

**REVISED
PLAN OF WORK**

Agricultural Research Center

College of Agriculture
And
Home Economics

Washington State University

Submitted to CSREES

July 1, 2001

Federal Fiscal Years

2002 to 2004

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SECTION I

INTRODUCTION

The Agricultural Research Center (ARC) (state agricultural experiment station), College of Agriculture and Home Economics (CAHE), Washington State University (WSU), has chosen to submit an individual Plan of Work (POW) rather than a joint plan with Cooperative Extension (CE) at WSU.

CAHE is now almost through the implementation of a 1997-2002 Strategic Plan. The ARC chose to develop the POW within the framework of the institutional strategic plan. The POWs of the individual units, which constitute Section II of this plan, are built around components of the WSU Strategic Plan. The individual unit "research programs" will encompass the continuing nature of research and are appropriate for the CSREES 2000-2004 POW. The Strategic Plan of the ARC is referenced in Appendix F.

Each of the following units of College of Agriculture and Home Economics (CAHE) are hereby designated as a "program unit," each of which has one or more planned research programs addressing issues important to one or more components of the agricultural industry of the State of Washington.

Program Planning Units

Agricultural Economics
Animal Sciences
Biological Systems Engineering
Crop and Soil Sciences
Entomology
Food Science and Human Nutrition
Horticulture and Landscape Architecture
Natural Resource Sciences
Plant Pathology
Rural Sociology

Special Program Units and Institutes

Center for Precision Agricultural Systems¹
IMPACT Center
Institute of Biological Chemistry
Veterinary Medicine - Field Disease Investigation Unit

In addition, ARC shares responsibility for fiscal and programmatic management at the following off-campus research and extension centers/units, which are designated program-planning units. Other off-campus research extension units have chosen to include the research activities of their

¹ Center for Precision Agricultural Systems was opened in FY2001

faculty in the disciplinary planning units.

WSU-Puyallup Research and Extension Center (Puyallup REC)
WSU-Vancouver Research and Extension Unit (Vancouver REU)
WSU-Wenatchee Tree Fruit Research and Extension Center (TFREC)

POINT OF CONTACT

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POW DEVELOPMENT AND REVISION

The WSU ARC Plan of Work was originally developed around the individual-planning units' **Strategic Institutional Plans** in relation to the five national goals. Each program-planning unit (PPU) identified selected projects within the units planned research programs, which separately or in combination address one or more of the national goals. To facilitate tracking of information/results, all included projects have been aligned with newly revised CRIS RPA codes. Each PPU developed the brief program description(s) applicable to their planned research program. Not all research programs of a PPU are included in the POW -- only those most clearly relate to the national goals. While most basic research can be indirectly related to the national goals, identifying specific output and outcome indicators is somewhat difficult. The 2000-2004 POW tends to include more applied research projects but does not exclude selected basic research projects. The ongoing nature of most unit research programs and the number of individual research projects undertaken make it impractical to designate portions thereof as short, intermediate and long term in nature. Virtually all research programs have components of each. Individual research projects have objectives which in part reflect the anticipated time required to accomplish the objectives. Many research projects continue over many years as objectives are accomplished and new objectives are developed.

In the present revision of the POW, we have noted as footnotes the addition of new projects, the removal of other projects that have terminated, and the movement of other projects to different goals. Some McIntire-Stennis, Animal Health, and State projects and USDA NRI, Special, and Other grants have been included in the plan to illustrate the diversity of the WSU ARC Program of Research.

PLANS FOR ANNUAL REPORTS/POW UPDATES

Collection of some data for "output indicators" and "outcome indicators" will be expected for all units "Research Programs." In addition, the Associate Dean, Director of ARC, will select certain programs for more in-depth data collection and reporting.

WSU ARC will provide impact statements, which are associated with funding sources. For example, CAHE is committed to the Washington State Legislature to document economic benefits of \$200 million to the state economy from funding of the Safe Food Initiative at \$7.5 million biennially. Such a return on investment is expected in a 5- to 10-year period.

COMPLIANCE WITH THE AGRICULTURAL RESEARCH, EXTENSION AND EDUCATION REFORM ACT OF 1998

Washington State University, in order that it comply with sections 105 and 204 of the Agricultural Research, Extension and Education Reform Act of 1998 (AREERA), has received a target percentage of 2% integrated activities on which to report for the fiscal year 2001 (FY2001) and 3% integrated activities for FY2002 and thereafter. We have, therefore, identified the following projects containing integrated activities on which to report in the year 2001. These projects represent a mix of activities on the east and west side of Washington and are representative of activities generally important for the Pacific Northwest Region.

Project 0250 Cropping Systems for Low Precipitation Dryland in Eastern Washington
Project 0722 Beneficial Use of Organic Amendments in Agriculture and Urban Soils
Project 0670 Disease Resistance and Cultural Practices for Control of Cephalosporium
Stripe in Wheat

RESEARCH FUNDING

In federal FY2000 the ARC received \$2,043,113 in Hatch formula funds and \$1,465,967 in Hatch Multistate Research funding for a total of \$3,509,080. The State of Washington provided \$13,402,367 with grant funding totaling \$17,797,762. Total Hatch, state, and grant funding was \$34,709,209. Total Hatch Act formula funding including Multistate Research funds constituted 10.1% of the FY2000 ARC budget expenditures. Hatch funds alone constituted 5.9% of the ARC budget expenditures.

Hatch formula funds are allocated to ARC/CRIS-approved research projects in partial support of faculty and staff salaries, good and services, and travel. The budget allocation process used by WSU does not provide for separation of fund sources at the departmental, center, or unit level. The "resources allocation" data provided for each unit research program is based on actual expenditure data for federal FY2000.

Hatch Multistate Research funds are allocated to specific Multistate Research projects and to Regional Coordinating Committee projects. See Appendix C for a list of Multistate Research Projects and participating faculty. Consult Appendix D for a list of Multistate Coordinating Committees and participating faculty.

Data extracted from the CRIS report AD 419 documents the following total expenditures from various fund resources.

<u>Source</u>	Fed. FY2000 <u>Expenditures</u>	<u>%</u>
Hatch Formula	\$3,509,080	10.1
State	\$13,402,367	38.6
Grants	<u>\$17,797,762</u>	<u>51.3</u>
	\$34,709,209	100.0

WSU more than adequately meets all matching requirements.

\$1,509,034 of the \$2,043,113 Hatch funds are assigned to research projects included in the ARC POW. The remaining \$453,079 of Hatch funds are used in support of projects not included in the POW. However, these remaining funds have been assigned to the CSREES goals and are included in Table 1.

\$739,647 of \$1,465,967 of the Hatch Multistate Research Funds are assigned to projects included under the CSREES Goals in the POW. The remaining \$726,320 is assigned in support of other Multistate Research and Coordinating Committee projects not included in the POW. See Appendices C & D for additional information. However, these remaining funds have been assigned to the CSREES goals and are included in Table 1.

Table 1: Fed FY 2000 Expenditures & Estimated Future Allocations Supporting CSREES Goals

Funding Source	CSREES Goals					
	1	2	3	4	5	Total
Hatch Funds	\$1,417,881	\$199,041	\$4,649	\$409,533	\$12,009	\$2,043,113
Hatch Multistate Research Funds	\$972,331	\$122,950	\$3,379	\$334,352	\$32,955	\$1,465,967
Federal Research Grants	\$4,731,674	\$433,547	\$0	\$614,683	\$41,348	\$5,821,252
State Appropriation	\$6,296,133	\$605,149	\$237,437	\$2,045,878	\$280,872	\$9,465,469
Industry & Other Grants	\$5,823,055	\$223,090	\$42,887	\$1,736,975	\$27,752	\$7,853,759
Totals	\$19,241,074	\$1,583,777	\$288,352	\$5,141,421	\$394,936	\$26,649,560

FTEs	249.3	18.47	4.11	68.38	4.58	344.84
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In federal FY2000 ARC expended \$13,402,367 of state-appropriated funds. Of that amount \$9,465,469 was spent on projects included in this POW. The remaining portion of state funds in expended in support of other research efforts.

Over the past 10 years, substantial decreases in base programs have occurred from budget reductions. In order to reach stated goals, it was necessary to downsize, while developing more focus, and to maintain and build on areas of strength. The ARC can have its greatest impact by emphasizing research related to food and fiber systems. This includes (a) basic research and (b) research directed toward food and fiber production; disease and pest control; natural resource management and protection; the quality, safety, and processing of products; economics and marketing; nutrition and health of consumers; and community issues related to food and fiber systems. We have downsized dramatically while focusing our efforts on food and fiber systems and attempting to preserve strength by selective reductions. This has resulted in serious gaps in expertise in some core areas.

As a result of gaps in expertise and program delivery, stakeholders for the Washington agricultural industry worked closely with CAHE to identify the most urgent concerns and developed a plan to remedy some of these staffing issues. The result was the Safe Food Initiative, which was supported by over 40 agricultural stakeholder groups and organizations. A consensus for increased support for agricultural research and extension united these groups; and the Initiative was fully funded by the Washington Legislature, beginning on July 1, 2000. We have now implemented this initiative.

WASHINGTON AGRICULTURAL ECONOMY

The State of Washington has a very diverse climate and geography, which supports an extremely diverse agricultural industry. The 1999 value of agricultural production totaled \$5.30 billion. The farmgate value of 40 different commodities exceeds \$3.0 million each with the value of production of apples (No.1) being \$850 million in 1999. Over 230 commodities contribute to the Washington agricultural economy.

STAKEHOLDER INPUT AND IDENTIFICATION OF CRITICAL AGRICULTURAL ISSUES

Through cooperative planning efforts with stakeholders CAHE identified the following critical agricultural issues.

- **Ensure safe food products for domestic and global markets by elimination of risks from food-borne pathogens.**
- **Protect food crops from devastating pests through new crop-protection techniques and materials.**
- **Help farmers and ranchers produce food safely and economically while conserving**

natural resources.

These formed the basis for the "Safe Food Initiative" (SFI) for consideration by the Washington State Legislature. The initiative requested \$7.5 million in new permanent funding beginning in the 1999-2001 biennium. The Washington State Legislature approved full funding, but deferred the initial funding until July 1, 2000. Currently, 19 of 20 faculty and 19 of 20 technicians have been hired.

The following advisory groups or organizations have regular opportunities to provide advice to college administrators and faculty concerning needed research and extension education programs and were involved in the SFI.

- CAHE Advisory Council
- Ag 101 - Presidential "Kitchen Cabinet"
- Association of Agricultural Presidents
- Commodity Commissions
- Commodity and Agricultural Organizations

See Appendix A for additional information

In addition, college leadership and faculty regularly attend and participate in the annual meetings of commodity and farm organizations such as the Washington Association of Wheat Growers, Farm Bureau, Washington Horticulture Society, Western Washington Horticultural Association, Washington Friends of Farms and Forests, etc.

Two constituent groups with which CAHE-ARC did not have a long working tradition are Washington Tilth Producers and the Washington Sustainable Food and Farming Network. Through the leadership of College Administration, both groups endorsed the SFI. The new cooperative working agreements should result in better research and extension service to these previously underserved groups. A new Director for the Center for Sustainable Agriculture and Natural Resources (CSANR) was hired with equal responsibility to both research and extension.

As evidence of broad constituent input into research and extension programs, the following organizations and groups endorsed the Safe Food Initiative.

Statewide and Local Organizations

- Washington Ag Presidents Association
- Washington State Farm Bureau
- Washington State Council of Farmer Cooperatives
- Washington Tilth Producers
- Washington Association of Conservation Districts
- Washington Sustainable Food & Farming Network
- Washington Rangeland Committee
- Washington Women for Agriculture
- Columbia - Snake River Irrigators Association
- Far West Fertilizer and Agri-Chemical Association
- Washington Friends of Farms and Forests
- King County Agriculture Commission
- Washington State Farmers Market Association
- Washington State Grange
- Washington State Association of Counties
- Washington State Nursery and Landscape Association
- Northwest Agricultural Research Foundation

Commodity Groups

Washington State Tree Fruit Research Commission
Washington State Wheat Commission
Washington State Potato Commission
Washington Association of Wheat Growers
Washington State Barley Commission
Washington State Horticultural Association
Washington Growers Clearinghouse
Hop Growers of Washington
Washington Asparagus Association
Washington - Oregon Asparagus Growers Association
Washington Dry Pea and Lentil Commission
U.S. Dry Pea, Lentil, and Chickpea Council
Idaho Dry Pea and Lentil Commission
Washington Association of Wine Grape Growers
Washington State Egg Commission
Washington State Red Raspberry Commission
Washington State Bee Keepers Association
Washington State Strawberry Commission
Washington Cattlemen's Association
Washington State Dairy Federation
Washington State Sheep Producers
Washington Cranberry Alliance
Washington State Dairy Products Commission
Washington State Hay Growers Association
Darigold Farms

Regional Newspapers

Capital Press
Skagit Valley Herald
Tri-City Herald
Wenatchee World
Spokane Spokesman-Review

A weekly update on the hiring process was mailed to representatives of key constituent groups during the past year, and many of the support groups participated on search committees. Newly hired faculty members are currently involved in team-building efforts to address priority issues identified by SFI.

In addition to the above-mentioned methods of obtaining constituent input, several planning units and research and extension centers have internal and external advisory committees. State extension specialists have appointments in academic departments and in most cases are housed with their research colleagues which helps facilitate cooperation and gives both partners more opportunities to communicate research and educational needs. Some units have individual stakeholder advisory committees.

The College of Agriculture and Home Economics (CAHE) at Washington State University (WSU) has a long tradition of addressing research and extension educational needs of the citizens of the state. As early as 1894, the first off-campus agricultural experiment station was established near Puyallup, WA to address the needs of people in western Washington. Since those early days two additional major research and extension centers have been built in addition to smaller off-campus units established to address very specific needs of local agricultural producers.

Nomination and selection processes of individual citizens to serve on the wide array of advisory committees and commodity commissions differ according to the charter or authority under which they were organized. The process for selecting commodity commissioners is imbedded in Washington State statutes and the administrative codes governing their formation and operation.

AGRICULTURAL RESEARCH CENTER - COOPERATIVE EXTENSION COORDINATION

Faculty of the ARC and CE cooperate in program planning and delivery primarily on an individual basis. Fifty-eight faculty, including 12 college administrators, have split appointments between ARC and CE. Such assignments assure a significantly high level of cooperation and coordination. Scientists stationed at the off-campus research and extension centers/units routinely conduct research and extension education responsibilities jointly.

The newly assigned funding for the Safe Food Initiative will enable and ensure even more jointly planned and implemented research/extension programming. Refer to Appendix B for information on the SFI "teams" and the research/extension splits of newly authorized faculty positions.

REGIONAL COOPERATION

On a Pacific Northwest regional basis there has been cooperation/collaboration among research, extension, and teaching faculty of WSU, the University of Idaho, and Oregon State University for many years. As fiscal and human resources have declined, the institutions have agreed to focus selected research, extension, and academic programs at a single institution to the degree that is possible. For example, the lead institution in serving the regional swine industry is WSU. The University of Idaho provides leadership for the sheep industry. Examples of other regional cooperation are:

- Tri-state potato variety breeding programs conducted cooperatively by scientists at University of Idaho (UI), Oregon State University (OSU), USDA-Agricultural Research Services (ARS), and WSU.
- Cool Season Food Legume Research Program with scientists at UI.
- Jointed Goatgrass: A Threat to U.S. Wheat Production involves coordinated research in the states of Colorado, Idaho, Kansas, Montana, Nebraska, Oklahoma, Oregon, Utah, Washington, and Wyoming.
- STEEP III - Solutions to Environmental and Economic Problems. Research and extension programs to protect soil and water resources in the Pacific Northwest - UI, OSU, WSU, USDA-ARS.
- Grass Seed Cropping Systems in cooperation with UI and OSU.
- Barley Genome Study involving personnel at WSU and OSU.
- WSU, OSU, and UI have entered into joint agreements on release of all new varieties on all crops, the majority of which are cereal grains.
- The Northwest Center for Small Fruit Research and Northwest Center for Nursery Crop Research continue to be effective vehicles for obtaining stakeholder input on research needs and coordination of research for the Pacific Northwest land-grant universities.

Institutions in the Western Region cooperate in sponsorship of multistate research projects and regional coordinating committees. Refer to Appendices C and D for detailed information about each effort.

The directors of experiment stations at the three PNW land-grant institutions meet at least semi-annually to discuss and plan cooperative and/or coordinated research programs. Regional ARS administrators also participate.

RESOURCE ALLOCATION

For each unit (department, center, institute, R & E center/unit) research program, the resources (FTEs, salaries, and operations) are allocated to specific research projects. These include all sources of funds expended in addressing the objectives of the research programs. In many cases faculty expend effort and funds on research projects, portions of which fall under one or more of the CSREES goals. Resource allocations are usually only reported under one CSREES goal to avoid duplication of data.

Sources of the resources expended at off-campus units are partially reported in the departmental allocations because faculty off-campus are members of academic departments. Where efforts have not been included in the department, resource allocations are provided.

PEER REVIEW OF RESEARCH PROJECTS

All CRIS projects administered by ARC undergo a formal peer review at the time of initiation and revision. Academic department chairs appoint three to five scientists with the required expertise to review proposed research projects. Reviewers may be internal or external or a combination of both. Reviewers are asked to consider the following questions:

1. Does the outline clearly state the problem to be solved or specify the nature of the knowledge to be sought?
2. Are the objectives clearly stated and sufficiently specific that accomplishment within reasonable project duration can be expected?
3. Do the procedures suggest reasonable approaches to the accomplishment of each objective?
4. Does the outline give evidence of the leader's familiarity with essential literature, concepts, and methods relevant to the research?
5. Are the experimental materials, methods, samples, and criteria of measurements likely to provide interpretable results?
6. Are adequate provisions made for the scientific competencies essential to the conduct of the research?
7. Are definable benefits being sought; and, if so, are they attainable from the successful pursuit of this research? Have appropriate means been identified for disseminating the research findings?
8. Is the project likely to contribute significantly to the cumulative knowledge of the discipline and the targeted clientele?
9. Does the proposed study complement on-going research in the department or in other departments at WSU? Have relevant individuals or units been contacted for possible cooperation?

Upon receipt of the peer review comments by the academic chair, the reviewers' comments are provided to the author of the research proposal for consideration and incorporation. The academic chair prepares a summary of the reviewers' comments for submission to ARC administration along with the other required documentation for all CRIS projects. ARC administrators review the project proposal/CRIS forms and, if satisfied that the proposed research is important, submit it to CSREES/CRIS for approval and processing.

USDA SIGNATURE AUTHORITY FOR ARC

Incumbents in the following administrative positions have USDA signature authority for certification of Merit/Peer Review Process at Washington State University.

{signature on file in ARC}
Ralph P. Cavalieri
Associate Dean for Research

Director, Agricultural Research Center

{signature on file in ARC}
Sandra S. Ristow
Associate Director, Agricultural Research Center

{signature on file in ARC}
Thomas J. Kelly
Fiscal/Budget Manager, Agricultural Research Center

EQUAL EMPLOYMENT OPPORTUNITY POLICY OF WASHINGTON STATE UNIVERSITY

WSU is an Equal Opportunity/Affirmative Action Educator and Employer. See Appendix E for the WSU policy statement. Requests for the institutional EED report required by the Department of Education should be directed to Lori Lamb, Assistant Vice President for Personnel and Administration, Washington State University, Pullman, WA 99164-1045.

UNIT PLANS OF WORK

The POW for each Departmental, Center or Institute and off-campus Research and Extension Centers/Units are provided in alpha order in Section II.

CERTIFICATION

I, _____, Ralph P. Cavalieri, Associate Dean for Research and
Director, Agricultural Research Center, College of Agriculture and Home Economics,
Washington State University, do hereby certify that this Plan of Work constitutes official
submission of all reporting requirements.

SECTION II

CSREES GOAL 1

AN AGRICULTURAL SYSTEM THAT IS HIGHLY COMPETITIVE IN THE GLOBAL ECONOMY

WSU PROGRAM PLANNING UNITS

Department of Agricultural Economics

A. Department Research Program -- Production Economics

Department Goals

To assist targeted agricultural and resource industries to become more effective in providing their products and services to consumers.

To maintain the capacity to work with scientists from other disciplines to address important agricultural, natural resource, and community development problems that require expertise from several disciplines.

Department Objective -- Farm management and production economics

RPA 601 - Economics of Agricultural Production and Farm Management

Generate and disseminate management- and decision-related economic intelligence relevant to current and future agricultural production and firm decision making.

Proj. 0269 Dryland Grain Growers' Income Risk Management and Its
Environmental Impacts

Proj. 0275 Agricultural Production, Processing, Trade, and Environmental Quality
RPA 602 Business Management, Finance Taxation and Estate Planning²

Research focusing on management and administrative techniques applied to farming, agricultural business and enterprises to enhance planning, decision making, and resource use, including economic analysis of the wine grape industry.

Proj. 0317 Wine Grape Economic Research

RPA 610 Domestic Policy Analysis³

Generate and disseminate management- and decision-related economic intelligence relevant to current and future public policy regarding agricultural production, output supply and input demand decisions.

Proj. 0227 Rural Communities and Public Lands in the West: Impacts and
Alternatives

Proj. 0265 The Effects of Farmland Prices

Proj. 0269 Dryland Grain Growers' Income Risk Management and Its
Environmental Impacts

Proj. 0275 Agricultural Production, Processing, Trade, and Environmental Quality

Proj. 0998 Rural Economic Development: Alternatives in the New Competitive
Environment

Statement of Issue

Because of rapidly changing technologies, demographics, and world policies, the market for agricultural products and the demand for resources to support agricultural production will continue to be highly volatile. Crop and livestock producers also face exceptional production risk due to weather, pests, and resource depletion. Commodity commissions, departmental advisory committee, and a comprehensive assessment of stakeholders by C-FARE, AAEA, and USDA have expressed the need to improve farm income and risk management tools, to increase understanding of economic and social impacts of biological and other technologies, to protect the environment while maintaining profitability, and to provide economic intelligence relevant to current and future agricultural production, farm, and public policy decision making.

² RPA 602 and Proj. 0317 have been added to the POW.

³ Proj. 0227, Proj. 0265, and Proj. 0998 have been added to the POW.

Performance Goals

1. Develop strategies for increasing expected firm profits and/or reducing risks in response to five new technologies, major market and/or policy changes in a five-year period.
2. Generate relevant information to improve foundations for public policy debate on five agricultural production and resource issues by farmers, commodity groups, government agencies, agricultural service firms, and conservation groups in a five-year period.
3. Provide useful economic and risk management decision-making tools, data, and procedures to agricultural managers.
4. Improve ability to give relevant economic guidance to decision-makers in the future.

Key Program Components

1. Measure the impacts of changing technologies, weather and pests, markets, public policies, and other risks on production decisions.
2. Assess the dynamics of firm response to changing technologies, markets, and public policies.
3. Measure aggregate effects of firm decisions.
4. Develop economic intelligence to guide future firm and public policy decisions to increase firm income, reduce risks, and assure a stable food supply.
5. Develop improved conceptual and quantitative tools for managing risk, augmenting firm income, and/or developing public policies to facilitate these objectives.

Internal and External Linkages

Much of the work in production economics is multidisciplinary in nature. Agricultural economists will collaborate with scientists from other disciplines as needed. First class agricultural science expertise is abundant in the Pacific Northwest; production and farm management economists have a long and successful track record of working with these scientists. Agricultural economics extension faculty will be involved in coordinated research and educational delivery programs to agricultural producers.

Target Audiences

Target audiences include conventional farmers; producers involved in sustainable production practices, agribusinesses that serve growers, and public policy makers.

Evaluation Framework

The evaluation framework includes quantitative and qualitative research output data as well as acceptance by clientele as evidenced by changes in production decisions and decision-making procedures.

Output Indicators

1. Number of strategies developed for increasing firm profits and/or reducing risks in response to new technologies, major market and/or policy changes.
2. Number of commodities, commodity groups, and/or types of firm for which historical producer output and input decision making behavior is examined in response to changing technologies, markets, and/or public policies.
3. Number of refereed journal articles, bulletins, policy and trade magazine articles published and electronic media releases that communicate the findings of production economic research.

Outcome Indicators

1. Acceptance by clientele (recommendations adopted by decision-makers, publication citations, web site hits).
2. Documented improvements possible from alternative decisions through increased profits and/or decreased risks.

Program Duration

The program has both short and long term features.

Allocated Resources

Faculty and staff FTEs	3.75
Funding	
Hatch	
Hatch Multistate	\$7,800
Fed. Res. Grants	
State Approp.	\$252,176
Other Grants	\$41,610

B. Department Research Program -- Agricultural Marketing

Department Goals

To assist targeted agricultural and resource industries become more effective in marketing their products and services to consumers.

To initiate studies on the farm and non-farm effects of concentration in agricultural production and food processing and on the economics of food safety.

Department Objective -- Marketing

RPA 603 Market Economics⁴

Generate and disseminate economic intelligence concerning impacts of changes in private and public strategies, technologies, consumer behavior, and public policies on the economic performance of the food system.

Proj. 0218 New Economic Theories and Econometric Methods for Agricultural Economics Analysis

Proj. 0301 Private Strategies, Public Policies, and Food System Performance

Proj. 0303 Economic Aspects of Growing Vinifera Wine Grapes on Rootstocks and Marketing Washington Wine

Proj. 0794 Food Demand, Nutrition and Consumer Behavior

Proj. 4301 Reputation and State Commodity Promotion

RPA 604 Marketing and Distribution Practices⁵

Generate and disseminate management- and decision-related economic intelligence relevant to current and future agricultural marketing and distribution practices.

Proj. 0278 The Prospects and Pitfalls of Financing Cooperatives Through Patron Demand Deposit Accounts

Proj. 0806 Fruit and Vegetable Supply-Chain Management, Innovations, and Competitiveness

RPA 606 International Trade and Development Economics⁶

Generate and disseminate management- and decision-related economic intelligence relevant to current and future international trade policies and firm decisions.

RPA 609 Economic Theory and Methods⁷

⁴ Proj. 0218, Proj. 0303, and Proj. 4301 have been added to the POW.

⁵ Proj. 0200A, Transportation Needs of Washington Intermodal Corridors, has terminated and, therefore, been removed from the POW.

⁶ Proj. 0764, Enhancing the Global Competitiveness of U.S. Red Meat, has terminated and, therefore, been removed from the POW.

⁷ RPA 609 and Proj. 0218 have been added to POW.

Develop improved methods of estimation and interference
Proj. 0218 New Economic Theories and Econometric Methods for Agricultural
Economics Analysis

Statement of Issue

Advances in biotechnology and information technology, changes in demographics, a movement toward freer trade and agricultural policy reform have resulted in rapidly changing food markets and changing relationships in the food supply chain in recent years. Agricultural producers, processors, food manufacturers, distributors, and consumers operate in an environment of unprecedented uncertainty about economic, health, and environmental impacts of choices. Commodity commissions and a comprehensive assessment of stakeholders by C-FARE, AAEA, and USDA have expressed the need to (a) examine the impacts of the changing farm and agribusiness structure, (b) evaluate trade policies and barriers, (c) assess how changes in consumer demand for nutritional, food safety, and environmental attributes affect consumer welfare and producer opportunities, and (d) provide economic intelligence relevant to current and future agricultural marketing, firm, and public policy decision making.

Performance Goals

1. Develop strategies for increasing firm profits and competitiveness, improving food quality, reducing food costs, and/or reducing risks in response to five new marketing or trade opportunities in a five-year period.
2. Measure demand for agricultural products, international trade decisions, and consumer decision making behavior in response to changing market conditions, demand for product attributes, consumer perceptions about food safety or environmental impacts, income, demographics, and/or public policies for five commodities, commodity groups, and/or types of firm in a five-year period.
3. Improve ability to give relevant economic guidance to market and consumer decision-makers in the future.

Key Program Components

1. Measure the impacts of changing technologies, markets, public policies, and associated risk and uncertainty on marketing and trade decisions.
2. Assess the dynamics of firm marketing and trade response to changing technologies, markets, and public policies.
3. Measure aggregate effects of firm decisions.
4. Develop economic intelligence to guide future firm and public policy decisions to reduce food marketing costs, food prices, and economic and environmental risks; increase firm income, food quality and safety; and assure

- a stable food supply.
5. Develop improved theoretical and quantitative tools for evaluating and managing market risk, augmenting firm income, reducing consumer food costs, increasing food quality, and/or developing public policies to facilitate these objectives.

Internal and External Linkages

Much of the work in marketing economics is multidisciplinary in nature. Scientists from other disciplines will be involved as needed. Talent available in the Pacific Northwest is abundant. Frequent cooperation among scientists, departments, institutions, and states is the norm. Extension faculty will be involved in coordinated research and educational delivery programs to food marketers and consumers.

Target Audiences

Target audiences include agricultural producers, food agribusinesses, consumers, and public policy makers.

Evaluation Framework

The evaluation framework includes quantitative and qualitative research output data as well as acceptance by clientele as evidenced by changes in marketing decisions and decision-making procedures.

Output Indicators

1. Number of strategies developed for increasing firm profits and/or reducing risks in response to new marketing opportunities.
2. Number of commodities, commodity groups, and/or types of firm for which historical demand for agricultural products or consumer decision making behavior is examined in response to changing markets, product attributes, consumer perceptions about food safety or environmental impacts, income, demographics, and/or public policies.
3. Number of refereed journal articles, bulletins, policy and trade magazine articles published and electronic media releases that communicate the findings of market and trade research.

