mites, and Other Arthropods Affecting Plants
- 511 6% New and Improved Non-Food Products and Processes
- 701 6% Nutrient Composition of Food

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

With the recent advances made in sequencing plant genomes of both scientific and industrial (agricultural and forestry) significance, much now remains to be established as to how plants make their individual components and well-defined plant structures. The Institute faculty are committed to defining and delineating many of these complex biochemical processes, and to place a high premium on gaining not only new knowledge but in the training of the next generation of university scholars, researchers and educators.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)**1. Assumptions made for the Program**

We are in the process of restructuring the Institute's capabilities, and would like to add several new faculty programs in the next 5-6 years. The faculty operating within the Institute are keenly aware of the remarkable opportunities that lie ahead, i.e. as regards needs to develop new plant products that enhance fiber and wood quality, or for bioenergy and biofuel applications. Other applications are to increase crop productivity, as well as improving the nutritional/health-protecting capacity of various plant species, together with the ability to improve resistance to opportunistic pathogens. Currently, the Institute covers many of the main areas in plant metabolism, but will need to expand the

overall scientific areas of study (e.g. to include more extensive bioinformatic, proteomic, etc., capabilities). It is an expectation that within the next 5-6 years the research program will attract circa \$5.5 million annually.

2. Ultimate goal(s) of this Program

The expectation of the Institute of Biological Chemistry is for each faculty member to have an internationally (i.e. truly world class) research program, which is of benefit to humanity (i.e. in terms of science, plant utilization and in education outreach). This will largely involve dissemination of scientific discoveries and training of the next generation of plant scientists.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	63.0	0.0
2009	0.0	0.0	63.0	0.0
2010	0.0	0.0	63.0	0.0
2011	0.0	0.0	63.0	0.0
2012	0.0	0.0	63.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

The Institute of Biological Chemistry faculty have a most vigorous graduate research and training program. This leads to the graduation and placement of its highly trained (Ph.D./M.S.) scientists, to publications in high quality journals, to developing patents and working with industry to implement the technologies developed, as well as carrying out needed outreach activities (e.g. to focus groups, high school students, general public, etc.).

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> Demonstrations 	<ul style="list-style-type: none"> Web sites

3. Description of targeted audience

The primary target audience of the Institute of Biological Chemistry are scientists within various disciplines in plant biotechnology, particularly plant biochemistry. Their research activities attract attention within the biochemical, forest products, and agricultural industries.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	0	0	0
2009	0	0	0	0
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :2 2009 :2 2010 :2 2011 :2 2012 :2

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	40	0
2009	45	0
2010	45	0
2011	50	0
2012	50	0

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :40 2009 :45 2010 :45 2011 :50 2012 :50

- Supporting graduate students on Agricultural Research Center and External Funding

2008 :34 2009 :36 2010 :40 2011 :45 2012 :45

V(I). State Defined Outcome

1. Outcome Target

Increase numbers of students

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :34 2009 :34 2010 :36 2011 :36 2012 :38

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 701 - Nutrient Composition of Food

1. Outcome Target

Patents

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :2 2009 : 2 2010 : 2 2011 :2 2012 : 3

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 511 - New and Improved Non-Food Products and Processes
- 701 - Nutrient Composition of Food

1. Outcome Target

External Funding in millions of dollars

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 5 2010 : 5 2011 :5 2012 : 0

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 511 - New and Improved Non-Food Products and Processes
- 701 - Nutrient Composition of Food

1. Outcome Target

Peer reviewed journal articles

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :40

2009 : 45

2010 : 45

2011 :50

2012 : 50

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 511 - New and Improved Non-Food Products and Processes
- 701 - Nutrient Composition of Food

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Research activities (scope and extent) are dependent upon: (1) securing extended extramural research funding and (2) recruiting high quality graduate students. Factors primarily affecting this area are the economy, appropriation changes, and competing public priorities.

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

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

Target productivity indices in all areas are assessed annually on a per faculty and per institute basis.

2. Data Collection Methods

- Other (See Below)

Description

Data is collected on an individual faculty and individual student basis. The data is then evaluated for overall programmatic strength and in meeting the Institute goals and mission collectively. Annually, the overall progress towards meeting target goals is evaluated and changes in direction are made as needed and appropriate.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Agricultural Animal Health

2. Brief summary about Planned Program

The Agricultural Animal Health Program (AAHP) bridges two colleges: The College of Veterinary Medicine and the College of Agricultural, Human and Natural Resource Sciences. Research efforts of the AAHP are designed to consolidate disease control efforts on behalf of the agricultural animal industries in the State of Washington. This program has the unifying purpose of responding to diseases and disease agents that threaten the well-being of food animals and the safety of food animal products through comprehensive control efforts extending from the field to the basic research laboratory. It is a multidisciplinary program with expertise in individual animal and population medicine, field epidemiology, laboratory diagnostics, and research. Unification of purpose and consolidation of efforts focuses disease control on priorities identified by the veterinary medical and animal production communities, enhances utilization of existing resources, and promotes expansion of targeted programs. Through the integrated efforts of component units, the AAHP strives to provide enhanced infrastructure for recognition of emergent animal and public health problems; response to disease outbreaks; industry access to disease control methods and research results; international marketability and economic return to producers; and provision of a wholesome and safe food supply.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 307 10% Animal Management Systems
- 308 10% Improved Animal Products (Before Harvest)
- 311 10% Animal Diseases
- 312 10% External Parasites and Pests of Animals
- 313 10% Internal Parasites in Animals
- 314 10% Toxic Chemicals, Poisonous Plants, Naturally Occuring Toxins, and Other Hazards Affecting Animals
- 403 10% Waste Disposal, Recycling, and Reuse
- 711 10% Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.
- 712 10% Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins
- 722 10% Zoonotic Diseases and Parasites Affecting Humans

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

The mission of the AAHP is to enhance the well being of agricultural animals and wholesomeness of food animal products through integrated disease diagnosis, field investigation, and research. It is given that there is a huge national concern about the wholesomeness of food animal products, their safety, and biosecurity of animals that provide those products. Thus, efforts to ensure the highest quality must be applied in support of the consumers' interests. The efforts described herein are directed at pre-harvest issues. To date, the AAHP has defined the natural occurrence and shedding patterns of E. coli O157:H7 in cattle herds and in local and regional farm environments, has recognized Salmonella Typhimurium DT 104 as an emerging and zoonotic pathogen in the USA, has demonstrated contamination of feedstuffs and water sources as important factors in dissemination of zoonotic pathogens and normal flora with antimicrobial resistance, and has determined that mycoplasma mastitis is an emerging mastitis pathogen. The AAHP has taken a field based approach to research. The commercial farm becomes the experimental unit, the livestock specie the replicate. Thus although diagnostic and genomic tests may be developed in the laboratory, the basis of the development is isolation of pathogens from "real-life" commercial settings. The application of the intervention studies that are applied and tested subsequent to the development of laboratory tests are done with the assurance that the pre-harvest situation of interest was one that was typical of the problem at large.

2. Scope of the Program

- Integrated Research and Extension
- In-State Research
- Multistate Research
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The AAHP has an excellent history of research that is relevant to improvement of the well being of livestock in Washington State, and in ensuring the wholesomeness of their products. Thus, the consumers and perhaps specifically, the stakeholders of the State, have been well rewarded for their support. The basis of that support are tax dollars that directly and indirectly fund the Colleges of Veterinary Medicine and the College of Agricultural, Human, and Natural Resource Sciences. The AAHP receives financial support from both Colleges to primarily fund core positions. The joint funding testifies to the importance the University places on the AAHP research program. Thus, it could be argued that the assumption of continued support is strong, given the current University commitment. Funding support has historically been received from commodity groups, state agencies, and national research initiatives. Again, given the history of success of the Program, coupled with the need for fundamental research to ensure the wholesomeness and safety of food, suggests that the assumption that funding will continue, is well grounded.

2. Ultimate goal(s) of this Program

The goal of this program is to enhance the well being of agricultural animals and wholesomeness of food animal products through integrated disease diagnosis, field investigation, and research.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	2.0	0.0
2009	0.0	0.0	2.0	0.0
2010	0.0	0.0	2.0	0.0
2011	0.0	0.0	2.0	0.0
2012	0.0	0.0	2.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

The following are the project studies planned for the next five years: (1) Information will be disseminated in the form of manuscripts in research journals, lay press, and extension bulletins. (2) We shall investigate the epidemiology and ecology of Salmonella enterica in and around farms. The ultimate goal is to develop strategies to prevent entry of infection to the farm and to mitigate zoonotic risk (3) We shall conduct molecular biology studies on zoonotic bacteria such as Salmonella spp., Campylobacteria spp., Listeria spp. and E. coli 0157. Recent human problems with E. coli 0157 and other zoonotic agents of livestock origin have elevated the need for a descriptive epidemiology, determination of risk factors for herd status, on-farm ecology and association with food chain and human disease. (4) Through molecular epidemiology, we shall determine the antibiotic resistance elements of microbes associated with livestock, either as commensally associated flora or disease agents. (5) We shall conduct bovine mastitis research to identify transmission factors for Staphylococcus. aureus and Mycoplasma spp, the epidemiology, and immune responses to these agents. (6) We shall develop milk tests to better diagnose these mastitis agents and improve management of dairy teat chapping and milking time hygiene. (7) We shall detect copper deficiency in beef and dairy cattle, mapping the copper deficient areas, and develop strategies for supplementation. (8) We shall identify plant toxicities, describing previously uncharacterized problems, and develop strategies for reduction of problems, including studies on pasture/animal

disease interactions. (9) We shall identify determinants of neonatal mortality in calves as a failure of passive transfer of colostral immunoglobulin and determine farm level management strategies for optimization of maintenance of calf antibody titre. (10) We shall identify the determinants for regional and on-farm variation in risk for lupine-induced arthrogryposis (crooked calf disorder) in range cattle.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Group Discussion ● Other 1 (Address producers and industry) 	<ul style="list-style-type: none"> ● Other 1 (Extension Bulletins) ● Newsletters

3. Description of targeted audience

Our target audience includes academicians, clinicians, microbiologists, public health authorities, practicing veterinarians, farmers and the general public.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	90	4000	50	100
2009	90	4000	50	100
2010	150	4000	50	100
2011	160	4000	50	100
2012	160	4000	50	100

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	10	1
2009	15	2
2010	15	2
2011	15	2
2012	15	2

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :10 2009 :15 2010 : 15 2011 :15 2012 :15

- Graduate students supported on agricultural research center funds and grants

2008 :5 2009 :6 2010 :6 2011 :6 2012 :6

V(I). State Defined Outcome

1. Outcome Target

Define natural occurrence and shedding patterns of E. coli O157:H7

2. Outcome Type : Change in Condition Outcome Measure

2008 :1 2009 : 1 2010 : 1 2011 :1 2012 : 1

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 403 - Waste Disposal, Recycling, and Reuse
- 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 Occuring Toxins

1. Outcome Target

Determine the extent of Salmonella typhimurium DT 104 as an emerging and zoonotic pathogen

2. Outcome Type : Change in Condition Outcome Measure

2008 :1 2009 : 1 2010 : 1 2011 :1 2012 : 1

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 403 - Waste Disposal, Recycling, and Reuse
- 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 Occuring Toxins
- 722 - Zoonotic Diseases and Parasites Affecting Humans

1. Outcome Target

Develop PCR test for mycoplasma mastitis in milk samples

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :1 2009 : 1 2010 : 1 2011 :1 2012 : 1

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 311 - Animal Diseases
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Reduce prevalence of Mycoplasma mastitis in dairy herds from the current 8 percent to 2 percent of herds

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 **2009 :** 0 **2010 :** 0 **2011 :**1 **2012 :** 1

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 311 - Animal Diseases
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Research support in dollars for the project on E. coli O157:H7

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :70000 **2009 :** 50000 **2010 :** 50000 **2011 :**50000 **2012 :** 50000

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 308 - Improved Animal Products (Before Harvest)
- 311 - Animal Diseases
- 403 - Waste Disposal, Recycling, and Reuse
- 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 Occuring Toxins

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Currently the areas of Biosecurity (Knowledge Areas 311- Animal Diseases), Environmental Stewardship (Knowledge Area 403- Waste Disposal, Recycling, and Reuse), and Food Safety (Knowledge Areas 711 and 712- Ensure food products free of harmful chemicals, including residues from agricultural and other sources; Protect food from contamination by pathogenic microorganisms, parasites, and naturally occurring toxins) are targeted areas of the USDA for research. It is assumed that the reason for the focus on these targeted areas is due to the concern by the public. Should those concerns change, then reduced funding would be available for research. No doubt, and this would have a significant effect on progress of the AAHP research accomplishments. However, it should be noted that the AAHP does not exclusively target the "hot topics," and that several research areas of AAHP focus, although part of 4 areas, 22 targeted programs of ARS research, are not areas for which funding is readily available. Historically, the unit has been able to make significant progress in these research areas despite the fact that these have not been

areas target for substantial funding. If history is a predictor of the future, then it can be said with confidence that our program will continue to make research progress in all areas.

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

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)

Description

The program is reviewed both by individual investigator and by program at annual review time.

2. Data Collection Methods

- Journals
- Other (Grant dollars)

Description

Annually the numbers of publications, grant dollars, graduate students, invited presentations, and studies in progress will be tabulated and scored. Progress or the lack there of will be summarized.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Animal Science

2. Brief summary about Planned Program

Research efforts of the Department of Animal Sciences are to increase the efficiency of food animal production through improved nutrient utilization in animals, better reproductive performance, enhanced genetic potential, better air and water quality and new, improved and safer animal products for human consumption. Our aim is to do this through better knowledge of both basic and applied processes with a combination of individual and multidisciplinary research efforts. Focus will be on dairy and beef cattle but will also utilize swine, laboratory animals, and mathematical models. Major focus areas will include reproductive physiology, ruminant and non-ruminant nutrition, quantitative and molecular genomics, nutrient waste management, animal growth and development and new, safe and improved meat products. Some examples include better knowledge of mechanisms of spermatogenesis, endocrine systems and genetics to realize greater reproductive performance; studying mitochondrial DNA to compare breeds for differences in efficiency of energy utilization; searching for candidate genes and markers that will lead to selection of animals with greater quality and yield of meat; studying methods of manufacturing animal feeds to improve animal health and production. These efforts will be of benefit to citizens of the state and nation because of healthier and safer foods, new products and methods that will be adopted by businesses resulting in economic development.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 133 4% Pollution Prevention and Mitigation
- 301 28% Reproductive Performance of Animals
- 302 14% Nutrient Utilization in Animals
- 303 5% Genetic Improvement of Animals
- 304 11% Animal Genome
- 305 11% Animal Physiological Processes
- 307 6% Animal Management Systems
- 308 12% Improved Animal Products (Before Harvest)
- 311 3% Animal Diseases
- 701 3% Nutrient Composition of Food
- 722 3% Zoonotic Diseases and Parasites Affecting Humans

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Improvement of food animal production is important for many reasons. Probably most important is that society expects and demands a safe and abundant food supply. Animals produce a high quality and nutritious source of protein, which is essential for good health. Safe, high quality food is essential for maintaining a high quality standard of living. So the ultimate and most important recipients of our research are the millions of consumers in the U.S. and around the world. More directly the livestock producers need and utilize the efforts of our research program to be more biologically and economically efficient. As the population grows and the land available for animal production is reduced due to housing and business development, improved efficiency of food production must increase. Research scientists in the Department of Animal Sciences have years of experience and extensive knowledge working in both basic and applied aspects of food animal production. We believe that an integrated approach to research and training new scientists are the keys to success in our research programs.

2. Scope of the Program

- Multistate Extension
- Multistate Research
- Integrated Research and Extension
- In-State Extension
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Our assumption is that multiple levels of research are required to develop new and improved methods of food animal production. Applied research, especially in beef and dairy production is needed to bring immediate assistance to these two important segments of our food animal production system. However, understanding of the basic processes in reproduction, nutrition and genetics is mandatory to develop new ideas for improved productivity and to understand how differences in applied methods of nutrition, physiology, genetics and management are achieved. Funding for basic research in food animals will continue to be available because it provides a two-pronged benefit. Directly it benefits potential for improved animal production and therefore better and healthier food for consumers. Basic research in animals also provides a unique opportunity to develop greater understanding of the biological mechanisms in humans. This will lead to new methods of improved nutrition, reproduction and health in the human population. Experiments can be conducted with food animals that are impossible to do with humans and even when studies can be done in humans many times more critical and detailed studies can be done with food animal. In many instances food animals provide a better model for research than rodents or other animal species.