Outcome Indicators

1. Acceptance by clientele (adoption of recommendations by decision-makers, publication citations, web site hits).
2. Documented improvements possible from alternative decisions through

increased profits, decreased risks, improved food quality, and/or lower food costs.

Program Duration

The program has both short- and long-term features.

Allocated Resources

Faculty and staff FTE	3.73
Funding	
Hatch	\$2,630
Hatch Multistate	\$21,267
Fed. Res. Grants	\$42,922
State Approp.	\$210,052
Other Grants	\$52,602

Department of Animal Sciences

A. Departmental Research Program -- Nutrition, Physiology, and Breeding of Livestock

Department Goal -- *Improvement in the Efficiency of Livestock Production*

Departmental Objectives

RPA 301 - Reproductive Performance of Ruminants^{8, 9}

Increase conception rates, reduce embryonic mortality and develop methods to increase overall reproductive efficiency in livestock.

Develop vaccines to block the estrous cycle in feedlot heifers.

Proj. 0380 Detection of the Polymeric Immunoglobulin Receptor, PIGR, in Porcine Oviductal Epithelial Cells

Proj. 0706 Germ Cell and Embryo Development and Manipulation for the Improvement of Livestock

Proj. 0928 Role of Oxytocin in Control of the Estrous Cycle of Swine

Proj. 0957 Reproductive Performance in Domestic Ruminants

Proj. 6957 Sterilization Vaccine for Cattle

Allocated Resources

Faculty & Staff FTE	3.31
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⁸ Proj. 0189, Improved Efficiency of Artificial Insemination in Large Dairy Herds, Proj. 0194, Synthesis of Growth Promoting Cytokines by Bovine Binucleate Cells, and Proj. 0313, Sperm/Oviductal Cell Interactions as an In Vitro Model for Fertility Evaluation, have terminated and, therefore, been removed from the POW.

⁹ Proj. 0380 and Proj. 6957 have been added to the POW.

Funding	
Hatch	3558
Hatch Multistate	142124
Fed. Res. Grants	70647
State Approp.	109710
Other Grants	12320

RPA 302 - Nutrient Utilization in Animals^{10 11},

Optimize rations to maximize maintenance, lactation, growth, and efficiency in livestock.

Evaluate various grains for their potential as animal feedstuffs.

Study with the objective to optimize the level of carotenoids in feedstuffs to maximize health and immunity in livestock.

Proj. 0167 Enhancement of Dietary Energy Use for Maintenance, Growth, and Lactation by Beef Cattle

Proj. 0213 Dietary and Genetic Manipulation of the Lipid Composition and Palatability of Red Meat

Proj. 0304 Altering Fermentation of Plant Fiber

Proj. 0328 Investigation of Direct Fed Microbial (DFM) Products Based on Aspergillus Fermentation Extract

Proj. 0374 Nutrient Management: Feeding for Reduced Excretion of Nitrogen, Phosphorus, Zinc, and Selenium by Ruminants

Proj. 0862 Metabolic Relationships in Supply of Nutrients for Lactating Cows

Allocated Resources

Faculty & Staff FTE	5.03
Funding	
Hatch	\$27,124
Hatch Multistate	\$43,257
Fed. Res. Grants	
State Approp.	\$228,503
Other Grants	\$72,176

RPA 303, Genetic Improvement of Livestock

Identify and predict the genetic potential to transmit desirable traits i.e., marbling, growth, conformation, and milk production in livestock.

Proj. 0181 Genetic Variation in Growth, Carcass Composition, Quality and Fatty Acid Composition of Wagyu Cattle

Allocated Resources

Faculty & Staff FTE	0.21
Funding	
Hatch	\$1,995

¹⁰ Proj. 0186, Role of Carotenoids on Immunity and Health, Proj. 0408, Maternal Transfer of Copper, Selenium, and Zinc, and Proj. 0702 Evaluation and Improvement of Barley for Food and Feed, have terminated and, therefore, been removed from the POW.

¹¹ Proj. 0304, Proj. 0328, and Proj. 0374 have been added to the POW.

Hatch Multistate	\$319
Fed. Res. Grants	
State Approp.	\$25,590
Other Grants	

RPA 305, Animal Physiologic Profiles¹²

Develop model systems to study the metabolism of dairy cows in relationship to feed formulation and milk production.

To characterize and isolate rumen fungi for their ability to digest cellulose increasing feed efficiency.

Study the mechanisms controlling muscle regeneration and fat cell deposition in relation to wound healing in livestock.

Proj. 0237 Equine Muscle Healing and Regeneration

Proj. 0249 Homeorhetic Regulation and Quantitative Modeling of Metabolism in Lactation and Growth

Proj. 0769 Targeting Fat Deposition for Greater Production Efficiency in Ruminants

Proj. 0913 Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation

Allocated Resources

Faculty & Staff FTE	4.45
Funding	
Hatch	\$2,599
Hatch Multistate	\$53,929
Fed. Res. Grants	(\$4345)
State Approp.	\$145,993
Other Grants	\$126,800

RPA 307, Animal Production Management Systems¹³

Examine the nutrient flows in dairy cattle to reduce the production of nitrogen and phosphorus in waste.

Develop beef cattle feeding systems, which result in a high quality, consistent grade of meat that is competitive in a global market.

¹² Proj. 0953, Enzymatic Characterization of the Cellulase System for Ruminant Fungi, has terminated and, therefore, been removed from the POW.

¹³ Proj. 0154, Environmental and Economic Impacts of Nutrient Flows in Dairy Forage, and Proj. 0929, Management Systems for Improved Decision Making and Profitability, have terminated and, therefore, been removed from the POW.

Proj. 0764 Enhancing the Global Competitiveness of U.S. Red Meat

Allocated Resources

Faculty & Staff FTE
Funding
Hatch
Hatch Multistate
Fed. Res. Grants
State Approp.
Other Grants

RPA 311 Animal Diseases¹⁴

Examine the mechanisms of disease resistance and immunity.

Proj. 0289 Immunological Characteristics of the T Cell Compartment of Trout
Clones

Proj. 0331 Importance of Dietary Carotenoids on Immunity and Cancer in the
Canine and Feline

Proj. 0709 Mastitis Resistance to Enhance Dairy Food Safety

Statement of Issue

Livestock producers face three key issues as we move toward the new millennium: 1) effects of increased US market concentration, corporate agriculture and larger production in units, 2) implications of competing in an ever increasing global economy, and 3) demand for increased management and technology advancement to increase efficiency of production. These three issues must be addressed in an atmosphere of increased accountability in environmental stewardship and reduced federal subsidy.

Performance Goal(s)

10. Improve the efficiency of livestock production by developing strategies gained through studies on the nutrition, physiology, diseases, genetics and animal breeding of beef and dairy cattle, swine, and salmonids.
11. Develop new approaches to make animal food and fiber competitive in an ever increasing global economy.
12. Develop new management approaches that will ensure good environmental stewardship.

Program Components

1. Continue basic nutritional studies designed to optimize feed components of rations to provide maximum efficiency at the lowest cost.
2. Study reproductive physiology to elucidate mechanisms which control early embryonic death,

¹⁴ RPA 311, Proj. 0289, Proj. 0331, and Proj. 0709 have been added to the POW.

- control of the estrous cycle and breeding efficiency in beef and dairy cattle, and swine.
3. Develop vaccines to control many of the common diseases found in hatchery-raised salmonids.
 4. Evaluate new production practices and educate producers on improving environmental stewardship.

Internal and External Linkages

1. Many of our departmental scientists work together on nutrition, reproduction, genetics, and animal breeding programs and with researchers in other departments. Examples include the Wagyu Beef Project, Food Animal Disease Investigative Unit, Western Regional Aquaculture Consortium and The Center For Reproductive Biology. Nine of our scientists cooperate on regional research projects and all of our research faculty interact with producers, commodity groups and private companies. Our faculty conduct information symposiums, serve on the boards of commodity organizations and work closely with the Dairy Products Commission, Dairy Federation, Washington Swine and Sheep Producers, Washington Beef Commission and Cattle Feeders Association.

Target Audiences

1. Target audiences include all segments of the livestock industry in Washington including small and large-scale producers and the meat processing industry.
2. Scientific societies and professional colleagues to exchange information and build collaborative relationships.
3. Commodity groups and organizations to deliver information and learn of their needs and future directions.
4. Private companies working in the livestock industry and collaborate to better meet the needs of our common clientele.

Evaluation Framework

1. The evaluation framework includes refereed papers, abstracts, presentations at scientific meetings, graduate student theses, articles in proceedings, extension bulletins and reports, patent applications, and popular press articles as evidenced by peer review evaluation and acceptance of this new information into production practices and management.

Output and Outcome Indicators

1. The acceptance of Wagyu genetics into the Pacific Northwest by over 30 cow calf feedlot operators, and packing plants as a profitable niche beef commodity.
2. New dietary recommendations for selenium and zinc levels of the diets of dairy cattle and swine.
3. Proving no reduction in feedlot performance or carcass quality by the inclusion of potato by-product in barley fed cattle compared to straight corn fed cattle.
4. Development of a restructured steak product to create a value added product from the low valued round of beef.
5. Using animal models to study early embryonic death, the effect of chronic alcohol consumption, wound healing and muscle regeneration which have a direct impact on animal and human health.
6. The identification of different varieties of barley and wheat as improved sources of animal feeds.
7. The inclusion of carotenoids in the diet to optimize the animal's immune system to fight disease.

Program Duration

The research programs have both programmatic and basic science components. The basic science components have more of a long-term timetable until these results reach the livestock industry.

Allocated Resources

Faculty & Staff FTE	6.65
Funding	
Hatch	\$3,446
Hatch Multistate	\$987
Fed. Res. Grants	\$206,934
State Approp.	\$102,027
Other Grants	\$174,843

Department of Crop and Soil Sciences

A. Departmental Research Program -- Agronomic Crop Production

Departmental Goals -- Enhance Production Efficiency and Competitiveness of Washington Agriculture in a Global Economy

Departmental Objectives

Develop improved crop cultivars and new cropping systems

RPA 201 - Plant genome, genetics and genetic mechanisms^{15, 16}

Proj. 0196 Molecular Markers for Barley Disease Resistance Genes

Proj. 0232 Breeding and Genetics of Winter Wheat

Proj. 0251 Breeding of Value-Added Barley by Incorporation of Protein-Engineered Beta-Glucanases

Proj. 1006 Breeding and Genetics of Barley

Proj. 1790 Breeding Dry Pea, Lentil, and Chickpea Germplasm for Stress Tolerance, Disease Resistance and Quality

Proj. 1851 Enhancing Winter Wheat for Coldhardiness

Proj. 3251 Fusarium Resistant Germplasm by Altered Gene Expression in the Barley Seedcoat

Proj. 6106 Dissecting a Complex Barley Chromosome Region Containing Malting Quality QTL

Proj. 6197 Molecular Genetics of the Barley Stem Rust Resistance Gene Families

RPA 202 - Plant genetic resources and biodiversity¹⁷

Proj. 0282 Germplasm and Cultivar Development of Hop

Proj. 1134 Plant Genetic Resource Conservation and Utilization

RPA 203 - Plant biological efficiency and abiotic stresses affecting plants^{18, 19, 20}

¹⁵ Proj. 1570, Improving Spring Wheat Varieties for the Pacific Northwest, has terminated and, therefore, been removed from the POW.

¹⁶ Proj. 3251 and Proj. 6197 have been added to the POW.²³

¹⁷ Proj. 0282 has been added to the POW.

- Proj. 0182 Impact of No Till on Soil Quality Physical, Chemical, and Microbial Properties
- Proj. 0196 Molecular Markers for Barley Disease Resistance Genes
- Proj. 0232 Breeding and Genetics of Winter Wheat
- Proj. 0242 Developing Sustainable Agricultural Systems with Conservation Tillage and Site Specific Management
- Proj. 0250 Cropping Systems Research for Low-Precipitation Dryland in Eastern Washington
- Proj. 0251 Breeding of Value-Added Barley by Incorporation of Protein-Engineered Beta-Glucanases
- Proj. 0277 Ecologically Based Weed Management for Dryland Cropping Systems
- Proj. 0281 Alternative Crops and Cropping Systems for Irrigated Central Washington
- Proj. 0309 Spectral Reflectance and Spatial Analysis of Plant Stress Indicators in Vitis
- Proj. 0332 Evaluation and Management of Turfgrass Species and Cultivars
- Proj. 0358 Grass Seed Cropping Systems for a Sustainable Agriculture
- Proj. 0664 Seed Biology, Technology, and Ecology
- Proj. 0688 Developing Crops and Cropping Systems for Moisture-Limiting Environments
- Proj. 1006 Breeding and Genetics of Barley
- Proj. 1790 Breeding Dry Pea, Lentil, and Chickpea Germplasm for Stress Tolerance, Disease Resistance and Quality
- Proj. 1851 Enhancing Winter Wheat for Coldhardiness
- Proj. 3669 Development and Feasibility of Perennial Wheat for Highly Erodeable Lands
- Proj. 4703 Sustainability of Three Apple Production Systems: Conventional, Organic, and Integrated
- Proj. 6106 Dissecting a Complex Barley Chromosome Region Containing Malting Quality QTL

RPA 204 - Plant production quality and utility (preharvest)^{21, 22, 23}

- Proj. 0110 Alfalfa Growth and Quality: Environmental and Plant Factors
- Proj. 0175 Adaptation Studies of Cereal Varieties and Selections

¹⁸ Proj. 0557, Evaluation and Management of Turfgrass Species and Cultivars for Eastern Washington, and Proj. 6196, Cloning Barley Rust Resistance Genes Using Rice as an Inter-Genomic Vehicle, have terminated and, therefore, been removed from the POW.

¹⁹ Proj. 0281, Proj. 0309, Proj. 0332, Proj. 0358, and Proj. 3669 have been added to the POW.

²⁰ Proj. 0264, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, will be terminating fairly soon and the program will not be continued by Congress. Therefore, the project has been removed from the POW.

²¹ Proj. 0708, East Asian Agriculture, and Proj. 1570, Improving Spring Wheat Varieties for the Pacific Northwest, have terminated and, therefore, been removed from the POW.

²² Proj. 0110, Proj. 0334, and Proj. 0359 have been added to the POW.

²³ Proj. 0264, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, will be terminating fairly soon and the program will not be continued by Congress. Therefore, the project has been removed from the POW.

Proj. 0250 Cropping Systems Research for Low-Precipitation Dryland in Eastern Washington
Proj. 0334 Improving Spring Wheat Varieties for the Pacific Northwest
Proj. 0359 Early Generation and Market Specific Quality Evaluation of Wheat Varieties
Proj. 1006 Breeding and Genetics of Barley
Proj. 1851 Enhancing Winter Wheat for Coldhardiness

RPA 205 - Plant production management systems²⁴, ²⁵, ²⁶

Proj. 0110 Alfalfa Growth and Quality: Environmental and Plant Factors
Proj. 0175 Adaptation Studies of Cereal Varieties and Selections
Proj. 0242 Developing Sustainable Agricultural Systems with Conservation Tillage and Site Specific Management
Proj. 0250 Cropping Systems Research for Low-Precipitation Dryland in Eastern Washington
Proj. 0277 Ecologically Based Weed Management for Dryland Cropping Systems
Proj. 0309 Spectral Reflectance and Spatial Analysis of Plant Stress Indicators in Vitis
Proj. 0329 Perennial Ryegrass Seed Production in the Puget Sound Without Burning
Proj. 0358 Grass Seed Cropping Systems for a Sustainable Agriculture
Proj. 0376 Integrated Management of Winter Annual Grass Weeds in Eastern Washington Dryland Crop Systems
Proj. 3669 Development and Feasibility of Perennial Wheat for Highly Erodable Lands
Proj. 3776 Effect of Cropping Systems on Shrub-Steppe Habitat
Proj. 4703 Sustainability of Three Apple Production Systems: Conventional, Organic and Integrated

RPA 206 - Basic plant biology.

Proj. 0245 STEEP III
Proj. 0296 STEEP III

Statement of Issues

Agronomic systems in the 21st century must be profitable, diverse, site-specific, resource conserving and evolving to have environmentally sound practices.

²⁴ Proj. 0145, Diseases in Dryland and Irrigated Cropping Systems without Grass Burning, Proj. 0146, Evaluation of Diverse Kentucky Bluegrass Germplasm for Seed Production in Alternative Residue Management Systems, Proj. 0147, Cultivar Identification and On-Farm Technology for Sustained Kentucky Bluegrass Seed Production, and Proj. 0557 Evaluation and Management of Turfgrass Species and Cultivars for Eastern Washington, have terminated and, therefore, removed from the POW.

²⁵ Proj. 0110, Proj. 0309, Proj. 0329, Proj. 0358, Proj. 0376, Proj. 3669, and Proj. 3776 have been added to the POW.

²⁶ Proj. 0264, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, will be terminating fairly soon and the program will not be continued by Congress. Therefore, the project has been removed from the POW.

Demand for agricultural products will increase with population and affluence, but government policies will increase the uncertainty and risk being borne by growers. While agricultural production (food, feed, fiber, seed, and turf) is local, marketing systems are global. As competitors in this global market, PNW growers must produce high quality, consistent, identity preserved products (both raw and value added) that are in high demand and reach a broad market base, including diverse niche markets.

Performance Goals

1. Develop new cultivars, crops, and germplasm resources having improved end-use and/or value-added qualities recognized in the global market, production efficiencies, yield, and adaptation to improved cropping systems.
2. Produce new technologies and advanced scientific information on the genetics, molecular biology, physiology and biochemistry of crops and weeds.
3. Develop economically viable, diverse, and environmentally sound cropping system practices in managing land for the production of safe and high quality crop products with special emphasis on precision farming, reduced tillage, and integrated weed control strategies.

Key Program Components

1. Cultivar Development: Improved cultivars having resistance to prevailing pests and environmental stresses, and improved end-use qualities will be developed. In addition, efforts will be undertaken to develop cultivars adapted to new cropping systems and to niche production areas in Washington. We shall develop improved methods and strategies to enhance breeding progress and efficiency and production of transgenic crops. It is also anticipated that a coordinated strategy and resources for evaluating cultivar performance and adaptation under conventional and reduced tillage systems will be developed and the information made available to Washington growers.
2. Cropping systems will be developed which reduce the potential for soil loss and environmental degradation, and increase profitability of crop production in Washington. These systems will use: alternative crops to enhance crop diversity, improve rotational alternatives and increase production efficiency; precision management of fertilizer and pesticide inputs to minimize impacts of these materials on the environment and to maximize net returns to growers; new technologies and improved tillage practices for reducing wind and water erosion; alternatives to open-field burning of crop residue; and improved control of weeds and other pests.

Internal and External Linkages:

Formal linkages have been established with all production-related departments

and ARS units in the CAHE at WSU and many related departments in colleges of agriculture around the country, especially in the Tri-State region. Additionally, linkages have been established with international institutes like CIMMYT and ICARDA. Linkages with breeding programs at Oregon State, University of Idaho, Hybritech, and Monsanto are especially strong. Tri-State cropping systems cooperation is also quite strong, supported by the joint appointment of Roger Veseth at WSU/UI. Extension collaboration is strong with Ag Horizons, dairy, and other groups.

Target Audiences

We are targeting growers and users of new crop varieties, cropping systems, turf management practices, and weed control measures in the Pacific Northwest. The following audiences are specifically targeted: growers of winter wheat, spring wheat, barley, peas, lentils, chickpeas, hops, alternative agronomic crops, turf grass, and the agriculture industry that supports these commodities.

Evaluation Framework

The evaluation framework is based on: Grower and user acceptance of alternative crops, cropping systems, turf management practices, and weed control measures. These innovations are expected to be accepted based on their attractive attributes. Efforts will be made to develop cultivars with greater stress resistance for adaptation to new cropping systems and for niche areas of the state.

Output Indicators

Output indicators include: Release of new crop cultivars having improved pest resistance, end-use qualities yield and performance under existing management systems (short term) and under newly developed cropping systems (long term). Scientific publications and discoveries, development of new methods and technologies, identification and development of new genetic resources, and value-added germplasm are also output indicators.

Outcome Indicators

Outcomes are indicated by area under production (short term) of new cultivars and cropping systems, and reductions in soil loss and corresponding increases in water and soil quality (long term). Adoption of new technologies, citation of publications, and parentage of new cultivars will also be noted.

Program Duration

The development of new cultivars and cropping systems is an on-going process

fed by adoption of new technologies into the development process. New cultivars containing pest resistance are constantly subjected to evolving diseases and insects; and cropping systems must constantly evolve to incorporate changing forms and types of inputs and introduced pests. Many outputs such as cultivars and systems require 10-20 years of development and testing.

Allocated Resources

Faculty & Staff FTE	43.03
Funding	
Hatch	\$212,106
Hatch Multistate	\$9,256
Fed. Res. Grants	\$713,734
State Approp.	\$920,405
Other Grants	\$1,133,916

Department of Entomology

- A. Departmental Research Program** -- Integration of Biological Control into existing and developing Integrated Pest Management programs.

Departmental Goals

Integrated Biological Control.

Integrated Pest Management.

Reduce our citizenry's dependence on broad-spectrum pesticides.

Department Objectives

RPA 211 - Insects, mites, and other arthropods affecting plants^{27, 28, 29}

Continue and increase our efforts to demonstrate strategies to control insect pests below an economical threshold level without broad-spectrum pesticides.

Document insect diversity, including pollinators, beneficial insects in various ecosystems.

Proj. 0244 Molecular Genetics of Honey Bee Subspecies and Assessment of Populations in Northern American

²⁷ Proj. 0243 has been moved to Goal 4

²⁸ Proj. 0509, Dynamics and Management of Forest Insect Populations, and Proj. 0635, Economically Important Diptera of Washington, have been terminated and, therefore, removed from the POW.

²⁹ Proj. 0342 and Proj. 3335 have been added to the POW.

Proj. 0342 Investigation of Neural-like Properties of a Colorado Potato Beetle Cell Line

Proj. 3335 Commodity and Pest Management Profiles in Washington State

Allocated Resources

Faculty & Staff FTE	1.16
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	
State Approp.	\$53,099
Other Grants	\$10,547

RPA 215 - Biological control of pests affecting plants³⁰

The Department of Entomology will achieve its primary goal of Integrating Biological Control into existing and developing Integrated Pest Management programs throughout Washington.

Proj. 0272 Biological Management of Yellow Starthistle in Washington

Proj. 0337 Biological Control of Aphid Pests

Allocated Resources

Faculty & Staff FTE	1.06
Funding	
Hatch	\$6
Hatch Multistate	
Fed. Res. Grants	\$16,316
State Approp.	\$30,207
Other Grants	\$47,930

RPA 216 - Integrated Pest Management Systems^{31, 32, 33}

Statement of Issues

To fulfill our mission, it is essential that we first have a strong program in basic and applied research to provide the science necessary to develop effective control

³⁰ Proj. 0121 has been moved to Goal 4

³¹ Proj. 0122 and Proj. 0206 have been moved to Goal 2.

³² Proj. 0225, Proj. 0270, Proj. 0405, Proj. 0742, Proj. 0801, and Proj. 1090 have been moved to Goal 4.

³³ Proj. 0187, Developing a New Approach to Evaluate the Ecotoxicity of Pesticides to Nontarget Arthropods, Proj. 0209, Biology and Control of Insect and Mite Pests of Wine Grapes, Proj. 0355, Developing IPM Systems to Enhance Effects of Biological Control Agents on Arthropod Pests of Plants, Proj. 3125, Benefit Assessment of Pesticides in Washington State, and Proj. 3172, Biological and Economic Assessment of Apple Pest Management, have terminated and, therefore, removed from the POW.

programs for arthropod pests and to facilitate management of beneficial insects of great economic importance to our agriculture. Secondly, a strong educational program to train entomologists to conduct research that will be critical in the future and to disseminate the knowledge gained through our research to the general public, growers, ranchers/dairymen, environmentalists, beekeepers, health care workers, veterinarians, industrial concerns, pest control operators, etc.

Performance Goals

1. Integrating Biological Control into existing and developing Integrated Pest Management programs throughout Washington.
2. To expand IPM strategies to minor crops where research and education is still needed.
3. Reduce our citizenry's dependence on broad-spectrum pesticides.

Key Program Components

1. Continue our efforts to serve key production agriculture commodities (i. e. tree fruits, small fruits, cereal crops, row crops, and seed production, etc.) by identifying potential insect pests early enough to develop an IPM program to counter their adverse effects.
2. Evaluate various means of controlling pestiferous insects by chemical, cultural, or biological control methods.
3. Help define the best Integrated Pest Management practices for each commodity and where possible, integrating biological control in these IPM programs.

Internal and External Linkages

1. Our adjunct faculty members include seven Ph.D. entomologists employed by the United State Department of Agriculture in both Pullman and Wapato, WA.
2. We regularly exchange communication and resources with members of the Washington State Department of Agriculture; several are graduates of our Department.
3. Faculty members of the Department of Plant, Soil and Entomological Sciences at the University of Idaho have collaborated with our faculty on various crop protection problems that our two states share.
4. Tree fruit researchers in Oregon, California and British Columbia, Canada Columbia have collaborated in promoting 'mating disruption' for the codling moth.
5. We have had an active exchange program with the University of Chile, especially regarding tree fruits and potato production.
6. The Northwest Biocontrol Insectary and Quarantine facility has been a focal point of cooperative programs throughout the region.

7. Most of our cooperative extension specialists have split appointments with ARC; thereby, reinforcing our linkage between these two divisions of CAHE.

Target Audiences

1. We serve key production agriculture commodities (i. e. tree fruits, small fruits, cereal crops, row crops, and seed production, etc.) and minor cropping systems through our IR-4 work to reduce crop losses due to insect infestations.
2. Our efforts aid all growers, regardless of their production methods (conventional vs. organic), to reduce their need for crop protection expenditures.

Evaluation Framework

The evaluation framework includes baseline data gathering to document increased acceptance for Integrated Pest Management programs. In tree fruits an example would be the number of orchards managed under a ‘mating disruption’ strategy.

Output Indicators

1. Number of individual insect pests researched.
2. Number of new or revised control strategies developed.
3. Number of biocontrol agents collected, screened, released, and established.
4. Number and quality of publications published.
5. Number of clientele informed of our research data.
6. Acceptance by growers of IPM strategies developed by researchers.
7. Acceptance research findings of other researchers.
8. Integration of biological control into existing or developing IPM programs.

Outcome Indicators

1. Reduce the public’s dependence on broad-spectrum pesticides.
2. Acceptance by growers of new strategies (i.e. mating disruption) for reducing pest pressure on various crops.
3. Documentation of biological control agents becoming established in Integrated Pest Management program.
4. Develop a more educated citizenry by disseminating our research results to our clientele.

Program Duration

Our Integrated Pest Management strategy has both short and long term features.

Department of Food Science and Human Nutrition

A. **Department Research Program -- Food Science, Processing Technology**

Department Goal

Promote advancement of knowledge through selective excellence in graduate education and research in Food Science

Department Objective

Implement research projects in identified areas, which meet the expertise of the food science and human nutrition faculty, the needs of the state's residents and industries, and has potential funding sources.

RPA 501 - New and improved food processing technologies^{34, 35, 36}

Continue to investigate new thermal and non-thermal processes to produce safe, value-added food products.

Develop better understanding of the physical and microbiological changes that food and food components undergo during value-added processing.

Proj. 0208 Enological and Viticultural Practices on Fermentation Microbiology, Chemistry, and Quality of Wines

Proj. 0288 Microbiological and Chemical Factors Affecting the Flavor and Textural of Cheddar Cheese

Proj. 0560 Genetic Improvement of Beans (*Phaseolus vulgaris* L.) for Yield, Disease Resistance, and Food Value

Proj. 0719 Milling and Flour Quality Characteristics of Wheat Selections

Proj. 0846 Enological and Viticultural Practices on Fermentation Microbiology, Chemistry, and Quality of Wines

Proj. 3468 Surface Hydrophobicity and Functionality of Proteins in the Molten Globule State

Proj. 6305 Non-invasive Method for Predicting Safety and Quality of Foods

RPA 502 - New and Improved Food Products³⁷

³⁴ Proj. 0199, Modeling Changes in Bakery Products During Thermal Processing, Proj. 0223, Application of Microwave Heating in Food and Agriculture Processes, and Proj. 7223, Physical and Micro-Structural Properties of Gellan Gels in Food Application, have terminated and, therefore, been removed from the POW.

³⁵ Leadership responsibilities for Proj. 0271, Preservation of Foods by Oscillating Magnetic Fields, and Proj. 0467, Improvement of Thermal Processes for Food, have been transferred to the Department of Biological Systems Engineering. For project information see that unit's section of the POW.

³⁶ Proj. 0560, Proj. 0846, Proj. 3468, and Proj. 6305³³ have been added to the POW.

³⁷ RPA 502, Proj. 0205, Proj. 0305, and Proj. 0537 have been added to the POW.

Proj. 0205 Biochemical Composition of Grapes and Wine As Influenced by
Viticultural and Enological Factors

Proj. 0305 Develop a Non-invasive Spectroscopic Method to Predict
Safety/Quality of Cured/Smoked Food Products

Proj. 0537 Factors Affecting the Quality of Washington Wine and Wine Grapes
(Vitis vinifera)

RPA 503 Quality maintenance in storing and marketing food products

Investigate quality attributes of grains and potatoes that change during storage or affect processing and/or the marketability of the commodities.