2. Ultimate goal(s) of this Program

The goal of this program is to improve the production efficiency and quality and yield of product from food animals.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	15.6	0.0
2009	0.0	0.0	15.6	0.0
2010	0.0	0.0	15.6	0.0
2011	0.0	0.0	15.6	0.0
2012	0.0	0.0	15.6	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

We shall: (1) evaluate nutritional, physiological and genetic mechanisms for differences in the use of dietary energy for growth, lactation and animal maintenance, (2) evaluate sources of feedstuffs and methods of processing for enhanced rumen function and productivity in animals, (3) search for candidate genes and DNA markers for improved quality and yield of meat in beef cattle, (4) Search for candidate genes and DNA markers for enhanced reproduction and nutrient utilization in dairy and beef cattle, (5) develop new approaches and investigate the molecular and biological regulation of germ and somatic cells in mammalian spermatogenesis, (6) define the underlying mechanisms responsible for the hormonal regulation of somatic tissue growth and development in rainbow trout and other species. (7) Develop mathematical models to better understand and evaluate factors related to metabolism in the lactating dairy cow, (8) develop a vaccine for the sterilization of either male or female cattle, (9) obtain gaseous and particulate emissions data from cattle feedlots and provide credible scientific information for making air quality policy decisions, and (10) determine the basic molecular mechanisms regulating skeletal muscle growth and differentiation.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (Field days) ● Education Class ● Demonstrations ● Workshop ● Group Discussion 	<ul style="list-style-type: none"> ● Newsletters ● Web sites ● Other 1 (Publications)

3. Description of targeted audience

In general, the target audience for the program includes consumers of food products produced by the livestock industry. However, the pathway of information from our research program includes commercial and seed stock producers in the dairy, beef, swine and sheep industries. It also includes companies that produce feeds, pharmaceuticals, and consulting to these industries.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	2300	4500	1200	2200
2009	2300	4500	1200	2200
2010	2500	5000	1300	2500
2011	2500	5000	1300	2500
2012	2500	5000	1300	2500

2. (Standard Research Target) Number of Patents

Expected Patents

2008 : 1 2009 : 1 2010 : 1 2011 : 1 2012 : 1

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	30	2
2009	30	4
2010	30	4
2011	30	5
2012	30	5

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :25 2009 :25 2010 : 25 2011 :25 2012 :25

- Graduate Students supported by Agricultural Research Center and other grant funds

2008 :31 2009 :34 2010 : 37 2011 :40 2012 :40

V(I). State Defined Outcome

1. Outcome Target

Construct a whole genome association map of nuclear encoded mitochondrial genes for traits in beef cattle

2. Outcome Type : Change in Action Outcome Measure

2008 :0 2009 : 0 2010 : 1 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 304 - Animal Genome

1. Outcome Target

Develop mitigation strategies to reduce the impact of animal CAFOs on air and water quality

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 307 - Animal Management Systems

1. Outcome Target

Determine some keys to obesity with research conducted in fat cells

2. Outcome Type : Change in Action Outcome Measure

2008 :1 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 305 - Animal Physiological Processes

1. Outcome Target

Enhanced agricultural sustainability through pollution mitigation strategies

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 307 - Animal Management Systems

1. Outcome Target

Define mineral requirements in dairy cows to reduce mineral excretion

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 1 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals

1. Outcome Target

Data for CAFOs on air and water quality will be made available to allow policy decisions

2. Outcome Type : Change in Action Outcome Measure

2008 :1 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 307 - Animal Management Systems

1. Outcome Target

Sulfur hexachloride tracer technologies developed for measuring methane production by free ranging livestock

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals

1. Outcome Target

Better understanding of of the percent of Wagyu genetics required in breed crosses of composite breeds to produce quality beef for domestic and world consumption

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :1 2012 : 0

3. Associated Knowledge Area(s)

- 303 - Genetic Improvement of Animals
- 701 - Nutrient Composition of Food

1. Outcome Target

Identification of factors regulating male fertility and sire potential in cattle and swine

2. Outcome Type : Change in Action Outcome Measure

2008 :0 2009 : 1 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals

1. Outcome Target

Enhance agricultural stability through increases in reproductive efficiency in cattle and swine

2. Outcome Type : Change in Action Outcome Measure

2008 :0 2009 : 0 2010 : 1 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals

1. Outcome Target

Techniques developed to accelerate the production of genetically modified animals for value-added products and biotechnology

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :1 2012 : 0

3. Associated Knowledge Area(s)

- 304 - Animal Genome

1. Outcome Target

Develop a whole genome association map of genes defining fertility and longevity in dairy cows

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 1 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 304 - Animal Genome

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

There are many factors that will affect the outcome of our expected research program, but the most important is the availability of funding primarily at the federal level, and to some extent from companies that are interested in utilizing or marketing results of our research program. We are not expecting support from state government except for facilities and salaries for research technicians, graduate students, and secretarial support. We would like to receive more financial support from our commodity stakeholders. This support, which has not been strong in the past, could enhance our research efforts. Facility upgrades are very important to the conduct of our research. A new 400-cow dairy is being planned which would greatly enhance our ability to conduct large-scale trials in this important industry in Washington State. We also are being encroached upon by other university entities at our beef cattle feeding and reproduction research facilities on the campus. These facilities along with our feed mill and farm shop need to be moved to Tula Young Hastings farm with our other animal facilities.

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

1. Evaluation Studies Planned

- Other (See below)
- During (during program)

Description

Research programs will be continuously evaluated to determine their effectiveness and probability of reaching the stated objectives. The evaluation will include annual written progress reports, quality and quantity of publications and evaluation of continued funding resources.

2. Data Collection Methods

- Other (Grant dollars)
- Portfolio Reviews
- Journals

Description

There is an accounting of grants submitted, grants funded, and peer review publications. The faculty are reviewed on their annual accomplishments reports, and their department summaries.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Biological Systems Engineering

2. Brief summary about Planned Program

The Department of Biological Systems Engineering will conduct research in three main areas: (1) soil, water and environmental engineering, (2) food engineering, and (3) biofuels and bioproducts engineering. It is the goal of the department to develop a strong and well-funded research program that can provide a solid foundation to a nationally-competitive graduate education program. For this purpose, we are conducting a targeted hiring process aimed at attracting talented young faculty members to support our vision for the future.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 133 10% Pollution Prevention and Mitigation
- 205 11% Plant Management Systems
- 403 23% Waste Disposal, Recycling, and Reuse
- 405 11% Drainage and Irrigation Systems and Facilities
- 501 38% New and Improved Food Processing Technologies
- 502 7% New and Improved Food Products

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Agriculture in the State of Washington is extremely diversified, with multiple irrigated and rainfed crops and commodities and a significant fraction of the output traded in the global market. Rainfall amounts fluctuate from 180 to over 1200 mm per year on average across state locations, with a significant fraction of the agricultural output produced under a Mediterranean type of climate that further enhances diversity. The location of the state, open to the Pacific Rim, increases the opportunities for trade with emerging Asian economies. Factors associated with increasing oil prices, global competition, climate change, and competing pressure for soil and water resources from other sectors of the economy are strong drivers of research needs in the state. Our research focus on environmental conservation and value-added agriculture is critical for the future of the state. Research opportunities for food processing technologies that utilize less energy while producing innovative products will capitalize on the state agricultural diversity to develop healthy and appealing new products. More efficient technologies for biofuel production will complement the fossil-oil production system of the state while developing new bioproducts offering new income opportunities for growers and foresters. More efficient production of other products (industrial chemicals, pharmaceuticals) from what is now biological waste material will provide less expensive products while enhancing incomes in agriculture and forestry. Land and water conservation practices under scenarios of climate change and oil shortages are critical for the future of the state. All areas of departmental research are high on the list of priorities from the Governor's Office and the State Legislature.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)**1. Assumptions made for the Program**

We are currently in the process of re-aligning our research capabilities with emerging state and national needs, including hiring new research personnel. It is our assumption that the current faculty size of nine will grow to twelve to fourteen faculty members during the period of this plan of work. This year the faculty size will reach eleven members. We are making efforts to concentrate

human resources in basic research that can easily connect with applied research and needs via multidisciplinary teams. It is our expectation that the current level of annual extramural support expenditures (around \$2.8 M per year) will be sustained or increased to support a graduate program of about forty graduate students, mostly PhDs, and over twenty post-doctoral research associates. We assume that certain social and economic trends will continue in the short, medium, and long term. It seems safe to assume continuing attention paid to the environment with developing or maintaining a clean, sustainable environment important to Americans both socially and economically. We further assume that Americans will continue to want food that is safe and nutritious with natural flavors, yet easy to prepare and to store. Agriculture and forestry producers, we believe, will continue to have low profit margins that mean it is important to provide additional income to them with new products that they can sell in strong markets. Researchers in this department will be able to enhance their effectiveness by collaborating with their colleagues both in the department and elsewhere, as they do now. We see the continuing need for multidisciplinary teams to solve research problems and faculty members in this department leading or forming such teams or serving as active members. We are adding faculty members in the department based on our needs and on the needs of the university and of the state in the assumption that the new skills brought to us will be important in solving crucial research problems with which we are not dealing today.

2. Ultimate goal(s) of this Program

New technologies created by this program will result in (1) soil and water conservation practices that are cost effective and suitable for adoption by growers and other resource managers, (2) food processing technologies that reduce energy consumption while providing nutritional food products that take advantage of the diverse agricultural output of the state, and (3) new non-food products from agricultural crops and efficient conversion of biomass to energy.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	37.9	0.0
2009	0.0	0.0	37.9	0.0
2010	0.0	0.0	37.9	0.0
2011	0.0	0.0	37.9	0.0
2012	0.0	0.0	37.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

We plan to support a vigorous graduate research program crucial to the development of high quality research in our focal areas of interest. We will develop and evaluate innovative water/soil management practices that mitigate the effects of uncertain water resources (both precipitation and irrigation) and other factors associated with climate change and atmospheric CO2 elevation. We will develop a roadmap for bioproducts and bioenergy technology that is specific to the region’s energy needs and to the crops/biomass grown in the region. We will develop food processing technologies that provide nutritious new products, increase the safety of existing products, and help improve the overall health of the population.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● One-on-One Intervention ● Other 1 (Seminars) ● Workshop 	<ul style="list-style-type: none"> ● Other 1 (Popular press articles) ● Web sites ● Newsletters

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :2 2009 : 2 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 501 - New and Improved Food Processing Technologies

1. Outcome Target

Initiate pilot scale research on processing of two agricultural feedstocks to produce new products or energy sources

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 2 2010 : 2 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 501 - New and Improved Food Processing Technologies

1. Outcome Target

Processing technology of one agricultural commodity to produce new products or energy sources available for transfer

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :1 2012 : 0

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 501 - New and Improved Food Processing Technologies

1. Outcome Target

Process Technology Development at the laboratory bench for first three years; 4th year to the pilot scale; 5th year to the industry

2. Outcome Type : Change in Condition Outcome Measure

2008 :1 2009 : 2 2010 : 1 2011 :1 2012 : 0

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products

1. Outcome Target

Development of computer models or modules to existing models and Best Management Practices (BMPs)

2. Outcome Type : Change in Condition Outcome Measure

2008 :1 2009 : 2 2010 : 2 2011 :2 2012 : 0

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 205 - Plant Management Systems
- 403 - Waste Disposal, Recycling, and Reuse
- 405 - Drainage and Irrigation Systems and Facilities

1. Outcome Target

Hire one faculty member or expand research in biofuels and bioproducts engineering

2. Outcome Type : Change in Action Outcome Measure

2008 :1 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 501 - New and Improved Food Processing Technologies

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Other (Changes in Market)
- Competing Public priorities
- Public Policy changes
- Economy
- Appropriations changes
- Competing Programatic Challenges

Description

The main factors potentially affecting the outcomes of the program are: a) our ability to attract highly qualified faculty members, support personnel, post-doctoral associates, and graduate students, b) our ability to obtain sufficient extramural support to fully fund our planned research, and c) a positive state and university budgetary situation allowing us to compete for resources to enhance our research position (infrastructure, equipment, seed funds, etc.). Lower funding levels for the university and the Agricultural Research Center will prevent us from hiring new faculty members as planned and might even reduce the size of the department to the point where we would have difficulty sustaining research efforts. Lower funding levels from granting agencies might prevent us from having the extramural money necessary to proceed with research even when all faculty members are aggressively pursuing opportunities to secure money for their research. Public policy changes and changes in markets for new food products or for new biologically based products are two factors that could adversely affect us, but such change seems improbable. Attention to environmental issues hardly seems likely to wane. Likewise, the current attempt to pursue alternatives to petroleum based products—as fuel, chemicals, or pharmaceuticals—appears to be a trend that will continue for the life of this plan. Americans seem highly likely to continue preferring convenience foods that are safe and nutritious and that have an attractive taste; this trend might even accelerate based on overseas demand. We believe, in short, that these two factors will be in our favor in the next five years, but one or both could change.

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

1. Evaluation Studies Planned

- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Retrospective (post program)
- After Only (post program)
- Other (See below)

Description

Comparisons with other similar departments across the country.

2. Data Collection Methods

- Other (See below)
- Journals

Description

A quantitative and qualitative survey regarding annual activities is conducted each year. Achievements for the year are compiled and compared with benchmark targets. These are from faculty reports of activity.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Community and Rural Sociology

2. Brief summary about Planned Program

The overall goal of the department's research program is to address the social dimensions of agriculture, technology, the environment and community development. The guiding theme of this research is human dimensions of sustainability. Most definitions of sustainability as they apply to natural resource use, including agriculture, are based on the recognition that human and natural resource systems are highly interdependent. Thus, it is argued that an agri-food production system can be sustainable only if it contributes to cultural, economic, political and ecological well-being and permanence. Technological advancement can be a tool for contributing to this process when it empowers human actors to interact with the physical environment in such a way that sustains human communities and their ecological surroundings. Research in the Department of Community and Rural Sociology is directed towards understanding the challenges facing families and communities as they attempt to create sustainable agri-food and other types of natural resource production systems. This includes research on the role of technology and social institutions in integrating, or failing to integrate, human, and ecological systems, as well as methods research that serves as a foundation for the larger program.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 608 6% Community Resource Planning and Development
- 803 62% Sociological and Technological Change Affecting Individuals, Families and Communities
- 805 32% Community Institutions, Health, and Social Services

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

The key problem that needs to be addressed is how to assess, and assist, families and communities dependent on agri-food and other natural resource dependent industries in a way that will enable them to become more socially, politically and economically sustainable, while at the same time using their surrounding ecological systems in a manner that will preserve the ability of future generations to utilize their physical environment. This is an issue for the family members, families and communities that are either directly or indirectly connected to these industries. These stakeholders include farm households (including small and medium sized farms comprising the vast majority of the U.S. farm population), individual and family entrepreneurs who utilize agricultural and other natural resource commodities (such as food processing firms and lumber mills), and those who are employed in these businesses, including women and minorities that have been traditionally underserved by land grant programs. Unless these industries can evolve in such a way as to minimize ecological impact while maximizing human well-being for all potential stakeholders, they will weaken with a corresponding negative impact on the lives of these stakeholders, as well as the consuming public. Emerging research on these issues (for one example, see Flora, Cornelia (ed.). 2001. *Interactions Between Agroecosystems and Rural Communities*. New York: CRS Press.) recognizes the importance of understanding: (1) how the various components (cultural, economic, political) of human systems interact with one another; (2) how the various components (water, soil, climate) of ecological systems interact with one another; and (3) how the human and ecological systems are interconnected. Previous research by department researchers has been successful in investigating some, but not all of these interactions. Over the next five years, one of the primary objectives will be to expand the scope of the previous research and to address in more depth the crucial role that emerging technologies, including biotechnology, play in structuring how human and ecological systems in agriculture become interconnected, as well as how the demographic profile of the human groups involved in these systems is evolving.

2. Scope of the Program

- In-State Extension
- Integrated Research and Extension
- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

One of the key assumptions of the program is the importance of thinking holistically about agri-food and other natural resource based production systems. Thus, the assumption that technological solutions to agricultural and environmental problems exists in a social vacuum is rejected. A second key assumption is that stakeholder input into research programs is essential for the success of the research and the proposed recommendations that flow from that research. The program is also based on the expectation that resources, both in terms of financial support and talent, is improving. This recognition is based on the fact that a vacant faculty position in the Department with an eighty percent ARC appointment was filled in 2006. This individual, whose areas of interest include the analysis of the potential role of biotechnology in contributing to sustainable agri-food systems, as well as the role of women and minorities in agri-food systems, is helping to re-invigorate the program programmatically and intellectually.

2. Ultimate goal(s) of this Program

The ultimate goal of this research program is the discovery of new institutional and policy strategies at the community level for improving the sustainability of agri-food, and other natural resource based industries in Washington State. Some example of those strategies that faculty are currently involved with include: (1) improved survey research methods that improve the ability of social scientists to assess current structural conditions in rural communities; (2) expanded opportunities for increasing direct market sales within communities and regions, thus enhancing the profitability of small farms; and (3) better knowledge of the global and national contexts of agri-food system change, which leads to more viable options for improving agri-food system sustainability. Important future programmatic efforts will be assessments of the contribution of emerging agricultural technologies to natural resource use and community sustainability.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	1.9	0.0
2009	0.0	0.0	1.9	0.0
2010	0.0	0.0	1.9	0.0
2011	0.0	0.0	1.9	0.0
2012	0.0	0.0	1.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

In 2006, the Department’s sponsored a Conference on Sustainable Agriculture, Communities & Environments in the Pacific Northwest. The basic theme of the conference was the exploration of the ways that farmers, agriculture-related businesses, communities and social institutions, and others are responding to the challenges and opportunities presented by an increasingly globalized agriculture as they strive to create a more sustainable agri-food system. This Conferences was highly successful. The Department plans on building on the success of this conference by organizing a follow-up conference, perhaps as early as 2008. The department also is continuing to actively utilize its website for the dissemination of research results. A majority of all faculty in the department, including several who do not have ARC appointments, now utilize the department’s web site as a home for placing results of the department’s research and other programmatic activities. The Department will continue to expand its use of the internet for sharing information with stakeholder groups, and has plans to develop an on-line questionnaire for those who

access the department's web site. On-going measurement of the number of stakeholders accessing data via this web site, and qualitative assessments of the value of that information to stakeholders, has been incorporated as an official benchmark of department activities.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Education Class ● Workshop 	<ul style="list-style-type: none"> ● Web sites

3. Description of targeted audience

The target audience will include other social scientists, persons interested in sustainable agriculture, communities, agri-businesses, demographers and policy makers.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	400	2500	0	0
2009	425	2750	0	0
2010	450	3000	0	0
2011	500	3250	0	0
2012	500	3500	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	6	0
2009	7	0
2010	8	0
2011	9	0
2012	10	0

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :6 2009 :7 2010 :8 2011 :9 2012 :10

- Graduate students supported by Agricultural Research Center funds including grants

2008 :2 2009 :3 2010 :3 2011 :4 2012 :4

V(I). State Defined Outcome

1. Outcome Target

Steady increase in the number of state residents accessing bulletins and other stakeholder directed publications via the department website

2. Outcome Type : Change in Action Outcome Measure

2008 :2500 2009 : 2750 2010 : 3000 2011 :3250 2012 : 3500

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 803 - Sociological and Technological Change Affecting Individuals, Families and Communities
- 805 - Community Institutions, Health, and Social Services

1. Outcome Target

Steady increase in number of state residents accessing survey results via the department website

2. Outcome Type : Change in Action Outcome Measure

2008 :550 2009 : 600 2010 : 650 2011 :700 2012 : 750

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development
- 803 - Sociological and Technological Change Affecting Individuals, Families and Communities
- 805 - Community Institutions, Health, and Social Services

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Public Policy changes
- Economy
- Government Regulations
- Competing Public priorities

Description

The external factors that may affect program factors in Community and Rural Sociology include the following areas: a) Global and National Economy; b) Public Policy Changes; c) Government Regulations; and d) Competing Public Priorities.