Proj. 0128 Marketing and Delivery of Quality Cereals and Oilseeds

Statement of Issue(s)

Consumers desire high quality, nutritious, convenient, safe food that is compatible with their income. New ways of processing and storing agricultural commodities are required to meet these consumer needs and to add value to the basic commodities.

Performance Goal(s)

Develop new food processing or storage technologies and document the acceptability and safety of these new and novel food-processing methodologies.

Effectively communicate research findings to the food processing industry in the Pacific Northwest and the nation.

Key Program Components

1. Continue to investigate new processing technologies including high hydrostatic pressure, pulsed electric fields, microwave, radio frequency, fermentation and others.
2. Develop novel product quality monitoring methodologies for during storage or processing.

Internal and External Linkages

1. Scientists in Biological Systems Engineering (WSU)
2. Food Scientists from the University of Idaho and Oregon State University
3. Northwest Food Processing Association
4. Institute of Food Technologists
5. Other appropriate state and federal agencies

Target Audience(s)

1. Target audiences are food processing companies including those working in new product development, quality control and new processing development.
2. Northwest Food Processing Association

Evaluation Framework

The evaluation framework would be acceptance of peer reviewed journal articles and adoption of new processes or modified processes by the food processing and storage industry.

Output Indicators

Scientific publications, along with graduate students trained in advanced processing techniques.

Visits and inquiries from food processing company personnel.

Documented new information related to new and novel food processing methods.

Documented safety issues related to the new processing methodologies.

Outcome Indicators

Approval of new processing methodologies by regulatory agencies and acceptance of new processing methodologies by the food processing industry.

Program Duration

The program has both short and long term features

Allocated Resources

Faculty & Staff FTE	11.59
Funding	
Hatch	\$45,388
Hatch Multistate	
Fed. Res. Grants	\$14,247
State Approp.	\$370,078
Other Grants	\$233,086

Department of Horticulture and Landscape Architecture

B. **Departmental Research Program** -- Breeding, Management, and Production of Tree Fruits and Small Fruits

Departmental Goals

Develop and release tree fruit and small fruit varieties and cultivars that enhance the competitiveness of Washington's horticultural industry

Improve efficiency of production and enhance quality of products in tree fruit and small fruit crops

Department Objectives

RPA 201 - Plant Genome, Genetics, and Genetic Mechanisms

Continue with research that is dedicated to the development of an understanding of the genetic mechanisms that control factors related to fruit production and quality.

Continue with research, which focuses on isolation of genes that influence horticultural characteristics such as ripening, pest resistance, and storage potential of fruit.

Proj. 0321 Calcium-Mediated Signaling in Plants: Calmodulin and Ca²⁺/ Calmodulin-Dependent Protein Kinase

Proj. 0910 Regulating Plant Fertility by Manipulation of Flavonol Levels in Pollen

RPA 202 - Plant Genetic Resources and Biodiversity^{38, 39}

Continue with research that is directed at the development and release of apple varieties that will meet the needs of the Washington tree fruit industry.

Continue research programs that focus on the development and release of raspberry and strawberry varieties for the Washington small fruit industry.

Expand on research dedicated to the development and release of cherry varieties for the Washington tree fruit industry.

Proj. 0201 Sweet Cherry and Other Prunus Tree Fruit Germplasm, Production, and Physiology

RPA 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants^{40, 41, 42, 43, 44}

³⁸ Proj. 0038 and Proj. 0640 are reported in the WSU Puyallup Research and Extension portion of the POW.

³⁹ Proj. 0156 and Proj. 0260 are reported in the WSU Wenatchee Tree Fruit Research and Extension Center portion of the POW.

⁴⁰ Proj. 0179, Effect of Dwarfing Rootstocks on Nitrogen Metabolism and Assimilate Partitioning in Apple Trees, and Proj. 0222, Landscape Ecology in Horticultural, Coastal and Forest Ecosystems: Spatial/Vertical Plant Dynamics, have terminated and, therefore, removed from the POW.

⁴¹ Proj. 0215 is reported in the WSU Puyallup Research and Extension Center portion of the POW.

⁴² Proj. 0217 is now reported in the WSU Puyallup Research and Extension Center portion of the POW.

Investigate the viability of alternative rootstocks for use in apple and cherry production in the Washington tree fruit industry.

Continue research directed at the identification of the most effective nutrient management strategies for Washington tree fruit orchards.

Develop an understanding of the physiological mechanisms involved in fruit damage resulting from extreme environmental conditions.

Identify environmental factors that affect production and quality in tree fruits and small fruits.

Investigate the effects of cultural practices on plant root health and the establishment of landscape plants.

Develop an understanding of environmental and cultural factors that effect water stress and cold hardiness in landscape plants.

Proj. 0346 Physiological and Biochemical Markers of Potato Seed-Tuber Age and Their Relevance to Production

Proj. 0519 Environmental Factors and Management Practices Influencing Wine Grape Crop Physiology and Cold Hardiness

Proj. 0937 Effects of Environmental Factors on Reproductive Growth and Development of Apple (*Malus domestica*)

Proj. 1984 Production and Environmental Inputs Affecting Yield and Quality of Vegetables

RPA 204 - Plant Product Quality and Utility⁴⁵

Examine factors that influence the initiation of flowering in small fruits.

Examine factors affecting crop load and determine rates of sugar accumulation and fruit maturation.

Proj. 0210 Wine Grape Viticultural Research

Proj. 6046 Potato development and Improvement in the Northwest

RPA 205 - Plant Production Management Systems^{46, 47, 48}

⁴³ Proj. 0452 and Proj. 0747 are reported in the WSU Wenatchee Tree Fruit Research and Extension Center portion of the POW.

⁴⁴ Proj. 0346 and Proj. 1984 have been added to the POW.

⁴⁵ Proj. 6046 has been added to the POW.

⁴⁶ Proj. 0188, Horticultural and Economic Impacts of Sustainable Pear Production, has terminated and, therefore, been removed from the POW.

⁴⁷ Proj. 0298 is reported in the WSU Wenatchee Tree Fruit Research and Extension Center portion of the POW.

⁴⁸ Proj. 0044, Proj. 0346, Proj. 0377, and Proj. 1984 have been added to the POW.

Examine sustainable tree fruit production management systems.

Develop bioregulation methods for vegetative growth and fruit development.

Identify production methods for optimum yield in small fruits.

Proj. 0044 Potato Cultivar Evaluation and Commercial Potato Seed Lot Trial

Proj. 0346 Physiological and Biochemical Markers of Potato Seed-Tuber Age and
Their Relevance to Production

Proj. 0377 Production Horticultural and Integrated Management Systems of
Grapes

Proj. 0480 Concord Grape Production for Optimum Yield With Minimum Cost of
Production

Proj. 1639 Orchard and Physiological Investigation on Asian Pear

Proj. 1984 Production and Environmental Inputs Affecting Yield and Quality of
Vegetables

RPA 206 - Basic Plant Biology^{49, 50}

Identify mechanisms affecting utilization of calcium.

Identify factors affecting growth, development, and physiology of small fruits.

Identify factors affecting reproductive growth and development in tree fruits

Proj. 0321 Calcium-Mediated Signaling in Plants: Calmodulin and Ca²⁺/
Calmodulin-Dependent Protein Kinase

Proj. 0346 Physiological and Biochemical Markers of Potato Seed-Tuber Age and
Their Relevance to Production

Proj. 0937 Effects of Environmental Factors on Reproductive Growth and
Development of Apple (*Malus domestica*)

RPA 213 - Weeds Affecting Plants⁵¹

⁴⁹ Proj. 0783 is reported in the WSU Vancouver Research and Extension Unit portion of the report.

⁵⁰ Proj. 0346 has been added to the POW.

⁵¹ Proj. 0639 is reported in the WSU Puyallup Research and Extension Center portion of the report.

Statement of Issues

Washington's tree fruit and small fruit industries play a very significant role in the state's agricultural economy. These crops contribute nearly \$1.3 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 77% 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.

Performance Goals

1. Develop and release new apple varieties that will insure the competitiveness of the Washington tree fruit industry.
2. Develop and release new cherry varieties that will insure the competitiveness of the Washington tree fruit industry.
3. Develop and release new raspberry and strawberry varieties that will insure the competitiveness of the Washington small fruit industry.
4. Develop new management approaches to minimize the effects of extreme environmental conditions on production of fruit crops.
5. Release information related to the effectiveness of bioregulators on vegetative growth and fruit set.
6. Provide nutrient management guidelines for the fruit industry.

Key Program Components

1. Continuation of the apple breeding program at the Tree Fruit Research and Extension Center in Wenatchee.
2. Continuation of the raspberry and strawberry breeding programs at the Western Washington Research and Extension Center in Puyallup.
3. Evaluation of cherry cultivars from the breeding program at the Irrigated Agriculture Research and Extension Center in Prosser.
4. Continuation of on-going research programs at several locations that focus on the affects of extreme environmental factors on fruit production and quality.
5. Continuation of research programs directed at the study of tree fruit and small fruit nutrition.

6. Expansion of research aimed at identifying effective growth regulators.

Internal and External Linkages

There are many linkages associated with these programs, both internally (WSU) and externally. Principal investigators on the projects associated with this program work closely with scientists from other departments at WSU: Crop and Soil Science, Biosystems Engineering, Botany, Plant Physiology, Entomology, Plant Pathology, and with USDA scientists at several locations. There is also close collaboration with scientists from the Washington Tree Fruit Research Commission and the horticultural industry. In many cases, research is conducted in cooperation with growers, at private orchard and vineyard locations.

Target Audiences

1. The tree fruit and small fruit industries of Washington and the region.
2. Scientific societies and professional organizations.
3. The Washington Tree Fruit Research Commission, and other commodity organizations.
4. Private companies that provide services to the horticultural industry.

Evaluation Framework

This research program will be evaluated within the context of how well it serves the needs of the tree fruit and small fruit industries of the state and region, and how it has contributed to horticultural science. Evaluation criteria will be quantitative as well as qualitative. Quantitative criteria will include number of publications in peer reviewed journals as well as trade journals, numbers of new plant varieties released, and new procedures or products. In some cases it will be possible to evaluate success of a program in economic terms. Qualitative criteria will relate to the acceptance of products or procedures by the horticultural industry.

Output Indicators

1. Number of publications in peer reviewed and trade journals.
2. Number of new plant varieties.
3. Number of horticultural products produced or reviewed.
4. Number of horticultural management strategies developed and communicated.

Outcome Indicators

1. Acceptance of new plant varieties by the horticultural industry - this can be measured in both qualitative and quantitative (e.g. number of acres converted

- to new varieties) ways.
2. The extent to which new management strategies are being implemented.
 3. The extent to which new products (that are either produced or evaluated by WSU programs) are adopted.
 4. The extent to which research publications produced by WSU scientists are referenced by other researchers.

Program Duration

The projects that make up this program vary in duration. Some of the projects that are focused on the development of horticultural management strategies have relatively short duration (3-5 years), while those that emphasize plant breeding and genomics may have a duration of up to 20 or more years. The apple-breeding program, in particular, is a very long-term project. It will take 7 to 10 years to produce even preliminary information.

Allocated Resources

Faculty & Staff FTE	20.17
Funding	
Hatch	\$83,874
Hatch Multistate	
Fed. Res. Grants	\$70,673
State Approp.	\$421,288
Other Grants	\$982,632

B. Departmental Research Program -- Breeding, Management, and Production of Vegetable Crops

Departmental Goals

Develop and release vegetable crop varieties and cultivars that enhance the competitiveness of Washington's horticultural industry.

Improve efficiency of production and enhance quality of vegetable crops.

Department Objectives

RPA 201 - Plant Genome, Genetics, and Genetic Mechanisms

Continue with research that is dedicated to the development of an understanding of the genetic mechanisms that control factors related to vegetable production, pest resistance, and quality.

Continue with research, which focuses on isolation of genes that influence horticultural characteristics such as pest resistance, storage potential and processing qualities of vegetable crops.

Proj. 0168 Gene Transfer for Potato Variety Development
Proj. 0321 Calcium-Medicated Signaling in Plants: Calmodulin and Ca²⁺/
Calmodulin-Dependent Protein Kinase

RPA 202 - Plant Genetic Resources and Biodiversity

Continue with research that is directed at the evaluation and release of potato cultivars that will meet the needs of the Washington potato industry.

Continue involvement in the Tri-State Variety Release Program for potatoes.

Proj. 0044 Potato Cultivar Evaluation and Commercial Potato Seed Lot Trial

RPA 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants⁵²

RPA 204 - Plant Product Quality and Utility⁵³

Expand research related to the identification of vegetable crops that have utility for export markets.

Continue with research related to environmental inputs affecting yield and quality of vegetable crops.

Continue research directed at improvements in potato management production.

Proj. 0239 Vegetable Crops Research for the Export Market
Proj. 1984 Production and Environmental Inputs Affecting Yield and Quality of
Vegetable Crops

Statement of Issues

Washington enjoys an extremely diverse vegetable industry that 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 industry, and is second only to Idaho in production. Washington potato growers produced almost 9 billion pounds of potatoes in 1997 valued at nearly

⁵² Proj. 0661, Vegetable Culture in Maritime Climate, has terminated and, therefore, been removed from the POW.

⁵³ Proj. 5676, Potato Development and Improvement in the Northwest, has terminated and, therefore, been removed from the POW.

\$432 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.

Performance Goals

1. Evaluate and release new potato cultivars that will insure the competitiveness of the Washington potato industry.
2. Identify and develop management strategies for alternative vegetable crops that will increase diversity and insure competitiveness of the Washington horticultural industry.
3. Develop and release new management approaches to improve yield and quality of vegetable crops.
4. Provide nutrient management guidelines for the vegetable industry.

Key Program Components

1. Continuation of the Tri-State Variety trials in potatoes.
2. Continuation of research directed at the identification of alternative vegetable crops for the Columbia Basin and maritime environments of Washington.
3. Evaluation of potato cultivars and commercial seed lots.
4. Continuation of on-going research programs at several locations that focus on environmental factors that affect management and production of vegetable crops.
5. Continuation of research programs directed at the study of vegetable nutrition.

Internal and External Linkages

There are many linkages associated with these programs, both internally (WSU) and externally. Principal investigators on the projects associated with this program work closely with scientists from other departments at WSU: Crop and Soil Science, Biosystems Engineering, Plant Physiology, Entomology, Plant Pathology, Food Science and Human Nutrition, and with USDA scientists at several locations. In several cases, research is conducted in cooperation with farmers and other industry scientists. These projects also involve very close collaboration with County Extension personnel.

Target Audiences

1. The potato industry and other vegetable industries of Washington and other northwestern states.

2. Scientific societies and professional organizations.
3. The Washington State Potato Commission, and other commodity organizations.
4. Private companies that provide services to the horticultural industry.

Evaluation Framework

This research program will be evaluated within the context of how well it serves the needs of the potato industry and other vegetable industries of the state and region, and how it has contributed to horticultural science. Evaluation criteria will be quantitative as well as qualitative. Quantitative criteria will include number of publications in peer reviewed journals as well as trade journals, numbers of new potato cultivars released, alternative crops identified, and new procedures or products. In some cases it will be possible to evaluate success of a program in economic terms. Qualitative criteria will relate to the acceptance of products or procedures by the horticultural industry.

Output Indicators

1. Number of publications in peer reviewed and trade journals.
2. Number of new plant varieties.
3. Number of alternative vegetable crops identified.
4. Number of horticultural products produced or reviewed.
5. Number of horticultural management strategies developed and communicated.

Outcome Indicators

1. Acceptance of new cultivars by the potato industry - this can be measured in both quantitative (e.g. acres converted to new varieties) and qualitative ways.
2. Alternative crops being grown for the export market.
3. The extent to which new management strategies are being implemented.
4. The extent to which new products (that are either produced or evaluated by WSU programs) are adopted.
5. The extent to which research publications produced by WSU scientists are referenced by other researchers.

Program Duration

The projects that make up this program vary in duration. Some of the projects that are focused on the development of horticultural management strategies have relatively short duration (3-5 years), while those that emphasize cultivar evaluation and genomics may have a duration of several years.

Allocated Resources

Faculty & Staff FTE	3.30
Funding	
Hatch	\$21,182
Hatch Multistate	
Fed. Res. Grants	\$62,003
State Approp.	\$47,853
Other Grants	\$66,934

Some resources are allocated under previous unit programs in Goal 1.

Department of Natural Resource Sciences

A. Department Research -- Ecophysiology and intensive culture of forest trees

Departmental Goal -- Through research and education, empower the agricultural and Forestry system with knowledge that will improve competitiveness in domestic production, processing and marketing

Departmental Objectives⁵⁴

Proj. 0113 Effects of Enhanced UV-B Radiation and CO² Levels on
Ecophysiology of Tree Species

Proj. 0307 Physiological and Genetic Control of Hybrid Poplar Nutrition

Issues and Key Program Components

Expanding demands for products and other amenity values of forest trees are coupled with finite resource bases that are becoming further constricted by increasing regulations governing forest management on both public and private lands. It is apparent that an increasing proportion of wood/fiber needs will by necessity have to come from intensive culture forestry, in lieu of problems faced by more extensive silvicultural practices - particularly on federal forestlands. Forest tree productivity is also subject to an increasing array of environmental perturbations, including potential effects of changes in various facets of climate and the atmosphere.

Meeting these and other issues is clearly dependent upon improved understanding of the basic autecology and ecophysiology of important forest tree species, and of responses of tree species/genotypes to environmental variables. Based upon such information, applied research on improved cultural practices and genetic tree improvement can proceed to yield improved, more sustainable productivity of and from forest trees.

⁵⁴ Proj. 4113, Effect of Enhanced UV-B Radiation on Carbon Dynamics in Selected Tree Species, has terminated and, therefore, removed from the POW.

Key components in this NRS Program Area are research thrusts in three broad areas:

3. Fundamental research on autecological and ecophysiological responses of regionally important forest tree species and/or genotypes to environmental variables, including atmospheric, water, nutritional and pathological factors.
2. Applied research on tree/genotypic improvement and management practices associated with intensive culture of commercially and/or environmentally important tree species/genotypes (most notably, hybrid poplars)
3. Applied and/or demonstration research on the use of selected tree species or genotypes for economic benefit and/or environmental improvement

Performance Goals

1. Expand basic knowledge of tree autecology and physiologic function, and ecophysiological responses to environmental variables
2. Development of improved tree species and/or genotypes to enhance productivity and/or efficiency of silvicultural systems in Washington and elsewhere
3. Development of improved cultural practices and/or management strategies to enhance productivity and/or efficiency of silvicultural systems in Washington and elsewhere
4. Effective dissemination of research-derived, basic/applied knowledge to both the scientific community and to potential users groups and other constituents

Internal and External Linkages

This program area will involve scientists and facilities at both the main (Pullman) campus and at the Puyallup Research and Extension Center, and will involve collaboration between scientists in NRS and a number of other WSU units (e.g., Plant Pathology, Wood Products Lab, IBC, Biological Systems Engineering). NRS scientists in this program area will continue to work in direct collaboration with colleagues in the College of Forest Resources at the University of Washington, in continuation of the long-term cooperative hybrid poplar research program, with UW contributions most significant in the area of tree genetics/genetic improvement. Similar, although less formalized, relationships will be maintained with scientists at Oregon State University. Outreach/extension efforts will be conducted through the NRS/WSU statewide forestry extension team, as well as through the regional agroforestry program of USDA-NRCS. Existing relationships with the forest products industry will be maintained, and hopefully expanded via industry-WSU research cooperatives focusing upon specific aspects of intensive tree culture. Research funding and other forms of support/cooperation will be maintained and hopefully expanded with a number of relevant state and federal agencies.

Target Audiences

The primary users of information generated by this program will be the forest

products industry (both wood and fiber-based products), federal/state/local agencies involved in bioremediation using trees; and woodland/farm landowners interested in growing trees for economic return.

Evaluation Framework

Evaluation will be based upon a dual consideration of how well the research advances basic scientific understanding (i.e., is recognized/utilized by the scientific community), and how well research outcomes serve the needs of various public/private clientele sectors who have a stake or interest in the condition and values of forest resources and products in the State. The proposed evaluation criteria (i.e., Output and Outcome Indicators) include both quantitative and qualitative parameters:

Output Indicators

1. Publications in peer-reviewed scientific outlets
2. Publications targeted to user, public and/or other clientele groups
3. Relevant products, technologies, methodologies and/or management techniques/systems developed
4. Presentations to scientific, public and/or other clientele audiences

Outcome Indicators

1. Degree of reference, use and other forms of recognition of research outputs by the peer scientific community
2. Degree of adoption or use of information, products, technologies, methodologies and/or management practices developed through research by scientific peers and/or clientele
3. Degree to which recognition/use of outputs of research stimulates maintained or increased external support for further research

Program Duration

Long-term, with periodic (ca. 5 year) evaluations and potential redirections of major, specific projects.

Allocated Resources

Faculty & Staff FTE	0.5
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	

State Approp. \$32,997
Other Grants

Department of Plant Pathology

A. Departmental Research Programs

1. Biology of disease-causing organisms.
2. Ecology and epidemiology of plant diseases.
3. Detection of disease-causing organisms and control of plant diseases.

Department Goals

Environmentally sound agricultural production systems.

Environmentally friendly and effective disease control.

New fundamental understanding of pathogens and their interactions with plants and the environment.

Department Objectives

RPA 212 - Disease and Nematodes Affecting Plants^{55, 56, 57} (all except that listed below)

To continue and increase efforts to control fungi, bacteria and nematodes with less toxic chemicals and/or smaller amounts of them and to increase use of sophisticated weather forecasting for more efficient chemical applications.

To seek and utilize disease resistance when feasible.

To support basic research on the genetics, biochemistry, and molecular biology of pathogenesis, host defense responses, and the influence of the biotic and abiotic environments.

Proj. 0185 Genetic Variability in the Cyst and Root-Knot Nematodes
Proj. 0212 Epidemiology and Control of Powdery Mildew of Grape

⁵⁵ Proj. 0123, Integrated Chemical and Cultural Control of Potato Late Blight in Washington, Proj. 0124, Biology and Management of Pea Cyst Nematode, Proj. 0149, Control of Aphanomyces Root Rot of Peas through Breeding, Cultural Practices, and Seed Treatments, Proj. 0650, Management of the Columbia Root-Knot Nematode on Potato, and Proj. 0945, Control of Wheat and Barley Root Diseases in No-Till Systems, have terminated and, therefore, removed from the POW.

⁵⁶ Proj. 0252 is reported in the Puyallup Research and Extension Center portion of the report.

⁵⁷ Proj. 0274, Proj. 0292, Proj. 0300, Proj. 0572, Proj. 0837, Proj. 0876, Proj. 1767, and Proj. 5263 have been added to the POW.

- Proj. 0231 The Molecular Genetics of Bean Common Mosaic and Related Potyvirus Infecting Phaseolus Vulgaris L.
- Proj. 0248 Controlling Bacterial Pathogens of Grapevines
- Proj. 0274 Development and Implementation of Direct Seed Cereal Based Cropping Systems for the Inland Northwest
- Proj. 0290 Characterization and Control: Plant Viruses and Virus-Like Agents the Infect Perennial Fruit Crops
- Proj. 0292 Fungal and Viral Diseases of Hops and Their Control
- Proj. 0300 Population Biology of Plant Pathogenic Fungi
- Proj. 0565 Fungi of the Pacific Northwest
- Proj. 0572 Teleomorph-Anamorph Connections in Lignicolous Pyrenomycetes
- Proj. 0669 Improving Resistance to Eyespot in Winter Wheat
- Proj. 0670 Disease Resistance and Cultural Practices for Control of Cephalosporium Stripe in Wheat
- Proj. 0678 Disease Warning Systems for Potato and Mint
- Proj. 0795 Etiology, Epidemiology and Control of Fungal and Bacterial Diseases of Tree Fruits
- Proj. 0823 Control of Cereal Rusts
- Proj. 0837 Systematics and Biology of Phytopathogenic Fungi with Emphasis on Tilletiales
- Proj. 0876 Molecular Biology of Plant Pathogenic Bacteria and New Approaches in Disease Control
- Proj. 1262 Develop and Distribute Deciduous Fruit Tree Clones that are Free of Known Graft-Transmissible Pathogens
- Proj. 1767 Mycobiotic, Revisionary, and Monographic Studies in Xylariaceae
- Proj. 1844 Regulation of Disease Resistance Genes in Transgenic Potatoes and Other Plants
- Proj. 5263 Cherry Leafroll Virus Control and Management in Sweet Cherry Orchards

RPA 215 - Biological Control of Pests Affecting Plants

Discover efficient biological control systems to replace chemicals, particularly soil fumigants and others, which are becoming illegal.

- Proj. 0947 Metabolites of Biocontrol Agents that Suppress Root Pathogens of Wheat and Barley

Statement of Issue(s)

Producers of potatoes, vegetables, small fruits, small grains and specialty crops have repeatedly expressed the need for advanced techniques for managing disease to reduce losses and at the same time protect the natural resource base. Commodity commissions meet regularly to identify research priorities.

Performance Goal(s)

1. Develop disease control strategies based on knowledge gained through studies on the etiology and epidemiology of diseases including potato late blight, pea cyst nematode, downy and powdery mildews of hops, rusts, smuts and root diseases of small grains, virus and fungal diseases of cool season legumes and powdery mildews of tree fruits and grapes. New or revised strategies for disease control will be developed on five commodities within a five-year period.
2. Develop biological control methods for control of take-all disease of wheat.

Key Program Components

1. Continue basic life cycle studies of several plant pathogens to identify the most effective stages of development where control measures should be applied.
2. Evaluate methods of control under a variety of climatic and disease pressure situations.
3. Identify and evaluate potential biological control techniques and organisms.
4. Evaluate integrated systems of disease management before advocating adoption in the appropriate crops.

Internal and External Linkages

Scientists from other disciplines will be involved as needed. Talent available in the Pacific Northwest is abundant and frequent cooperation among scientists, departments, institutions, and states is the norm. Extension faculty will be involved as need and to conduct educational programs for growers.

Target Audience(s)

Target audiences include conventional farmers, organic farmers, producers involved in sustainable production practices and the agribusinesses, which serve growers.

Evaluation Framework

The evaluation framework included quantitative and qualitative data as well as acceptance by clientele as evidenced by changes in disease control practices.

Output Indicators

1. Number of individual diseases researched.
2. Number of new or revised control strategies developed.
3. Successful development of a biological control method.
4. Development and implementation of an integrated control strategy in one or more crops.

Outcome Indicators

1. Efficiency of control measures.

2. Acceptance by clients (practice change rates).
3. Costs vs. return.
4. Deployment of biological control organisms in limited test areas.
5. An overall more environmentally sound agriculture in which growers protect the national resources base and make a reasonable return on their investments.

Program Duration

The program has both short and long term features.

Allocated Resources

Faculty & Staff FTE	33.30
Funding	
Hatch	\$127,923
Hatch Multistate	\$19,829
Fed. Res. Grants	\$403,123
State Approp.	\$976,097
Other Grants	\$658,363

SPECIAL PROGRAM PLANNING UNITS AND INSTITUTES

Center for Precision Agricultural Systems⁵⁸

A. Center Research Program

Center Objectives

Development of precision agricultural systems

Precision irrigation

Precision application of pesticides, fertilizers, and herbicides

Site specific meteorology

RPA 205 - Plant Production Systems

Proj. 0333 Precision Agricultural Systems

⁵⁸ The Center was established after the original POW was developed. This section has been added to reflect the Center's current activities.

RPA 307 - Animal Production Management Systems

Proj. 0333 Precision Agricultural Systems

RPA 404 - Instrumentation and Control Systems

Proj. 0333 Precision Agricultural Systems

Statement of Issues

Knowledge is often lacking concerning the precise use of water, pesticides, fertilizers, and other issues in agriculture. The new precision technologies (Global Information Systems, Global Positioning Systems, advanced sensing, computer-aided diagnostics, wireless communication, satellite communication, and others) now may be applied to agricultural operations. Producers are already using some of this technology and have made it known at symposia and other meetings that they want to apply the more advanced technologies to their own operations.

Performance Goals

1. Develop practical knowledge for the precise application of water, pesticides, fertilizers, etc.
2. Continue developing techniques for application of modern computerized technology to the production of agricultural commodities.

Key Program Components

1. Continue the study of precision irrigation.
2. Continue applying computerized technology to agricultural production.
3. Establish a Hatch project on precision agriculture with Francis Pierce, Center Director, as Principal Investigator.
4. Work with PAWS (Public Agriculture Weather System) which utilizes site-specific meteorology to assist growers.
5. Continue to work with the wine grape and potato producers.
6. Develop additional relationships with tree fruit producers and other commodity groups.

Internal and External Linkages

The Center has developed extensive linkages regarding precision agriculture at WSU and other universities across the country as well as in agriculture-related industries. The Center has worked with growers interested in precision agriculture by serving as co-organizer (with Crop and Soil Sciences) for Pacific Northwest precision agriculture conferences. Several commodity groups, including the Washington State Potato Commission and Washington Tree Fruit Research Commission, the wine grape growers, the Pacific Northwest National Laboratory, Idaho National Engineering and Environmental Laboratory, and several federal and state agencies work with the Center to promote precision agricultural systems.

Target Audiences

WSU faculty, in cooperation with scientists at other universities and in the private sector, will continue to assist growers by continuing to develop and improve methods to incorporate computer technology and other precision agriculture techniques for production of various crops.

Evaluation Framework

Evaluation framework is based on the ability of information developed in these projects to help agricultural producers use more precise methods for measuring the need and applying irrigation water, pesticides, fertilizer, and other factors for production.