The external “environmental” factors that would be most likely to have an impact on the Department’s main program area are those economic, political and social conditions at a national and international level that have an impact on the strategic options available for farmers and other rural community entrepreneurs to improve the sustainability of their farm operations. Thus, research in the program area must constantly assess, and account for, changing national and global conditions.

An additional factor that could affect the success of the program will have to do with the viability of the Department of Community

and Rural Sociology. A pressing need for this program area, as with many other program areas, is operating funds. The unit has few operating funds available and researchers must constantly search for external resources to support project. This is linked to the availability of external funding sources. One example of the challenges this leads to is the unit's interest in conducting more research and outreach on the community health impacts of alternative agri-food systems. Numerous attempts have been made to access funds to support this element of the unit's program, so far without success. While there is significant policy interest in this research question, the amount of competitive grant funds available to support such research is limited. This is an excellent example of the challenges facing a unit that has an interest in developing creative programs to address critical problem areas.

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

1. Evaluation Studies Planned

- Comparisons between program participants (individuals,group,organizations) and non-participants
- During (during program)
- Retrospective (post program)

Description

There will be comparisons between where the program operates and sites without program intervention.

2. Data Collection Methods

- Case Study
- Mail
- Sampling
- Structured
- Other (Intranet)
- Whole population

Description

Are starting Intranet Based Surveys

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Crop Genetics and Breeding

2. Brief summary about Planned Program

Exploration of fundamental crop genetic mechanisms, crop germplasm screening and improvement, variety development, selection and testing for yield, end-use quality, nutrient use efficiency, pest resistance, regional adaptability are the goals of this program. This program has a century long tradition of supporting the regional agriculture with improved genetic lines that have contributed to the economic growth of the PNW. Recent wheat varieties released by our program dominate the wheat acreage planted in eastern Washington. Barley, turfgrass, forages, and bean germplasm selection and improvement are also being pursued.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 201 66% Plant Genome, Genetics, and Genetic Mechanisms
- 202 10% Plant Genetic Resources
- 204 24% Plant Product Quality and Utility (Preharvest)

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Wheat and barley are the dominant crops grown in rotation in the Inland Northwestern U.S., due its Mediterranean climate, dry summers and deep loessial soils. These conditions are ideal for small grain cereal production. The access to seaports gives this region access to Pacific Rim markets that are increasing their consumption of wheat based food products. The environmental conditions of the area are most conducive to producing the lower protein, soft wheats that are used to produce eastern flat breads, noodles, and pastries. Increasing bread consumption is increasing the demand for hard wheat as well, which requires shifts in cultivar selection and cultural practices in order to consistently produce high quality grain in the area. Genetic improvement of end use quality and crop production attributes such as nutrient use and pathogen resistance are of primary interest. In addition, new research on biofuel and bioproduct attributes are being explored while genetic lines best fitted to sustainable agroecosystems of the region for oilseed crops such as soybean, rapeseed, mustards, and forage crops are also being pursued.

2. Scope of the Program

- Integrated Research and Extension
- Multistate Integrated Research and Extension
- In-State Research
- In-State Extension
- Multistate Extension
- Multistate Research

V(D). Planned Program (Assumptions and Goals)**1. Assumptions made for the Program**

The successful conduct of the research proposed for this program area assumes that: (1) Small grain cereal crops will continue to dominate the cropping systems of the inland Pacific Northwest. (2) Selective international markets will place increasing emphasis on end use quality and diversity of products. (3) There will be in increasing domestic market for high quality cereals, including those organically or sustainably produced. (4) The world will continue to increase its demand for biofuels and bioproducts. (5) Input costs will continue to rise, making grower competitiveness on the world markets razor thin. (6) This proposal also assumes that state and federal support will continue to provide resources necessary to sustain programs led by seven core faculty with adequate operating funds and technical support.

2. Ultimate goal(s) of this Program

The ultimate goal of this project is to create a select new agronomic crop cultivars grown in the Pacific Northwest that address emerging markets and production challenges which will improve sustainability of the agriculture in the region. We will also produce new tools and fundamental knowledge about wheat and barley genetic characteristics that function towards crop improvement.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	50.0	0.0
2009	0.0	0.0	50.0	0.0
2010	0.0	0.0	50.0	0.0
2011	0.0	0.0	50.0	0.0
2012	0.0	0.0	50.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Develop, test, PVP and release new commercial cultivars of wheat and barley.

Publish journal papers on the development of new breeding techniques that improve efficiency by using genetic markers.

Establish patents on biologically unique organisms and processes.

Publish journal papers on wheat and barley genomes, genome structure and function.

Develop and adapt cultivars for specific management systems, such as direct seed, organic, perennial or animal-based systems.

Publish papers and advance technology transfer of novel end use purposes for food, bioproduct and bioenergy applications for commercial adaptation.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Demonstrations ● Workshop ● One-on-One Intervention ● Other 1 (Field plot tours/Field days) ● Other 2 (Grower/Industry Meetings) 	<ul style="list-style-type: none"> ● Web sites ● Newsletters ● Other 1 (Trade magazines)

3. Description of targeted audience

The target audience includes other crop scientists, economists, commodity commissions, policy makers, legislators, agribusiness, food processors, and farmers.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	2300	2500	100	1000
2009	2400	2600	100	1100
2010	2500	2700	100	1200
2011	2600	2800	100	1300
2012	2700	2900	100	1400

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 : 1 2011 :0 2012 :1

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	31	2
2009	32	2
2010	33	3
2011	34	3
2012	35	4

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal publications

2008 :31 2009 :32 2010 : 33 2011 :34 2012 :35

- Graduate students supported on Agricultural Research Center or other external funds

2008 :21 2009 :22 2010 : 23 2011 :24 2012 :25

- Plant Patents and plant variety protections (PVPs)

2008 :2 2009 :2 2010 : 2 2011 :2 2012 :2

V(I). State Defined Outcome

1. Outcome Target

Publications on improved knowledge of wheat, barley genetics, genome, new breeding tools impacting the national, international breeding, and genetic scientific community

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :31 2009 : 32 2010 : 33 2011 :34 2012 : 35

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 204 - Plant Product Quality and Utility (Preharvest)

1. Outcome Target

Commercial cultivar releases that are adapted regionally.

2. Outcome Type : Change in Action Outcome Measure

2008 :2

2009 : 2

2010 : 2

2011 :2

2012 : 2

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 204 - Plant Product Quality and Utility (Preharvest)

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

External factors include year to year and location-dictated climate, farm economy, energy and bioproduct markets, international market demand, farm policy, stakeholder acceptance of change. Internal factors include stakeholder financial support and government support of staff, equipment and operating funds.

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

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

Evaluation plan includes: (1) monitoring of research products by the internal accountability system at WSU (WORQS) during annual review, commission reviews, monitoring variety releases through the WSU variety release committee, number of PVPs and plant patents. WA Agricultural statistics will also be reviewed periodically for acreage and economic impact.

2. Data Collection Methods

- Sampling
- Whole population
- Mail
- On-Site
- Other (Faculty Reviews)
- Portfolio Reviews

Description

Sampling is usually done, occasionally whole population mail surveys by NASS/WSDA for varieties planted of wheat and barley, some on-site surveys are conducted at meetings, portfolio reviewing includes Faculty publications on WORQS.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Economic Sciences

2. Brief summary about Planned Program

This program of research resides in a university environment with very limited institutional research support. Researchers are responsible for raising virtually all needed research funds from extramural sources. As a result, faculty are expected to obtain extramural funding to support all aspects of their research including equipment, research assistants, travel, supplies, etc. Faculty members are viewed as the entrepreneurial research engines underlying the research program and in the mentoring of graduate students. IMPACT seed grants provide limited funds for scientists to begin developing projects and collect initial data, which will enhance their abilities to pursue funding from other sources.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 601 5% Economics of Agricultural Production and Farm Management
- 602 10% Business Management, Finance, and Taxation
- 603 20% Market Economics
- 604 5% Marketing and Distribution Practices
- 605 15% Natural Resource and Environmental Economics
- 606 5% International Trade and Development
- 607 10% Consumer Economics
- 609 10% Economic Theory and Methods
- 610 10% Domestic Policy Analysis
- 901 10% Program and Project Design, and Statistics

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

The long run sustainability of the agricultural sector, the natural resource base of the region, and the environment is a vitally important issue that interests and affects farmers, ranchers, industry groups, government policy makers, and the general public. Invariably, the issue of sustainability goes well beyond the physical and biological factors that affect sustainability, and are driven by economic costs, benefits, and incentives that guide agricultural production decisions, the management and use of resources, and the stewardship of the environment. Incentives can be derived from markets, both domestic and international, as well as from government intervention in the way of policies, laws, and regulations. The methods and tools of economic research are ideally suited for analyzing benefits, costs, and tradeoffs, denominated in terms of profitability and overall social welfare, resulting from agricultural and non-agricultural business decisions, natural resource access and allocation decisions, government regulations of businesses, natural resources, and the environment, and market and non-market forces that affect the operation of State and regional economies. Stakeholders that will have interest in the issues addressed in the economic research program envisioned here encompasses literally every citizen of the State and region, every agricultural and non-agricultural business enterprise, and the governments of the State and region. The long run sustainability, security, and cost of the food supply, the availability and quality of natural resources, and the state of the environment can affect the quality of life and the efficiency of business enterprises that operate within the region. The common long run interests of all of these stakeholders are ultimately served by a better-informed decision environment supported by a clear understanding of the economic and social impacts of business behavior and public policy choices, on economic vitality, the use of natural resources, and the care of the environment. All of the endeavors envisioned in this research agenda contribute in various ways to creating a more-informed decision environment.

2. Scope of the Program

- Integrated Research and Extension
- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Major assumptions for the proposed research program to be successful in generating economic intelligence on the range of issues being investigated include: (1) the continuation or expansion of current levels of faculty FTEs and operational funding in support of research efforts, (2) continuation or expansion of infrastructure support within the School and university in terms of facilities and services, as well as staff support, and (3) continuation or expansion in the level of Graduate Research Assistantship support for the research programs of School faculty. Faculty in this research program are expected to supplement funding in support of the research agenda by securing external grant funds for additional graduate assistantships, data collection, supplemental computational needs in the way of specialized software and hardware, travel, supplies, and other supportive materials and services. It is also assumed that faculty members performing research under this program will successfully seek interdisciplinary collaboration on topics that would benefit from such collaboration, potentially resulting in both a broader and deeper analysis of the issues involved. Decreases in state and/or federal research and operations funding, or decreases in the availability or amount of extramural funding would adversely affect research productivity, and would likely prevent some components of the research program to not be researched at all.

2. Ultimate goal(s) of this Program

The overall goal of this research program is to generate economic intelligence that will lead to more profitable farm, ranch, and agribusiness enterprises, enhance the overall sustainability of the agricultural sector, promote a proper balance between the use and protection of natural resources, foster appropriate stewardship of the environment, and facilitate more informed, effective, and efficient decision making by individuals, businesses, and government policy makers.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	21.4	0.0
2009	0.0	0.0	21.4	0.0
2010	0.0	0.0	21.4	0.0
2011	0.0	0.0	21.4	0.0
2012	0.0	0.0	21.4	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

The expected outputs from this research will occur in a number of different forms. One form is the publication of high quality refereed journal articles, which will validate the scientific merit of the research performed under this project, and will stand as long term contributions to the inventory of knowledge in the respective areas of inquiry. It is also expected that a number of peer-reviewed and other research bulletins, research reports, and both peer-reviewed and invited presentations disseminating the results of the research will be delivered to appropriate clientele by faculty analysts themselves. In addition to outreach efforts by research faculty, which is an expectation of all faculty in the School of Economic Sciences, the research results will also be translated into an outreach and engagement effort through collaboration with extension faculty, and timely and relevant deliverables in this regard will include extension bulletins, workshops, downloadable data, tables, and reports, and other outreach and engagement activities with appropriate clientele. It is expected that the knowledge disseminated through the aforementioned

mechanisms to appropriate decisions makers in various segments of the agricultural sector, government, and in general society will generate an appropriately informed decision environment and sufficient insights into the economic and societal consequences of decisions so that actual decisions made will enhance the sustainability of the agricultural sector, balance the need for uses and preservation of natural resources, and further good stewardship of the environment.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Workshop ● One-on-One Intervention ● Group Discussion 	<ul style="list-style-type: none"> ● Other 1 (Extension Bulletins) ● Web sites

3. Description of targeted audience

The target audience of the School of Economic Sciences include decision makers in various segments of the agricultural sector, government and the general society. Our work will also influence economists in academia nationally and internationally.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	750	1000	0	0
2009	750	1000	0	0
2010	800	1000	0	0
2011	800	1000	0	0
2012	850	1000	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0

2009 :0

2010 :0

2011 :0

2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	20	7
2009	22	9
2010	24	11
2011	26	12
2012	28	12

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :20 2009 :22 2010 : 24 2011 :26 2012 :28

- Graduate students supported by experiment station and grant funds

2008 :39 2009 :40 2010 : 42 2011 :45 2012 :45

V(I). State Defined Outcome

1. Outcome Target

Number and Quality/reputation of refereed journal publications (mid-tier economics journals and above)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :20 2009 : 22 2010 : 24 2011 :26 2012 : 28

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Number and quality of other research bulletins, reports and presentations at major conferences

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :25 2009 : 28 2010 : 30 2011 :30 2012 : 30

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Degree of contribution of fundamental knowledge within the fields researched (percent increase)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :5 2009 : 5 2010 : 5 2011 :5 2012 : 5

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Number and value of external grants in support of the research program (units are dollars)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :850000 2009 : 950000 2010 : 1100000 2011 :1200000 2012 : 1300000

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Contribution to improved/new research methods/tools (percent of output)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :5 2009 : 5 2010 : 5 2011 :5 2012 : 5

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics

- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Relevant knowledge generated for use by policy and decision makers (percent of output)

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :10 2009 : 10 2010 : 10 2011 :10 2012 : 10

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Number of graduate students trained and placed in the job market

2. Outcome Type : Change in Action Outcome Measure

2008 :12 2009 : 13 2010 : 14 2011 :15 2012 : 15

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Degree to which overall research funding is increased (percent)

2. Outcome Type : Change in Action Outcome Measure

2008 :10 2009 : 10 2010 : 10 2011 :10 2012 : 10

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics

- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

1. Outcome Target

Number of additional institutionally funded and externally funded GRAs that are studying and researching in the School

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 2009 : 1 2010 : 2 2011 :3 2012 : 3

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 605 - Natural Resource and Environmental Economics
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 901 - Program and Project Design, and Statistics

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

The environment in which the planned research program resides, and the factors that frame that environment, can affect the outcomes of the planned research program in two general ways. One concerns the effect of the program environment on the ability of researchers to command sufficient resources, and avoid constraints and encumbrances in order to be able to freely conduct and complete research endeavors successfully. The other concerns the potential changing priorities of problems and issues as circumstances change with regard to the working of the economy and the nature of government laws, policies and regulations. The program of research resides in an environment of scant ongoing institutional research funding as well as limited institutional resources for updating research infrastructure to facilitate modern research capabilities. Beyond a faculty member's office and nominal support in terms of telephone, internet access, incidental office supplies, and moderately capable computer support, any appreciable enhancement in the level of research funds in support of a faculty member's research program must generally be secured by the faculty members themselves through extramural grant funding. In the absence of additional institutional support, a program environment restriction in the sense of reduced availability and/or reduced success in terms of extramural grant supplementation of research resources will act to reduce the ability of affected faculty members to achieve those components of their research programs that require additional resources for effective or successful completion, and alter research outcomes

accordingly. The research program also resides within a dynamically fluctuating environment of changing markets and market conditions, a changing economy, changing external influences to the economy, and a changing inventory of effective government laws, policies, and regulations. As factors affecting the State and regional markets, economies, and society change, the problems, issues, and priorities relating to them change as well. Thus, the types of research outcomes that will benefit the agricultural sector, the management of natural resources, and the state of the environment might appropriately change within the research agenda to respond to changed needs of clientele resulting from a changed program environment.

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

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

Prior to the start of any program, each Hatch project proposal that is submitted to the Director of the School is first subjected to a peer review by a minimum of two other PhD economists in or outside of the SES, the objective being to evaluate the relevance of the proposed problems or issues to be researched by the project, to evaluate the command of the problem context and the relevant literature by the proposer, to check the appropriateness of the proposed research methodology to be used in addressing the problems or issues stated, and finally, to verify the adequacy of the stated outcomes of the research relative to the goals stated in the proposal. During the time when the program is active, the progress of each faculty member with a Hatch project is reviewed annually by the Director of the School, followed by the Dean and Directors of the College of Agricultural, Human and Natural Resource Sciences. Measures of progress on Hatch projects include the number of refereed journal articles produced, the quality of refereed journal articles produced, the quantity and quality of other peer and non-peer reviewed research bulletins, reports and presentations generated, the level of extramural funding received from external sources in support of the research program, and the number of masters and doctoral students completing their degrees that have theses or dissertations that in part, or in whole, contribute research addressing the goals set forth in the Hatch project proposal. Also considered is the degree to which program research results have been disseminated effectively to clientele through outreach and engagement efforts, the latter often in collaboration with Extension faculty.