Output Indicators

1. Number of publications on precision irrigation and other precision agriculture technologies.
2. Continued support of regular conferences on precision agriculture in the Pacific Northwest.

Outcome Indicators

1. Acceptance by producers of principles of precision agriculture.
2. Continued high attendance at Western Precision Agriculture Conferences.

Program Duration

5 years

Allocated Resources

Faculty & Staff FTE	0.38
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	
State Approp.	\$118,196
Other Grants	\$55,243

IMPACT Center

C. **Center Research Program** -- Enhancing competitiveness of Pacific Northwest agricultural exports

Center Goal 1

Collecting and disseminating information on rapidly changing foreign markets, including consumption trends, distribution channels, trading systems, laws and regulations.

Center Objective

RPA 606 - International Trade and Development Economics^{59 60}

⁵⁹ Proj. 3171, Enhancing Competitiveness of Agricultural and Forest Products, and Proj. 3701, Enhancing Competitiveness of Agricultural and Forest Products, have terminated and, therefore, been removed from the POW.
⁶⁰ Proj. 3901 and Proj. 4901 have been added to the POW.

Continue IMPACT Center efforts to monitor and analyze the rapid changes that are taking place in all aspects of foreign markets likely to affect Pacific Northwest agricultural exporters.

Proj. 0171 International Marketing Program for Agricultural Commodities and Trade
Proj. 3801 Enhancing the Competitiveness of Agricultural and Forest Products
Proj. 3901 Enhancing the Competitiveness of Agricultural and Forest Products
Proj. 4901 Enhancing the Competitiveness of Agricultural Products

Statement of Issues

Because of language, cultural and information barriers, producers and exporters in the Pacific Northwest have difficulty in monitoring a multiplicity of foreign markets and of responding rapidly to their changing demands. University scientists have been vital in closing that information gap.

Performance Goals

Develop a stream of vital information on key markets for Pacific Northwest agricultural exports on changing consumption trends, distribution systems, trading systems, laws and regulations and activities of major competitors.

Key Program Components

1. Assembling of needed data from published reports, on-line sources, literature searches, surveys.
2. Analyzing the relevance of findings for exports of key commodities to specific target countries.
3. Assessing alternative strategies available to PNW agriculture for increasing its competitiveness in these markets.

Internal and External Linkages

Scientists from other disciplines at WSU will be involved as needed. Key disciplines will be Economics, Marketing, Agricultural Economics, Crop and Soil Sciences, Foreign Languages and WSU Libraries.

Links with other institutions in key target countries such as research universities, Departments of Agriculture, Commerce, Supply or Trade, and industry associations will be important, as will links with other U.S. institutions which exchange information with these foreign entities.

Target Audiences

1. Leaders in the selling or promotion of PNW agricultural products in global markets. These include both private entrepreneurs and board members and

- executives of major commodity commissions.
2. All producers interested either directly or through intermediaries in selling their product in global markets.

Evaluation Framework

The evaluation framework would include (a) quantitative data on countries, commodities or products studied, and findings made accessible in published reports, on-line databases, through interviews, seminars and presentations, etc. and (b) qualitative data on how findings have been incorporated into industry export activities.

Output Indicators

1. Number of countries researched
2. Number of product markets reviewed
3. Number of strategies for improved competitiveness developed

Outcome Indicators

1. Acceptance by clients of recommended activities
2. Export trends by value, volume and price
3. Increased export competitiveness of PNW agricultural exporters

Program Duration

The program is long term, since it requires continuous monitoring of rapidly changing markets.

Allocated Resources

Faculty & Staff FTE	5.04
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	\$356,900
State Approp.	\$143,998
Other Grants	\$8,439

Center Goal 2

Applying research techniques to technical, economic and social problems that are impeding exports of specific products.

Center Objective

RPA 205 - Plant Production Management Systems⁶¹

Continue IMPACT Center efforts to prepare plants that are exported commercially to better meet the rigors of long-distance handling, storage and shipment and to meet increasingly sophisticated demands of foreign consumers.

Proj. 0971 Management System for Sustaining Productivity and Developing Markets for Walla Walla Sweet Onions

RPA 606 - International Trade and Development Economics⁶²

Continue IMPACT Center studies of major trade agreements, both bilateral and multilateral, that impede the free flow of agricultural exports from the Pacific Northwest to numerous foreign markets.

Proj. 0974 Economic Effects of the North American Free Trade Agreement on the PNW

Statement of Issues

Impediments to exports can rise from government regulations, consumer tastes, formal trade barriers or failure to meet product specifications of foreign customers. Science has been a very effective tool in mitigating or eliminating many different impediments.

Performance Goals

For many of these impediments, specific performance goals and timetables can be set. A key step is correctly identifying and characterizing the impediment to be examined. Performance can then be measured in terms of whether and when the impediment was mitigated or removed.

Key Program Components

1. Systematic assessment of the production and marketing system in which these technical, economic and social impediments arise.
2. Developing solutions to these impediments.
3. Developing systems for integrating these solutions into exporters' normal exporting activities.

⁶¹ Proj. 3805, Onion Seed Project, Proj. 3806, Alternative Crops Production, Proj. 3708, Onion Seed Project – continuation, and Proj. 3711, Root and Tuber Crops, have terminated and, therefore, been removed from the POW.

⁶² Proj. 3803 U.S. – Asia Trade/High Value Foods, and Proj. 5171, U.S. – Asia Trade/High Value Foods, have terminated and, therefore, been removed from the POW.

Internal and External Linkages

In most cases, dealing with impediments will require the principal investigator to assemble a multidisciplinary team of researchers, extension specialists and county agents appropriate to the problem in hand.

Links with other institutions both in the U.S. and overseas will be critical. This includes government trade agencies, universities and government and private sector international bodies such as WTO, APEC, NAFTA, PECC and PBEC.

Target Audiences

1. Leaders in the sale or promotion of PNW agricultural products in global markets. These include both private entrepreneurs and board members and executives of major commodity commissions.
2. All producers in the Pacific Northwest whose products enter the international marketing system.

Evaluation Framework

The evaluation framework would include both (a) quantitative data on exports of specific commodities before and after impediments were removed and (b) qualitative data on improvement in the industry's capacity to compete effectively under changing trading rules.

Output Indicators

1. Number of specific impediments targeted and either mitigated or eliminated.
2. Improved systems established and integrated into Pacific Northwest commercial agriculture.

Outcome Indicators

1. Number of former impediments mitigated or eliminated.
2. Change in PNW agriculture's capacity to deal with similar impediments arising in the future.

Program Duration

The program is long term. Advances in scientific measurement continue to raise new concerns in importing countries about the quality, health, safety or processes used in PNW products. In addition, as tariff impediments to trade have been reduced, countries have become innovative in developing new nontariff barriers.

Allocated Resources

Faculty & Staff FTE	3.06
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	
State Approp.	\$168,165
Other Grants	

Center Goal 3

Developing new products, services and processes that help Washington agricultural supporters gain a competitive edge or satisfy a market niche.

Center Objective

RPA 501 - New and Improved Food Processing Technologies⁶³

Continue IMPACT Center efforts to develop new food processing technologies that lower input use but produce more desirable food characteristics.

Proj. 0972 Development of Nutritional Value-Added Exportable Snack-Foods from the Pacific NW

RPA 502 - New and Improved Food Products⁶⁴

Develop new products that can be incorporated into the commercial agriculture production, processing and marketing system in the Pacific Northwest.

Statement of Issues

Much of the success of Pacific Northwest agriculture has been based on the importation and adaptation of new products from other regions and the successful exploitation of new or improved food processes. This strategy continues to be critical to the region's global competitiveness. The PNW must fund a steady stream of new products and processes in which it can have a competitive edge. University scientists can play a major role in innovative products and technology.

Performance Goals

⁶³ Proj. 3808, Pulsed Electric Foods, Proj. 3809, Biosensor Control/Food Processing, Proj. 3811, CO₂ and Microwave Drying, Proj. 3812, Quarantine Treatment for Fruit, have terminated and, therefore, have been removed from the POW.

⁶⁴ Proj. 3804, East Asia Crops, has terminated and, ⁵⁸therefore, been removed from the POW.

Develop a continuing series of new products and processes that can be successfully integrated into the exporting activities of commercial agriculture in the Pacific Northwest.

Key Program Components

1. Assessing the commercial feasibility of producing, processing and exporting products new to the Pacific Northwest successfully in global markets. All levels of the marketing chain are assessed.
2. Assessing the commercial feasibility of developing new processing techniques applicable to Pacific Northwest agricultural products.

Internal and External Linkages

Investigation of new products that can be exported from the Pacific Northwest are normally led by the appropriate disciplinary specialist (e.g. horticulturist for fruits, crop scientist for field crops or animal scientist for livestock). Other research and extension scientists are involved as appropriate. Industry advisory groups are used at each stage.

Investigation of new processes and processing techniques involves similar internal linkages. In addition, because many of the technologies are pathbreaking and untested, it is necessary to work closely with the few individuals or laboratories around the world that have done exploratory work on these technologies.

Target Audiences

New plants and crops are targeted towards the more adventurous growers and processors in the Pacific Northwest who are most willing to cooperate in trials of new products. The reasoning is that if these innovators are successful, other producers will imitate them.

In the case of new processes and new processing technologies, initial target firms have to be chosen more selectively because of limitations of capital or technical expertise. Many of the commercial trials have to be concentrated in one or two firms before the technologies are made generally available.

Evaluation Framework

The evaluation framework would track the number of new products and processes in development, the stage of progress of each in the concept to commercialization

continuum, the number of farmers and acres committed and the volume of product produced under new processing systems.

Output Indicators

1. Number of products developed and stage of development.
2. Number of processing technologies developed and stage of development.
3. Volume of product produced from new products of with new processes.

Outcome Indicators

1. Incorporation of new products into the normal commercial operations of Pacific Northwest farmers.
2. Incorporation of new processing technologies into the normal commercial operations of Pacific Northwest food processors.

Program Duration

The program is long term, since it requires continuous monitoring of rapidly changing markets.

Allocated Resources

Faculty & Staff FTE	1.88
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	
State Approp.	\$107,838
Other Grants	

Department Goal 4

Supporting directly and indirectly, instructional programs in international marketing.

Department Objective

RPA 606 - International Trade and Development Economics⁶⁵

Institute of Biological Chemistry

A. Institute Research Program -- Forestry Product Enhancement

⁶⁵ Proj. 0976, International Marketing Education, has terminated and, therefore, been removed from the POW.

Institute Goal - Improve and enhance wood and wood products

Institute Objectives

RPA 123 - Management of Forest Resources

Proj. 0202 Metabolic Compartmentation During (Heart)Wood and Seed Coat Development

Proj. 0967 Diterpene Biosynthesis in Taxol Production and Conifer Defense

Statement of Issue(s)

Various industries have expressed the need for plant biotechnological strategies directed toward introducing fundamental changes in the properties of commercially important woody species. Modifying certain woody species to enhance wood yield and increase the production of important wood products such as the anti-cancer drug, taxol, would make these industries more economically competitive.

Performance Goal(s)

3. Identify the mechanisms involved in heartwood formation to apply various biotechnological approaches to modify properties of selected woods.
4. Identify and isolate certain genes in the yew species to be able to overexpress the genes for increasing production of taxol.

Key Program Components

1. Obtain gene in selected species.
2. Delineate the biochemical pathways.
3. Transform the species.
4. Examine outcome.

Internal and External Linkages

1. Researchers will collaborate with other scientists in this field as appropriate.
2. Scientists from other disciplines will be consulted as needed.

Target Audience(s)

1. Forest management companies; tree growers; pulp/paper manufacturers.
2. Pharmaceutical companies interested in anti-cancer drugs.

Evaluation Framework

The evaluation framework includes:

1. Progress reports submitted as part of annual review of personnel
2. Progress reports to funding agencies
3. Annual review of graduate students working with program projects
4. Ad hoc reviews
5. Final project reports

Output Indicators

1. Publications, including refereed papers, theses, bulletins
2. Papers or posters presented at meetings
3. Invited seminars
4. Patents or provisional patent applications
5. Collaborative arrangements relying on intellectual property or expertise developed by the projects

Outcome Indicators

1. Greater crop yield of heartwood in the forestry industry.
2. Greater and more efficient harvest of taxol to make the process commercially viable.

Program Duration

The program has been ongoing for several years and is expected to continue for several more.

Allocated Resources

Faculty & Staff FTE	14.60
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	\$648,281
State Approp.	\$115,963
Other Grants	\$279,314

B. Institute Research Program -- Crop Improvement by Biotechnological Means

Institute Goal

Understand the genetic and biological mechanisms of plants to improve and enhance the production and yield of various crops, including forest species

Institute Objectives

RPA 201 - Plant Genome, Genetics and Genetic Mechanisms⁶⁶, ⁶⁷

Using genetic mutants, examine the various metabolic responses of plants to the stress of cold temperature.

⁶⁶ Proj. 3235, Intercellular Movement of Potyviruses, and Proj. 6795, Genetic Mechanisms of Chilling Tolerance, have terminated and, therefore, been removed from the POW.

⁶⁷ Proj. 0590, Proj. 3252, Proj. 3589, and Proj. 6204 have been added to the POW.

Proj. 0773 Nutrient Exchange and Metabolism in the Rhizobium-Legume Symbiosis

Explore a variety of genetic, molecular and biochemical approaches to investigate the regulation and role(s) of plant lipids.

Proj. 0253 Lipid Biosynthesis in Leaves and Seeds

Proj. 0590 mRNA Sorting in Plants

Proj. 3252 Biochemistry of Oilseeds: New Strategies for Improving Oils

Proj. 3589 mRNA Targeting to Subdomains of the Endoplasmic Reticulum: The Role of RNA Binding Proteins

Proj. 7795 Genetic and Molecular Approaches to Modifying the Composition of Seed Oils

Using genetic mutants, study the symbiotic interaction and reveal important features of the coupling of plant and bacterial metabolism.

Proj. 6773 Bacterial Dicarboxylate Transport in Symbiotic Nitrogen Fixation

Using a mutant gene that controls a virus restriction mechanism in plants, study how viruses evade plant defense systems.

Proj. 0235 Genetic Analysis of Plant Virus Infection

Proj. 6236 Host Responses to Potyviruses

Using molecular biology techniques, explore the lignan biosynthetic pathways in conifers.

Proj. 6204 The Metabolic Basis of Heartwood Formation: A New Frontier to Exploit Wood Properties

RPA 202 - Plant Genetic Resources and Biodiversity⁶⁸

Proj. 3775 Genetics of Symbiotic Effectiveness in Legumes

RPA 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants^{69, 70}

Explore how photosynthesis operates in living plants exposed to cold temperatures.

Proj. 3775 Genetics of Symbiotic Effectiveness in Legumes

Proj. 4119 Metabolic Engineering of Plants for Enhanced Productivity

⁶⁸ RPA 202 and Proj. 3775 have been added to the POW.

⁶⁹ Proj. 5197, Photosynthetic Electron Transfer in Cold-Tolerant and Cryophilic Algae, has terminated and, therefore, been removed from the POW.

⁷⁰ Proj. 3775, Proj. 4119, and Proj 4589 have been added to the POW.

Proj, 4589 Metabolic Engineering of Plants for Enhanced Productivity

RPA 206 - Basic Plant Biology^{71, 72}

Study the effects of photosynthesis on plant metabolism.

Proj. 0119 Regulation of Photosynthetic Processes

Proj. 0197 Control of Photosynthetic Electron Flow in the Steady State

Determine how protein sorting and storage occurs in plants.

Proj. 0262 Sorting of Proteins to Vacuoles in Plant Cells

Proj. 3589 mRNA Targeting to Subdomains of the Endoplasmic Reticulum: The Role of RNA Binding Proteins

Elucidate the biochemical, molecular and cellular basis of plant defense proteins.

Proj. 1791 Structure, Evolution and Function of Plant Proteinase Inhibitors

Proj. 3967 Defense Reactions in Conifers: Oleoresinosis

Study the biochemistry of plant terpenoids and the regulation of terpenoid metabolism to enhance terpenoid production in plants.

Proj. 0268 Biochemistry of Plant Terpenoids.

Statement of Issue(s)

Each year both farmers and foresters face valuable resources and hence revenue losses due to low crop yields because of the affects of climate variations, disease, and pest infestation. By studying the basic processes (biochemical and metabolic) of plants, scientists can develop new methods and strategies to help further optimize the productivity of plants in the face of these limitations a plant's response to climate variations, disease and pest infestation. This will help to increase crop yields.

Performance Goal(s)

1. Develop strategies for enhancing and improving the partitioning of carbon into useful storage products.
2. Develop approaches to limit the effects of biological predation on plant resources.

Key Program Components

⁷¹ Proj. 0234, Compartmentation of Proteins in Plant Cells, and Proj. 3593, Localization of Prolamine mRNAs to the Protein Body Endoplasmic Reticulum, have terminated and, therefore, been removed from the POW.

⁷² Proj. 3589 and Proj. 3967 have been added to the POW.

1. A principal thrust is to identify the key biochemical processes involved in distinct areas of plant metabolism.
2. Identifying the mechanisms by which pathogens, etc. infiltrate plants, and develop counter-strategies (via biotechnological means) to limit or prevent them.

Internal and External Linkages

1. Scientists from other disciplines will be consulted as needed, and can be drawn from worldwide as necessary.
2. Collaboration among researchers in this field is the norm.

Target Audience(s)

Plant Biotechnology Companies

Forestry Biotechnology Companies

Producers of plant medicinals and plant nutraceuticals

Evaluation Framework

The evaluation framework includes:

1. Progress reports submitted as part of annual review of personnel
2. Progress reports to funding agencies
3. Annual review of graduate students working with program projects
4. Ad hoc reviews
5. Final project reports

Output Indicators

1. Publications, including refereed papers, theses, bulletins
2. Papers or posters presented at meetings
3. Invited seminars
4. Patents or provisional patent applications
5. Collaborative arrangements relying on intellectual property or expertise developed by the projects

Outcome Indicators

1. Plants or plant management techniques demonstrating increased ability of crops to deal with biotic or abiotic stresses
2. Plants with increased primary productivity
3. Plants with increased secondary productivity or altered allocation of resources into new secondary plant products

Program Duration

5 years

Allocated Resources

Faculty & Staff FTE	51.97
Funding	
Hatch	\$139,659
Hatch Multistate	(\$362)
Fed. Res. Grants	\$2,048,987
State Approp.	\$1,045,981
Other Grants	\$1,270,181

C. Departmental Research Program -- Pest and Pathogen Controls in Crops

Department Goal - Improve and enhance a plant's natural defense against pests and pathogens

Departmental Objectives

RPA 211 - Insects, Mites, and other Arthropods Affecting Plants⁷³

Study various plant mechanisms that trigger defense proteins and systemins in response to insect attack.

Proj. 3153 Role of Wound-Inducible Polygalacturonase of Plant Leaves

RPA 212 - Diseases and Nematodes Affecting Plants

Study the biosynthetic pathway of the antifungal compound in avocado to enhance natural fruit resistance and prevent decay development in ripening fruit.

Proj. 8892 Regulation of Avocado Resistance to Postharvest Pathogens by Modulation of Antifungal Compounds

Statement of Issue(s)

Insect- and fungus- mediated consumption and spoilage leads to loss of marketable crop or decreased crop value.

Performance Goal(s)

Increased crop yield and post-harvest marketability.

Key Program Components

1. Understand mechanisms of natural anti-insect and antifungal defenses.
2. Manipulate natural anti-insect and antifungal defenses to increase pre- and post-harvest pest and pathogen control.

Internal and External Linkages

⁷³ Proj. 0153, Natural Products Chemistry as a Resource for Biorational Methods of Insect Control, has terminated and, therefore, been removed from the POW.

1. Scientists from other disciplines will be consulted as needed.
2. Collaboration among researchers in this field is the norm.

Target Audience(s)

Farm industry

Tree fruit industry

Forest industry

Other industries that rely on post-harvest storage, including those involved in transit and sales of crops to consumer.

Evaluation Framework

The evaluation framework includes:

1. Progress reports submitted as part of annual review of personnel
2. Progress reports to funding agencies
3. Annual review of graduate students working with program projects
4. Ad hoc reviews
5. Final project reports

Output Indicators

1. Publications, including refereed papers, theses, bulletins
2. Papers or posters presented at meetings
3. Invited seminars
4. Patents or provisional patent applications
5. Collaborative arrangements relying on intellectual property or expertise developed by the projects

Outcome Indicators

1. Crops grown with lower pesticide and fungicide use for good production
2. Harvested crops with longer storage life

Program Duration

The program has been ongoing for several years and is expected to continue for several more.

Allocated Resources

Faculty & Staff FTE	
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	\$46,469
State Approp.	
Other Grants	

OFF-CAMPUS RESEARCH AND EXTENSION CENTERS/UNITS

WSU Puyallup Research and Extension Center

A. Center Research Program Area – Western Washington Farm and Food Systems

Center Goal -- Improved economic competitiveness, environmental sustainability
Center Objective

RPA 123 - Management of Forest Resources⁷⁴

Proj. 0307 Physiological and Genetic Control of Hybrid Poplar Nutrition

RPA 204 - Plant Product Quality and Utility

Proj. 0038 Breeding Superior Strawberry Cultivars for the Pacific Northwest
Proj. 0640 Breeding Superior Raspberry Cultivars for the Pacific Northwest

RPA 206 - Basic Plant Biology⁷⁵

Proj. 0215 Freeze Damage and Protection of Horticultural Species

RPA 212 - Disease and Nematodes Affecting Plants⁷⁶

Proj. 0336 Integrated Disease Control Programs for Economically Important
Vegetable Crops in Western Washington

RPA 302 - Nutrient Utilization in Animals⁷⁷

Proj. 0154 Environmental and Economic Impacts of Nutrient Flows in Dairy
Forage Systems

RPA 601 - Economics of Agricultural Production and Farm Management

Proj. 0177 Economic Dimensions of the Washington Horticultural Landscape and
Maintenance Industry

RPA 604 - Marketing and Distribution Practices⁷⁸

⁷⁴ RPA 123 and Proj. 0307 have been added to the POW.

⁷⁵ RPA 206 and Proj. 0215 have been added to the POW.

⁷⁶ RPA 212 and Proj. 0336 have been added to the POW.

⁷⁷ RPA 302 and Proj. 0154 have been added to the POW.

⁷⁸ RPA 604 and Proj. 4179 have been added to the POW.

Proj. 4179 Understanding, Evaluating and Improving Direct Marketing Systems
for Small Farms

Statement of Issue(s)

Producers of agricultural commodities find themselves in an increasingly competitive global economy. Growers and consumers benefit from improved crop varieties. Baseline economic data on the nursery plant has been insufficient to provide insights into the economic impact of the industry and its key research needs. Input from commodity groups is used regularly to determine priorities for research topics that will significantly increase competitiveness.

Performance Goal(s)

1. Develop improved cultivars of raspberries
2. Develop improved cultivars of strawberries
3. Develop baseline economic data on nursery plant industry in Washington

Key Program Components

1. Evaluate germ plasm and new selections of raspberries to identify superior cultivars of raspberries for Pacific Northwest growing conditions
2. Evaluate germplasm and new selections of raspberries to identify superior cultivars of strawberries for Pacific Northwest growing conditions
3. Survey producers and retailers to determine economic magnitude of nursery plant industry in Washington

Internal and External Linkages

Scientists routinely collaborate with others within the institution and at others, particularly throughout the Oregon and British Columbia west of the Cascades

Target Audience(s)

For new plant cultivars: Farmers, suppliers, retailers of nursery plants, home gardeners. For economic survey information: growers, wholesalers, retailers, and policy makers.

Evaluation Framework

Numbers of acceptance by growers of new cultivars

Quality and usefulness of economic data

Output Indicators

Numbers and quality of refereed publications

Numbers and new characteristics of new plant varieties

Outcome Indicators

Acceptance of new varieties by growers
Usefulness of economic data to decision makers

Program Duration

The program has both short and long term components.

Allocated Resources

Faculty & Staff FTE	12.63
Funding	
Hatch	\$75,784
Hatch Multistate	\$192,179
Fed. Res. Grants	\$8,195
State Approp.	\$277,339
Other Grants	\$186,214

Other resources expended at off-campus units are reported in the departmental allocations because faculty off-campus are members of academic departments.

WSU Vancouver Research and Extension Unit

A. Unit Research Program – Production, Growth, and Physiology of Horticultural Crops

Unit Goal

Establish and maintain research support for culture and management of horticultural crops in the Pacific Northwest, especially small fruit production and environmental horticulture.

Unit Objective(s)

RPA 102 - Soil, Plant, Water Nutrient Relationships⁷⁹

Identify important soil parameters for use in crop production and site specific management.

Proj. 0375 Alternative Cropping Systems

RPA 202 - plant Genetic Resources and Biodiversity⁸⁰

Collect and evaluate *Fragaria* and *Rubus* germplasm internationally to acquire a diverse genetic base for improvement of crop productivity, pest resistance, and quality.

⁷⁹ RPA 102 and Proj. 0375 have been added to the POW.

⁸⁰ Proj. 0783, Growth, Development and Physiology of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

Gene pool enrichment and breeding of red raspberry and strawberry.

Evaluate nursery crop germplasm with potential for domestication / commercialization.

Maintain and evaluate germplasm collections, facilitate national efforts for small fruit crops.

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

RPA 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants^{81, 82}

Understand carbon dynamics and resource allocation in small fruit and nursery crops as they affect yield, productivity and quality.

Delineate physiological processes that determine yield efficiency in red raspberry.

Understand impact of stresses (water, nutrient, temperature, and pest) on growth and development of small fruit and nursery crops.

Develop cultural practices that alleviate stress in commercial scale plantings of small fruit and nursery crops.

Proj. 0258 Effect of Cultural Practices on Plant Root Health and Establishment of Landscape Plants

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

RPA 204 - Plant Product Quality and Utility (Preharvest)⁸³

Determine cultural management practices, which increase the quality and utility of nursery crops under production.

Develop strategies for optimal establishment of nursery crops in landscapes. Assess and refine cultural management practices (horticulture, entomology) in red raspberry in order to increase fruit quality.

Proj. 0258 Effect of Cultural Practices on Plant Root Health and Establishment of Landscape Plants

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

⁸¹ Proj. 0783, Growth, Development and Physiology of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

⁸² Proj. 0258 and its associated departmental objectives have been moved from Goal 5.

⁸³ Proj. 0783, Growth, Development and Physiology of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

RPA 205 - Plant Production Management Systems^{84, 85}

Develop fully integrated (horticulture, plant pathology, entomology) management system for red raspberry production based upon weather, plant and insect phenology and judicious management of crop loads.

Develop alternative nursery production systems that maximize plant growth and quality.

Proj. 0258 Effect of Cultural Practices on Plant Root Health and Establishment of Landscape Plants

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

Proj. 0375 Alternative Cropping Systems

RPA 206 - Basic Plant Biology⁸⁶

Using native and cultivated *Fragaria* and *Rubus*, develop models of carbon assimilation and allocation as determined by environment and reproductive capacity.

Develop models of heritability for physiological characteristics of native/cultivated *Fragaria*.

Understand the mode of action and physiological impact of Vesicular-Arbuscular (VA) mycorrhizae in native\cultivated nursery crops.

Proj. 0258 Effect of Cultural Practices on Plant Root Health and Establishment of Landscape Plants

Statement of Issues

Small fruit and nursery crop production both have world-leading centers of production in the Pacific Northwest, both are high-value crops, and in some ways are highly understudied in critical areas of growth and development. In the case of small fruit crops, much of the baseline information relative to growth and development physiology of native and cultivated *Rubus* have come from these research programs. Red raspberry yield potential is likely 3-5 times greater than that realized under cultivation, and significant constraints in biotic and abiotic influences need to be understood. Cultivated *Rubus* have relatively low photosynthetic maxima in temperature, allocate a relatively low

⁸⁴ Proj. 0375 has been added to the POW.

⁸⁵ Proj. 0783, Growth, Development and Physiology of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

⁸⁶ Proj. 0783, Growth, Development and Physiology⁷² of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

percentage of photoassimilates to reproduction yet act resource-starved. Fairly simple cultural modifications can be developed to accommodate the plant's physiological profile under cultivation with a goal of increasing yield per unit land area as well as fruit quality. In the environmental horticultural industries, demand for large numbers of new plant types for urban\suburban landscapes, as well as for land remediation and mitigation work, have placed tremendous pressure on scientists who seek to responsibly evaluate and understand the judicious placement of plant materials into a variety of landforms and landscapes. Water and land stewardship are a growing crisis for American urban\suburban landscapes. Environmental horticulturists must match desirable appearance and growth characteristics with rational management strategies and cost effective maintenance and utility. Maximizing establishment and growth of these plants under various conditions requires a comprehensive understanding of all phases of their growth, development, and care. The cultivation of small fruit and nursery crops are also greatly impacted by the potential or perceived environmental impact they have on natural systems, thus professional and public education and are an important means to effecting change.

Performance Goals

Increase our understanding of the biology and ecology of small fruit and nursery crops so as to enhance cultural management which impact land and water stewardship.

Increase efficiency of establishment, production and utility of small fruit and nursery crops in a variety of Pacific Northwest environments.

Increase the genetic diversity of small fruit and nursery crops through the national\international exploration, collection and evaluation of native genetic resources.

Use increased knowledge base to educate industry and the public so as to aid in decision making for practitioners, consumers and policymakers.

Key Program Components

Explore cultivated and native habitats in the Pacific Northwest and throughout the world for plant germplasm that will provide biological and genetic basis for

enhanced stewardship in the production of horticultural crops.

Use basic and applied research approaches to understand factors, which will enhance production of small fruit and nursery crops.

Provide new scientific information on the biology, ecology, and utilization of plants in commercial production and in cultivated\ native landscapes.

On-farm\on-nursery research and education for systemic reform of current industry practices and adoption of new practices which are cost effective and protect the environment.

Internal and External Linkages

All of the research described herein is interdisciplinary by its nature, and those relationships have been built within WSU, other institutions regionally, nationally and internationally. The work in these programs has a strong international component. Strong partnerships with regional university and USDA programs have eliminated duplication of effort, matched resources and have leveraged new programs and resources through cooperative efforts with industry. Industry input and dialogue in setting research priorities and addressing needs continues to increase.

Target Audiences

The primary target of the applied research accomplished in these programs is the industries served - the small fruit and environmental horticulture industries. At different levels, from farm owners and managers, to crop consultants, to processors and wholesale\retail businesses, this information is changing the way crops are cultivated, utilized, marketed and perceived by the public. Land and water stewardship are key areas for education. The primary targets of mission-oriented and basic biological research in these programs are other scientists, company field personnel, Cooperative Extension personnel, and government agencies that utilize, monitor, and disseminate information for public education and decision making purposes.

Evaluation Framework

Traditional indices for evaluation will continue in terms of results published in various arenas whether for scientific or clientele use. However, new forms of dissemination and interaction with scientific and

industry clientele will enhance outreach in form, function and ease of distribution as integrated into ongoing programs: website interaction, email listserves, electronic publication of disseminated information, timely provision of cultural management information, etc. Strong industry relations and communication will allow for significant feedback in terms of effectiveness of information and delivery.

Output Indicators

New methods, new plant materials, and information cycling through research programs and dissemination channels.

Documented success of new methods in on-farm/on-nursery trials.

Attendance of growers at field days, seminars and public events where new information is presented.

Wide array of disseminated information in various forms for various audiences, tabulated access records.

Better understanding of biological and ecological bases for research decisions as evidenced by regular assessment\redirection of program efforts.

Outcome Indicators

Changes in grower practices on a large scale, adoption through understanding.

Enhanced communication with industry through new venues of dialogue, both synchronous and asynchronous.

Publication of results in appropriate venues.

Enhanced crop productivity, quality and value.

Stable production and quality of crops.

Better public understanding of value of agriculture and land stewardship.

Program Duration

Short-term projects are mostly related to the evaluation and registration of specific practices and methods, which may become readily available to growers, and these projects can last 2-3 years with use or adoption to

follow. Intermediate length projects involve identifying key elements of plant biology and ecology, gathering foundational information on how plants are impacted by management practices, and exploring/collecting/evaluating new plant germplasm or potential predators. These projects often range between 3-5 years in length. Long term research programs requiring evaluation of breeding selections, understanding of basic biology and ecology of plants or whole systems which can take 7-10 years or longer in cycles.

Allocated Resources

Faculty & Staff FTE	5.58
Funding	
Hatch	\$719
Hatch Multistate	
Fed. Res. Grants	\$9,650
State Approp.	\$246,340
Other Grants	\$112,694

Funding from other sources is critical to the programs described herein. Funds from commodity commissions such as the WA Red Raspberry Commission, the WA Strawberry Commission, the Oregon Raspberry and Blackberry Commission, Washington Nursery License Fee program, the USDA, EPA, other state and federal agencies, private foundations and corporations make this work possible. For example, we have used commodity, state and federal funds work to develop a satellite research facility in the heart of the raspberry industry in northern WA. From this effort have come other types of funding to expand the work regionally for industry-wide support of cultural management in that crop.

Regional/Multi-State Programs

USDA Regional programs through the Northwest Center for Small Fruits Research and The Northwest Center for Nursery Crops Research.

WSU Wenatchee Tree Fruit Research and Extension Center

A. Center Research Program -- Tree fruit production and management

Center Goal

Establish environmentally sound, profitable and sustainable practices through the transfer of knowledge and technology

Departmental Objective

Achieve excellence and relevance in research and educational programs through high quality scholarly activity

RPA 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants⁸⁷
Proj. 0452 Rootstock and Interstem Effects on Pome and Stone Fruit Trees

RPA 204 Plant Product Quality and Utility (Preharvest)⁸⁸

Increase the efficient use of nutrients by fruit trees.

Regulate tree growth through use of bio-regulating chemicals that enhance productivity and fruit quality. These practices can also reduce impacts of pests on crops by limiting vegetative growth.

Proj. 0298 Bioregulation of Vegetative Growth and Fruit Development in Apple and Pear

Proj. 0338 The Effects of Exogenous Bioregulators on Regular Cropping of Apples

Proj. 0747 Nutrient Management in Washington Tree Fruit Orchards

RPA 205 Plant Production Management Systems⁸⁹

Develop new apple cultivars designed for the Washington growing environment.

Assess the new apple and pear rootstocks under Washington growing conditions.

Proj. 0156 Multidisciplinary Evaluation of New Apple Cultivars

Proj. 0260 Developing New Apple Cultivars for Washington State

Proj. 0326 Sunburn of Apple (*Malus domestica*)

Statement of Issue(s)

We are seeking improved methods for control of vegetative and reproductive growth of apple and pear trees in higher density plantings. Using bioregulators, we seek more efficient control methods that reduce vigor while enhancing reproductive behavior. We are examining bioregulators for maintenance or improvement of fruit quality at harvest and following postharvest storage and shipping to final destination. Regulating tree nutrition optimizes use of resources and eliminates potential sources of environmental contamination. Minor nutrient availability is a problem in many Washington soils, and these must be augmented in some way to keep trees healthy. Nitrogen is the highest requirement by fruit trees of all nutrients and we are determining ways to optimize its application and use by trees is a high industry priority.

Performance Goal(s)

The first goal is to develop strategies for bioregulator concentrations, number and timing of applications, and other criteria that produce effective changes in tree and/or fruit behavior pre- and postharvest. The second goal is to determine the

⁸⁷ RPA 203 and Proj. 0452 have been add to the POW.

⁸⁸ Proj. 0338 has been added to the POW.

⁸⁹ Proj. 0326 has been added to the POW.

levels of nutrients required to maintain tree health and vigor and mechanisms to deliver nutrients that minimize environmental contamination. A third goal is to develop new apple cultivars that will keep Washington's industry competitive in the global market. The fourth goal is to determine rootstocks that are best suited to the environmental growing conditions of Washington.

Key Program Component(s)

3. Make appropriate applications of candidate bioregulators to apple and pear trees. Select appropriate cultivar/rootstock/tree age/tree condition circumstances to effectively test for bioregulator efficacy under commercial conditions. Evaluate bioregulator use under a variety of climatic/edaphic conditions. Seek to understand mechanism(s) underlying bioregulator effects by taking appropriate data on tree and fruit growth and development.
4. Apply micro-nutrients to tree crops and evaluate symptoms compared to untreated trees.
5. Apply nitrogen in different programs and evaluate soil and foliage/fruit levels to determine treatment effects.
6. Make crosses with several apple parents, collect seeds, plant seedlings and select healthy ones for nursery plantings. Bud healthiest trees to M9 roots and plant in orchards, then select for growth and fruit quality. Select those trees with high fruit quality for second test phase.
7. Plant experimental rootstocks on different apple cultivars and evaluate growth and fruiting habits over time.

Internal and External Linkages

The Tree Fruit Extension Team will be involved in cooperative research projects, especially as they approach implementation at the grower level. Cooperative research projects funded from federal and state sources will be sought in conjunction with USDA-ARS and horticulturists from other land grant institutions in the western US and other countries. Interdisciplinary teams within WSU will be formed to determine the impact of horticultural practices on pests and natural enemies.

Target Audiences

Large and small fruit growers are the primary target audience; however, professional crop consultants or farm managers make many or most crop management decisions or at least make key recommendations to the growers. Influencing decisions of crop consultants is one of the most important means of reaching the primary target audience with new research results. Research and extension programs are designed to meet the needs of all farmers and to promote the sustainable nature of fruit production systems. Cooperative Extension agents are also a target audience because they are a key factor in disseminating information on new practices. Certain elements of the private agri-business community are an audience, especially research and development representatives who cooperate in the evaluation of new products.

Evaluation Framework

1. Qualitative and quantitative data collected to document changes in tree growth, development and fruit behavior resulting from experimental treatments with bioregulators.
2. Qualitative and quantitative measures of tree growth and nutrient content of foliage and fruit resulting from experimental treatments.
3. Measurements of soil nitrogen levels, tree growth and fruit quality resulting from different

nitrogen management programs.

4. Measures of growth habits, tree health and fruit quality of parental crosses.
5. Measures of tree growth and fruiting characters including fruit quality of trees on different experimental rootstocks.

Output Indicators

1. Completion of research trials and publication of reports.
2. Development of commercial recommendations for bioregulator products which effectively alter vegetative and/or reproductive growth while meeting appropriate environmental and registration criteria.
3. New recommendations to growers on products and rates for micro-nutrients in tree crops.
4. Recommendations on how to optimize nitrogen management in orchards.
5. Release of new apple varieties for Washington.
6. Recommendations on rootstock-cultivar combinations that would be expected to grow best under Washington conditions.

Outcome Indicators

Adoption of bioregulator use by commercial apple and pear producers will make for a more cost-effective means of managing vegetative growth in trees reducing dependence on labor. More efficient use of externally applied nutrients to trees will reduce grower costs and the potential for environmental contamination. The development of unique apple cultivars and rootstocks adapted to Washington's climate will keep the fruit industry competitive.

Program Duration

Both one-season and multi-year trials are underway. Multi-year trials are always needed to assure complete understanding of potential bioregulator effects on tree and fruit behavior. The apple breeding and rootstock programs are long-term evaluations. The former may require 15+ years to produce positive results, the latter trials typically last 7 to 10 years. Nutrition research trials on micronutrients can produce results in one to two years; however, soil mineral nutrition studies are typically multi-year in nature, requiring 2 to 5 years to show effects.

Allocated Resources

Faculty and staff FTEs	12.92
Funding	
Hatch	\$355,460
Hatch Multistate	
Fed. Res. Grants	\$16,938
State Approp.	\$146,238
Other Grants	\$297,211

CSREES GOAL 2

A SAFE AND SECURE FOOD AND FIBER SYSTEM

WSU PROGRAM PLANNING UNITS

Department of Biological Systems Engineering

D. Department Research Program

Department Objectives

RPA 402 - Engineering Systems and Equipment⁹⁰

Proj. 0341 Mechanical Dynamics in Agricultural Production Harvesting and Postharvest Systems
Proj. 7990 Measurement and Control of Fruit and Vegetable Impacts Sensitivity

RPA 501 - New and Improved Food Processing Technologies^{91, 92}

Center for Non-Thermal Processing of Food

Physical properties of food and other biological materials

Microwave enhanced drying processes

Sensors and controls for food

Finite element modeling of food and biological materials

Proj. 0271 Preservation of Foods by Oscillating Magnetic Fields. This project is studying the application of oscillating magnetic fields to food processing.

⁹⁰ RPA 402, Proj. 0341, and Proj. 7990 have been added to the POW.

⁹¹ Proj. 0223, Application of Microwave Heating in Food and Agriculture Processes, has terminated and, therefore, been removed from the POW.

⁹² Due to a change in leadership, Proj. 0271 and Proj. 0467 have been moved to this unit in the POW from the Department of Food Science and Human Nutrition.

Proj. 0320 Coupled Heat and Moisture Transfer Finite Element Analysis in Food Products. It is oriented toward applying finite element modeling techniques to the processing of food.

Proj. 0467 Improvement of Thermal and Alternative Processes for Food

RPA 503 - Quality Maintenance in Storing and Marketing Food⁹³

Proj. 4225 Thermal Mortality of Insects and Postharvest Control of Insect Pests in Nuts

Statement of Issues

The processing of food adds substantial value and adds significantly to the expense of food. An understanding of basic properties of foods and of the methods of processing them will improve the efficiency of the food processing system as well as adding to safety and producing new food products.

Performance Goals

1. Continue developing the Center for Non-Thermal Processing of Food.
2. Develop better understanding of food and food processing through research on properties of foods and computer modeling for processing of foods.
3. Continue developing new technologies in such areas as use of microwaves in food processing and improved sensors for food processing.

Key Program Components

1. Secure increasing external funding for the Center for the Non-Thermal Processing of Food.
2. Continue developing new knowledge of physical properties of foods and of computer modeling for food processing.
3. Work with industrial and other collaborators to develop and put into use new technologies in the use of microwaves in food processing and in improved on-line sensors for food processing.

Internal and External Linkages

The faculty members in the department are collaborating extensively with other scientists the University of Idaho, Oregon State University, other universities in the United States, government agencies, and food processing companies in the United States and overseas. Parts of this program, especially in the area of the use of microwave and radio frequency radiation in food processing, have strong national reputations. The Center for Non-Thermal Processing of Food includes research that is known throughout the United States and in other countries.

⁹³ RPA 503 and Proj. 4225 have been added to the POW.

Target Audiences

This research is oriented toward scientists and engineers at other universities and at food processing equipment manufacturers and processing firms in the United States and abroad.

Evaluation Framework

Evaluation of these projects is based on the acceptance of new technologies among food processors and the publication of research results in accepted journals.

Output Indicators

1. Number of publications on basic properties of foods and on new ways to model food production systems.
2. Continued support by industry of efforts to develop new technologies for food processing.

Outcome Indicators

1. Acceptance of publications in journals with significant reputations.
2. Continuing to obtain support from industry in the form of grants and contracts and of matching support for WSU efforts.
3. Acceptance of new computer modeling techniques useful in food processing.

Program Duration

This program has both short-term goals and long-term goals.

Allocated Resources -

Faculty and staff FTEs	4.97
Funding	
Hatch	\$8,575
Hatch Multistate	\$1,714
Fed. Res. Grants	\$356,891
State Approp.	\$123,752
Other Grants	\$57,952

B. Department Research Program

This department's efforts pertain only to storing agricultural products with no work on marketing.

Department Objective -- Postharvest storage and processing

RPA 503 - Quality Maintenance in Storing and Marketing Food Products^{94, 95}

Proj. 0371 Application of Electromagnetic Energy at Microwave and Radio Frequencies in Food and Agriculture Processes

Proj. 0990 Technology and Principles for Assessing and Retaining Postharvest Quality of Fruits and Vegetables. This project is a regional project. The goal is to study properties of fruits and vegetables to help protect them from damage during harvest and storage.

Proj. 3227 Non-Chemical Pest Control in Fruits and Nuts Using Electromagnetic Energy

Statement of Issues

An understanding of physical properties of fruits and vegetables will help prevent damage during harvest and storage. In the same way, an understanding of machinery will help minimize damage during harvest and storage.

Performance Goals

Efforts to move forward in the area of postharvest handling of fruits and vegetables are severely hampered by the loss of a Cooperative Extensive specialist in postharvest engineering. The goals are:

7. To continue developing better understanding of properties of fruits and vegetables suitable for postharvest storage in order to determine ways of minimizing damage.
8. To understand and adapt equipment that is used in harvesting and storing fruits and vegetables in order to minimize damage.

Key Program Components

1. Continue studying basic properties of fruits and vegetables that might be important in preventing damage.
2. Continue studying aspects of equipment used for processing and storage that could be improved to prevent damaging fruits and vegetables and to improve efficiency of storage.

Internal and External Linkages

⁹⁴ Proj. 0948, Specialized Equipment and Research for Agricultural Production, has terminated and, therefore, been removed from the POW.

⁹⁵ Proj. 0371 and Proj. 3227 have been added to the POW.

This project has extensive collaborations within the university, particularly in the Department of Horticulture and Landscape Architecture. The investigators are also cooperating with scientists at the University of Idaho and at other universities associated with the regional project.

Target Audiences

The target audiences are scientists studying similar issues, engineers designing equipment, growers who might change practices to reduce damage, and warehouse managers.

Evaluation Framework

Evaluation framework is based on developing new techniques for improving postharvest handling of fruits and vegetables and on the willingness of growers and warehouse managers to adopt these new techniques.

Output Indicators

1. Publications in recognized journals in the area of postharvest handling of fruits and vegetables.
2. Development and acceptance of new practices in the postharvest handling of fruits and vegetables.

Outcome Indicators

1. Number and quality of publications in recognized journals.
2. Acceptance of new practices for postharvest handling of fruits and vegetables.

Program Duration

This program has both short-term and long-term components.

Allocated Resources

Faculty & Staff FTE	2.27
Funding	
Hatch	
Hatch Multistate	\$24,434
Fed. Res. Grants	\$54,068
State Approp.	\$83,882
Other Grants	\$24,085

Department of Entomology

- A. **Departmental Research Program** -- Integration of Biological Control into existing and developing Integrated Pest Management programs.

Departmental Goals

Integrated Biological Control.

Integrated Pest Management.

Reduce our citizenry's dependence on broad-spectrum pesticides.

Department Objectives

RPA 216 - Integrated Pest Management Systems

Conducting research and developing academic teaching and extension activities aimed at educating Washington's citizenry in how to be wise stewards of our natural resources and ecological systems, while providing them with a means to competitively produce, protect and utilize our state's diverse plant and animal agricultural products.

Proj. 0122 A National Agricultural Program to Clear Pest Control Agents for Minor Uses
Proj. 0206 Development of Crop Protection Chemicals

Statement of Issues

To fulfill our mission, it is essential that we first have a strong program in basic and applied research to provide the science necessary to develop effective control programs for arthropod pests and to facilitate management of beneficial insects of great economic importance to our agriculture. Secondly, a strong educational program to train entomologists to conduct research that will be critical in the future and to disseminate the knowledge gained through our research to the general public, growers, ranchers/dairymen, environmentalists, beekeepers, health care workers, veterinarians, industrial concerns, pest control operators, etc.

Performance Goals

1. Integrating Biological Control into existing and developing Integrated Pest Management programs throughout Washington.
2. To expand IPM strategies to minor crops where research and education is still needed.
3. Reduce our citizenry's dependence on broad-spectrum pesticides.

Key Program Components

1. Continue our efforts to serve key production agriculture commodities (i. e. tree fruits, small fruits, cereal crops, row crops, and seed production, etc.) by identifying potential insect pests early enough to develop an IPM program to counter their adverse effects.
2. Evaluate various means of controlling pestiferous insects by chemical, cultural, or biological control methods.
3. Help define the best Integrated Pest Management practices for each commodity and where possible, integrating biological control in these IPM programs.

Internal and External Linkages

1. Our adjunct faculty members include seven Ph.D. entomologists employed by the United State Department of Agriculture in both Pullman and Wapato, WA.

2. We regularly exchange communication and resources with members of the Washington State Department of Agriculture; several are graduates of our Department.
3. Faculty members of the Department of Plant, Soil and Entomological Sciences at the University of Idaho have collaborated with our faculty on various crop protection problems that our two states share.
4. Tree fruit researchers in Oregon, California and British Columbia, Canada Columbia have collaborated in promoting ‘mating disruption’ for the codling moth.
5. We have had an active exchange program with the University of Chile, especially regarding tree fruits and potato production.
6. The Northwest Biocontrol Insectary and Quarantine facility has been a focal point of cooperative programs throughout the region.
7. Most of our cooperative extension specialists have split appointments with ARC; thereby, reinforcing our linkage between these two divisions of CAHE.

Target Audiences

1. We serve key production agriculture commodities (i. e. tree fruits, small fruits, cereal crops, row crops, and seed production, etc.) and minor cropping systems through our IR-4 work to reduce crop losses due to insect infestations.
2. Our efforts aid all growers, regardless of their production methods (conventional vs. organic), to reduce their need for crop protection expenditures.

Evaluation Framework

The evaluation framework includes baseline data gathering to document increased acceptance for Integrated Pest Management programs. In tree fruits an example would be the number of orchards managed under a ‘mating disruption’ strategy.

Output Indicators

1. Number of individual insect pests researched.
2. Number of new or revised control strategies developed.
3. Number of biocontrol agents collected, screened, released, and established.
4. Number and quality of publications published.
5. Number of clientele informed of our research data.
6. Acceptance by growers of IPM strategies developed by researchers.
7. Acceptance research findings of other researchers.

8. Integration of biological control into existing or developing IPM programs.

Outcome Indicators

1. Reduce the public’s dependence on broad-spectrum pesticides.
2. Acceptance by growers of new strategies (i.e. mating disruption) for reducing pest pressure on various crops.
3. Documentation of biological control agents becoming established in Integrated Pest Management program.
4. Develop a more educated citizenry by disseminating our research results to our clientele.

Program Duration

Our Integrated Pest Management strategy has both short and long term features.

Allocated Resources

Faculty & Staff FTE	2.86
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	(\$727)
State Approp.	\$120,161
Other Grants	\$62,815

Department of Horticulture and Landscape Architecture

A. Departmental Research Program -- Post-harvest quality of fruits and vegetables

Departmental Goal

Enhance quality of postharvest products in fruit and vegetable crops

Departmental Objectives

RPA 503 - Quality Maintenance in Storing and Marketing Food Products⁹⁶

Proj. 0797 Postharvest Physiology of Fruit

RPA 711 - Protect Food from Contamination by Pathogenic Organisms, Parasites, and Naturally Occurring Toxins

⁹⁶ RPA 503 and Proj. 0797 have been added to the POW.

Focus on research directed at the development of a further understanding of flavor chemistry in fruits.

Develop new strategies and technologies for maintaining fruit quality during storage.

Identify new techniques for the evaluation of potato cultivars for storage and processing qualities.

Conduct research directed at the identification of storage technologies to improve quality of potatoes and other vegetables.

Proj. 797 Postharvest Physiology of Fruits

Statement of Issues

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. What has made the state's tree fruit industry the world-wide leader is the ability to extend markets to several months through the use of controlled atmosphere (CA) storage. As noted above, Washington's potato crop (valued at nearly \$432 million annually) is used mostly 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.

Performance Goals

1. Identify factors affecting flavor in apple varieties.
2. Identify and develop CA storage strategies for tree fruits and small fruits such as cherries, strawberries, and raspberries.
3. Adopt new techniques for evaluation of storage and processing qualities of potato cultivars.
4. Identify improved post-harvest storage technologies for potatoes and other vegetable crops.

Key Program Components

1. Continuation of on-going programs directed at the identification of CA storage regimes for apples and other fruits.
2. Continuation of flavor chemistry research in apples.
3. Continuation of the post-harvest/processing quality component of Tri-State Variety trials in potatoes.
4. Initiation of research aimed at the identification of evaluation factors for potato processing quality.
5. Initiation of research directed toward the identification of strategies for storage of seed

potatoes.

Internal and External Linkages

There are many linkages associated with these programs, both internally (WSU) and externally. Principal investigators on the projects associated with this program work closely with scientists from other departments at WSU: Crop and Soil Science, Biosystems Engineering, Plant Physiology, Entomology, Plant Pathology, Food Science and Human Nutrition, and with USDA scientists at several locations. In several cases, research is conducted in cooperation with farmers, growers, and other scientists, especially those employed in the post-harvest and processing sectors of the horticultural industry. These projects also involve very close collaboration with County Extension personnel.

Target Audiences

1. The fruit and vegetable growers of Washington and other northwestern states.
2. The post-harvest storage and processing industries of the state and the region.
3. Scientific societies and professional organizations.
4. The Washington Tree Fruit Research Commission, the Washington State Potato Commission, and other commodity organizations in the state.
5. Private companies that provide post-harvest and processing services to the horticultural industry.

Evaluation Framework

This research program will be evaluated within the context of how well it serves the needs of the growers of fruits and vegetables and the post-harvest and processing industries of the state and region, and how it has contributed to horticultural science. Evaluation criteria will be quantitative as well as qualitative. Quantitative criteria will include number of publications in peer reviewed journals as well as trade journals, increases in effectiveness of post-harvest techniques, and efficiencies in processing. In some cases it will be possible to evaluate success of a program in economic terms. Qualitative criteria will relate to the acceptance of products or procedures by the horticultural industry.

Output Indicators

1. Number of publications in peer reviewed and trade journals.
2. Strategies developed for CA storage of new fruit and vegetable crops.
3. New techniques developed for evaluation of crop quality.

Outcome Indicators

1. Acceptance by industry of newly developed strategies for CA storage of fruits and vegetables.
2. Extent to which recommended storage and processing strategies have improved the efficiency of the processing industry.
3. Acceptance by consumers of fruits and vegetables stored under recommended regimes.
4. Effectiveness of recommended seed potato storage regimes in increasing yield and quality.

Program Duration

The projects included in this program vary in duration from short term to medium term. In some cases specific storage or processing problems identified by growers or processors can be resolved

in as little as several months. Most research related to this program is of an on-going, evolutionary nature. While there may be long term goals and objectives, there are often short-term gains and results that can be adopted or implemented by growers or processors.

Allocated Resources

Faculty & Staff FTE	1.88
Funding	
Hatch	
Hatch Multistate	\$34,919
Fed. Res. Grants	\$13,688
State Approp.	\$16,330
Other Grants	\$47,170

College of Veterinary Medicine - Field Disease Investigation Unit

A. Unit Research Program -- Investigation of Food Animal Diseases in the State of Washington.

Unit Goals

Definition and resolution of animal and zoonotic disease by the development of on-farm emerging control programs.

Unit Objectives

RPA 311 - Definition and resolution of emerging animal diseases in agricultural production systems.

On-farm investigation of new and unresolved disease problems in the State. Continue our close on-farm and commodity contacts, our liaison with The Washington Animal Diseases Diagnostic Laboratory and the monitoring of submissions to it, the contact with private practitioners and livestock agents and the perusal of local and overseas scientific veterinary literature.

Proj. 0858 Investigation of Food Animal Disease Problems in the State of Washington

Statement of Issues

Emerging animal diseases threaten the viability of farms. Zoonotic disease is a concern to the health of farm families from direct transmission, and to the community as a whole from transmission through animal products used for human food. The control of these infections at the level of the farm reduces risk for human disease at the lower end of the farm-to-fork food chain.

Performance Goals

Define the epidemiology of zoonotic and emerging diseases in farm animals and the farm environment.

Develop disease control strategies based on knowledge of the ecology and epidemiology of disease agents in the farm environment.

Key Program Components

Continue epidemiological studies on of zoonotic agents such as Escherichia coli O157:H7, Salmonella typhimurium DT104 and Staphylococcus aureus at the level of the farm.

Develop and test intervention strategies for control

Internal and External Linkages

The Field Disease Investigation Unit is funded as a conjoint program between the College of Agriculture and Home Economics and the College of veterinary medicine. This linkage allows close collaboration with scientists in the agricultural disciplines and with cooperative extension personnel in the State.

There is a close linkage with The Washington Animal Diseases Diagnostic Laboratory and there are linkages with veterinary scientists in the basic sciences.

The unit relies on close collaboration with the animal agricultural commodities and with individual private farms for its on-farm research.

Target Audiences

Target audiences include private farmers, private and public sector veterinarians, veterinary educators and veterinary scientists and cooperative extension personnel.

Evaluation Framework

Quantitative and qualitative data. Changes in disease control and management practices.

Output Indicators

Number and importance of diseases researched.

Publications.

New or revised disease control or management strategies developed.

Outcome Indicators

Improved knowledge of the epidemiology and ecology of emerging and zoonotic disease agents by producers and veterinarians.

Reduction of disease and/or infection at the level of the farm.

Adoption of disease control and management strategies.

Program Duration

The program has both short term and long term features.

Allocated Resources -- CAHE allocations

Faculty & Staff FTE	3.47
Funding	
Hatch	\$84,512
Hatch Multistate	

Fed. Res. Grants	
State Approp.	\$188,712
Other Grants	

College of Veterinary Medicine - Hatch Multistate Research Funds

A. Unit Research Program - Hatch-related Research in Veterinary Microbiology and Pathology

Unit Goals

Definition and resolution of animal and zoonotic disease by the development of on-farm emerging control programs.

Unit Objectives

RPA 313 - Internal Parasites in Animals

Laboratory and on-farm investigation of important disease problems in the State. Continue our close on-farm and commodity contacts, our liaison with The Washington Animal Diseases Diagnostic Laboratory and the monitoring of submissions to it, contact with private practitioners and livestock agents and the perusal of local and overseas scientific veterinary literature.

Proj. 0136 Control of Animal Parasites in Sustainable Agricultural Systems
Proj. 0261 Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety

RPA 712 - Protect Food From Contamination by Pathogenic Micro-organisms, Parasites, and Naturally Occurring Toxins

Proj. 0261 Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety

Statement of Issues

Emerging animal diseases threaten the viability of farms. Zoonotic disease is a concern to the health of farm families from direct transmission, and to the community as a whole from transmission through animal products used for human food. The control of these infections at the level of the farm reduces risk for human disease at the lower end of the farm to fork food chain.

Performance Goals

Define the epidemiology of zoonotic and emerging diseases in farm animals and the farm environment.

Develop disease control strategies based on knowledge of the ecology and epidemiology of disease agents in the farm environment.

Key Program Components

Continue epidemiological studies on of zoonotic agents such as Escherichia coli O157:H7, Salmonella typhimurium DT104 and Staphylococcus aureus at the level of the farm.

Develop and test intervention strategies for control

Internal and External Linkages

There is a close linkage with The Washington Animal Diseases Diagnostic Laboratory and there are linkages with veterinary scientists in the basic sciences.

Target Audiences

Target audiences include private farmers, private and public sector veterinarians, veterinary educators and veterinary scientists and cooperative extension personnel.