2. Data Collection Methods

- Observation
- On-Site
- Sampling
- Whole population
- Structured

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Entomology

2. Brief summary about Planned Program

The Program in Entomology is focused on natural resources and the environment, protection of plant and crop resources (particularly through biological and integrated pest management), insect genomics, and food and environmental quality. The program is also involved in biological diversity studies, especially on native and threatened habitats, in an effort to provide data allowing for conservation of diversity through efficient land-use management strategies. Management of invasive weeds through phytophagous arthropods (a tactic beneficial to low input range management) will continue to be a primary undertaking. The James Entomological Collection, maintained by the department, will continue to be a historical as well as contemporary source of biological diversity information for studies on the insect fauna of native and agro-native interface habitats. The Department will develop and institute pest management strategies implementing best management practices lessening detrimental environmental and non-target organism effects (including effects on human beings). These practices will primarily involve biological control and methods employing several integrated techniques including biorational and new-chemistry pesticides. Implementation of biological control strategies employing complex communities of natural enemies will be a primary focus. The department will continue the search for biocontrol organisms, as well as rear and release them. Additionally, we will study methods of habitat manipulation favoring biocontrol agents. Combined, these efforts will provide strategies benefiting and centering on commodities essential to the economic development of Washington and the Pacific Northwest; however, they will be applicable to a wide range of geographic locations and diverse agro-ecosystems. Primary commodities of interest include tree fruits, small fruits, and dryland and irrigated crops including those with high-value, specialty applications. Specific and general studies of insect genomics will center on honeybees and parasitic wasps. We will continue efforts to develop bees resistant to mites and disease, allowing for maximization of pollination activities as well as honey production. Entomology also is intimately involved in toxicological studies and the development of instruments to measure contaminants. These efforts provide potential means of minimizing contaminants and understanding their environmental and organismal fate. Interactions of those persons conducting toxicological assessments and those developing and implementing integrated pest management strategies provide for effective team and multidisciplinary cooperation in our efforts to better understand complex biological and physical processes.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 121 2% Management of Range Resources
- 135 2% Aquatic and Terrestrial Wildlife
- 136 6% Conservation of Biological Diversity
- 211 20% Insects, Mites, and Other Arthropods Affecting Plants
- 215 15% Biological Control of Pests Affecting Plants
- 216 35% Integrated Pest Management Systems
- 304 8% Animal Genome
- 711 12% Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Arthropod pests, especially insects, attack and eventually destroy approximately 20-30% of the food and fiber grown for human use. Insects, generally considered nuisances, can vector serious plant and animal diseases and are among the most invasive of pests. Techniques used to manage insect pests may sometimes have measured or unforeseen non-target effects. On the other hand, insects are beneficial in their pollination activities and may be used as biological control organisms. They are valuable in natural and fundamental biological and environmental processes and may be studied as model organisms. Understanding the roles insects play in their myriad of contacts, especially when human interests are involved, is essential to their effective management

and in the efficient use of beneficials. Management of pest species through more environmentally friendly and sustainable strategies is a primary focus of departmental research. Entomology is a leader in the development of integrated pest management techniques, especially those involving the judicious use of traditional pesticides, the testing of new pesticide chemistries that target physiological processes specific to insects, mating disruption techniques, and biological control. These methods provide for less environmental and non-target contamination often with a concurrent financial savings through a lessening of pesticide applications. We are centering many of our efforts on minor or regional commodities for which effective means of pest management have not been studied or achieved. These tactics allow for greater diversification of the agricultural base with more specialty crop and value-added opportunities. We have, through the resources of the James Entomological Collection, the opportunity to use arthropod biological diversity information, both historical and contemporary, in our efforts to better understand changes in habitat modification. This information will allow us to make wise land use decisions concerning subjects such as agricultural and environmental buffer zones, endangered and threatened species, damage potential of pestiferous invasive species, and the value and manipulation of habitat in order to enhance useful aspects of beneficial species. Pesticidal effects on the environment and non-target concerns also are major emphases of departmental research. Scientists of the Food and Environmental Quality Laboratory are developing and testing methods to monitor levels of contamination in agricultural and urban situations. Their methods may also be used to compare the effectiveness of various dispersal methods for pheromones employed in mating disruption pest management strategies. In separate efforts, toxicological studies undertaken by departmental personnel are leading to dramatic changes in the way the long-term effects of pesticides on the environment and non-target organisms are being evaluated. These studies benefit not only the agricultural sector, but also the general public, as we learn to recognize and mediate the potential detrimental effects of agricultural inputs.

2. Scope of the Program

- Multistate Research
- Multistate Integrated Research and Extension
- Integrated Research and Extension
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Providing the highest standards for environmental and human health while supplying effective pest management is critical to the financial future of the agricultural community and to the health of the human population. This goal can only be accomplished through research leading to innovative and novel means of managing pest arthropods, particularly insects. This goal has been a hallmark of entomological research at Washington State University and will continue through the current research programs led by personnel associated with the Department of Entomology. The objective of our research is not maintenance, but the development and implementation of new and innovative methods of pest management. At the same time, we will mediate and study these techniques as to their abilities to manage pests with increased sustainability and a lessening of known or potential environmental and health damaging aspects. This will be accomplished through methods such as biological control, mating disruption, the use of new pesticide chemistries, biorational techniques, and a more thorough integration of integrated pest management approaches. The need for a continued development and implementation of approaches as outlined above will not change. If funding and personnel levels remain constant or, hopefully, grow during the period of this plan of work, we will continue to have positive influences on the management of pest arthropods with minimal environmental and non-target effect. We are a Department of individuals that use multi-person and multi-disciplinary approaches to problem solving. When appropriate, we will use a team approach to provide long-term and sustainable solutions to complicated problems. We also possess the expertise to aid a variety of stakeholders having needs beyond simple pest management. Entomology at Washington State University explores basic principles of science in order to solve applied problems. We rely upon well-trained personnel with outstanding records of productivity and accomplishment, many of whom are recognized as leaders in their disciplines and have sound understandings of the fundamental science on which effective applied management strategies are built. We have strong expertise in insect pest management including traditional and newly developing strategies, insect systematics and biological diversity, toxicology, physiology, genomics, and ecology. It is our ability and willingness to work individually and as teams that will allow us to positively address current and future concerns.

2. Ultimate goal(s) of this Program

Our goal is to use applied and basic knowledge developed through departmental research activities to better manage pests and make more efficient use of beneficial arthropods, particularly insects. We intend to achieve less environmental and non-target contamination, allowing for the development of a healthier and more abundant food supply, and to increase the knowledge surrounding insects as model organisms.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	56.6	0.0
2009	0.0	0.0	56.6	0.0
2010	0.0	0.0	56.6	0.0
2011	0.0	0.0	56.6	0.0
2012	0.0	0.0	56.6	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Both basic and applied research will be conducted. Results of research efforts will be disseminated through refereed publications, general interest publications, Extension outlets, and presentations at scientific, stakeholder, and general public venues. A minimal amount of infrastructure will be constructed and equipment will be purchased during the plan of work period. All programs will involve the training of graduate students. Specific activities will include or produce a better understanding of biological diversity of native and disturbed habitats in Washington and the greater Pacific Northwest. Specimens collected and prepared during studies will be deposited in the James Entomological Collection. Studies of native and exotic species of arthropods in order to evaluate their potential for the control of and impact upon non-native, rangeland weed species. Studies directed at the management of direct and indirect pests through traditional technologies. Studies of basic biological and ecological principles as they relate to the management of pest and beneficial arthropods. Development and implementation of biological control and integrated pest management strategies for the management of pest arthropods, especially insects. Genomic studies of primarily honey bees and parasitic wasps to better enhance their beneficial potentials. The development and implementation of methods that measure and monitor agricultural chemicals in the environment. The development of methods that test the toxicological effects of agricultural chemicals on non-target organisms.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Group Discussion ● Education Class ● Other 1 (Extension outlets) ● Other 2 (Meetings with Stakeholders) ● Workshop 	<ul style="list-style-type: none"> ● Other 1 (Training of groups such as Maste) ● Web sites

3. Description of targeted audience

Target audiences for our work in the Department of Entomology include scientists in various related disciplines, farmers, extension, agribusiness, public policy maers, legislators, government agencies, and the general public.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	5500	1500	1000	100
2009	5500	1500	1000	100
2010	5500	1500	1000	100
2011	5500	1500	1000	100
2012	5500	1500	1000	100

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	30	20
2009	32	20
2010	33	20
2011	35	20
2012	35	20

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :30 2009 :32 2010 :33 2011 :35 2012 :35

- Graduate Students supported on Agricultural Research Center and other external funds

2008 :21 2009 :22 2010 :23 2011 :25 2012 :25

V(I). State Defined Outcome

1. Outcome Target

Percent of holdings that are implementing changes to IPM based on research findings

2. Outcome Type : Change in Action Outcome Measure

2008 :60 2009 :65 2010 :70 2011 :75 2012 :75

3. Associated Knowledge Area(s)

- 136 - Conservation of Biological Diversity
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 215 - Biological Control of Pests Affecting Plants

- 216 - Integrated Pest Management Systems

1. Outcome Target

Percent decrease in pesticide use

2. Outcome Type : Change in Condition Outcome Measure

2008 :4

2009 : 8

2010 : 11

2011 :15

2012 : 15

3. Associated Knowledge Area(s)

- 136 - Conservation of Biological Diversity
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

The research conducted by the Department of Entomology is governed by the expertise and problematic evaluations of the researchers as well as input from concerned stakeholders (including the public) and appropriate governmental agencies. Some of the work is proactive to foreseen or reactive to implemented governmental or industry imposed regulations. These are often initiated by public priorities. Resources are always a concern and have a direct affect on outcomes. Economic factors will affect the input of additional resources from the University, state and federal funding agencies, and stakeholders. Items such as technical support and equipment purchase often suffer during periods of economic exigency. We are hoping for added faculty positions during the period of work, which would allow for greater productivity and expansion of research subject area. We do not foresee the loss of any positions during this period but obviously, should they occur, they would lessen output.

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

1. Evaluation Studies Planned

- Retrospective (post program)
- During (during program)
- Time series (multiple points before and after program)
- Before-After (before and after program)

Description

Program evaluations take place on at least a yearly basis; they are primary topics during face-to-face annual reviews of faculty and programs. Most programs are also reviewed on a yearly or biannual basis by stakeholder concerns that often provide additional funding to a program. While each program is evaluated on an individual basis, criteria held in common to all programs include refereed publications in professional journals, professional proceedings, an evaluation of economic return, and, when applicable, the transfer of information to the public sector. Most of our departmental research is conducted by individuals with partial Extension appointments or in close association with others in the Department or college that have Extension appointments. This is done in order to ensure the efficient transfer of findings to those that will implement changes based on the research. Before a program is initiated, a preliminary proposal is reviewed by at least two (preferably three) individuals with experience in the subject. Changes in proposed programs are made based on these reviews. As stated, program reviews take place on an annual basis. If, based on these annual reviews, changes need to be made or performance is not satisfactory, changes are made. In some cases, the program may be evaluated for specific advances based on a pre-program schedule. If certain milestones are not met, then the

program may be modified. Each program is evaluated at termination.

2. Data Collection Methods

- Journals
- Observation
- On-Site

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Environmental Horticulture

2. Brief summary about Planned Program

There is evidence that humans have manipulated their environments by the use of cultivated plants for thousands of years. In some cases, these plantings are intended to moderate extreme environmental conditions (e.g. temperature, humidity, and wind), while in other cases their purpose is primarily aesthetic. In contemporary times the use of plants to create aesthetically pleasing environments is common place. Nurserymen, landscape contractors, and urban foresters face many challenges in creating and managing urban landscapes. Compacted soil, physical human impact, air quality, and water availability are all factors that affect the survival of plants in this environment. Research included in this program area focuses on addressing these issues. The influence plants have on physiological human well-being has only been moderately understood. Recent research suggests that there may be more subtle physiological influences, as well as psychological benefits provided by plants. It has been found, for instance, that hospital patients recover more quickly from surgery when in rooms having plants, or with views of landscape plants. Clearly, additional research, like that which is described here, is needed to develop a more thorough understanding of the benefits of plants to human well-being.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 124 10% Urban Forestry
- 134 10% Outdoor Recreation
- 203 25% Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 212 25% Pathogens and Nematodes Affecting Plants
- 724 5% Healthy Lifestyle
- 802 10% Human Development and Family Well-Being
- 804 10% Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures
- 903 5% Communication, Education, and Information Delivery

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

The landscape horticultural industry in the state of Washington is a strong and very important sector of the agricultural economy. It is estimated that plant products produced by this industry are worth \$250 million at the farm gate. It has further been estimated that the true contribution of the landscape horticulture industry to the state's economy exceeds \$800 million. This is a situation that is not unique to Washington. It has recently been reported that landscape nursery plants constitute the highest valued agricultural commodity in Oregon. These numbers are indicative of the high value that society places on aesthetically pleasing landscapes. In addition to these obviously measurable economic characteristics, there are many other benefits of healthy landscapes. Sustainable quality of life in our built environments is, in fact, dependent on the very existence of healthy landscapes.

2. Scope of the Program

- In-State Extension
- Integrated Research and Extension
- Multistate Extension
- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

There is little doubt that we will continue to be an urban dominated society, and questions of landscape management and plant/human interactions will require our attention. It is our assumption that society will continue to value plants in their built environments and this in turn will require research such as that described here. Further, we assume that there will be an increase in the need for this kind of research as populations expand and the demand for space to serve human needs increases. We assume that additional research capacity in urban horticulture and landscape architecture will be needed to adequately serve these needs. The scientists contributing to this program receive funding from a variety of sources: Federal competitive grants, the Washington State Department of Agriculture, several grower organizations, and many private organizations. It is assumed that this diversity as well as the overall amount of funding will continue or increase over the next ten years. These scientists, more often than not, work in a collaborative, integrated way to solve problems faced by the urban horticulture/landscape industry, and to answer more fundamental questions about plant and human interactions.

2. Ultimate goal(s) of this Program

The ultimate goal of this program to discover, disseminate and apply knowledge which emphasizes sound environmental practices in the landscape horticulture industries, and to develop an understanding of the physiological and psychological effects that plants have on people.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	3.3	0.0
2009	0.0	0.0	3.3	0.0
2010	0.0	0.0	3.3	0.0
2011	0.0	0.0	3.3	0.0
2012	0.0	0.0	3.3	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Specific activities that are part of this program include: investigations of the effects of cultural practices on plant root health and the establishment of landscape plants, research focusing on the development of an understanding or environmental and cultural factors that affect water stress and cold hardiness in landscape plants, research focusing on the identification of superior ornamental landscape plants for urban environments, studies of the influence of human experience in the development of perceptions related to urban landscapes, and research aimed at developing further understanding of the relationships between physical environments and human behavior.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Group Discussion ● Workshop ● Other 2 (Conference Presentation) ● Other 1 (Research Reviews, Field days) 	<ul style="list-style-type: none"> ● Web sites ● Newsletters

3. Description of targeted audience

The target audience for this program consists of other scientists in the discipline, extension personnel, social scientists, landscape horticulture industry, and the consumer/gardener,

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	600	100	0	0
2009	600	100	0	0
2010	600	100	0	0
2011	600	100	0	0
2012	600	100	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :1 2009 :1 2010 :1 2011 :1 2012 :1

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	9	0
2009	13	0
2010	13	0
2011	13	0
2012	13	0

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :9 2009 :13 2010 :13 2011 :13 2012 :13

V(I). State Defined Outcome

1. Outcome Target

See below under Evaluation.

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 124 - Urban Forestry
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 724 - Healthy Lifestyle

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

There are many external factors that could affect the research program mentioned here. None of these can be predicted at a level of precision that would suggest modifications of research protocols, and certainly none of them can be controlled. As noted above in section 5, regardless of these external factors, it is assumed that the horticulture industry will continue to be a major contributor to Washington's agricultural economy. The programs described here will change in response to external factors as necessary but will strive to continue to be responsive to grower and consumer needs.

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

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

This research program will be evaluated within the context of how well it serves the needs of the landscape horticulture industry, designers and planners, open space managers, and health care professionals. It will also be evaluated on how it has contributed to the body of knowledge related to the impact of plants on people. Evaluation criteria will be quantitative as well as qualitative. The short-term goal to discover knowledge which emphasizes sound environmental practices in the landscape horticulture industries, and to develop an understanding of the physiological and psychological effects that plants have and people will be evaluated by the extent to which research results are disseminated in the scientific literature. Mid term goals will be evaluated based on the success with which the information is communicated in trade journals, conference proceedings, and popular periodicals that influence the behavior of members of the landscape horticulture community. The long-term goals of the program will be evaluated based on: the acceptance by the landscape horticulture industry of newly developed strategies for plant establishment and production, the extent to which recommended design guidelines are implemented by open space and land management agencies, and the success of the research findings in influencing guidelines and recommendations developed for the use of plants to influence human health and well-being.

The outcomes from this program can be evaluated based on an assessment of the extent to which research products have been assimilated into the various components of the landscape horticulture industry, and the landscape architectural design and planning professions. There currently are no reliable data related to the use of the information and practices resulting from this Research Program, nor are there mechanisms in place to collect such data in the future. At best, any predictions about future adoption of research products from this program would be based on anecdotal information, and casual conversations with greenhouse and nursery managers, landscape installation and maintenance professionals, and landscape designers and architects. Research products that may be adopted include landscape plant material that is being evaluated for its potential to grow successfully in an urban environment, strategies that allow for more efficient root zone management in landscape plants, use of compost materials to amend urban soils, and information related to human psychological and physiological response to plants in interior and exterior environments.

2. Data Collection Methods

- On-Site
- Journals
- Unstructured
- Observation

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Food Science and Human Nutrition

2. Brief summary about Planned Program

The Department of Food Sciences and Human Nutrition coalesces expertise in the areas of food, nutrition, and health that will lead to the development of a nationally recognized program on the forefront of food research in the 21st century. A core mission of this initiative is to improve the value and profitability of agricultural products and nutritional components in foods produced in the State of Washington. Washington is recognized nationally and internationally as an important producer of tree fruits, berries, vegetables, seafood, meat and dairy products, grains, legumes and wine. The state is best situated to serve niche markets with specialty products of high value because of the diverse climate across Washington and the adaptability and sophistication of producers within the agricultural community to produce new products for emerging and value-added markets. The Washington industry has been a national leader in the development of sustainable practices and organic farming, a strong indication of its responsiveness to new trends and emerging market demands. The regional food industry responds to a diverse, eclectic, and trendsetting consumer base with a large health conscious segment. Washington has a large food processing industry, with a growing segment in specialty foods. Washington State is also a major exporter of food products, particularly to Pacific Rim nations.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 202 6% Plant Genetic Resources
- 501 17% New and Improved Food Processing Technologies
- 502 15% New and Improved Food Products
- 503 11% Quality Maintenance in Storing and Marketing Food Products
- 504 3% Home and Commercial Food Service
- 701 2% Nutrient Composition of Food
- 702 23% Requirements and Function of Nutrients and Other Food Components
- 703 11% Nutrition Education and Behavior
- 712 12% Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

In recent years, the cost of production and competition from international players in conventional agricultural commodities has increased. Washington producers, because of logistics, cost of production, and increasing environmental and regulatory requirements, are becoming less competitive in many commodity markets. This program will provide scientific and technical information that would assist producers and processors to develop profitable new products and new markets for healthy foods. This would include products that can reduce the risk of chronic debilitating diseases such as coronary heart disease, diabetes, rheumatoid arthritis, osteoporosis, cancer and obesity. Furthermore, the College of Agricultural, Human and Natural Resources Sciences is poised to provide this assistance to the state agricultural community by building upon existing strengths within the College regarding the production, processing and utilization of a variety of important food products as well as in the areas of nutrition, human health and consumer education. The presence of WSU Extension throughout the state and its programmatic emphasis on public health and nutrition will bolster community outreach aspects of this program.

2. Scope of the Program

- Integrated Research and Extension
- Multistate Integrated Research and Extension
- In-State Research
- In-State Extension
- Multistate Research
- Multistate Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The assumptions of this program are: (1) that the amount of funding, faculty and staff will remain at current 2005 levels, (2) that the societal concerns of diabetes, obesity and heart disease will increase over the next five years, (3) that the societal issues of protecting the food supply will also increase over the next five years, and that (4) the development of novel rapid methods to detect food microbiological and other food contaminants will be needed to protect the food supply for the public.

2. Ultimate goal(s) of this Program

Specific goals of this program are to: (1) assist with the development of new knowledge to better define the role of foods and food components in nutrition and human health, (2) evaluate the role cultivation practices and processing technologies have on the nutritive value of food and food components, focusing on emerging nutrients such as antioxidants, lipids, protein and fiber components, (3) ensure that products developed are both nutritious and safe, (4) improve current agricultural practices of total utilization, and (5) enhance education in food science and nutrition for students at the university.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	23.0	0.0
2009	0.0	0.0	23.0	0.0
2010	0.0	0.0	23.0	0.0
2011	0.0	0.0	23.0	0.0
2012	0.0	0.0	23.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

We will conduct research and disseminate results to the public, industry and scientists on food safety, quality, obesity and diabetes, (2) expand the existing pilot plant to better serve the needs of the food industry, and (3) deliver educational programs on diabetes, food handling and HACCP, and nutritional habits to the public.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (Focus Groups) ● Group Discussion ● Demonstrations ● Workshop 	<ul style="list-style-type: none"> ● Other 1 (Questionnaires) ● Newsletters ● Web sites

3. Description of targeted audience

Our target audience includes research and extension scientists in the disciplines of food sciences and human nutrition, food engineering, the medical community, persons interested in policy, legislators and the general public. We also have an audience in the Native American and Hispanic communities.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	5	3	0	0
2009	5	3	0	0
2010	6	3	0	0
2011	6	4	0	0
2012	6	4	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :3 2009 :4 2010 : 3 2011 :4 2012 :3

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	30	4
2009	30	4
2010	30	4
2011	35	4
2012	35	4

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal publications

2008 :23 2009 :24 2010 : 26 2011 :30 2012 :30

- Graduate students supported by experiment station funding and grants

2008 :11 2009 :12 2010 : 12 2011 :12 2012 :12

V(I). State Defined Outcome

1. Outcome Target

Investigation of rapid detection systems for food contamination

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :1 **2009 : 1** **2010 : 1** **2011 :1** **2012 : 1**

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Investigation of novel food processing and storage methods

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :3 **2009 : 2** **2010 : 4** **2011 :2** **2012 : 3**

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products

1. Outcome Target

Scientists and companies would use the information we have published to further their research and food production practices

2. Outcome Type : Change in Action Outcome Measure

2008 :11 **2009 : 10** **2010 : 12** **2011 :12** **2012 : 12**

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Rapid detection systems move to a pilot plant testing phase

2. Outcome Type : Change in Action Outcome Measure

2008 :1 **2009 : 2** **2010 : 2** **2011 :1** **2012 : 2**

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Information in published research is incorporated into production practices thus improving the safety of the food supply.

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :1 **2009 : 0** **2010 : 1** **2011 :1** **2012 : 1**

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Novel rapid detection methods for food pathogens become available to the food and processing industries improving the safety of the food supply

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 **2009 : 2** **2010 : 1** **2011 :1** **2012 : 1**

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

We envision that all of the items checked above will affect outcomes.

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

1. Evaluation Studies Planned

- Other (See below)

Description

The program will be continually evaluated using a variety of processes including; annual review of faculty, staff and graduate students, annual CRIS reporting of individual and regional projects, CRIS reviews of programs research, ADA and Food Science Associations accreditation, input from college and program advisory groups, graduate student exit interviews, annual evaluation of department accountability measures which include publication rate, grant support, enrollment and progress towards reaching research outcome measures.

2. Data Collection Methods

- Sampling
- Structured
- Other (See below)
- On-Site
- Whole population

Description

Focus groups: Meet at different target locations and collect data.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Fruit and Vegetable Development, Production and Management

2. Brief summary about Planned Program

Research activities included in this program will focus on two general areas of need: (1) development of fruit and vegetable crops particularly suited to Washington and the Pacific Northwest, and (2) creation of knowledge, tools, and techniques that can be applied to production and management of fruit and vegetable crops allowing Washington growers to remain competitive in a global food economy. Specific research activities include: (1) development and release of fruit and vegetable varieties meeting the needs of Washington industries, (2) elucidating genetic mechanisms controlling fruit and vegetable production and quality, (3) isolation of genes influencing horticultural characteristics such as ripening, pest resistance, and storage potential, (4) testing the viability of alternative rootstocks for use in apple and cherry production in the Washington tree fruit industry, 5) understanding the physiological mechanisms involved in fruit damage resulting from extreme environmental conditions, (6) identification of environmental factors that affect production and quality in tree fruits and small fruits, (7) identification the biological mechanisms controlling utilization of calcium, reproduction, growth, development, and physiology of fruits and vegetables, and, (8) establish production and management strategies to maximize efficiency and profits for the fruit and vegetable producers of Washington.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 201 8% Plant Genome, Genetics, and Genetic Mechanisms
- 202 10% Plant Genetic Resources
- 203 13% Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 30% Plant Product Quality and Utility (Preharvest)
- 205 25% Plant Management Systems
- 206 7% Basic Plant Biology
- 212 3% Pathogens and Nematodes Affecting Plants
- 216 1% Integrated Pest Management Systems
- 601 1% Economics of Agricultural Production and Farm Management
- 711 2% Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Washington's fruit and vegetable industries play a significant role in the state's agricultural economy. Tree fruit and small fruit crops contribute nearly \$1.5 billion in farm gate value. After processing and marketing of these commodities, their contribution to the state economy is considerably higher. Washington leads the nation in production of apples, pears, concord grapes, sweet cherries, and raspberries. About half of all apples, grapes, cherries, and pears, and 83% of all raspberries grown in the U.S. are produced in Washington. Competition from South American and Asian countries is beginning to seriously affect the tree fruit and small fruit industries of Washington. The Chinese apple industry has already had a serious effect on the price of apples used for juice concentrate. It is imperative that Washington's fruit growers have access to new crop varieties, and the most efficient production and management systems to remain competitive in this newly emerging global economy. The vegetable industry of Washington makes significant contributions to the state's economy. Vegetable growers produce asparagus, carrots, cucumbers, green peas, lettuce, onions, potatoes, and snap beans. They also produce considerable vegetable seed. Washington leads the nation in production of asparagus and processed carrots. The Washington potato industry is second only to Idaho in production. Washington potato growers produced almost 9 billion pounds of potatoes in 2001 valued at \$552 million (farm gate value). Nearly 90% of the Washington crop is used in the production of frozen potato products.

2. Scope of the Program

- Multistate Integrated Research and Extension
- Multistate Extension
- Integrated Research and Extension
- In-State Research
- In-State Extension
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The over-riding assumption of this research program is that the fruit and vegetable industries of Washington will continue to dominate the state’s agricultural economy in the future, and that fruit and vegetable growers will face increasing challenges competing in a global food economy. More than half of the departmental faculty members are engaged in research and extension activities related to this program, and it is assumed that this number will remain constant or perhaps increase in response to emerging industry needs. It is assumed that a current search to fill a newly created position in functional genomics focusing on horticultural crops will be successful. This is a very robust and mature program with contributions coming from several established senior scientists. These scientists have a full knowledge of the literature, accepted techniques, and procedures used in the research. They have, in fact, in many cases, established themselves as national and international experts in their area of study, and have contributed much to the body of knowledge of the science. It is also assumed that several faculty members who plan to retire in the next few years will be replaced, and newly appointed faculty will establish specific research programs aiming to benefit Washington’s fruit and vegetable industries. This does not necessarily mean that all existing programs will be continued, but that new programs will be created to address emerging needs and problems within the general context of fruit and vegetable production. Scientists contributing to this program receive funding from a great variety of sources including federal competitive grants, federal earmark funds (CSREES), several commodity commissions and grower organizations (e.g. Washington Tree Fruit Research Commission, Washington Potato Commission), State of Washington, and many private organizations. It is assumed that this diversity as well as the overall amount of funding will continue or increase over the next ten years. These scientists work in a collaborative, integrated way to solve problems faced by industry. Their work ranges from molecular to very applied. It is assumed that these types of activities will continue, and most likely increase, as the expertise of current faculty is supplemented with new appointments.

2. Ultimate goal(s) of this Program

The ultimate goal of this program to discover, disseminate and apply knowledge which emphasizes sound environmental practices and sustainable and efficient production of fruit and vegetable crops.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	45.3	0.0
2009	0.0	0.0	45.3	0.0
2010	0.0	0.0	45.3	0.0
2011	0.0	0.0	45.3	0.0
2012	0.0	0.0	45.3	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Specific activities and outputs vary across a wide range from molecular level inquiry to field based studies about the efficacy of horticultural production practices. These activities will include: basic research which focuses on the application of molecular biology, genetics and biochemistry, especially related to the calcium/calmodulin-mediated signal network which influences plant response to environmental factors; studies in fruit production and biology, with an emphasis on sustainability of fruit production systems; genomic, genetic, and breeding studies in apple, cherry, raspberry, and strawberry; studies of the anatomy and structure of grape berry during growth and development; research that emphasizes the use of plant bioregulators for apple, pear, and sweet cherry, studies related to the interaction of various environmental and production factors influencing yield and quality of potato tubers; research focusing on environmental factors and management practices as they influence grape physiology; studies of effects of deficit irrigation and partial root zone drying in apple, cherry, and grape; research which focuses on the development of an understanding of factors that cause skin disorders of apples; evaluation of potato cultivars for introduction into the Washington potato industry; studies focusing on practical mean of achieving balanced cropping and effects of new clonal rootstocks on scion productivity, growth, and fruit quality in cherry; and research focusing on novel management strategies for high density cherry production, and the potential for mechanical harvest of fresh-market quality, stemless sweet cherries. The outputs of these activities will include: patents, plant variety releases, scientific journal articles, conference publications and presentations, poster presentations, field day presentations, web sites, and knowledge about production and management practices that is passed along to users in other informal settings.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (Research Reviews, Field days) ● Workshop ● Group Discussion ● Other 2 (Conference Presentation) 	<ul style="list-style-type: none"> ● Web sites ● Newsletters

3. Description of targeted audience

The audience for this program will be other scientists, economists, agribusiness, farmers, horticulturists and the fruit tree and potato industries.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	1250	600	0	0
2009	1250	600	0	0
2010	1250	600	0	0
2011	1250	600	0	0
2012	1250	600	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 : 1 2009 : 1 2010 : 1 2011 : 1 2012 : 1

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	21	3
2009	22	3
2010	23	3
2011	24	4
2012	26	4

V(H). State Defined Outputs**1. Output Target**

- Peer reviewed journal articles

2008 :21 2009 :22 2010 : 23 2011 :24 2012 :26

- Variety Releases

2008 :4 2009 :4 2010 :3 2011 :3 2012 :3

- Plant Patents

2008 :1 2009 :1 2010 :1 2011 :1 2012 :1

- Number of graduate students supported by Agricultural Research Center and external funds

2008 :7 2009 :6 2010 :7 2011 :9 2012 :9

V(I). State Defined Outcome**1. Outcome Target**

See below under Evaluation.

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology

V(J). Planned Program (External Factors)**1. External Factors which may affect Outcomes**

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

Description

There are many external factors that could affect the research programs mentioned here. None of these can be predicted at a level of precision that would suggest modifications of research protocols, and certainly none of them can be controlled. As noted above regardless of these external factors, it is assumed that the fruit and vegetable industry will continue to be a major contributor to Washington's agricultural economy. The programs described here will change in response to external factors as necessary but will strive to continue to be responsive to grower needs

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

1. Evaluation Studies Planned

- Retrospective (post program)
- Before-After (before and after program)
- During (during program)

Description

A number of different measures will be used to evaluate the success of research projects described in this program at multiple points throughout the duration of the program. The short-term goal of creating new knowledge is evaluated by the extent to which this new knowledge is communicated throughout the scientific literature. The mid-term goal of communicating that knowledge to stakeholders will be evaluated based upon the success with which the information is disseminated through the use of presentations and posters given at grower sponsored conferences, workshops, and research reviews, and at university sponsored field days. The long-term goal of having direct impact on sound environmental practices and sustainable and efficient production in fruit and vegetable crops will be evaluated by the extent to which research findings are adopted throughout the industry. For those projects focusing on the investigation of production and management practices, (for example, research that emphasizes the use of plant bioregulators for apple, pear, and sweet cherry, studies related to the interaction of various environmental and production factors influencing yield and quality of potato tubers; research focusing on environmental factors and management practices as they influence grape physiology; studies of effects of deficit irrigation and partial root zone drying in apple, cherry, and grape), the extent to which recommended practices have been adopted will be used as the measure of success. In the case of research that focuses on the development of new products, such as sprays used to prevent sunburn in apple, or cracking in cherry the extend to which the new products are adopted for use throughout the industry will be used as a measure of success. For those projects which focus on fruit and vegetable breeding, the measure of success will be the extent to which newly released cultivars gain acceptance by growers, and begin to contribute to the agricultural economy. Most of the specific research projects included in this program are funded by commodity commissions and other agricultural stakeholder organizations. Scientists make progress reports on an annual basis to these organizations as a part of the process for continuation of funding. The extent to which these projects receive continued financial support is another measure of their success.

2. Data Collection Methods

- Observation
- Unstructured
- Journals

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)

1. Name of the Planned Program

Program in Natural Resource Sciences

2. Brief summary about Planned Program

Scientists in the Department of Natural Resource Sciences will work toward developing: (1) a better understanding of the ecology and restoration of native plants in annual grasslands of the Interior West, (2) a better understanding of the decline of various wildlife species, wildlife nutrition, and potential restoration techniques, and (3) superior management and restoration of lakes and streams in the western United States, with an emphasis on water quantity, quality and security. This ongoing research emphasis is expected to have a long-term duration.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

- 112 20% Watershed Protection and Management
- 121 10% Management of Range Resources
- 123 15% Management and Sustainability of Forest Resources
- 135 40% Aquatic and Terrestrial Wildlife
- 136 15% Conservation of Biological Diversity

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Research conducted by the faculty members in the topic areas listed previously are of interest to a wide array of stakeholders. This is particularly true for work centered on: (1) Aquatic and Terrestrial Wildlife and (2) Watershed Protection and Management. In the first case, research efforts are strongly influenced by the need for local and national compliance with a wide array of federal mandated environmental laws, including the Endangered Species Act. In addition, the protection and restoration of the natural environment in which we live is of critical concern to a wide array environmental groups and the public in general. Similarly, watershed protection and management is of increasing interest in the western United States due to population growth throughout the region and its limited supply for obvious reasons.

2. Scope of the Program

- In-State Extension
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Major assumptions underlying this program of research include: (1) the continuation of current levels of faculty funding support, and (2) current levels of infrastructure support with the department and university. Faculty members are expected to generate extramural support for graduate assistantships, data collection, equipment needs, etc. Hence, downturns in the state and federal economy and associated research funding levels could adversely affect research productivity. It is expected that these results will result in improved resource management, more sustainable developed and undeveloped ecosystems, and sustainable development within the state and region.