Evaluation Framework

Quantitative and qualitative data. Changes in disease control and management practices.

Output Indicators

Number and importance of diseases researched.

Publications.

New or revised disease control or management strategies developed.

Outcome Indicators

Improved knowledge of the epidemiology and ecology of emerging and zoonotic disease agents by producers and veterinarians.

Reduction of disease and/or infection at the level of the farm.

Adoption of disease control and management strategies.

Program Duration

The program has both short-term and long-term features.

Allocated Resources – CAHE allocations

Faculty & Staff FTE
Funding
Hatch

Hatch Multistate \$967
Fed. Res. Grants
State Approp.
Other Grants

OFF-CAMPUS RESEARCH AND EXTENSION CENTERS/UNITS

WSU Puyallup Research and Extension Center

A. Center Program Area -- Integrated plant and pest management

Center Goal -- Environmentally safe pest management practices

Center Objectives

RPA 212 - Diseases and Nematodes Affecting Plants

Proj. 0252 Diseases of Blueberry and Cranberry: Their Etiology, Epidemiology
and Control

Proj. 0496 Basal Rot Control During Hot Water Treatment of Daffodil Bulbs

RPA 216 - Integrated Pest Management Systems⁹⁷

Statement of Issue(s)

Producers of agricultural commodities face growing challenges in controlling pest species in ways that have minimal impact on the environment. In many cases, diseases or insect pests are the major factor limiting economic returns. Input from commodity groups is used regularly to determine priorities for research topics.

Performance Goal(s)

Develop improved, economically sound procedures for control of important plant pests.

Key Program Components

Assess new chemical and non-chemical control measures for control of important plant pests

Internal and External Linkages

⁹⁷ Proj. 5188, Selective Pesticides and Natural Enemies: Renewed Hope for IPM of Cole Crop Pests, has terminated and, therefore, been removed from the POW.

Scientists routinely collaborate with others within the institution and at others, both nationally and internationally

Target Audience(s)

Farmers, decision-makers in government and industry

Evaluation Framework

New control practices

Reduced environmental impact of new procedures

Acceptance of control practices by growers

Economic impact to producers

Output Indicators

Numbers and quality of refereed publications

New management practices

Outcome Indicators

Acceptance and use of findings by target audiences

Reduction in inputs by homeowners, turf producers

Improvement in safety to humans, non-target species, and the environment in general

Reduction in negative impact of dairies on water quality

Program Duration

The program has both short and long term components.

Allocated Resources

Faculty & Staff FTE	3.02
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Funding	
Hatch	\$61,815
Hatch Multistate	
Fed. Res. Grants	\$9,627
State Approp.	\$72,312
Other Grants	\$31,068

CSREES GOAL 3

A HEALTHY, WELL NOURISHED POPULATION

WSU PROGRAM PLANNING UNITS

Department of Food Science and Human Nutrition

A. Department Research Program -- Human Nutrition

Department Goal

Promote advancement of knowledge through selective excellence in graduate education and research in Human Nutrition

Department Objective

Implement research projects in identified areas, which meet the expertise of the food science and human nutrition faculty, the needs of the state's residents and industries, and has potential funding sources.

RPA 702 - Requirements and Function of Nutrients and other Food Components^{98, 99}

Continue to study the nutrition and health aspects and bioavailability of several nutrients including conjugated linoleic acid, leptin, vitamin B-6, calcium.

Proj. 0118 Conjugated Linoleic Acid: Dairy Enrichment, Dietary Intake, Cell Culture, and Cancer Prevention

Proj. 0286 Effect of Under- or Overconsumption on Serum Leptin and Food Regulation in Lean and Obese Subjects

Proj. 0370 Nutrition in the Treatment of Calcium Kidney Stones

Proj. 0905 Nutrient Bioavailability - A Key to Human Nutrition

Proj. 4118 Effect of Isomeric Conjugated Linoleic Acid Intake on Milk Fat Content and Growth During Early Postnatal Period

RPA 703 - Nutrition Education¹⁰⁰

⁹⁸ Proj. 0246, Nutrition in Prevention and Treatment of Chronic Diseases of Aging, Proj. 4108, Dietary Salt and Bone Turnover in Postmenopausal Women, and Proj. 5905, Vitamin B-6 Requirements of Women in Relation to Immune Competence, have terminated and, therefore, removed from the POW.

⁹⁹ Proj. 0370 and Proj. 4118 have been added to the POW.

¹⁰⁰ Proj. 0794 is reported in the Department of Agricultural Economics. Please see that unit's section of the POW.

Continue to study the Psychosocial and Dietary influencing nutrient intake and consumption behavior.
Proj. 0103 Dietary and Psychosocial Factors Affecting Self-Management of Type 2 Diabetes Mellitus
Proj. 0276 Factors Influencing the Intake of Calcium Rich Food Among Adolescents

Statement of Issue(s)

The desire to have a healthy and well-nourished population requires basic information related to nutrient composition, nutrient interaction and public health nutrition education methodology. This basic knowledge is required for the development of high quality, valid, public and private health policies.

Performance Goal(s)

Investigate selective nutrient levels required for good health protection and for disease prevention.

Develop and test programs, methodologies and tools to apply basic nutrition knowledge in the improvement of health and safety of the public.

Key Program Components

Nutrient requirement studies on selected nutrients related to the maintenance of good health and/or in disease prevention.

Research on the social science methodologies employed to access and facilitate dietary behavior changes and food safety concerns in at risk and diverse populations.

Internal and External Linkages

Research collaborators in Food Science, Animal Science, Biochemistry, Family and Consumer Science, Social and Economic science from WSU and other academic institutions.

Professional associations such as American Dietetic Association, Institute of Nutrition, Society for Nutrition Education, Association for the Study of Food and Society, FASEB.

Commodity commissions, state and federal departments of health and agriculture, public schools, private and public health care agencies.

Target Audience(s)

Public nutrition and food assistance programs, consumers (especially at risk groups), other researchers, educators, and nutrition policy-making agencies.

Evaluation Framework

The evaluation framework includes quantitative and qualitative research output and collaboration with research institutes along with private and public health agencies.

Output Indicators

Research publications related to: tested and documented nutrition educational strategies, new nutrient knowledge for at risk and diverse populations, nutrient levels required for health protection and disease prevention, factors influencing dietary behavioral changes.

Outcome Indicators

Incorporation of research results and educational materials into state and national educational programs and public health actions and recommendations.

Program Duration

There are both short and long term aspects of these programs.

Allocated Resources

Faculty & Staff FTE	4.11
Funding	
Hatch	\$3,618
Hatch Multistate	\$1,705
Fed. Res. Grants	
State Approp.	\$237,437
Other Grants	\$42,887

CSREES GOAL 4

AN AGRICULTURAL SYSTEM WHICH PROTECTS NATURAL RESOURCES AND THE ENVIRONMENT

WSU PROGRAM PLANNING UNITS

Department of Agricultural Economics

- A. **Department Research Program** -- Natural resource and environmental economics

Department Goals

To develop educational programs that will provide useful information and economic intelligence to an expanding clientele.

To assist targeted agricultural and resource industries become more effective in providing their products and services to consumers.

Department Objective -- Natural resource and environmental economics

RPA 605 - Natural Resource and Environmental Economics¹⁰¹

Generate and disseminate economic, environmental, and social intelligence concerning the impacts of public policy and changing resource conditions on food producers and processors

Proj. 0160 Agricultural Water Management Technologies, Institutions and Policies Affecting Economic Viability and Environmental Quality

Proj. 0299 Fisheries Management and Marketing of Marine and Aquaculture Seafood

Proj. 0343 Policy and Competitive Changes in Agricultural Transportation in Washington

Proj. 0347 Assessing the Economic Viability of Soil Conserving Farming Systems in Eastern Washington

Proj. 0691 Benefits and Costs of Resource Policies Affecting Public and Private Land

Statement of Issue

Because of rapidly changing technologies, demographics, and world policies, the market for food products and natural resources has been and will continue to be

¹⁰¹ Proj. 0100, Issues in Economic Evaluation for the Management of Multiple Use Natural Resources, and Proj 3160, Evaluating Water Policy Options Affecting Irrigated Agriculture and Fish Habitat in the Snake River Basin have terminated and, therefore, been removed from the POW.

highly volatile. Agricultural and seafood producers, processors, food manufacturers, distributors, and consumers operate in an environment of unprecedented uncertainty about environmental impacts of choices. Tensions between the partially competing goals of economic growth and environmental protection have escalated dramatically. Governmental regulations aimed at reducing the uncertainty and potentially negative consequences of unbridled economic growth have proliferated and have become an important source of the uncertainty and costs associated with food production and processing. Commodity commissions, departmental advisory committee, and a comprehensive assessment of stakeholders by C-FARE, AAFA, and USDA have expressed the need to identify economic and social consequences of environmental regulation and to provide economic, environmental, and social intelligence relevant to current and future food production, processing, and public policy decision making.

Performance Goals

1. Develop strategies for facilitating firm profitability and/or reducing risks in response to five new natural resource conflicts and/or resource/environmental policy changes in a five-year period.
2. Measure economic, environmental, and social impacts of five new public policies and/or changing resource conditions on food producers and processors in a five-year period.
3. Improve ability to give relevant economic guidance to food producers, processors, and other decision makers who seek environmentally friendly economic growth in the future.

Key Program Components

1. Assess the benefits and costs of governmental regulation affecting food production and environment.
2. Design and evaluate alternative policies and institutions to mitigate negative environmental impacts of food production.
3. Develop economic intelligence to guide future firm and public policy decisions to increase firm income, reduce risks, and assure a stable food supply while protecting the environment and critical natural resources.
4. Develop improved methods for measuring economic, environmental, and/or social impacts of environmental regulations and natural resource changes.

Internal and External Linkages

Much of the work in natural resource and environmental economics is multidisciplinary in nature. Scientists from other disciplines will be involved as needed. Talent available in the Pacific Northwest is abundant. Frequent cooperation among scientists, departments, institutions, and states is the norm. Extension faculty will be involved in coordinated research and educational delivery programs to food marketers and consumers.

Target Audiences

Target audiences include food producers and workers, food agribusinesses, environmentalists, and public policy makers.

Evaluation Framework

The evaluation framework includes quantitative and qualitative research output data and acceptance by clientele as evidenced by changes in production decisions and public policy to protect the environment while promoting economic growth.

Output Indicators

1. Number of strategies developed for facilitating firm profitability and/or reducing risks in response to new natural resource conflicts and/or resource/environmental policy changes.
2. Number of new public policies and/or changing resource conditions for which historical economic, environmental, and social impacts are measured.
3. Number of refereed journal articles, bulletins, policy and trade magazine articles published and electronic media releases that communicate the findings of natural resource and environmental economics research.

Outcome Indicators

1. Acceptance by clientele (adoption of recommendations by decision-makers, publication citations, web site hits).
2. Documented improvements possible from alternative decisions through increased profits, decreased risks, environmental preservation, and/or social welfare.

Program Duration

The program has both short and long term features.

Allocated Resources

Faculty & Staff FTE	3.39
Funding	
Hatch	\$17,309
Hatch Multistate	\$7,454
Fed. Res. Grants	\$7,452
State Approp.	\$225,721
Other Grants	\$104,352

Department of Biological Systems Engineering

A. Department Research Program¹⁰²

Department Objectives

¹⁰² This research program moved to the recently created Center for Precision Agricultural Systems and placed in Goal 1, which more appropriately describes the overall program.

Irrigation water use, scheduling and management

Precision irrigation

B. Research Program Area: Water

Department Objectives

Environmental water quality and watershed modeling

Agricultural systems modeling and analysis

Natural and other systems for wastewater treatment, especially from agricultural, food and aquacultural operations

Center for Multiphase Environmental Engineering (with College of Engineering and Architecture)

RPA 112 - Water: Watershed Protection and Management^{103, 104}

Proj. 0319 Field- and Catchment-Scale Hydrologic Modeling Using GIS and Simulation Models

Proj. 0352 A Watershed Scale Study on No-till Farming for Reducing Sediment Delivery

RPA 133 Pollution Prevention and Mitigation¹⁰⁵

Proj. 0357 Use of Simulation Modeling and Other Computer-based Tools for Decision Support in the Management of Agricultural Systems

RPA 307 - Animal Production Systems¹⁰⁶

Proj. 4222 Integrated Nutrient Management Modeling for Dairy Production Systems Featuring Dynamics and Optimization

RPA 403 - Waste Disposal, Recycling and Re-use¹⁰⁷

Proj. 4222 Integrated Nutrient Management Modeling for Dairy Production Systems Featuring Dynamics and Optimization

Statement of Issues

The protection of water implies knowledge of water—how it moves through the ground and how it moves in aquifers. The projects on groundwater in this department are dealing with the issues of water movement and water transport of

¹⁰³ Proj. 0220, A Systems Approach for Farm-Wide Waste Management, Proj. 0241, Modeling Perched Water Tables and Lateral Flow in Pacific Northwest Watersheds, and Proj. 0992, Assessment of Farm-Level Contribution to Nitrogen Pollution in the Central Columbia Plateau, have terminated and, therefore, been removed from the POW.

¹⁰⁴ Proj. 0352 has been added to POW.

¹⁰⁵ Proj. 0357 has been added to POW.

¹⁰⁶ RPA 307 and Proj. 4222 have been added to the POW.

¹⁰⁷ RPA 403 and Proj. 4222 have been added to the POW.

chemicals and soils. At the same time, one of the projects is grappling with the issue of preventing water pollution through more effective management of waste in agricultural and aquacultural operations.

Performance Goals

1. Develop and confirm new computer models for water movement and solids transport.
2. Apply existing computer models to the problem of hydrologic modeling.
3. Develop computer models for waste management in farming.
4. Work with the Center for Multiphase Environmental Engineering on issues identified by faculty of the Center in cooperation with faculty members in this department.

Key Program Components

1. Continue developing and confirming new computer models and adapting existing models to problems of water movement.
2. Study waste management in agricultural and aquacultural operations in order to develop better policies and better models.
3. Collaborate with the Center for Multiphase Environmental Engineering on continuing projects.

Internal and External Linkages

Faculty members in this department are cooperating with faculty members and scientists at the University of Idaho, the U.S. Forest Service, the Agricultural Research Service, and other universities and agencies in the Pacific Northwest as appropriate. Cooperation within the university is also developing continuing with the Center for Multiphase Environmental Engineering and with the Center for Environmental Education. Statewide and regional linkages include state agencies (Department of Ecology), local government (conservation districts) and Native American tribes. Much of the work in this area is based on regional concerns, such as unusual geologic features that determine water movement.

Target Audiences

This work is now oriented mainly toward officials who make policy at the national, regional, and state level. The computer modeling will be especially useful in developing policies for watersheds and other large areas where hydrology is important. Producers will benefit from new knowledge of the treatment of agricultural wastes.

Evaluation Framework

The evaluation framework is based on completion of computer models and adaptation of existing models. The acceptance of these models by other scientists in the field will be evidence of their value. The development of new methods of waste treatment and acceptance by producers will be evidence of the value of this research.

Output Indicators

1. Number of publications on water quality, on movement of water in the ground and on the surface, and on waste management.
2. Developing computer programs and adapting new programs.
3. Developing new methodology for waste management at the farm level.

Outcome Indicators

1. General acceptance of new knowledge on water quality, on water movement, and on waste management.
2. Acceptance of computer programs.
3. Changes in the way that producers manage waste.

Program Duration

The program has both short- and long-term features.

Allocated Resources

Faculty & Staff FTE	5.98
Funding	
Hatch	\$15,783
Hatch Multistate	
Fed. Res. Grants	\$100,310
State Approp.	\$181,072
Other Grants	\$65,115

Department of Crop and Soil Sciences

A. Departmental Research Program – Soil Environmental Stewardship

Departmental Goals

Promote soil environmental resources, land management systems and urban green space: seek greater harmony between agriculture production, land use, and soil environmental stewardship to achieve a safe and secure food system and to enhance ecosystem health.

Departmental Objectives

RPA 101 - Appraisal of Soil Resources

Proj. 0323 Remote Sensing for Land Management
Proj. 0598 Loess and Global Change
Proj. 0900 Soil Survey and Classification

RPA 102 - Soil, Plant, Water, Nutrient Relationships^{108, 109}

¹⁰⁸ Proj. 0242, Developing Sustainable Agricultural Systems with Conservation Tillage and Site Specific Management, and Proj. 0557, Evaluation and Management of Turfgrass Species and Cultivars for Eastern Washington, have terminated and, therefore, been removed from the POW.

Proj. 0152 Characterization of Flow and Transport Processes in Soils at Different Scales
Proj. 0182 Impact of No Till on Soil Quality Physical, Chemical, and Microbial Properties
Proj. 0203 Nutrient Cycling and Soil Building in Alternative Cropping Systems
Proj. 0250 Cropping Systems Research for Low-Precipitation Dryland in Eastern Washington
Proj. 0257 Developing Site Specific Approaches for Crop Nutrient Management in Irrigated Ag Systems
Proj. 0267 Sorption and Transport in Porous Media at Different Scales
Proj. 0277 Ecologically Based Weed Management for Dryland Cropping Systems
Proj. 0325 Grass Seed Cropping for a Sustainable Agriculture
Proj. 0329 Perennial Ryegrass Seed Production in the Puget Sound Without Burning
Proj. 0353 Soil Quality Changes with No-till Management Adoption for Wind Erosion Control
Proj. 0385 Physical Chemical State and Plant Availability of Uranium, Lead, Cadmium, Zinc, and Arsenic in Selected Washington Soils
Proj. 0598 Loess and Global Change
Proj. 0703 A Comparative Analysis of the Sustainability of Farming Systems
Proj. 6703 Sustainability of Three Apple Production Systems

RPA 104 - Alternative Uses of Land

Proj. 0900 Soil Survey and Classification

RPA 111 - Conservation and Efficient Use of Water¹¹⁰

Proj. 0309 Spectral Reflectance and Spatial Analysis of Plant Stress Indicators in Vitis

RPA 121 - Management of Range Resources¹¹¹

Proj. 3776 Effect of Cropping Systems on Shrub-Steppe Habitat

RPA 131 - Alternate Uses of Land¹¹²

Proj. 0344 Diversity and Sustainability of Plant and Arthropod Communities Within Agroecosystems

RPA 133 - Pollution prevention and mitigation^{113, 114}

Proj. 0245 STEEP III

¹⁰⁹ Proj. 0257, Proj. 0325, Proj. 0329, Proj. 0353, and Proj. 6703 have been added to the POW.

¹¹⁰ RPA 111 and Proj. 0309 have been added to the POW.

¹¹¹ RPA 121 and Proj. 3776 have been added to the POW.

¹¹² RPA 131 and Proj. 0344 have been added to the POW.

¹¹³ Proj. 0316, Proj. 0329, Proj. 0351, and 0358 have been added to the POW.

¹¹⁴ Proj. 0264, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, and Proj. 0306, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, will be terminating fairly soon and the program will not be continued by Congress. Therefore, the projects have been removed from the POW.

Proj. 0250 Cropping Systems Research Low-Precipitation Dryland in Eastern Washington

Proj. 0296 STEEP III

Proj. 0316 STEEP: Solutions to Environmental and Economic Problems

Proj. 0329 Perennial Ryegrass Seed Production in the Puget Sound Without Burning

Proj. 0351 STEEP: Solutions to Environmental and Economic Problems

Proj. 0358 Grass Seed Cropping Systems for a Sustainable Agriculture

RPA 211 - Insects, mites, and other arthropods affecting plants^{115, 116}

Proj. 0344 Diversity and Sustainability of Plant and Arthropod Communities within Agroecosystems

RPA 212 - Diseases and nematodes affecting plants^{117, 118}

Proj. 0232 Breeding and Genetics of Winter Wheat

Proj. 0245 STEEP III

Proj. 0296 STEEP III

Proj. 0316 STEEP: Solutions to Environmental and Economic Problems

Proj. 0325 Grass Seed Cropping Systems for a Sustainable Agriculture

Proj. 0329 Perennial Ryegrass Seed Production in the Puget Sound Without Burning

Proj. 0351 STEEP: Solutions to Environmental and Economic Problems

RPA 213 - Weeds affecting plants^{119, 120}

Proj. 0277 Ecologically Based Weed Management for Dryland Cropping Systems

Proj. 0318 Jointed Goatgrass: A Threat to U.S. Wheat Production

Proj. 0715 Integrated Weed Management in Dryland Cropping Systems in Washington

Proj. 0805 Weed Research in Irrigated Agronomic Horticultural and Specialty Crops in Washington

Proj. 4277 The Role of Microbially-Mediated Decay in Mortality of Annual Grass Weed Seeds

RPA 215 - Biological control of pests affecting plants^{121, 122}

Proj. 0344 Diversity and Sustainability of Plant and Arthropod Communities Within Agroecosystems

¹¹⁵ Proj. 0774, Integration of Rhizobia into a Management Program for Legume Pests, has terminated and, therefore, been removed from the POW.

¹¹⁶ Proj. 0344 has been added to the POW.

¹¹⁷ Proj. 1570, Improving Spring Wheat Varieties for the Pacific Northwest, has terminated and, therefore, been removed from the POW.

¹¹⁸ Proj. 0316, Proj. 0329, Proj. 0325, and Proj. 0351 have been added to the POW.

¹¹⁹ Proj. 0228, Precision Weed Management in Dryland Agricultural Production in Eastern and Central Washington, Proj. 3941, Jointed Goatgrass: A Threat to U.S. Wheat Production, and Proj. 8843 Jointed Goatgrass: A Threat to U.S. Wheat Production, have terminated and, therefore, been removed from the POW.

¹²⁰ Proj. 0318 and Proj. 0805 have been added to the POW.

¹²¹ Proj. 0774, Integration of Rhizobia into a Management Program for Legume Pests, and Proj. 1570, Improving Spring Wheat Varieties for the Pacific Northwest, have terminated and, therefore, been removed from the POW.

¹²² Proj. 0344 has been added to the POW.

RPA 216 - Integrated Pest Management Systems¹²³

Proj. 0318 Jointed Goatgrass: A Threat to U.S. Wheat Production
Proj. 0356 Jointed Goatgrass: A Threat to U.S. Wheat Production
Proj. 0805 Weed Research in Irrigated Agronomic Horticultural and Specialty Crops in Washington

RPA 402 - Engineering systems and equipment^{124, 125, 126}

Proj. 0250 Cropping Systems Research for Low-Precipitation Dryland in Eastern Washington
Proj. 0329 Perennial Ryegrass Seed Production in the Puget Sound Without Burning

RPA 403 - Waste disposal, recycling, reuse^{127, 128}

Proj. 0250 Cropping Systems Research for Low-Precipitation Dryland in Eastern Washington
Proj. 0245 STEEP III
Proj. 0296 STEEP III
Proj. 0316 STEEP: Solutions to Environmental and Economic Problems
Proj. 0351 STEEP: Solutions to Environmental and Economic Problems

RPA 404 - Instrumentation and control systems

Proj. 0323 Remote Sensing for Land Management

Statement of Issues

The public demands solutions to agriculturally induced environmental problems, protection and enhancement of natural resources, and higher quality products, thus agriculture should be conducted in harmony with the environment. New cultural systems will protect and enhance the environment and natural resources. Modern agriculture is based on scientific information and knowledge requiring practitioners, educators, and researchers to be life-long learners. Growers and the agriculture support industry personnel will be scientifically literate, knowledgeable of environmentally sound agricultural practices, and technologies, and aware of global market quality criteria.

Performance Goals

¹²³ RPA 216, Proj. 0318, Proj. 0356, and Proj. 0805 have been added to the POW.

¹²⁴ Proj. 0557, Evaluation and Management of Turfgrass Species and Cultivars for Eastern Washington, has been terminated and, therefore, removed from the POW.

¹²⁵ Proj. 0306 and Proj. 0329 have been added to the POW.

¹²⁶ Proj. 0264, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, and Proj. 0306, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, will be terminating fairly soon and the program will not be continued by Congress. Therefore, the projects have been removed from the POW.

¹²⁷ Proj. 0306, Proj. 0316, and Proj. 0351 have been added to the POW.

¹²⁸ Proj. 0264, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, and Proj. 0306, PM-10 Particulate Emission Prediction and Control in the Pacific Northwest, will be terminating fairly soon and the program will not be continued by Congress. Therefore, the projects have been removed from the POW.

1. Apply physical, chemical, and biological science principles to develop mechanisms for determining the fate of nutrients, global gases, chemicals and waste materials in the environment and food supply.
2. Develop best management technologies for crop productivity and to reduce the impact of inorganic and organic waste materials and pesticides on the food supply and the soil, water, and air environment.
3. Develop profitable tillage and nutrient management options that allow for diversity in our cropping systems, to reduce soil and water erosion and improve soil, water, and air quality.
4. Promote sound land management decisions, which provide harmony between crop and fiber production, recreational use, green space, and quality of life.

Internal and External Linkages

Formal linkages have been established with all environmentally related departments and ARS units at WSU and many related departments in colleges of agriculture around the country, especially in the Tri-State region. Very close ties are established with environmental protection agencies, grower groups, and international centers and governmental departments representing agriculture and fisheries.

Target Audiences

Agricultural and non-agricultural producers of air, soil and water pollution, monitoring agencies, environmental scientists, producer organizations, chemical and machinery companies

Evaluation Framework

Any efforts to reduce or eliminate sources of pollution must include economically viable solutions to change polluting practices to benign practices. The basic framework evaluation will be improvements in various measures of environmental quality.

Output Indicators

Conferences, videos, WWW sites, and printed materials on the value of green space for recycling of global pollutants and organic wastes; improved public awareness of pollutants for use in continuing education; quantification and assessment of teams to address food quality and environmental issues; regional teams to address environmental problems and coordinate problem solving; and output of advanced science as indicated by scientific publications and new technologies for better delivery of pesticides and fertilizers. Publications in the popular press, newsletters, WWW sites, grants, books, workshops, conferences, models; funding for research and education; success of the Waste Utilization Institute; industry-WSU residue utilization consortium, adoption of new technologies; and consciousness of the public.

Outcome Indicators

The number of acres in conservation and reduced tillage agriculture is the primary indicator, along with user acceptance of options, land area use alternatives, enterprises established; prediction of long-term effects of conservation tillage on soil quality; technical knowledge of growers, Washington citizens, and students on issues in conservation tillage; participation in IPM practices in both the urban and agricultural sectors; and improved environmental indicators such as use of water and soil quality at important monitoring locations. Profitable tillage and nutrient

management options with more diversity and less environmental impact.

Program Duration

The development of basic scientific principles and models, best management technologies, and profitable tillage and nutrient management options can take from a few years to decades to complete or bring to fruition.

Allocated Resources

Faculty & Staff FTE	17.09
Funding	
Hatch	\$80,603
Hatch Multistate	\$54,386
Fed. Res. Grants	\$290,598
State Approp.	\$507,245
Other Grants	\$318,502

Some resources are allocated under Goal 1.

Department of Entomology

- A. Departmental Research Program** -- Integration of Biological Control into existing and developing Integrated Pest Management programs.

Departmental Goals

Integrated Biological Control.

Integrated Pest Management.

Reduce our citizenry's dependence on broad-spectrum pesticides.

Department Objectives

RPA 133 - Pollution Prevention and Mitigation¹²⁹

Proj. 0349 Managing Agrochemical Behavior Under Drip Irrigation Systems

Proj. 0372 Mechanisms and Mitigation of Agrochemical Impacts on Human and Environmental Health

Proj. 0470 Reducing the Potential for Environmental Contamination by Pesticides and Other Organic Chemicals

Proj. 8131 Managing Drip Irrigation to Reduce Chemical Movement in Soil

RPA 211 - Insects, mites, and other arthropods affecting plants¹³⁰

Continue and increase our efforts to demonstrate strategies to control insect pests below an economical threshold level without broad-spectrum pesticides. Document insect diversity, including pollinators, beneficial insects in various ecosystems.

¹²⁹ RPA 133, Proj. 0349, Proj. 0372, Proj. 0470, and Proj. 8131 have been added to the POW.
¹³⁰ Proj. 0315 has been added to the POW.

Proj. 0243 Biological Diversity Studies of Arthropod Taxa
 Proj. 0315 Biology and Integrated Management of Insect and Mite Pests of Wine Grapes

Allocated Resources

Faculty & Staff FTE	2.94
Funding	
Hatch	\$623
Hatch Multistate	
Fed. Res. Grants	\$90,619
State Approp.	\$26,663
Other Grants	\$98,055

RPA 215 - Biological control of pests affecting plants¹³¹

The Department of Entomology will achieve its primary goal of Integrating Biological Control into existing and developing Integrated Pest Management programs throughout Washington.

Proj. 0121 Biological Control in Pest Management Systems of Plants
 Proj. 4362 The Impact of Generalist Predators in Agriculture and Refuge Habitats

RPA 405 Drainage and Irrigation Systems and Facilities¹³²

Proj. 0349 Managing Agrochemical Behavior Under Drip Irrigation Systems

Allocated Resources

Faculty & Staff FTE	
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	
State Approp.	
Other Grants	\$994

RPA 123 - Management of Forest Resources¹³³

Proj. 0302 Dynamics and Management of Pest and Natural Resource Populations

RPA 216 - Integrated Pest Management Systems^{134, 135, 136, 137}

¹³¹ Proj. 4362 has been added to the POW.

¹³² RPA 405 and Proj. 0349 have been added to the POW.

¹³³ RPA 123 and Proj. 0302 have been added to the POW.

¹³⁴ Proj. 0801, Secondary Pests of Deciduous Pome Fruits, has terminated and, therefore, been removed from the POW.

¹³⁵ Proj. 0225 and Proj. 1090 are reported in the WSU Wenatchee Tree Fruit Research and Extension Center section of the POW.

¹³⁶ Proj. 0270 is reported in the WSU Vancouver Research and Extension Unit section of the POW.

Conducting research and developing academic teaching and extension activities aimed at educating Washington's citizenry in how to be wise stewards of our natural resources and ecological systems, while providing them with a means to competitively produce, protect and utilize our state's diverse plant and animal agricultural products.

Proj. 0339 Development of Integrated Arthropod Management Systems for Irrigated Crops in Central Washington

Proj. 0405 Potential of Insect Growth Regulators for Controlling Insect Pests of the Pacific Northwest

Proj. 0742 Integrated Arthropod Pest and Pollinator Management

RPA 711 - Ensure Food Products Free of Harmful Chemicals, Including Residues From Agricultural and Other Sources¹³⁸

Proj. 0335 Pesticide Information Coordination

RPA 901 - Research Design and Statistics¹³⁹

Proj. 0302 Dynamics and Management of Pest and Natural Resource Populations

Allocated Resources

Faculty & Staff FTE	4.32
Funding	
Hatch	\$28
Hatch Multistate	
Fed. Res. Grants	\$32,598
State Approp.	\$172,340
Other Grants	\$113,891

Statement of Issues

To fulfill our mission, it is essential that we first have a strong program in basic and applied research to provide the science necessary to develop effective control programs for arthropod pests and to facilitate management of beneficial insects of great economic importance to our agriculture. Secondly, a strong educational program to train entomologists to conduct research that will be critical in the future and to disseminate the knowledge gained through our research to the general public, growers, ranchers/dairymen, environmentalists, beekeepers, health care workers, veterinarians, industrial concerns, pest control operators, etc.

Performance Goals

1. Integrating Biological Control into existing and developing Integrated Pest Management programs throughout Washington.
2. To expand IPM strategies to minor crops where research and education is still needed.
3. Reduce our citizenry's dependence on broad-spectrum pesticides.

¹³⁷ Proj. 0339 has been added to the POW.

¹³⁸ RPA 711 and Proj. 0335 have been added to the POW.

¹³⁹ RPA 901 and Proj. 0302 have been added to the POW.

Key Program Components

1. Continue our efforts to serve key production agriculture commodities (i. e. tree fruits, small fruits, cereal crops, row crops, and seed production, etc.) by identifying potential insect pests early enough to develop an IPM program to counter their adverse effects.
2. Evaluate various means of controlling pestiferous insects by chemical, cultural, or biological control methods.
3. Help define the best Integrated Pest Management practices for each commodity and where possible, integrating biological control in these IPM programs.

Internal and External Linkages

1. Our adjunct faculty members include seven Ph.D. entomologists employed by the United State Department of Agriculture in both Pullman and Wapato, WA.
2. We regularly exchange communication and resources with members of the Washington State Department of Agriculture; several are graduates of our Department.
3. Faculty members of the Department of Plant, Soil and Entomological Sciences at the University of Idaho have collaborated with our faculty on various crop protection problems that our two states share.
4. Tree fruit researchers in Oregon, California and British Columbia, Canada Columbia have collaborated in promoting ‘mating disruption’ for the codling moth.
5. We have had an active exchange program with the University of Chile, especially regarding tree fruits and potato production.
6. The Northwest Biocontrol Insectary and Quarantine facility has been a focal point of cooperative programs throughout the region.
7. Most of our cooperative extension specialists have split appointments with ARC; thereby, reinforcing our linkage between these two divisions of CAHE.

Target Audiences

1. We serve key production agriculture commodities (i. e. tree fruits, small fruits, cereal crops, row crops, and seed production, etc.) and minor cropping systems through our IR-4 work to reduce crop losses due to insect infestations.
2. Our efforts aid all growers, regardless of their production methods (conventional vs. organic), to reduce their need for crop protection expenditures.

Evaluation Framework

The evaluation framework includes baseline data gathering to document increased acceptance for Integrated Pest Management programs. In tree fruits an example would be the number of orchards managed under a ‘mating disruption’ strategy.

Output Indicators

1. Number of individual insect pests researched.

2. Number of new or revised control strategies developed.
3. Number of biocontrol agents collected, screened, released, and established.
4. Number and quality of publications published.
5. Number of clientele informed of our research data.
6. Acceptance by growers of IPM strategies developed by researchers.
7. Acceptance research findings of other researchers.
8. Integration of biological control into existing or developing IPM programs.

Outcome Indicators

1. Reduce the public's dependence on broad-spectrum pesticides.
2. Acceptance by growers of new strategies (i.e. mating disruption) for reducing pest pressure on various crops.
3. Documentation of biological control agents becoming established in Integrated Pest Management program.
4. Develop a more educated citizenry by disseminating our research results to our clientele.

Program Duration

Our Integrated Pest Management strategy has both short and long term features.

Department of Natural Resource Sciences

A. Program Area -- Conservation biology and ecological restoration

Program Area Objectives

RPA 121 - Management of Range Resource¹⁴⁰

Proj. 0238 Evaluation of Selected Pacific Northwest Eriogonum Species for Revegetation of Mine Spoils

Proj. 0247 Palouse Prairie Restoration

Proj. 0345 Design of Concepts and Application Protocols for Range Management Science

RPA 133 - Pollution Prevention and Mitigation

Proj. 0221 Biological Impacts and Efficacy of Microfloc Alum Injection for Lake Restoration

Issues and Key Program Components

Degradation of natural resources and ecosystems, with attendant impacts on environmental quality and biodiversity, represent issues of paramount importance locally, regionally, nationally and globally. Indeed, such issues have emerged as major drivers of natural resource and agricultural policy in recent years, as evidenced by the increasing impacts of laws/regulations (e.g., Endangered Species, Clean Water, Clean Air Acts) on the practice of forestry, agriculture and other forms of resource use. It is incumbent upon the scientific community to

¹⁴⁰ Proj. 0345 has been added to the POW.

conduct research appropriate to both improve understanding of ecosystem form, function and biodiversity (i.e., conservation biology), and to enhance our ability to preserve/conserves, improve or re-establish these ecosystem attributes following degradation (i.e., ecological restoration).

Key components in this NRS Program Area are research thrusts in three broad areas:

1. Fundamental research on plant/animal species and population/community ecology, and on form and function of both terrestrial and aquatic ecosystems.
2. Research to assess impacts of past/present disturbances (management practices, physical/biological disturbance agents, etc.) on species and ecosystems.
3. Applied research on strategies and practices to restore proper function and biological diversity to terrestrial and aquatic ecosystems that have been variously degraded or impacted by human activities.

Performance Goals

1. Expand basic knowledge on autecology and population/community ecology of plant and animal species of local/regional significance from the standpoint of biodiversity
2. Expand basic knowledge on form/function of terrestrial and aquatic ecosystems, and on the response of such ecosystems to past/current perturbations
3. Development of improved management strategies and techniques to either/both conserve-preserve existing form/function and biodiversity of terrestrial and aquatic ecosystems, or to restore proper form, function and biodiversity to severely impacted ecosystems
1. Effective dissemination of research-derived, basic/applied knowledge to both the scientific community and to potential users groups and other constituents

Internal and External Linkages

This program area will involve scientists and facilities at the main (Pullman) campus, and may involve collaboration between scientists in NRS and a number of other WSU units (e.g., Zoology, Water Research Center, Biological Systems Engineering). NRS scientists in this program area may work in direct collaboration with colleagues in the Washington Cooperative Fish and Wildlife Research Unit (University of Washington), the University of Idaho, the USFS Pacific Northwest Research Station (LaGrande and Wenatchee Labs), the USDA Natural Resource Conservation Service (including Pullman Plant Materials Center), and the Northern Rockies Cooperative Ecosystem Studies Unit (University of Montana). Outreach/extension efforts may be conducted through the NRS/WSU statewide forestry and range management extension team. Research funding and other forms of support/cooperation will be maintained and hopefully expanded with a number of relevant state and federal agencies.

Target Audiences

The primary users of information generated by this program will be various state and federal land/resource management and regulatory agencies, public interest/action groups focusing upon resource preservation and conservation, and private landowners (both industrial and non-industrial) with either/both a commitment to or mandate for natural resource conservation and improvement.

Evaluation Framework

Evaluation will be based upon a dual consideration of how well the research advances basic scientific understanding (i.e., is recognized/utilized by the scientific community), and how well research outcomes serve the needs of various public/private clientele sectors who have a stake or interest in biodiversity and ecosystem integrity. The proposed evaluation criteria (i.e., Output and Outcome Indicators) include both quantitative and qualitative parameters.

Output Indicators

1. Publications in peer-reviewed scientific outlets
2. Publications targeted to user, public and/or other clientele groups
3. Relevant technologies, methodologies and/or management techniques/systems developed
4. Presentations to scientific, public and/or other clientele audiences

Outcome Indicators

1. Degree of reference, use and other forms of recognition of research outputs by the peer scientific community
2. Degree of adoption or use of information, technologies, methodologies and/or management practices developed through research by scientific peers and/or clientele
3. Degree to which recognition/use of outputs of research stimulates maintained or increased external support for further research

Program Duration

Long-term, with periodic (ca. 5 year) evaluations and potential redirections of major, specific projects.

Allocated Resources

Faculty & Staff FTE	2.04
Funding	
Hatch	\$5,714
Hatch Multistate	
Fed. Res. Grants	\$17,386
State Approp.	\$74,651
Other Grants	\$48,287

- B. Program Area – Habitat, nutritional and population ecology of terrestrial wildlife**

Program Area Objective

RPA 135 - Natural Resources and Environment

Proj. 0226 Nutritional Ecology of Large Mammals

Issues and Key Program Components

Terrestrial wildlife have long comprised a focus of intense public interest, from standpoints of both aesthetic (and sometimes, economic) value and recognized importance as essential functional components of properly functioning natural ecosystems. This interest has promoted promulgation of an array of state/federal laws and regulations designed to protect, conserve and/or increase wildlife populations that have greatly influenced the mode of natural resource management on both public and private lands over the past several decades. In consequence, wildlife issues and attendant regulatory requirements have become extraordinarily important to the practice of forestry, livestock grazing, agriculture and other forms of natural resource use.

Improved understanding of nutritional and behavioral ecology of wildlife species, and how such ecology influences habitat requirements, is of critical importance to developing strategies for management of wildlife populations, and for integrating management of other resources/resource values with wildlife concerns in a manner that does not negatively impact wildlife. Our program in this area therefore incorporates both basic research on wildlife species and population characteristics and attributes, and research on the application of fundamental knowledge for improved on-the-ground management. Species of emphasis for work in this program area include both mammalian carnivores (e.g., grizzly and black bears) and mammalian herbivores (e.g., caribou, elk, deer, beaver).

Key components in this NRS Program Area are research thrusts in four broad areas:

1. Fundamental research on nutritional requirements of wildlife species, and habitat/population management implications
2. Fundamental research on feeding/foraging ecology and diet characteristics of wildlife species, and habitat/management implications
3. Fundamental and applied research on population and habitat ecology of sensitive (including threatened/endangered) wildlife species
4. Applied research on management strategies and practices to conserve wildlife species, solve wildlife-related managerial problems and promote concurrent management for wildlife and other natural resource values

Performance Goals

1. Expand basic knowledge on nutritional requirements, feeding/foraging ecology and habitat/population ecology of wild terrestrial carnivores and herbivores
2. Develop improved wildlife population and habitat management strategies and techniques to conserve/preserve existing populations of important wildlife species; restore or increase depleted populations of important wildlife species; resolve specific wildlife-related natural resource management problems; and/or promote co-existence of wildlife and other natural resource values in terrestrial ecosystems
3. Effectively disseminate research-derived, basic/applied knowledge to both the scientific

community and to potential users groups and other constituents

Internal and External Linkages

This program area will involve scientists and facilities at the main (Pullman) campus, and may involve collaboration between scientists in NRS and other WSU units (e.g., Zoology). NRS scientists in this program area may work in direct collaboration with colleagues in the Washington Cooperative Fish and Wildlife Research Unit (University of Washington), the USFS Pacific Northwest Research Station (Wenatchee Lab), and the Northern Rockies Cooperative Ecosystem Studies Unit (University of Montana). Outreach/extension efforts may be conducted through the NRS/WSU statewide forestry and range management extension team. Research funding and other forms of support/collaboration will be maintained and hopefully expanded with a number of relevant state and federal agencies, most notably the Washington Department of Fish and Wildlife and the USDI Fish and Wildlife Service.

Target Audiences

The primary users of information generated by this program will be various state and federal land/resource management and regulatory agencies, public interest/action groups focusing upon wildlife preservation and conservation, and private landowners (both industrial and non-industrial) with either/both a commitment to or mandate for wildlife conservation and management.

Evaluation Framework

Evaluation will be based upon a dual consideration of how well the research advances basic scientific understanding (i.e., is recognized/utilized by the scientific community), and how well research outcomes serve the needs of various public/private clientele sectors who have a stake or interest in wildlife conservation and management. The proposed evaluation criteria (i.e., Output and Outcome Indicators) include both quantitative and qualitative parameters.

Output Indicators

1. Publications in peer-reviewed scientific outlets
1. Publications targeted to user, public and/or other clientele groups
2. Relevant technologies, methodologies and/or management techniques/systems developed
3. Presentations to scientific, public and/or other clientele audiences

Outcome Indicators

1. Degree of reference, use and other forms of recognition of research outputs by the peer scientific community
2. Degree of adoption or use of information, technologies, methodologies and/or management practices developed through research by scientific peers and/or clientele
3. Degree to which recognition/use of outputs of research stimulates maintained or increased external support for further research

Program Duration

Long-term, with periodic (ca. 5 year) evaluations and potential redirections of major, specific projects.

Allocated Resources

Faculty & Staff FTE	1.03
Funding	
Hatch	\$415
Hatch Multistate	
Fed. Res. Grants	\$2,363
State Approp.	\$63,373
Other Grants	\$25,574

C. Program Area – Rangeland Ecology and Management

Program Area Objective

RPA 307 - Annual Production Management Systems¹⁴¹

RPA 123 - Management of Forest Resources

Proj. 0291 Grazing Influences on Seral Forest Ecosystem Processes

Issues and Key Program Components

Rangeland ecosystems (non-forested shrub and grasslands + grazeable woodlands) cover nearly one-third of the land base of Washington, and hence comprise both an important resource base for the state's livestock industry and (by virtue of extensiveness and distribution) an extremely important source for a wide array of environmental, social and aesthetic values. Significant concerns exist on the aggregate ecological health and productivity of Washington's rangelands that impact both the level and sustainability of the diversity of economic, environmental and social values currently/potentially realizable from such ecosystems. Important questions surround a number of currently pressing issues, including invasive species (i.e., weeds) and otherwise undesirable composition/productivity of plant communities; impacts of livestock grazing on riparian zones/fisheries and other aspects of watershed function; and interactions between livestock grazing and other aspects of rangeland use/value (e.g., wildlife, forestry, biodiversity). It is important that the scientific community respond to such issues to comprehensively address natural resource needs of the State. This program area does so through research emphasis both on basic conceptual foundations of range management and livestock management systems, and on basic and applied research focusing upon understanding rangeland ecosystem structure, function and response to varied managerial inputs.

Key components in this NRS Program Area are research thrusts in two broad areas:

1. Fundamental scholarship to review, synthesize and evaluate past/current principles and concepts of range and livestock management, and to propose

¹⁴¹ Proj. 0165, Sustainability and Conceptuality of Range Livestock Systems, has terminated and, therefore, removed from the POW.

new and/or improved principles/concepts needed to advance the scientific underpinnings of rangeland management

2. Applied research designed to describe the response of rangeland ecosystem conditions and processes to managerial and environmental variables, and hence to develop improved range management strategies and practices

Performance Goals

1. Development of new or refined concepts and fundamental principles for range management science
2. Expansion of basic knowledge on the structure and functional processes of rangeland ecosystems, and their responses to managerial and environmental perturbations
3. Development of improved rangeland management strategies, methods and techniques that address needs of rangeland users, sustainability of multiple values of/from rangeland ecosystems, and maintenance/improvement of ecological conditions
4. Effective dissemination of research-derived, basic/applied knowledge to both the scientific community and to potential users groups and other constituencies

Internal and External Linkages

This program area will involve scientists and facilities at the main (Pullman) campus, and may involve collaboration between scientists in NRS and other WSU units (e.g., Animal Science). NRS scientists in this program area may work in direct collaboration with colleagues at the University of Idaho, Oregon State University, and in the USFS Pacific Northwest Research Station (La Grande and/or Wenatchee Labs). Outreach/extension efforts will be conducted through the NRS range management extension team. Research funding and other forms of support/collaboration may be expanded with a number of relevant state and federal agencies, most notably the Washington Department of Natural Resources, USDA Forest Service, USDA Natural Resource Conservation Service, and the USDI Bureau of Land Management.

Target Audiences

The primary users of information generated by this program will be various state and federal land/resource management and regulatory agencies, private landowners (particularly the ranching sector), and public interest/action groups focusing upon conservation and management of rangeland resources.

Evaluation Framework

Evaluation will be based upon a dual consideration of how well the research advances basic scientific understanding (i.e., is recognized/utilized by the scientific community), and how well research outcomes serve the needs of various public/private clientele sectors who have a stake or interest in rangeland conservation and management. The proposed evaluation criteria (i.e., Output and Outcome Indicators) include both quantitative and qualitative parameters.

Output Indicators

1. Publications in peer-reviewed scientific outlets

2. Publications targeted to user, public and/or other clientele groups
3. Relevant technologies, methodologies and/or management techniques/systems developed
4. Presentations to scientific, public and/or other clientele audiences

Outcome Indicators

1. Degree of reference, use and other forms of recognition of research outputs by the peer scientific community
2. Degree of adoption or use of information, technologies, methodologies and/or management practices developed through research by scientific peers and/or clientele
3. Degree to which recognition/use of outputs of research stimulates maintained or increased external support for further research

Program Duration

Long-term, with periodic (ca. 5 year) evaluations and potential redirections of major, specific projects.

Allocated Resources

Faculty & Staff FTE	0.25
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	
State Approp.	(\$3,934)
Other Grants	\$1,258

OFF-CAMPUS RESEARCH AND EXTENSION CENTERS/UNITS

WSU-Puyallup Research and Extension Center

A.Center Program Area -- Environmental quality

Center Program Goal -- Environmentally beneficial technologies and management practices for plant and animal production

Center Program Objectives

RPA 102 - Soil, Plant, Water Nutrient Relationships

- Proj. 0256 Soil Conditions, Crop Productivity and Ground Water Quality in Some Western Washington Soils
- Proj. 0308 Characteristics of Calcareous Sands Used for Turfgrass Root Zones
- Proj. 0689 Environmental Improvement of Western Washington Agricultural Lands Utilizing Forage Grasses and Silage Corn

Proj. 0690 Chemistry and Bioavailability of Waste Constituents in Soils
Proj. 0722 Beneficial Use of Organic Amendments in Agricultural and Urban
Soils

RPA 202 - Plant Genetic Resources and Biodiversity¹⁴²

Proj. 0314 Wine Grape Research in a Cool Maritime Climate

RPA 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants¹⁴³

Proj. 0285 Environmental/Cultural Factors on Water Stress Resistance/Growth/
Cold Hardiness of Landscape Plants
Proj. 0314 Wine Grape Research in a Cool Maritime Climate

RPA 204 - Plant Product Quality and Utilization (Preharvest)¹⁴⁴

Proj. 0217 Cultural and Cultivar Studies for Fruit Production in a Maritime
Climate
Proj. 0314 Wine Grape Research in a Cool Maritime Climate

RPA 205 - Plant Production Management Systems¹⁴⁵

RPA 211 - Insects, Mites, and Other Arthropods Affecting Plants^{146, 147}

Proj. 0327 Ecological and Toxicological Approaches to Estimate Effects of
Pesticides to Nontarget Organisms

RPA 213 - Weeds Affecting Plants¹⁴⁸

Proj. 0297 Weed Interference in and Herbicide Effects on Western Washington Crops
Proj. 0639 Weed Control in Cranberries

RPA 216 - Integrated Pest Management Systems¹⁴⁹

Proj. 0327 Ecological and Toxicological Approaches to Estimate Effects of
Pesticides to Nontarget Organisms
Proj. 4741 Low Risk Tactics for Cranberry Insect and Disease Management in the
Pacific Northwest

RPA 302 - Nutrient Utilization in Animals

¹⁴² RPA 202 and Proj. 0314 have been added to the POW.

¹⁴³ Proj. 0314 has been added to the POW.

¹⁴⁴ RPA 204, Proj. 0217, and Proj. 0314 have been added to the POW.

¹⁴⁵ Proj. 0907A, Evaluation of Integrated Turfgrass Management Techniques, has terminated and, therefore, been removed from the POW.

¹⁴⁶ Proj. 0187, Developing a New Approach to Evaluate the Ecotoxicity of Pesticides to Nontarget Arthropods, has terminated and, therefore, been removed from the POW.

¹⁴⁷ Proj. 0327 has been added to the POW.

¹⁴⁸ Proj. 0297 has been added to the POW. 122

¹⁴⁹ RPA 216, Proj. 0327, and Proj. 4741 have been added to the POW.

Proj. 0154 Environmental and Economic Impacts of Nutrient Flows in Dairy Forage Systems

Statement of Issue(s)

Increasing population pressures and knowledge of human impacts has increased tremendously the need for improved, environmentally sound production practices. Growers and consumers benefit from safer, economically practical production practices that increase the quality and safety of foods and other agricultural products.

Performance Goal(s)

4. Develop better understanding of environmental impacts of pesticides on nontarget organisms
5. Develop improved soil management practices
6. Develop management practices of turf and landscape plants that minimize water use and other inputs
7. Develop environmentally sound nutrient management practices for dairies

Key Program Components

1. Develop new techniques for assessing environmental impact of pesticides on non-target organisms
2. Evaluate biosolids and other organic amendments for soil management
3. Assess plant varieties and management procedures to minimize water, fertilizer, and pesticide inputs
3. Develop conceptual framework and research-derived data on nutrient flows in dairies

Internal and External Linkages

Scientists routinely collaborate with others within the institution and at others, particularly throughout the Oregon and British Columbia west of the Cascades

Target Audience(s)

Producers, home owners, and decision-makers in government and industry

Evaluation Framework

Development of improved practices

Usefulness of concepts and data to decision-makers

Output Indicators

Numbers and quality of refereed publications

Numbers and new characteristics of new plant varieties

Outcome Indicators

Acceptance of new varieties by growers

Usefulness of economic data to decision makers

Program Duration

The program has both short and long term components.

Allocated Resources

Faculty & Staff FTE	18.24
Funding	
Hatch	\$196,481
Hatch Multistate	\$106,856
Fed. Res. Grants	\$43,870
State Approp.	\$506,702
Other Grants	\$288,014

WSU Vancouver Research and Extension Unit

A. Unit Research Program -- Pest Management of Horticultural Crops

Unit Goal

Establish and maintain research support for culture and management of horticultural crops in the Pacific Northwest, especially small fruit production and environmental horticulture.

Unit Objective

RPA 211 - Insects, Mites, and Other Arthropods Affecting Plants¹⁵⁰

Identify and study new and existing pests of small fruit and nursery crops, understand their biology and ecology.

Evaluate effectiveness of chemical and biological control agents.

Study impact of small fruit pests on plant physiology and productivity.

Study impact of timing and methodologies for cultural practices such as spraying and plant management on pest dynamics.

Collect and evaluate *Fragaria* and *Rubus* germplasm internationally to acquire genetic base for pest resistance and tolerance.

Breed and identify red raspberry and strawberry genotypes resistant and tolerant of pests.

¹⁵⁰ Proj. 0783, Growth, Development and Physiology¹²⁴ of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

RPA 212 - Diseases and Nematodes Affecting Plants¹⁵¹

Understand interaction between root diseases and plant physiology, growth and productivity.

Assess role of strains of Vesicular-Arbuscular (VA) mycorrhizae in protection from root diseases in nursery crops.

Gain better understanding of the interaction among root diseases and winter injury/arthropod pest susceptibility in red raspberry.

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

Proj. 0258 Effect of Cultural Practices on Plant Root Health and Establishment of Landscape Plants

RPA 215 - Biological Control of Pests Affecting Plants

Identify and study natural enemies of horticultural crop pests in the Pacific Northwest.

Explore, collect (internationally), evaluate and maintain potential predators of arthropod pests.

Facilitate mass rearing of natural enemies of arthropod pests, monitor use.

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

RPA 216 - Integrated Pest Management Systems^{152, 153}

Understand life cycles and population dynamics of pest/prey interactions.

Study effectiveness of large-scale implementation of IPM practices through on-farm trials.

Assess interactions of conventional and contemporary pest management systems on crop productivity.

Refine sampling and threshold determination protocols for more effective implementation.

Strengthen applied research and education efforts to develop systemic reform of pest control strategies in small fruit and environmental horticulture industries.

Proj. 0270 Biology and Control of Arthropod Pests of Berry Crops

¹⁵¹ Proj. 0783, Growth, Development and Physiology of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

¹⁵² Proj. 0783, Growth, Development and Physiology of Small Fruit Crops, has terminated and, therefore, been removed from the POW.

¹⁵³ Proj. 0375 has been added to the POW.

Proj. 0375 Alternative Cropping Systems

Statement of Issues

Small fruit and nursery crop production both have world-leading centers of production in the Pacific Northwest. Arthropod and disease pests of small fruit and nursery crops are serious problems in that these high value horticultural crops can suffer significant economic losses due to rapidly developing infestations for which few control measures may be available due to developed pest resistance or regulatory actions (chemical pesticides), logistics of large scale implementation (biological methods) and lack of grower acceptance of new methods.

Understanding the pests as well as the prey/cultural practices used to combat them and their impact on the plant are important elements of this work. The collection and exploitation of plant material, which will offer genetic solutions to pest issues in horticultural crops, is essential to ongoing resistance/tolerance breeding efforts. The cultivation of these crops are also greatly impacted by the potential or perceived environmental impact they have on natural systems, thus on-farm research and grower education are important to effecting change.

Performance Goals

4. Increase our understanding of the biology and ecology of pests, their predators and the influence of cultural management on the growth and productivity of crops.
5. Continue the successful development of predator/prey strategies, germplasm enhancement and evaluation and implementation of large-scale integrated pest management systems.
6. Use increased knowledge base to educate industry and to establish systemic reform of traditional pest control strategies through greater use of on-farm trials, enhanced monitoring of pests, and facilitation of large-scale implementation of IPM/biological control strategies.

Key Program Components

1. Explore cultivated and native habitats in the Pacific Northwest and throughout the world for enemies of pests as well as plant germplasm, which will provide biological and genetic strategies for pest control, and productive cultivation of small fruit and nursery crops.
2. Through evaluation and facilitation of rearing (insectaries) and propagation (repositories), provide researchers and growers with new, potential biological agents and enhanced germplasm.
3. Evaluate new chemicals and biological control agents for use and registration.
4. Provide new scientific information on the biology, ecology, and plant impacts of pests and new pest control and plant management strategies.
5. On-farm research and education for systemic reform of current industry practices and adoption of new practices, which are effective biologically, cost effective and protect the environment.

Internal and External Linkages

All of the research described herein is interdisciplinary by its nature, and those relationships have been built within WSU, other institutions regionally, nationally and internationally. The work in these programs has a strong international component. Strong partnerships with regional university

and USDA programs have eliminated duplication of effort, matched resources and have leveraged new programs and resources through cooperative efforts with industry. Industry input and dialogue in setting research priorities and addressing needs continues to increase.

Target Audiences

The primary target of the applied research accomplished in these programs is the industries served - the small fruit and environmental horticulture industries. At different levels, from farm owners and managers, to crop consultants, to processors and wholesale\retail businesses, this information is changing the way crops are cultivated, utilized, marketed and perceived by the public. The primary targets of mission-oriented and basic biological research in these programs are other scientists, company field personnel, Cooperative Extension personnel, and government agencies who utilize, monitor, and disseminate information for public education and decision making purposes.

Evaluation Framework

Traditional indices for evaluation will continue in terms of results published in various arenas whether for scientific or clientele use. However, new forms of dissemination and interaction with scientific and industry clientele will enhance outreach in form, function and ease of distribution as integrated into ongoing programs: website interaction, email listserves, electronic publication of disseminated information, timely provision of information for pest management decisions, etc. Strong industry relations and communication will allow for significant feedback in terms of effectiveness of information and delivery.

Output Indicators

1. New methods, predators, germplasm and information cycling through research programs and dissemination channels.
2. Documented success of new methods in on-farm\on-nursery trials.
3. Attendance of growers at field days, seminars and public events where new information is presented.
4. Wide array of disseminated information in various forms for various audiences, tabulated access records.
5. Better understanding of biological and ecological bases for research decisions as evidenced by regular assessment\redirection of program efforts.

Outcome Indicators

1. Changes in grower practices on a large scale, adoption through understanding.
2. Enhanced communication with industry through new venues of dialogue, both synchronous and asynchronous.
3. Reduction in the use of chemical pesticides with grower acceptance of alternatives.
4. Enhanced crop productivity, quality and value.
5. Stable production and quality of crops.
6. Better public understanding of value of agriculture and land stewardship.