2. Ultimate goal(s) of this Program

The ultimate goal of this program of research is: improved insights into the management of developed and less-developed aquatic and terrestrial ecosystems.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	12.7	0.0
2009	0.0	0.0	12.7	0.0
2010	0.0	0.0	12.7	0.0
2011	0.0	0.0	12.7	0.0
2012	0.0	0.0	12.7	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

In our research in the Department of Natural Resource Sciences we perform laboratory and field experiments. Data is collected and analyzed. Papers, books, book chapters and reports are written. Presentations are given in local, national and international venues. Graduate students and undergraduate students are mentored and trained. Curriculum is revised and developed.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Group Discussion ● One-on-One Intervention ● Demonstrations ● Education Class ● Workshop 	<ul style="list-style-type: none"> ● Web sites ● Newsletters

3. Description of targeted audience

Our target audience includes other researchers within and without the discipline of natural resource sciences including extension educators, persons in industry, economics, policy makers and the general public.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	0	100	0	0
2009	0	100	0	0
2010	0	100	0	0
2011	0	100	0	0
2012	0	100	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	10	0
2009	10	0
2010	10	0
2011	10	0
2012	10	0

V(H). State Defined Outputs

1. Output Target

- Peer Reviewed Publications

2008 :10 2009 :10 2010 : 10 2011 :10 2012 :10

- Graduate students supported on experiment station and grant funds

2008 :15 2009 :15 2010 : 15 2011 :15 2012 :15

V(I). State Defined Outcome

1. Outcome Target

graduate students and post-docs trained

2. Outcome Type : Change in Action Outcome Measure

2008 :5 2009 : 5 2010 : 5 2011 :5 2012 : 5

3. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management
- 121 - Management of Range Resources
- 123 - Management and Sustainability of Forest Resources
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity

1. Outcome Target

Percent increase in research support

2. Outcome Type : Change in Action Outcome Measure

2008 :5 2009 : 5 2010 : 10 2011 :10 2012 : 10

3. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

- 121 - Management of Range Resources
- 123 - Management and Sustainability of Forest Resources
- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity

1. Outcome Target

New personnel in research positions

2. Outcome Type : Change in Condition Outcome Measure

2008 :1 2009 : 1 2010 : 1 2011 :1 2012 : 0

3. Associated Knowledge Area(s)

- 135 - Aquatic and Terrestrial Wildlife
- 136 - Conservation of Biological Diversity

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Public Policy changes
- Appropriations changes
- Economy
- Government Regulations

Description

This program of research resides in a university environment with very limited institutional research support. Faculty members are responsible for raising virtually all needed research funds from extramural sources. Faculty are provided with an office, laboratory and related space within which to conduct their research. The unit does not have any state/federally supported research assistants and very limited funding for teaching assistants. Faculty members are not provided with any base level research funding. As a result, they are expected to obtain extramural funding to support all aspects of their research including equipment, research assistants, travel, supplies, etc. In summary, faculty members are viewed as the entrepreneurial research engines underlying the research program and in the mentoring of graduate students.

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

1. Evaluation Studies Planned

- Other (See below)

Description

Each faculty member with a Hatch project included in this group are reviewed annually first by the Department Chair and subsequently by the Dean and Directors of the College of Agricultural, Human and Natural Resource Sciences. Target Measures used include: (1) Number of refereed journal articles produced, (2) Quality of refereed journal articles produced, (3) Amount of extramural funding received from other sources in support of these research efforts and (4) the number of masters and doctoral students completing their degrees. Over the longer term, the chair considers the impact of the research on resource management decisions. Unfortunately, these evaluations typically occur several years after the completion of the research.

2. Data Collection Methods

- Sampling
- Other (See below)

Description

Captive Animal trials

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Plant Pathology

2. Brief summary about Planned Program

Washington State has the second most diverse agricultural production in the U.S.; and consequently, the number and types of pathogens causing disease on crops of importance in the State is also large. This Research Program supports the agricultural, forestry, horticultural, seed, and nursery enterprises of the state, nation, and world, and all faculty members in the Department of Plant Pathology have a research appointment. Research activities are grouped by crop focus and scientific expertise. Several host groups receive specific attention from one or more individuals including flower bulbs, forest trees, legumes, mint, potatoes, small grains, tree fruits, and vegetables. Research activities in the department fall into three broad areas: Biology of disease-causing organisms; Ecology and epidemiology of plant diseases; and Detection of disease-causing organisms and control of plant diseases. The activities range from basic studies of disease biology, host-parasite interactions, and disease forecasting to applied research directed at disease control practices including chemical, cultural, biological, and disease resistance strategies.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 212 100% Pathogens and Nematodes Affecting Plants

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Plant diseases cause direct economic losses to crops through reduced production and decreased quality of the harvested commodity. Plant pathogens can also cause indirect losses because of restricted trade and commerce that may occur because of their presence in a state or region. For example, nursery trade in some areas is restricted because *Phytophthora ramorum*, cause of Sudden Oak Death, is present in the region. Consequently, the efforts of individuals involved in this Program in controlling both the direct losses attributable to disease and eradication of plant pathogens from production areas are of primary importance to farmers and those engaged in trade, and secondarily to consumers as a result of higher food and commodity prices. Many producer organizations recognize the need for ongoing research to develop new strategies for controlling plant disease and provide funds to conduct research. Likewise, many state and federal government programs exist to provide funding to conduct research on plant diseases because of their recognized importance to food security. This Program has a long history of providing applied, problem-solving research for the citizens of Washington State, and providing basic information to science.

2. Scope of the Program

- In-State Extension
- In-State Research
- Integrated Research and Extension
- Multistate Integrated Research and Extension
- Multistate Extension
- Multistate Research

V(D). Planned Program (Assumptions and Goals)**1. Assumptions made for the Program**

This plan is based on the assumption of level funding for the next 5 years, with a possibility of limited internal reallocation of resources to meet specific goals. A major assumption is that plant pathologists will continue to be required by the agricultural and landscape enterprises locally, nationally, and internationally. The programs of this department will continue to serve the agricultural and landscape industries of Washington through applied and basic research and extension activities.

2. Ultimate goal(s) of this Program

The ultimate goals of this program are to develop environmentally sound agricultural production systems, environmentally friendly and effective disease control, and to increase our understanding of pathogens and their interactions with plants and the environment.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	67.8	0.0
2009	0.0	0.0	67.8	0.0
2010	0.0	0.0	67.8	0.0
2011	0.0	0.0	67.8	0.0
2012	0.0	0.0	67.8	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Grant proposals will be written. Experiments will be designed. Applied and basic research will be conducted in laboratories, greenhouses, and in field plots. Results of these studies will be summarized, and analyzed statistically. Results of studies will be disseminated to producers in the State, to the lay public, and to other scientists in the discipline and in other disciplines through oral presentations at meetings, field plot tours, extension bulletins, scientific publications, newsletters, and electronically through websites. Peer-reviewed scientific papers, popular press articles, and book chapters will be published. Data will be provided to support registration of crop protection chemicals. Graduate students will be trained to conduct and disseminate research.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (Field plot tours/Field days) ● Demonstrations ● One-on-One Intervention ● Group Discussion ● Education Class ● Workshop 	<ul style="list-style-type: none"> ● Other 1 (Scientific publications) ● Public Service Announcement ● Web sites ● Newsletters

3. Description of targeted audience

Targeted audience: Primary producers of and dealers involved with trade of agricultural, forestry, horticultural, seed, and nursery commodities produced in the state; Homeowners and policy makers with need for plant health information; and, other scientists conducting related research. Extension specialists and teachers involved in transmitting information to the public and students.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	11	22	0	0
2009	12	24	0	0
2010	13	26	0	0
2011	14	28	0	0
2012	15	30	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	57	27
2009	59	28
2010	61	29
2011	63	30
2012	63	31

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :57 2009 :59 2010 :61 2011 :63 2012 :63

- Graduate students supported by experiment station funds

2008 :27 2009 :28 2010 :29 2011 :30 2012 :31

V(I). State Defined Outcome

1. Outcome Target

Increased numbers of publications

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :57 2009 : 59 2010 : 61 2011 :63 2012 : 63

3. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

1. Outcome Target

Increased graduate student enrollment

2. Outcome Type : Change in Action Outcome Measure

2008 :27 2009 : 28 2010 : 29 2011 :30 2012 : 31

3. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

1. Outcome Target

Reduced Fungicide Use

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 212 - Pathogens and Nematodes Affecting Plants

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Appropriations changes
- Public Policy changes

Description

As a public institution, all programs are affected by changes in appropriations, public policy and competing public priorities. We depend on allocation of public funds to conduct parts of our mission and changes in the allocation for any reason can have a significant impact on the program. A reduced allocation would most likely result in a reduction in technical support staff that would reduce our capacity to complete the objectives of our programs. In contrast, increased allocation would allow us to add capacity and complete our objectives sooner and/or add objectives not part of the current plan.

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

1. Evaluation Studies Planned

- Other (After)
- During (during program)

Description

Evaluation will take place annually. Accomplishments of the faculty in addressing the short- and medium-term goals will be summarized and reported. Progress toward the long-term goal will be summarized at the end of the program.

2. Data Collection Methods

- Journals
- Unstructured

Description

The Department Chair meets annually with each faculty member to discuss accomplishments. There is an accounting of grants submitted, grants funded, and peer reviewed publications through WSU WORQS for each faculty member. The data is collected through annual faculty accomplishment reports and department summary reports.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Statistics

2. Brief summary about Planned Program

The Department of Statistics does theoretical and applied research in most areas of statistics applicable to the agricultural, biological and engineering sciences. However, the two projects currently being conducted by Departmental faculty supported in part by Hatch funds deal with binary data analysis and resource selection. The first emphasizes the development of more powerful methods for analyzing data arising from plant and animal experiments with 0-1 observations while the second deals with the development of more appropriate methods for modeling wildlife and plant distributions, as well as how animals use terrestrial habitats and food.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 901 100% Program and Project Design, and Statistics

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

The project on binary data analysis deals with the development of better methods to analyze data arising from experiments where observational results consist of an animal or plant either exhibiting some characteristic of interest or not after the experiment is performed. The results of this project will allow animal and plant scientists to more efficiently design such experiments as well as obtain more information from data generated. The project on the evaluation of methods to analyze resource selection data is designed to determine which resource allocation data techniques work best in differing circumstances. The results obtained from this research will help wildlife managers make more intelligent decisions about how to distribute resources based on available data.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)**1. Assumptions made for the Program**

The faculty members conducting the two projects described above both have extensive backgrounds in the relevant research areas and both have previously published refereed journal articles in these areas. Because of their backgrounds, both will make significant progress on the research being conducted.

2. Ultimate goal(s) of this Program

The ultimate goal of both projects is to provide appropriate scientists and statistical consumers with better and more powerful statistical methods with which to make more intelligent decisions based on available data or to better plan and analyze data arising from their experiments.

V(E). Planned Program (Inputs)**1. Estimated Number of professional FTE/SYs to be budgeted for this Program**

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.3	0.0	0.8	0.0
2009	0.3	0.0	0.8	0.0
2010	0.3	0.0	0.8	0.0
2011	0.3	0.0	0.8	0.0
2012	0.3	0.0	0.8	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

It is expected that the results obtained from each project will be disseminated to other scientists at professional meetings through contributed or invited presentations as well as through peer reviewed publications resulting from the research conducted.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (Professional meetings) ● Other 2 (Invited Presentations) 	<ul style="list-style-type: none"> ● Other 1 (Peer Reviewed Publications)

3. Description of targeted audience

The target audience is other academic staticians, biologists and scientists other disciplines who are consumers of knowledge concerning statistical functions.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	20	40	0	0
2009	20	40	0	0
2010	20	40	0	0
2011	20	40	0	0
2012	20	40	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 : 0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	1	0
2009	1	0
2010	1	0
2011	2	0
2012	1	0

V(H). State Defined Outputs

1. Output Target

- Peer reviewed publications

2008 :1 2009 :1 2010 : 1 2011 :2 2012 :1

V(I). State Defined Outcome

1. Outcome Target

Immediate dissemination of knowledge gained from research projects through talks presented and peer reviewed publications

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :2 2009 : 2 2010 : 2 2011 :2 2012 : 2

3. Associated Knowledge Area(s)

- 901 - Program and Project Design, and Statistics

1. Outcome Target

Number of peer reviewed journal and proceedings papers, number of talks given

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :2 2009 : 2 2010 : 2 2011 :2 2012 : 2

3. Associated Knowledge Area(s)

- 901 - Program and Project Design, and Statistics

1. Outcome Target

Implementation of statistical methodologies and procedures derived from individual research projects in our department by other scientists

2. Outcome Type : Change in Condition Outcome Measure

2008 :2 2009 : 5 2010 : 5 2011 :5 2012 : 5

3. Associated Knowledge Area(s)

- 901 - Program and Project Design, and Statistics

1. Outcome Target

Number of citations for articles published which are based on individual research projects

2. Outcome Type : Change in Condition Outcome Measure

2008 :2

2009 : 5

2010 : 5

2011 :5

2012 : 5

3. Associated Knowledge Area(s)

- 901 - Program and Project Design, and Statistics

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Other (See below)

Description

The projects involve individual statistical research. Therefore, the completion of the projects is relatively immune to the effects of external factors other than possible additional faculty responsibilities such as teaching and consulting.

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

1. Evaluation Studies Planned

- During (during program)

Description

The program will be reviewed by the chair and administration as part of the annual review of faculty and departments.

2. Data Collection Methods

- Other (See below)

Description

Simulation of data is used to assess quality of models.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in Sustainable Crop and Soil Management

2. Brief summary about Planned Program

The research in this program area is designed to develop profitable and environmentally sound crop and soil management programs that encourage soil conservation through reduced tillage and direct seeding, carbon sequestration through improved soil organic matter storage, and reduced nutrient losses to surrounding water bodies by judicious fertilizer use and the improved use of organic nutrient cycles. Constraints on direct seed adoption, such as optimizing seed zone moisture for early plant growth establishment and residue management induced shifts in nutrient cycles have been identified. Changes in crop rotations are feasible with direct seeding, which increases soil water conservation. Organic systems are being developed in vastly different agroclimatic zones throughout WA state in response to a rapidly growing segment of WA agriculture.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 102 100% Soil, Plant, Water, Nutrient Relationships

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Sustaining the soil resource is a major challenge in preserving the natural resource base of Washington. Productive soils underpin the diverse agriculture of the state, yet are quite vulnerable to wind and water erosion and nutrient depletion with intensive cropping. Soils of the Palouse and Columbia plateau regions of Eastern Washington are ranked among the most highly erodible soils in the U.S. Decades of soil erosion and sustainable soil management research have resulted in tangible results. University researcher-grower partnerships have spawned the Pacific Northwest Direct Seed Association, which has become an independent grower organization formed to promote the adoption of direct seeding in the PNW. Improved soil carbon sequestration and soil quality with reduced tillage cropping is of interest to producers and environmentalists. Crop rotation studies have documented impacts of direct seeding on carbon sequestration, which in turn has led to contractual agreements (\$40,000) between the National Research Defense Council and the Pacific Northwest Direct Seed Association. According to NRCS (2001) data, more than 40% of Palouse cropland is now under no-till or conservation-till, and water erosion rates have been reduced from an average of 45 Mg/hectare in 1978 to an average of 38 Mg/hectare in 2001. Soil erosion from dry farmed cropland in all regions of the Inland PNW still exceeds tolerable rates. CTIC reports that direct seeded wheat in 2004 occupied 10-18% of the acreage, but as high as 60-70% in Columbia County. Incidents of air quality violations reported by local municipalities due to soil particulate emissions have decreased but have not been eliminated. Organic grain cropping systems research has increased the interest and responded to market demand for organic and sustainably produced grains. Locally marketed flour produced under a sustainable market label has increased consumer interest in local agriculture.

2. Scope of the Program

- Multistate Research
- In-State Extension
- In-State Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The research proposed in this program assumes that there will continue to be an increasing societal demand for environmental services obtained from our agricultural systems, e.g. carbon sequestration, wildlife habitats, waste recycling. In addition, we assume there will continue to be advancements in machinery technology and geospatial information for improving soil management systems. The proposal also assumes that state and federal support will continue to provide resources necessary to sustain programs lead by eleven core faculty members in this group with adequate operating funds and technical support.

2. Ultimate goal(s) of this Program

The ultimate goal of this program is to create new crop and soil management systems to address emerging markets and production challenges that will improve sustainability of the agriculture in the region. It will create new soil management tools and fundamental knowledge about soil functioning and biological dynamics.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	39.9	0.0
2009	0.0	0.0	39.9	0.0
2010	0.0	0.0	39.9	0.0
2011	0.0	0.0	39.9	0.0
2012	0.0	0.0	39.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- Develop bioproducts from crop residues
- Demonstrate high quality and safe food from organic and sustainable production systems
- Document environmental services provided by sustainable cropping systems.
- Improve efficiency and safety of waste recycling systems in agricultural production
- Identify soil biological organisms important in crop production, residue decomposition and soil building.
- Develop soil management programs for new crop species and cultivars of evolving cropping systems in collaboration with crop genetic and breeding teams.
- Publish journal papers on unique findings related to the above topics.
- Establish patents on biologically unique organisms and processes.
- Disseminate information on the above systems to facilitate adoption and commercialization

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Demonstrations ● Other 2 (Grower/Industry Meetings) ● One-on-One Intervention ● Other 1 (Field plot tours/Field days) ● Workshop 	<ul style="list-style-type: none"> ● Web sites ● Other 1 (Trade magazines) ● Newsletters

3. Description of targeted audience

The target audience includes other soil scientists, economists, commodity commissions, policy makers, legislators, agribusiness, and farmers.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	2400	2000	0	0
2009	2500	2100	0	0
2010	2600	2220	0	0
2011	2700	2300	0	0
2012	2800	2400	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	47	2
2009	48	3
2010	49	3
2011	50	4
2012	51	4

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal publications

2008 :47 2009 :48 2010 :49 2011 :50 2012 :51

- Graduate students supported by Agricultural Research Center and other external funds

2008 :20 2009 :20 2010 :20 2011 :20 2012 :20

V(I). State Defined Outcome

1. Outcome Target

Publications dealing with improved knowledge of crop rotations, nutrient cycling, soil building and carbon sequestration, fertility management, soil structure and soil water movement, chemical movement in soils, tools for spatial monitoring and management.

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :26

2009 : 27

2010 : 28

2011 :29

2012 : 30

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships

V(J). Planned Program (External Factors)**1. External Factors which may affect Outcomes**

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

Description

External factors include year to year and location dictated climate, farm economy, energy and bioproduct markets, international and domestic market demand for organic and sustainable food products, farm policy and farm payments on commodity crops and soil conservation practices, stakeholder acceptance of change. Extreme pressures on producers due to rising input costs (fertilizers, fuel, pesticides) will apply downward pressure on adoption of conservation practices. Internal factors include stakeholder financial support and government support of staff, equipment and operating funds.

V(K). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- During (during program)
- Before-After (before and after program)

Description

The evaluation plan includes monitoring of research products and outreach impact by AICS during annual review and commission reviews, number of PVPs and plant patents. Organic agriculture growth will be monitored through agricultural statistics. NRCS and WA DOE evaluations of improvements in environmental services will also be monitored.

2. Data Collection Methods

- Other (See below)

Description

A number of agencies collect data associated with this program. The Washington State Department of Agriculture publishes agricultural statistics. The NRCS and EPA collect data on acreage in crops, tillage practices, and soil and water quality. The number of carbon sequestration contracts is tallied by the Pacific Northwest Direct Seed Association. The Washington Department of Ecology records the field burning acreage. The number of certified organic agriculture acres is recorded by the Washington State Department of Agriculture.

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Program in the Post Harvest Quality of Fruits and Vegetables

2. Brief summary about Planned Program

The strength of Washington's food-based horticultural industries is very much dependent on effective and affordable post-harvest storage and processing of fruits and vegetables. The use of controlled atmosphere (CA) storage has made the Washington tree fruit industry the world-wide leader in the ability to extend markets to several months. Washington's potato crop (valued at over \$550 million annually) is used chiefly for processing into frozen potato products. Due to post-harvest storage limitations and tuber quality, this processing is only about 60% efficient. The post-harvest research activities of the Department of Horticulture and Landscape Architecture are directed at increasing the efficiency of processing industries, improving storage capabilities of growers and processors, and enhancing the quality of fruit and vegetable crops for domestic and export markets.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 201 10% Plant Genome, Genetics, and Genetic Mechanisms
- 202 10% Plant Genetic Resources
- 203 10% Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 10% Plant Product Quality and Utility (Preharvest)
- 205 10% Plant Management Systems
- 206 10% Basic Plant Biology
- 501 10% New and Improved Food Processing Technologies
- 502 10% New and Improved Food Products
- 503 5% Quality Maintenance in Storing and Marketing Food Products
- 701 5% Nutrient Composition of Food
- 711 5% Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources.
- 712 5% Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Washington's fruit and vegetable industries play a very significant role in the state's agricultural economy. Tree fruit and small fruit crops contribute nearly \$1.5 billion in farm gate value to the state's economy. After processing and marketing, the contribution is considerably more. In several crops, Washington leads the nation in production. The state is ranked number one in the nation in the production of apples, pears, concord grapes, sweet cherries, and raspberries. About half of all apples, grapes, cherries, and pears, and 83% of all raspberries grown in the U.S. are produced in Washington. Competition from South American and Asian countries is beginning to seriously affect the tree fruit and small fruit industries of Washington. The Chinese apple industry has, for instance, already had a serious effect on the price of apples used for juice concentrate. It is imperative that Washington's fruit growers have access to new crop varieties, and the most efficient production and management systems to remain competitive in this newly emerging global economy. Washington enjoys an extremely diverse vegetable industry that also makes significant contributions to the state's economy. Washington vegetable growers produce asparagus, carrots, cucumbers, green peas, lettuce, onions, potatoes, and snap beans. The state's farmers also produce considerable vegetable seed. In some cases, such as asparagus, and processed carrots, Washington leads the nation in the production of these crops. The Washington potato industry is a major economic contributor, and is second only to Idaho in production. Washington potato growers produced almost 9 billion pounds of potatoes in 2001 valued at nearly \$552 million (farm gate value). Nearly 90% of the Washington crop is used in the production of frozen potato products. This adds significantly to the value of the crop.

2. Scope of the Program

- In-State Research
- In-State Extension
- Multistate Research
- Integrated Research and Extension
- Multistate Integrated Research and Extension
- Multistate Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The over-riding assumption of this research program is that the fruit and vegetable industries of Washington will continue to dominate the state’s agricultural economy in the future, and further, that fruit and vegetable growers will face increasing challenges in competing in a global food economy. Several of the faculty in the department are engaged in research and extension activities related to this program, and it is assumed that this number will remain constant or perhaps increase in response to emerging industry needs. It is assumed for instance that the current search that is underway to fill a newly created position in functional genomics focusing on horticultural crops will be successful. This is a very robust and mature program with contributions coming from several well established senior scientists. There is no doubt that these scientists have a full knowledge of the literature and the accepted techniques and procedures used in the research. They have in fact, in many cases, established themselves as national and international experts in their area of study, and have contributed much to the body of knowledge of the science. The group of scientists contributing to this program receive funding from a great variety of sources: Federal competitive grants, Federal earmark funds (CSREES), several commodity commissions and grower organizations (e.g. Washington Tree Fruit Research Commission, Washington Potato Commission) the State of Washington, and many private organizations. It is assumed that this diversity as well as the overall amount of funding will continue or increase over the next ten years. These scientists more often than not work in a collaborative, integrated way to solve problems faced by industry. The work ranges from very molecular to very applied. It is assumed that these types of activities will continue, and most likely increase, as the expertise of current faculty is supplemented with new appointments.

2. Ultimate goal(s) of this Program

The ultimate goal of this program is to enhance quality of postharvest products from fruit and vegetable crops, and to identify new technologies that can be used in food storage and processing.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	15.0	0.0
2009	0.0	0.0	15.0	0.0
2010	0.0	0.0	15.0	0.0
2011	0.0	0.0	15.0	0.0
2012	0.0	0.0	15.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Specific activities and outputs vary across a wide range from molecular level inquiry to field and lab based studies related to postharvest handling, storage, and processing of horticultural crops. These activities will include: basic research which focuses on the application of molecular biology, genetics and biochemistry, related to the biological, chemical, and physiological mechanisms that explain postharvest phenomenon in horticultural crops, studies directed at the identification of CA storage regimes for apples

and other fruits, investigation of flavor chemistry in apples, studies of the post-harvest/processing quality component of Tri-State Variety trials in potatoes, research aimed at the identification of evaluation factors for potato processing quality, research directed toward the identification of strategies for storage of seed potatoes, research focused on the mechanical harvest and subsequent handling and storage requirements in asparagus, studies which address the use of microwave-vacuum drying technology for fruits and vegetables, studies which focus on lenticel breakdown and fruit finish in apples, and research which focuses on crop management factors that affect postharvest fruit and vegetable quality.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (Research Reviews, Field days) ● Other 2 (Conference Presentation) ● Group Discussion ● One-on-One Intervention ● Workshop 	<ul style="list-style-type: none"> ● Newsletters ● Web sites

3. Description of targeted audience

The target audience will be scientists in the area of postharvest quality of fruits and vegetables, agribusiness, economists, and the participating vegetable and fruit industries (in particular the stone and pome fruit industries, and the potato industry).

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	500	300	0	0
2009	500	300	0	0
2010	500	300	0	0
2011	500	300	0	0
2012	500	300	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 : 1 2009 : 1 2010 : 1 2011 : 1 2012 : 1

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	12	0
2009	13	0
2010	14	0
2011	15	0
2012	16	0

V(H). State Defined Outputs**1. Output Target**

- Peer reviewed journal articles

2008 :12 2009 :13 2010 : 13 2011 :14 2012 :16

- Graduate students supported on Agricultural Research Center and external funding

2008 :4 2009 :4 2010 : 4 2011 :4 2012 :4

V(I). State Defined Outcome**1. Outcome Target**

Please see written paragraph under evaluation.

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 204 - Plant Product Quality and Utility (Preharvest)
- 205 - Plant Management Systems
- 206 - Basic Plant Biology
- 501 - New and Improved Food Processing Technologies

V(J). Planned Program (External Factors)**1. External Factors which may affect Outcomes**

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

Description

There are many external factors that could affect the research programs mentioned here. None of these can be predicted at a level of precision that would suggest modifications of research protocols, and certainly none of them can be controlled. As noted above regardless of these external factors, it is assumed that the fruit and vegetable industry will continue to be a major contributor to Washington's agricultural economy. The programs described here will change in response to external factors as necessary but will strive to continue to be responsive to grower needs.

V(K). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- Before-After (before and after program)
- During (during program)

Description

A number of different measures will be used to evaluate the success of research projects described in this program at multiple points throughout the duration of the program. The short-term goal of creating new knowledge is evaluated by the extent to which this new knowledge is communicated throughout the scientific literature. The mid-term goal of communicating that knowledge to stakeholders will be evaluated based upon the success with which the information is disseminated through the use of presentations and posters given at grower sponsored conferences, workshops, and research reviews, and at university sponsored field days.

The long-term goal to enhance quality of postharvest products in fruit and vegetable crops, and to identify new technologies that can be used in food storage and processing will be evaluated by the extent to which research findings are adopted throughout the industry. For those projects focusing on the investigation of improved storage practices, the extent to which recommended practices have been adopted by the food storage and processing industries will be used as the measure of success. In the case of research that focuses on the development of new products, such as material that is applied to potato tubers to suppress sprouting during storage, the extent to which the new products are adopted for use throughout the industry will be used as a measure of success. For those projects which focus on the selection of fruit and vegetable cultivars that have good potential for value added contributions, the measure of success will be the extent to which newly released cultivars gain acceptance by growers, and begin to contribute to the agricultural economy.

Most of the specific research projects included in this program are funded by commodity commissions and other agricultural stakeholder organizations. Scientists make progress reports on an annual basis to these organizations as a part of the process for continuation of funding. The extent to which these projects receive continued financial support is another measure of their success.

The outcomes from this program can be evaluated based on an assessment of the extent to which research products have been assimilated into the post harvest storage and processing activities of fruit and vegetable industries. There currently are no reliable data related to existing post harvest management practices, nor are there mechanisms in place to collect such data in the future. At best, any predictions about future adoption of research products from this program would be based on anecdotal information, and casual conversations with growers, storage managers, and processors. This situation is compounded by the proprietary nature of the fruit and vegetable processing industry. Much of the success of the Washington apple industry rests on past research findings from WSU related to controlled atmosphere (CA) storage requirements of fruit. This work continues as new apple varieties are introduced into production in Washington orchards. Although it is not possible to quantify this impact, there is no doubt that findings from this research program will be adopted by the fruit storage industry. Historically Washington has lead the nation in the production of processed asparagus. Recently the two remaining processors moved out of the state, creating the need to transform the asparagus industry from one based on processed product to one based on a fresh market product. Specific activities that are a part of this Research Program are aimed at developing a mechanical harvester and at new storage strategies that will prolong the shelf life of harvested asparagus. It is expected that these technologies will provide an opportunity for asparagus acreage in the state to increase by 50% or more in the next two to three years. A natural derivative of potato has been synthesized that is a very effective inhibitor of sprouting in potato. This product has been patented and is currently under commercial development for use in potato storage. It is expected that it will be adopted for use on about 30% of the Washington potato crop in the next two or three years.

2. Data Collection Methods

- On-Site
- Journals
- Unstructured
- Observation

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)**1. Name of the Planned Program**

The IMPACT Center

2. Brief summary about Planned Program

Through the application of multidisciplinary research, the IMPACT Center will work toward improving the competitiveness of Pacific Northwest agriculture in the world marketplace by focusing on: (1) economic effects of changing markets, policies and trading rules including technical barriers to trade (TBT), sanitary and phytosanitary (SPS) barriers, biotechnology, food safety, bioeconomics, invasive species, bioterrorism, and consumer preferences; (2) innovative uses of agricultural and forest products for the international marketplace, including bio-products and uses for agricultural byproducts; and (3) new food safety and processing technologies to enhance the competitiveness of PNW agricultural products in global markets.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 501 10% New and Improved Food Processing Technologies
- 502 10% New and Improved Food Products
- 603 10% Market Economics
- 604 10% Marketing and Distribution Practices
- 606 10% International Trade and Development
- 607 10% Consumer Economics
- 609 10% Economic Theory and Methods
- 610 10% Domestic Policy Analysis
- 611 10% Foreign Policy and Programs
- 712 10% Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

The state of Washington is the most trade dependent state in the United States, and the second in dependence on trade in agricultural products. As global markets expand, the profitability of Washington producers depends upon their ability to improve their competitiveness in world markets. Increased competition from foreign producers has depressed world prices for several of Washington's primary exports, including apples, potatoes and wheat. Exporters also face many obstacles including high import tariffs and sanitary and phytosanitary concerns, as well as technical barriers to trade. Consumer attitudes toward genetically modified products are an important issue that affects the future of Washington producers in both domestic and international markets. Many Washington agricultural producers, processors and industry associations lack the financial strength and scientific personnel needed to solve the many technical and marketing issues they face. The IMPACT Center draws on its staff and researchers throughout the university to assemble project teams capable of generating practical solutions to these issues.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)**1. Assumptions made for the Program**

Major assumptions underlying this program of research include: 1) the continuation of current levels of faculty funding support, and 2) current levels of infrastructure support with the department and university. Faculty members are expected to generate extramural support for graduate assistantships, data collection, equipment needs, etc. Hence, downturns in the state and federal

economy and associated research funding levels could adversely affect research productivity. It is expected that these results will result in improved resource management, more sustainable developed and undeveloped ecosystems, and sustainable development within the state and region.

2. Ultimate goal(s) of this Program

The ultimate goal of the IMPACT Center is to use advances in science and technology to improve the competitiveness of food and agricultural systems in the world marketplace.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	15.3	0.0
2009	0.0	0.0	15.3	0.0
2010	0.0	0.0	15.3	0.0
2011	0.0	0.0	15.3	0.0
2012	0.0	0.0	15.3	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

The IMPACT Center can expect to continue to: (1) develop science, technology, and economic and market intelligence to enhance the competitiveness of Washington’s agricultural products in the international marketplace, (2) address export oriented technical, economic, and social issues in a timely and relevant fashion, and (3) provide exporters and policymakers with timely assessments of the effects and implications of changes in the world marketplace. In addition, (4) scholarly publications and grants received by IMPACT scientists would be a suitable outcome.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Other 1 (Stakeholders) ● Group Discussion ● Workshop 	<ul style="list-style-type: none"> ● Newsletters ● Web sites ● Other 1 (Media interviews)

3. Description of targeted audience

The target audience includes economists, farmers, exporters, policy makers, legislators and scientists in the fields supported by the IMPACT Center funds.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	1000	1400	0	0
2009	1500	2000	0	0
2010	2000	3000	0	0
2011	2500	4000	0	0
2012	3000	5000	0	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :1 2009 :1 2010 : 2 2011 : 2 2012 : 2

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	40	10
2009	40	10
2010	40	10
2011	40	10
2012	40	10

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :40 2009 :40 2010 : 40 2011 :40 2012 :40

- Graduate students supported by experiment station and grant funding

2008 :10 2009 :10 2010 : 10 2011 :10 2012 :10

V(I). State Defined Outcome

1. Outcome Target

Scientific Publications

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :40 2009 : 40 2010 : 40 2011 :40 2012 : 40

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 603 - Market Economics

- 604 - Marketing and Distribution Practices
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 611 - Foreign Policy and Programs
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Graduate students and post-docs trained

2. Outcome Type : Change in Action Outcome Measure

2008 :15 2009 : 15 2010 : 15 2011 :15 2012 : 15

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 611 - Foreign Policy and Programs
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Research Support increased in percent.

2. Outcome Type : Change in Action Outcome Measure

2008 :10 2009 : 10 2010 : 10 2011 :10 2012 : 10

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis

- 611 - Foreign Policy and Programs
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Developmental Research Advanced (percent)

2. Outcome Type : Change in Condition Outcome Measure

2008 :10 2009 : 10 2010 : 10 2011 :10 2012 : 10

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 611 - Foreign Policy and Programs
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

1. Outcome Target

Improved research Quality in percent.

2. Outcome Type : Change in Condition Outcome Measure

2008 :5 2009 : 5 2010 : 5 2011 :5 2012 : 5

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 502 - New and Improved Food Products
- 603 - Market Economics
- 604 - Marketing and Distribution Practices
- 606 - International Trade and Development
- 607 - Consumer Economics
- 609 - Economic Theory and Methods
- 610 - Domestic Policy Analysis
- 611 - Foreign Policy and Programs
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occuring Toxins

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

{NO DATA ENTERED}

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

1. Evaluation Studies Planned

- During (during program)

Description

Each faculty member with a Hatch project is reviewed annually first by the Unit Head and subsequently by the Dean and Directors of the College of Agricultural, Human and Natural Resource Sciences. Target Measures used include: 1) Number of refereed journal articles produced, 2) Quality of refereed journal articles produced, 3) Amount of extramural funding received from other sources in support of these research efforts and 4) the number of masters and doctoral students completing their degrees.

2. Data Collection Methods

- Telephone
- Sampling

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Western Regional Plant Introduction Station (W-006)

2. Brief summary about Planned Program

In response to the negative impacts of biotic and abiotic variables on crop production, a broad genetic base is critical for U. S. agriculture in the development of new cultivars or the improvement of existing ones. The wide array of plant genetic resources (germplasm) that are maintained as part of the W-6 Regional Research Project, also known as the Western Regional Plant Introduction Station (WRPIS), provide stakeholders the genetic materials to achieve crop development. For W-6 these resources include forage and turf grasses, beans, cool season food legumes (pea, lentil, chickpea, fava bean, lupine, etc.), lettuce, safflower, onion relatives, and forage legume crop species to name just a few. Other important taxa relate to new crops, ornamental species, and medicinal plants. Availability of this germplasm is critical to researchers in the Western Region who represent both public and private sectors. Ready availability of the most diverse collections of these genes is best maintained through the existing infrastructure of the USDA, ARS, National Plant Germplasm System (NPGS) and the close association with the other germplasm related Regional Research Projects, which include the North Central (NC-7), Northeastern (NE-9) and Southern (S-9), as well as the other 22 special clonal and seed germplasm repositories. These genetic resources are readily recognized as important and crucial in the agricultural production system as water, air, soil, and minerals.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : No

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 201 15% Plant Genome, Genetics, and Genetic Mechanisms
- 202 50% Plant Genetic Resources
- 206 10% Basic Plant Biology
- 211 10% Insects, Mites, and Other Arthropods Affecting Plants
- 212 10% Pathogens and Nematodes Affecting Plants
- 215 5% Biological Control of Pests Affecting Plants

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

3. The conservation and utilization of these genetic resources ultimately affect our quality of life. This project safeguards and promotes utilization of a wide array of plant genetic resources for grower, processor and consumer stakeholders. This project, one of the four initial Regional Plant Introduction Stations established in the 1950s, is a vital component of the USDA, NPGS. The WRPIS is responsible for 15.4% of the total accessions and 23.5% of the total taxa in the NPGS. The size of the collection has grown from 53,000 accessions to over 70,000 accessions in the past ten years. Project research, information documentation and germplasm conservation relate directly to all aspects of the USDA, ARS National Program Action Plan. Specifically, the use of plant germplasm by researchers in the Western Region, particularly scientists associated with the SAES Universities, is significant. Plant germplasm is utilized in the region to support crop development, help to sustain small farm agriculture, preserve endangered species, and even repatriate crops to centers of diversity. It is also used to develop new U.S. crops, and encourage international trading diplomacy through exchange of plant germplasm. Over the past seven years public and private sector plant researchers from the Western Region request approximately 26% of the germplasm distributed by the whole NPGS, and ranges between around 26,000 to over 61,000 accessions per year. Of this material, W-6 directly provides 5,000 to 7,000 accessions each year to researchers in the Western Region.

2. Scope of the Program

- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

4. Successful agricultural production of most crops in the United States is based upon plant species that are not native to this country. Scientists rely on introduced germplasm to provide new genes to improve major crops, minor regional crops, and to develop new crops. There is an acute and ever increasing sensitivity to environmental issues. The problems addressed by this project are to preserve and provide genes for specific crop species to support such efforts. Collectively, the Western Regional Plant Introduction Station (WRPIS) personnel at Pullman and other associated sites conduct one of the most extensive and well-established genetic resource management projects in the United States. In terms of numbers of populations managed, the fiscal, personnel, and facility resources utilized and the genetic diversity addressed, it is one of the most important components of the NPGS. Activities at the WRPIS are the collection, preservation, evaluation, distribution and research of plant germplasm. We utilize current technologies and information to best achieve germplasm conservation. Acquisition approaches are enhanced by the use of geographic information systems technology and global positioning system devices when planning and carrying out collecting trips. Genetic monitoring of collections and regeneration protocols are enhanced by use of PCR based molecular genetic techniques, especially when used in conjunction with morphologic genetic markers. Seed storage facilities are in place to allow relatively long-term storage of critical seed lots at -18E C. Regeneration population size has been increased for grass species to ensure reduction in genetic drift and loss of minor alleles. Insect pollinators are being evaluated and utilized in controlled pollination field increases. There are nine scientists in this CRIS. The project sites in this MU are located at Pullman, Central Ferry, Prosser, WA, and Parlier, CA. The range in environments provides conditions amenable to the production of high quality seed of a wide range of plant germplasm.

2. Ultimate goal(s) of this Program

The ultimate goal is the continued maintenance of quality germplasm of the species maintained at this site and to deliver it to researcher programs around the world. From the utilization of this germplasm both basic and applied research will result. This includes new cultivars, production of genetic maps, analyses of diversity, new medicinal plants, ornamentals, etc. and restoration or re-patriotization of germplasm to seed banks in countries from whence the original germplasm came. Quality (good viability and seed integrity) germplasm is distributed, free of charge, to researchers in all areas of plant science. Plant Introduction material is and will continue to be utilized in the development of superior cultivars for use in the national agriculture industry. Enhanced productivity, nutritional value and alternate use of plant material will result from the use of germplasm maintained at the WRPIS. By incorporating relevant research at this station and others, optimum efficiency in conserving the widest possible genetic base for each taxa will be achieved.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	3.5	0.0
2009	0.0	0.0	3.5	0.0
2010	0.0	0.0	3.5	0.0
2011	0.0	0.0	3.5	0.0
2012	0.0	0.0	3.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

We shall acquire and conserve specific germplasm, and manage associated information. The outcome is the continued provision of quality germplasm of the species maintained by W-006 and deliver it to researchers. From the utilization of this germplasm both basic and applied research will result. This includes new cultivars, production of genetic maps, analyses of diversity, new medicinal plants and ornamentals. We shall characterize germplasm, using morphological and molecular markers to enhance

conservation management, increase utilization of collections, and incorporate the genetic data into public databases. We shall reduce genetic drift in heterogenetic accessions, through sampling procedures that maximize effective population. This information will be applied to regeneration programs to provide cost effective methodology to maximize effective population size during regeneration of species and accessions. We shall genotype germplasm collections for diversity analysis and duplication. Results will provide the basic information needed to characterize germplasm collections. It will be useful to scientists interested in the interaction between marker systems and DNA sampling. Characterization data will be made available to the public on GRIN. We shall characterize and enhance Kentucky bluegrass germplasm for seed production in alternative residue management systems. An enhanced understanding of turf quality and yield will provide an understanding if yield can be improved without detrimental effects to turf quality. This should assist the plant breeding community in cultivar development. We shall apply co-dominant markers, cross-taxa and species markers, and the development of parallel methods to elucidate allelic diversity across legume germplasm. This research will result in the identification of unique germplasm in each food legume taxa readily available for basic research and applied plant breeding programs. We shall conduct research on selected germplasm collections for response to close organismal associates such as microorganisms, pathogens, saprophytes, and significant insect pests and disease vectors. Completion of entomology research will identify sources of insect-resistant germplasm for use by breeding programs. We shall detect, identify and control microorganisms which are agents of plant disease or which induce disease in humans or animals consuming such plants. The exploitation of microbial symbionts or saprophytes for enhancement of desirable germplasm properties or resistance to pests & diseases. The use of targeted microbial and plant germplasm for breeding of pest-resistant crops. We shall transfer technology in the form of plant germplasm propagules (seed/clones), research publications and other associated information to scientists. Quality germplasm is distributed, to plant researchers. Plant Introduction material is and will continue to be utilized in the development of superior cultivars. Enhanced productivity, nutritional value and alternate use of plant material will result. By incorporating relevant research at this station and others, optimum efficiency in conserving the widest possible genetic base for each taxa will be achieved.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Demonstrations 	<ul style="list-style-type: none"> ● Other 1 (Scientific publications) ● Web sites

3. Description of targeted audience

The target audience for this program is plant researchers.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	30	1000	100	100
2009	30	1500	100	100
2010	30	2000	150	150
2011	30	2500	150	150
2012	30	3000	200	200

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :0 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	10	3
2009	10	3
2010	10	3
2011	10	3
2012	10	3

V(H). State Defined Outputs

1. Output Target

- Peer reviewed journal articles

2008 :10 2009 :10 2010 :10 2011 :10 2012 :10

- Graduate students supported on Agricultural Research Center or other grant funds

2008 :1 2009 :1 2010 :1 2011 :1 2012 :1

V(I). State Defined Outcome

1. Outcome Target

Completion and publication of our work in peer reviewed journals

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :10 2009 : 10 2010 : 10 2011 :10 2012 : 10

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants

1. Outcome Target

Continued distribution of valuable germplasm and information

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :18000 2009 : 18000 2010 : 18000 2011 :18000 2012 : 18000

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources

- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants

1. Outcome Target

Development of valuable germplasm

2. Outcome Type : Change in Action Outcome Measure

2008 :1 2009 : 1 2010 : 1 2011 :1 2012 : 1

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 215 - Biological Control of Pests Affecting Plants

1. Outcome Target

Continued distribution of valuable germplasm

2. Outcome Type : Change in Action Outcome Measure

2008 :18000 2009 : 18000 2010 : 18000 2011 :18000 2012 : 18000

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 215 - Biological Control of Pests Affecting Plants

1. Outcome Target

Development of new collaborative projects with state federal and international research scientists

2. Outcome Type : Change in Action Outcome Measure

2008 :2 2009 : 3 2010 : 3 2011 :3 2012 : 3

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 206 - Basic Plant Biology
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Pathogens and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants

1. Outcome Target

Continued provision of quality germplasm of the species maintained at the Pullman site and delivered to researchers worldwide

2. Outcome Type : Change in Condition Outcome Measure

2008 :18000 2009 : 18000 2010 : 18000 2011 :18000 2012 : 18000

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources

- 215 - Biological Control of Pests Affecting Plants

1. Outcome Target

Basic and applied research resulting from the sharing of germplasm--production of genetic maps, analyses of diversity, new medicinal plants, ornamentals,etc.

2. Outcome Type : Change in Condition Outcome Measure

2008 :12 2009 : 12 2010 : 12 2011 :12 2012 : 12

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources

1. Outcome Target

Restoration and re-patriotization of germplasm to seed banks in countries of origin. [This is difficult to predict.]

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 2009 : 0 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 206 - Basic Plant Biology

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

Description

The major factor that will hinder or limit the success of this program is the reduction of fiscal resources. This is dependent on the political environment over which we have no control. Environmental concerns are annual, in that there is a significant portion of the program that is done in the field, but these are constraints that are and always have been dealt with each year. This project supports (15%) a larger USDA, ARS, program, but the coordination and collaboration with the SAES is critical to the continued success and productivity of the entire effort. The major factor that will hinder or limit the success of this program is the reduction of fiscal resources.

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

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

{NO DATA ENTERED}

2. Data Collection Methods

- Sampling
- Observation

Description

{NO DATA ENTERED}

V(A). Planned Program (Summary)**1. Name of the Planned Program**

Wood Materials Engineering Laboratory

2. Brief summary about Planned Program

The heavy reliance on finite petroleum resources for energy and chemical/material feedstocks has created serious problems and concerns in our national security, economy, and the environment. Sustainability of our nation's economy needs the utilization of renewable resources for energy and materials. Investment and innovation in bioproduct research is absolutely necessary in order to end our reliance on foreign oil, address larger scale environmental issues such as global warming, and create new opportunities for our agricultural industries. Biopolyesters produced from agricultural feedstocks, poly(lactic acid) (PLA) and polyhydroxyalkanoates (PHAs), are increasingly important. There exists a large gap between the reality in commercial applications of biopolyesters and the promise from research results due to both technical and economic barriers. The production costs of biopolymers have been reduced greatly and are now competitive with some fossil oil-based plastics such as PET and polystyrene, but are still more expensive than polyethylene, polypropylene, etc. Nevertheless, biopolyesters become very attractive if the factors of using renewable resources and the benefits to the environment are considered. As emerging resins, biopolyesters still have some technical issues to be addressed before they can replace the current fossil oil-based resins in broad applications. As one of the solutions, this program offers to investigate the manufacturing of microcellular foam of natural fiber reinforced biopolyesters (biocomposites). The proposed research aims to develop a new technology of bioproducts with cost effectiveness, energy efficiency and performance enhancement. The research approach draws upon interdisciplinary skills. The findings from this research will advance the knowledge of bioproducts and potentially result in new commercial applications of biopolyesters.

3. Program existence : Mature (More than five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)**1. Program Knowledge Areas and Percentage**

- 511 100% New and Improved Non-Food Products and Processes

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Producing materials from renewable resources is not only an option but a mandate for the near future. Bioplastics are making inroads into the marketplace. Both PLA and PHAs are thermoplastic biopolyesters derived from starch feedstock, and are the major thermoplastic biopolymers that can currently be produced in large industrial scale. PLA and PHAs demonstrate high tensile strength and modulus comparable to many fossil oil based plastics, for example, polypropylene. Niche applications of biopolyesters, such as utensils, food packaging, grocery bags, and mulch films, are emerging. However, bioplastics have only an insignificant share in the current marketplace dominated by fossil oil based plastics. While the effort is continuously made to reduce resin costs, developing and manufacturing cost effective and performance enhanced products become critical to the promotion of bioproduct applications in the conventional plastics marketplace, and contribute to the transition of our economy to one built on sustainable and renewable materials and energy resources rather than on fossil oil. In general, the major obstacles for biopolyester plastics include: a narrow processing window, easy thermal degradation, low melt strength. Performance is inhibited by post process embrittlement, low impact strength and low heat distortion temperature. The production cost is relatively more expensive than mainstream plastics (polyethylene and polypropylene). In this project, we will investigate fully biodegradable microcellular foams of biopolyester/natural fiber composites with balanced design of the properties. A ternary composite system, composed of natural fiber and biopolyester as the major component, and poly(butylene adipate-co-terephthalate) as a toughener, will be investigated. The material saved from foamed products and the use of low-cost reinforcing natural fibers contribute to cost reduction. Microcellular foam demonstrates overall superior mechanical properties to conventional foams, and presents one of the most promising new materials. Impact strength, tensile toughness and fatigue life of MCP are found higher than that of solid plastics when the relative foam density is above a specific level. The microcellular foaming process is also environmentally friendly because it uses CO₂ or N₂ as blowing agents for foaming.

2. Scope of the Program

- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Developing the technology of microcellular biocomposites requires profound knowledge and expertise in interfacial adhesion, toughening mechanisms, fracture mechanics, preparation of multicomponent polymeric materials, and microcellular foaming technology. This study could result in great opportunities for biocomposite foams to replace polystyrene and polyethylene foams, which are commonly used for packaging and building materials. The proposed research concepts include: (1) preparing natural fiber reinforced biopolyester composites (biocomposites), (2) preparing microcellular foam using the biocomposites, (3) developing an environmentally benign foaming process. Hurdles to be overcome by the proposed plan are: (1) low impact strength/toughness and embrittlement, (2) low heat distortion temperature (for PLA), (3) a narrow processing window, and (4) production cost barriers. The economic benefits will be an economical resin and energy saving resulting from weight reduction which will render biocomposites competitive to those petrochemical foamed products. The environmental benefits will be products which are mostly composed of renewable materials and completely biodegradable which can be composted. The manufacturing process will be environmentally benign.

2. Ultimate goal(s) of this Program

New technology of microcellular foam of biopolyester composites will be developed, promoting broad applications of biopolyesters to replace conventional petrochemical plastics.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2008	0.0	0.0	4.9	0.0
2009	0.0	0.0	4.9	0.0
2010	0.0	0.0	4.9	0.0
2011	0.0	0.0	4.9	0.0
2012	0.0	0.0	4.9	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

- 1). Characterize composite composition-morphology-properties relationships
- 2). Optimize microcellular foam extrusion design and processing
- 3). Define morphology and mechanical and physical properties of microcellular foams
- 4). Develop applications

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension	
Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Group Discussion ● One-on-One Intervention ● Demonstrations ● Other 1 (conduct research) ● Education Class ● Other 2 (dissemination of research result) 	<ul style="list-style-type: none"> ● Web sites ● Other 1 (Research Publications)

3. Description of targeted audience

The target audience for this program will be the forest products industry, composite industry and packaging materials industry.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2008	150	3000	2	0
2009	150	3000	2	0
2010	150	3000	2	0
2011	150	3000	2	0
2012	150	3000	2	0

2. (Standard Research Target) Number of Patents

Expected Patents

2008 :1 2009 :0 2010 :0 2011 :0 2012 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target
2008	3	2
2009	3	2
2010	3	2
2011	3	2
2012	3	2

V(H). State Defined Outputs

1. Output Target

- Peer Reviewed journal Articles

2008 :3 2009 :3 2010 :3 2011 :3 2012 :3

V(I). State Defined Outcome

1. Outcome Target

Methods to improve the compatibility of natural fiber and biopolyesters and melt strength of biocomposites, knowledge of composition-morphology-property relationships of composites

2. Outcome Type : Change in Knowledge Outcome Measure

2008 :1 2009 : 1 2010 : 0 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 511 - New and Improved Non-Food Products and Processes

1. Outcome Target

Microcellular foaming extrusion process design and processing optimization of biocomposites; characterization of composition-morphology-property relationships of microcellular foam

2. Outcome Type : Change in Action Outcome Measure

2008 :1 2009 : 1 2010 : 1 2011 :0 2012 : 0

3. Associated Knowledge Area(s)

- 511 - New and Improved Non-Food Products and Processes

1. Outcome Target

Product application development of microcellular foaming technology of biocomposites

2. Outcome Type : Change in Condition Outcome Measure

2008 :0 2009 : 0 2010 : 1 2011 :1 2012 : 0

3. Associated Knowledge Area(s)

- 511 - New and Improved Non-Food Products and Processes

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Government Regulations
- Public Policy changes

Description

Cellulose and starch are the two most abundant plant polymers extensively available in the United States. Utilization of these polymers or their derivatives for materials results in direct energy saving and environmental benefit. Favorable governmental regulations such as the federal procurement of biobased products boost the research and development interest from both academic institutions and industry. This project addresses the research need in the national biomass technologies roadmap for the development of alternatives to petroleum-based chemicals, polymers, plastics, and synthetic fibers. According to this roadmap, production of chemicals and materials from biomass will need to increase from 5% of the production of target US chemical commodities in 2001, to 18% in 2020, and to 25% in 2030.

The proposed research is directly responsive to one National Research Initiative priority in Biobased Products and Bioenergy Production Research, which calls for innovative non-food uses of biomass for the sustainable production of industrial products. This project is also aligned with the current NRI and USDA strategic planning in enhancing economic opportunities for agricultural producers and protecting the nation's environment.

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

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)

Description

A coordinating committee will be created including the PI, the lab director, and a senior faculty member. The committee will meet semi-annually to review the progress, discuss the problems, and recommend solutions. The committee members will also assist in exposing the research activities to education and professional societies.

2. Data Collection Methods

- Other (See below)

Description

Lab Research