Program Duration

Short-term projects are mostly related to the evaluation and registration of chemicals and methods which may become readily available to growers, and these projects can last 2-3 years with use or

adoption to follow approval processes, but interim registration and small scale use are supported by this research as well and are critical for these industries. Intermediate length projects involve elements such as identification of a new insect pest or predator, understanding key elements of its biology and ecology, gathering foundational information on how plants are impacted by pests and practices, and exploring/collecting/evaluating new plant germplasm or potential predators. These projects often range between 3-5 years in length. Long term research programs requiring evaluation of breeding selections, understanding of basic biology and ecology of insects, plants or whole systems can take 7-10 years or longer in cycles.

Allocated Resources

Resources are allocated under Goal 1.

WSU Wenatchee Tree Fruit Research and Extension Center

A. Center Research Program -- Pest management of insects

Center Goal

Establish environmentally sound, profitable and sustainable practices through the transfer of knowledge and technology

Departmental Objective

RPA 102 - Soil, Plant, Water Nutrient Relationships¹⁵⁴

Proj. 0954 Biogeochemistry and Management of Salts and Potentially Toxic Trace Elements in Arid-zone Soils, Sediments and Waters

RPA 133 - Pollution Prevention and Mitigation¹⁵⁵

Proj. 0954 Biogeochemistry and Management of Salts and Potentially Toxic Trace Elements in Arid-zone Soils, Sediments and Waters

RPA 211 - Insects, mites, and other arthropods affecting plants^{156, 157}

Identify new pests attacking tree fruit crops and investigate their biology and ecology.

Develop novel control tactics to mitigate the impact of pest on crops. Use predictive models to make control tactics and management activities more efficient.

Proj. 0225 Management of Arthropod Pests of Pear
Proj. 0386 Secondary Pests of Deciduous Pome Fruits

¹⁵⁴ RPA 102 and Proj. 0954 have been added to the POW.

¹⁵⁵ RPA 133 and Proj. 0954 have been added to the POW.

¹⁵⁶ Proj. 0386, Proj. 3279 and Proj. 4089 have been added to the POW.

¹⁵⁷ Proj. 0801, Secondary Pests of Deciduous Pome Fruits, has terminated and, therefore, been removed from the POW.

- Proj. 1090 Pest Management of Direct Pests of Apple in Washington Tree Fruit Orchards
- Proj. 3279 Integrated Control of Apple Replant Disease and Impact on Microbial Communities
- Proj. 4089 Building a Multi-Tactic Pheromone-Based Pest Management System in Western Orchards

RPA 215 - Biological control of pests affecting plants¹⁵⁸

Conserve and augment natural enemies of pests by using insecticides that have reduced or no impact on these organisms.

Alter the environment of orchards to provide alternate food sources or refuges for natural enemies.

- Proj. 0225 Management of Arthropod Pests of Pear
- Proj. 1090 Pest Management of Direct Pests of Apple in Washington Tree Fruit Orchards

RPA 216 - Integrated pest management systems^{159, 160}

Develop monitoring systems and action thresholds for key pests.

Organize an information delivery system that makes information on pests and biological control agents and control tactics readily available over computer networks such as the internet.

Develop educational programs for place-bound crop consultants that will provide them with the depth of knowledge necessary to implement new information intensive IPM systems.

- Proj. 0225 Management of Arthropod Pests of Pear
- Proj. 1090 Pest Management of Direct Pests of Apple in Washington Tree Fruit Orchards
- Proj. 3279 Integrated Control of Apple Replant Disease and Impact on Microbial Communities
- Proj. 4089 Building a Multi-Tactic Pheromone-Based Pest Management System in Western Orchards

Statement of Issue(s)

Insect and mite pests of tree fruit crops are an annual threat to destroy or reduce the quality of the crop. Nearly half of all insecticide applications to orchards are for secondary pests. Many of these insecticide applications are induced by disruption of biological controls. High quality standards for fruit produce require pest management tactics that provide high levels of crop protection. Faced with increasing pest resistance to “traditional” broad-spectrum pesticides and new

¹⁵⁸ Proj. 0801, Secondary Pests of Deciduous Pome Fruits, has terminated and, therefore, been removed from the POW.

¹⁵⁹ Proj. 3279 and Proj. 4089 have been added to the POW.

¹⁶⁰ Proj. 0801, Secondary Pests of Deciduous Pome Fruits, has terminated and, therefore, been removed from the POW.

regulations limiting use or availability of these products, the fruit industry research commission has identified new alternatives for pest control as a high priority.

Performance Goal(s)

1. Increase our knowledge on the biology and ecology of pests and natural enemies which would support a more biologically based management system.
2. Conserve and augment natural enemies of tree fruit pests as a means to reduce dependence on broad-spectrum pesticides. Evaluate the effects of new pesticides on biological control agents to assess direct and sublethal effects. Identify new biological control agents discovered inhabiting the orchard ecosystem.
3. Evaluate pest control tactics, such as mating disruption or biological pesticides, that could reduce pesticide residue levels of traditional broad-spectrum pesticides, especially those identified as being safe to humans and the environment.
4. Determine base-line information on pest susceptibility to new insecticides and develop a program for tracking resistance development and resistance management strategies to prevent resistance development or slow its progress.

Key Program Component(s)

1. Use life table methods to examine the life history of pests and natural enemies. Rear insects in controlled conditions to establish developmental thresholds.
2. Sample orchard and native habitats to identify hosts used by biological control agents. Expose biological control agents to pesticides to establish dose-mortality relationships and determine sublethal effects.
3. Assess the impact of pest densities on fruit trees using whole-tree respiration methods (secondary pests) or direct measures of crop losses (direct pests).
4. Determine the efficacy of mating disruption on several species of moth pests.
5. Design different cover and alternative cropping systems that promote orchard plant diversity with the goal of stabilizing pest densities below injury thresholds.

Internal and External Linkages

The Tree Fruit Extension Team will be involved in cooperative research projects, especially as they approach implementation at the grower level. Cooperative research projects funded from federal, state and private sources will be sought in conjunction with USDA-ARS and entomologists from other land grant institutions in the western US. Interdisciplinary teams within WSU will be formed to determine the impact of increasing orchard plant diversity through redesign of the cover crop and surrounding orchard vegetation.

Target Audiences

Large and small fruit growers are the primary target audience; however, professional crop consultants or farm managers make many or most pest management decisions or at least make key recommendations to the growers. Influencing decisions of crop consultants is one of the most important means of reaching the primary target audience with new research results. Research is designed to meet the needs of conventional and organic farmers and to promote the sustainable nature of fruit production systems. Farm workers also represent an indirect target audience because many of the programs that are developed most directly impact their quality of life.

Evaluation Framework

Program evaluation will be based in part on public access to new information in the form of popular articles, oral presentations at meetings and workshops, internet delivery formats, and personal computer-assisted learning and decision-based systems. Changes in growers' practices, both qualitative and quantitative, will be evaluated through periodic surveys that track pesticide use and other pest management tactics and practices.

Output Indicators

1. Updates or revisions to old information on pest or natural enemy biology.
2. New computer-assisted tools for predicting pest development or predator-prey interactions.
3. New insects or natural enemies under research programs.
4. Tabulated area or growers adopting a new pest control tactic or management tool.
5. Assessments of the number of broad-spectrum insecticides used in orchards under different programs.
6. Measures of natural enemy densities or frequency of successful biological control of pests in orchards.
7. Changes in pest susceptibility to new insecticides over time.

Outcome Indicators

1. Percentage of growers (acres) adopting full use of IPM tactics.
2. Reduced use of highly toxic insecticides for pest control.
3. Fewer instances of pest outbreaks associated with the disruption of biological control agents.
4. Residue levels of toxic pesticides on fruit are lower.
5. Longevity of efficacy of new insecticides introduced into the fruit pest management system.

Program Duration

Developing new information on the biology and ecology of pests and natural enemies is an ongoing process. Generally, 3 to 5 years are required to develop a database on a single insect to fully understand elements of their life histories that relate to management. Pesticide effects on pests and natural enemies are more short-term projects, requiring 2 to 3 years to gather data on one pesticide. Studies to conserve and augment biological control agents and to modify the orchard ecology require long-term, 4 to 10 year, time frames.

Allocated Resources --

Faculty and staff FTEs	12.95
Funding	
Hatch	\$1,515
Hatch Multistate	
Fed. Res. Grants	\$29,487
State Approp.	\$282,655
Other Grants	\$669,745

B. Center Research Program -- Pest management of diseases

Center Goal

Establish environmentally sound, profitable and sustainable practices through the transfer of knowledge and technology

Departmental Objective

RPA 212 - Diseases and nematodes affecting plants

Identify new pests attacking tree fruit crops and investigate their biology and ecology.

Develop novel control tactics to mitigate the impact of pests on crops. Use predictive models to make control tactics and management activities more efficient.

Proj. 0795 Etiology, Epidemiology and Control of Fungal and Bacterial Diseases of Tree Fruits

RPA 216 - Integrated pest management systems

Develop models to predict infection periods and development of diseases.

Organize an information delivery system that makes information on diseases and control tactics readily available over the internet.

Develop intensive educational programs for place-bound crop consultants that will provide them with the depth of knowledge necessary to manage diseases without traditional chemical controls.

Proj. 0795 Etiology, Epidemiology and Control of Fungal and Bacterial Diseases of Tree Fruits

Statement of Issue(s)

Increase in powdery mildew incidence and severity due to: 1) changing cultivar composition, 2) changing cultural practices, 3) fungicide resistance and 4) loss of fungicides

Performance Goal(s)

1. Increase our knowledge on the biology and epidemiology of plant diseases and competitors which would support a more biologically based management system.
2. Evaluate disease control tactics that would reduce control costs for growers.
3. Develop predictive models useful in management of plant diseases.

Key Program Component(s)

1. Understanding of disease epidemiology.
2. Development of fungicide resistance management programs.
3. Develop alternative controls for diseases.

Internal and External Linkages

The Tree Fruit Extension Team will be involved in cooperative research projects, especially as they approach implementation at the grower level. Cooperative research projects with plant pathologists at other land grant institutions in the western US. Interdisciplinary projects within

WSU, especially entomology and horticulture.

Target Audiences

Large and small fruit growers are the primary target audience; however, professional crop consultants or farm managers make many or most pest management decisions or at least make key recommendations to the growers. Research is designed to meet the needs of conventional and organic farmers and to promote the sustainable nature of fruit production systems. Farm workers also represent an indirect target audience because many of the programs that are developed most directly impact their quality of life.

Evaluation Framework

Program evaluation will be based in part on public access to new information, that is, number of popular articles, oral presentations at meetings and workshops, internet delivery formats, and personal computer-assisted learning and decision-based systems. Changes in growers' practices, both qualitative and quantitative, will be evaluated through periodic surveys that track pesticide use and other pest management tactics and practices.

Output Indicators

1. Updates or revisions to old information on disease epidemiology.
2. New predicting tools for disease development.
3. Tabulated area or number of growers adopting new disease control tactics or management tools.
4. Assessments of the number of fungicides used in orchards under different management programs.
5. Changes in pest susceptibility to new fungicides over time.

Outcome Indicators

1. Percentage of growers (acres) adopting new disease management tactics.
2. Fewer instances of crop losses to disease organisms.
3. Longevity of efficacy of new fungicides introduced into the fruit pest management system.

Program Duration

Developing new information on the epidemiology of disease organisms is an ongoing process. Generally 3 to 5 years are required to develop a database on a single disease that relates to management. Fungicide efficacy tests are more short-term projects requiring 2 to 3 years to gather data on one pesticide.

Allocated Resources

Faculty & Staff FTE	0.15
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	
State Approp.	\$9,390

Other Grants	\$1,299
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CSREES GOAL 5

ENHANCED ECONOMIC OPPORTUNITY AND QUALITY OF LIFE FOR AMERICANS

WSU PROGRAM PLANNING UNITS

Department of Horticulture and Landscape Architecture

- A. Departmental Research Program IV** – Environmental horticulture and the effects of plants on people

Departmental Goal

Departmental Objectives

RPA 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plant¹⁶¹

RPA 802 - Human Development and Family Well-Being

Investigate the effects that plants have on human well-being in several settings.

Investigate the influence of human experience in the development of perceptions related to urban landscapes.

Develop further understanding of the relationships between physical environments and human behavior.

Proj. 0695 The Impacts of Plants on People

Statement of Issues

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. 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 total 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

¹⁶¹ RPA 203 moved to Goal 1 in the POW.

the state of Oregon. These numbers are indicative of the high value that society places on aesthetically pleasing landscapes.

The influence plants have on physiological human well-being has been moderately well 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 is needed to develop a more thorough understanding of the benefits of plants to human well-being.

Performance Goals

1. Identify cultural factors that affect plant root health.
2. Identify cultural practices that affect water stress and cold hardiness in landscape plants.
3. Generate new information about the physiological and psychological effects of plants on people.
4. Create design guidelines for use of plant materials to influence human behavior.

Key Program Components

1. Develop research that is directed at identification of factors affecting plant root health.
2. Continue existing research project addressing water stress and cold hardiness in landscape plants.
3. Continue with research focusing on the development of an understanding of the relationships between plants and people.
4. Implement a new research program directed at investigating the relationship between plants and other design elements and human behavior in urban parks.

Internal and External Linkages

The research programs that make up this program all involve collaboration among faculty from several departments at WSU. Those projects focusing on environmental factors affecting plant growth and development involve collaboration with scientists in Botany, Crop and Soil Sciences, and Natural Resource Sciences. The projects focusing on plant/people relationships involve scientists in Psychology, Sociology, and Landscape Architecture. These projects also involve collaboration with external constituencies in the landscape horticulture industry, and professionals in the medical and criminal justice disciplines.

Target Audiences

1. The landscape horticulture industry of Washington and other northwestern states.
2. Scientific societies and professional organizations.
3. Landscape architects, environmental designers, city planners, and community and urban forestry professionals.
4. Urban open spaces and land management agencies.

5. Health care professionals and others concerned with the impacts of plants on people.
6. Law enforcement and crime prevention professionals.
7. The general public.

Evaluation Framework

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, health care professionals, and the criminal justice community. It will also be evaluated on how it has contributed to the body of knowledge related to the impact of plants on people science. Evaluation criteria will be quantitative as well as qualitative. Quantitative criteria will include number of publications in peer reviewed journals as well as trade journals and popular periodicals, and improvements in management strategies for landscape plants. Qualitative criteria will relate to the acceptance of recommended programs and design guidelines that address people/plant interactions.

Output Indicators

1. Number of publications in peer reviewed journals, trade journals, and popular periodicals.
2. Management strategies developed to address the establishment and production of landscape plants.
3. Design guidelines developed for management of landscape elements in public open spaces.
4. Guidelines and recommendations developed for the use of plants to influence human health and well-being.

Outcome Indicators

1. Acceptance by the landscape horticulture industry of newly developed strategies for plant establishment and production.
2. Extent to which recommended design guidelines are implemented by open space and land management agencies.
3. Acceptance by health care professionals and others involved with human health and well being.

Program Duration

There is much to be learned about this subject, and therefore this program is expected to be of long-term duration. Individual projects that contribute to the program are expected to be of short to medium duration, with new projects evolving as more is learned about the subject, or as opportunities arise.

Allocated Resources

Faculty & Staff FTE	0.93
Funding	
Hatch	\$3,110
Hatch Multistate	
Fed. Res. Grants	\$3,321
State Approp.	\$51,020
Other Grants	

Department of Natural Resource Sciences

A. Program Area -- Social and economic dimensions of natural resource sciences

Program Area Objectives

RPA 605 - Natural Resources and Environmental Economics^{162, 163}

Proj. 0312 Contribution of an Expanded Special Forest Products Industry to Community and Economic Development

RPA 803 - Sociological and Technological Changes Affecting Individuals, Families and Communities

Proj. 0982 Natural Resource Based Communities in the Era of Globalization

Issues and Key Program Components

Natural resources provide a wide array of economic, social, environmental and aesthetic values to society that, in aggregate, contribute largely to the overall social well being of our state, nation and world. We live in an age of often-competing values of and from natural resources, wherein values/interests of different segments of society are often in real - or perceived - conflict with those of others (e.g., environmental vs. economic values of natural resources). Significant policy and management questions have thus arisen over appropriate balance afforded to different resource values, and over the concurrent sustainability of multiple values ranging from commodity to environmental to aesthetic/spiritual. It becomes essential to integrate socioeconomic with ecological research to derive answers to such complex questions.

The approach of this NRS program area on social and economic dimensions therefore is to address economic, social and policy issues of direct relevance to natural resources in a fashion that incorporates socioeconomic concerns (and input from social science fields) with those of the various fields of applied ecology relevant to resource management. The former includes two inter-related foci of research on economic and sociologic aspects of natural resource values and uses. With these foci, key components are research thrusts in five broad areas:

1. Fundamental research on the nature and importance of natural resource-based economies in Washington and elsewhere in the region
2. Fundamental research on the nature of social structures, values, relationships, processes and policies in relation to and as dependent upon natural resources
3. Applied research on development of refined or new economic potentials based upon natural resources
4. Basic and applied research on socioeconomic adaptability to change in natural resource policies, and means to promote such adaptability
5. Applied research on development of means to resolve social conflict and enhance sustainability and compatibility of socioeconomic and ecological/environmental values of and from natural resources.

¹⁶² Proj. 0164, Contribution of an Expanded Special Forest Products Industry to Community and Economic Development, has terminated and, therefore, been removed from the POW.

¹⁶³ Proj. 0312 has been added to the POW.

Performance Goals

1. Expand basic knowledge on social and economic dimensions of natural resource values and management in Washington and elsewhere in the region.
2. Develop information promoting new and/or improved means to attain sustainable and environmentally/socially acceptable economic benefit from natural resources
3. Develop strategies and approaches to increase adaptability to changes in resource management and policies in resource-dependent communities/sectors of society
4. Develop and demonstrate new and/or refined approaches for conflict resolution on natural resource issues
5. Effective dissemination of research-derived, basic/applied knowledge to both the scientific community and to potential user groups and other constituents

Internal and External Linkages

This program area will involve scientists and facilities at the main (Pullman) campus, and may involve collaboration between scientists in NRS and a number of other WSU units (e.g., Agricultural Economics, Rural Sociology, Sociology, Political Science). NRS scientists in this program area have established linkages and may work in direct collaboration with colleagues at several other regional universities (e.g., Idaho, Oregon State, Washington, Montana, Utah State), the USFS Pacific Northwest Research Station, and the Northern Rockies Cooperative Ecosystem Studies Unit (University of Montana). Outreach/extension efforts may be conducted through the NRS/WSU statewide forestry and range management extension team. Research funding and other forms of support/cooperation will be maintained and hopefully expanded with a number of relevant state and federal agencies.

Target Audiences

The primary users of information generated by this program will be various state and federal land/resource management and regulatory agencies, public advisory groups to those agencies, local governments and NGO's, public interest/action groups, and private landowners (both industrial and non-industrial) in both the forestry and range management sectors.

Evaluation Framework

Evaluation will be based upon a dual consideration of how well the research advances basic scientific understanding (i.e., is recognized/utilized by the scientific community), and how well research outcomes serve the needs of various public/private clientele sectors who have a stake or interest in social and economic aspects of natural resources. The proposed evaluation criteria (i.e., Output and Outcome Indicators) include both quantitative and qualitative parameters.

Output Indicators

1. Publications in peer-reviewed scientific outlets
2. Publications targeted to user, public and/or other clientele groups

3. Relevant technologies, products, methodologies and/or management approaches/processes developed
4. Presentations to scientific, public and/or other clientele audiences

Outcome Indicators

1. Degree of reference, use and other forms of recognition of research outputs by the peer scientific community
2. Degree of adoption or use of information, products, methodologies and/or management approaches/processes developed through research by scientific peers and/or clientele
3. Degree to which recognition/use of outputs of research stimulates maintained or increased external support for further research

Program Duration

Long-term, with periodic (ca. 5 year) evaluations and potential redirections of major, specific projects.

Allocated Resources

Faculty & Staff FTE	1.08
Funding	
Hatch	
Hatch Multistate	
Fed. Res. Grants	\$38,027
State Approp.	
Other Grants	

Department of Rural Sociology

- A. Department Research Program** -- Development of knowledge to help individuals, families and communities participate in and guide their own change in a globalizing world.

Department Goals

Assess community level processes of energy consumption, movement toward sustainable buildings and attitudes toward environmental issues.

Analyze implications of social and demographic change for local communities including the globalization of food systems, and impacts on local communities.

Investigate factors contributing to individual and family well-being.

Investigate impacts of emerging technologies on survey methodology.

Department Objective

RPA 803 - Sociological and Technological Change Affecting Individuals, Families and Communities¹⁶⁴

¹⁶⁴ Proj. 3230 has been added to the POW.

- Proj. 0127 Local Dimensions of the Globalization of Food and Agricultural Marketing Systems
- Proj. 0141 Public Concern for the Environment: International Comparisons
- Proj. 0230 Commodities, Consumers, and Communities: Local Food Systems in a Globalizing Environment
- Proj. 0280 Green Buildings, Technology Markets and Environmental Sustainability
- Proj. 0932 Self-Conceptions and Marital Interaction: Process of Commitment and Estrangement in New Marriages
- Proj. 0942 Improvement of Rural and Agricultural Sample Survey Methods
- Proj. 0981 Social and Economic Change in Nonmetro Washington
- Proj. 3230 Enhancing the Viability of Local Agri-food Systems

Statement of Issue(s)

Families and communities face a variety of challenges. These include rapidly evolving attitudes towards environmental issues, the need to develop more energy efficient buildings, family instability, the globalization of markets, greater disparities in power and income, and shifts in population. Departmental programs are aimed at providing sound research that will help clarify the causes and consequences of these changes, help communities and their residents develop responses to these changes, as well as developing effective survey research strategies for assessing these issues.

Performance Goal(s)

1. Contribute to the development of policy approaches that enhance environmental sustainability in the built environment.
2. Enhance methods that monitor levels of public concern for environmental quality.
3. Develop approaches that small-scale producers can use to more successfully market their commodities in local food systems.
4. Contribute to models of social and demographic transitions in local areas.
5. Develop a model of marital functioning and commitment based on longitudinal research of couples in the first five years of marriage.
6. Develop methods to improve measurement and response rates for surveys including new techniques for designing surveys.

Key Program Components

1. Analyze market dynamics affecting sustainability in the buildings sector and identify opportunities for policy innovation to enhance energy and resource efficiency.
2. Improve measurement techniques for assessing public concern for environmental quality.
3. Map the participation in community agri-food systems of local producers, wholesalers, and retailers and analyze the interconnections between mainstream and alternative agri-food systems.
4. Track ongoing social and demographic change in local areas and analyze the implications of these changes.
5. Analyze three waves of survey data on a sample of married couples, utilizing correlation, regression and analysis of variance procedures.
6. Continue experiments on how visual design and layout of questionnaires influences measurement of concepts and develop new research on designing web survey methodology.

Internal and External Linkages

Faculty serve on two regional research committees, NE-185 and W-183. Other faculty work with extension personnel, participate on extension/research teams and/or work with colleagues from other universities (both within and outside of the US) in refining their research priorities. In addition, some faculty work with government agencies, private sector organizations and public sector interest groups.

Target Audience(s)

Audiences include local communities, county based extension agents, small-scale agricultural producers, family practitioners, state and federal agencies including energy/resource policy agencies, private businesses including sustainable building businesses, and environmental policy makers, interest groups and other stakeholders in environmental policy making.

Evaluation Framework

The evaluation framework will include quantitative and qualitative data as well as the:

Adoption of social science perspectives by building industry networks and the adoption of innovative market based approaches by building industry contractors and government agencies promoting sustainable building practices.

Use of findings on environmental issues by other researchers and policy-makers.

Participation of agricultural producers, food retailers and wholesalers as stakeholders in research design.

Adoption of new survey methodologies.

Output Indicators

Increased use of theory-based market analysis by policy agencies, energy companies and sustainability advocacy organizations.

Improved knowledge of public and stakeholder perceptions and preferences regarding environmental issues.

Increased use of theory-based research on marital satisfaction by family practitioners.

Improved knowledge leading producers, consumers and retailers to participate in local food systems.

Increased use and understanding of demographic data by local planners, social service agencies and citizen groups.

Improved questionnaire design for agricultural and rural surveys and for surveys done by state agencies and private sector organizations.

Outcome Indicators

Increased energy and resource efficiency of the built environment.

Improved use of environmental orientation measures.

Enhanced viability of local food systems.

Enhanced understanding of community change and development.

Reduction of divorce rates and increases in levels of marital satisfaction and commitment.

Reduction of measurement error and improvement of response rates.

Program Duration

The program has both short and long term features

Allocated Resources

Faculty & Staff FTE	2.57
Funding	
Hatch	\$6,236
Hatch Multistate	\$16,627
Fed. Res. Grants	
State Approp.	\$229,852
Other Grants	\$27,752

APPENDIX A

College of Agriculture and Home Economics Advisory Groups

- CAHE Advisory Council
- Ag 101 - Presidential "Kitchen Cabinet"
- Commodity Commissions
- Food and Environmental Quality Laboratory
- Association of Agricultural Presidents

Appendix A documents and details the various groups/organizations which routinely have input into decisions concerning agricultural research.

**COLLEGE OF AGRICULTURE AND HOME ECONOMICS
ADVISORY COUNCIL**

PURPOSES

5. Advise the Dean and Directors in identifying and developing broad programs and priorities to promote excellence within the College.
6. Communicate information to clientele groups and advocate support for College programs.
7. Actively support the College budget with clientele, other appropriate interest groups, and the legislature.
8. Provide a means for clientele to participate in examining short-term special issues which may face the College from time-to-time.
9. Participate with other states in national activities to support agriculture and home economics programs in the land-grant universities.

CRITERIA FOR MEMBERSHIP

1. Knowledge of the College's programs and/or willingness to learn.
2. Recognized leader who can represent clientele interests and concerns.
3. Ability to take a broad view of the College's programs.
4. Available time (about ten days a year).
5. Geographic dispersion within the state.

MEMBERSHIP REPRESENTATION

The College of Agriculture and Home Economics has a broad range of programs appropriate to many groups, individuals and communities. Full representation of all interests would be impossible, but Council members should represent broad components of the College's clientele. Groups which are affected by or have interests in the College's programs include the following:

1. Agribusiness – supply, marketing, finance.
2. College alumni associations.
3. Commercial agricultural producers.
4. Family organizations or groups.
5. Youth programs in agriculture and home economics.
6. Human services organizations/agencies.
7. Limited resource agriculture.
8. Local government.
9. Consumers of food and fiber products.
10. Labor.
11. Business and industry.

The council of 20 people is constituted and appointed as follows:

Number	Representation	Selected By
6	Agriculture, natural resources, environment	Dean upon recommendation from organization
6	Home economics, family, youth (4-H)	Dean upon recommendation from faculty committee
2	Local government	Dean and Director of Extension
2	Alumni	College alumni association board
3	At large	Dean and Directors
1	State Dept of Agriculture	Dean and State Director of Agriculture
20	TOTAL	

Appointments are for 3-year terms with a maximum of two terms and are filled on a rotating basis. The chairman of the council is elected by the members.

ORGANIZATION

The Council meets at least three times a year. The dean and all directors participate in all meetings of the group.

CAHE ADVISORY COUNCIL MEMBERS

May 2, 2001

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Ellensburg, WA 98926

Hannah Swartzel
P.O. Box 2405
Pullman, WA 99165

Max Benitz, Jr.
620 Market Street
Prosser, WA 99350

Dorothy Baroch
P.O. Box 2218
Leavenworth, WA 98826

Clay Sprague
3610 25th Street SE
Puyallup, WA 98374

Ag 101 - Presidential "Kitchen Cabinet"

President Samuel H. Smith retired in May 2000. His successor, V. Lane Rawlins, has not determined whether he will continue with this informal advisory group or not.

Commodity Commissions

In Washington there are 25 commodity commissions. Most were originally organized to establish a check-off system of assessment for the expressed purpose of funding agricultural research. Several have a dual responsibility of promotion of the commodity. Members of commissions are elected by constituents who produce the commodity represented by the commission.

Members of the various commodity commissions meet regularly to identify research needs which are communicated to ARC administration through several channels. Research faculty members prepare research proposals based on the previously identified needs and on research which they as scientists feel is needed. Each commission conducts a research review of the prior year's research results and considers research projects proposed by scientists. Commodity commissions provide in excess of \$3.75 million in research support to ARC faculty. There are similar commodity commissions in Idaho and Oregon. Research scientists routinely submit invited proposals to commissions to adjoining Pacific Northwest states. Commissions with similar interests often coordinate identification of research needs and expect research proposals from scientists in any of the three Pacific Northwest institutions.

Following is a list of all Washington Commodity Commissions:

Washington State Alfalfa Seed Commission Washington State Red Raspberry Commission
Washington State Apple Commission Washington State Seed Potato Commission
Washington State Asparagus Commission Washington State Beef Commission
Washington State Barley Commission Washington State Fruit Commission
Washington State Blueberry Commission Washington State Potato Commission
Washington State Bulb Commission Washington State Strawberry Commission
Washington State Cranberry Commission Washington State Tree Fruit Research Commission
Washington State Dairy Products Commission Washington State Turfgrass Seed
Washington State Dry Pea & Lentil Commission Commission
Washington State Egg Commission Washington State Wheat Commission
Washington State Fryer Commission Washington State Wine Commission
Washington State Hop Commission Puget Sound Gillnet Salmon Commission
Washington State Mint Commission

Food and Environmental Quality Laboratory Advisory Board

The Food and Environmental Quality Laboratory (FEQL) at Washington State University was established in the early 1990s by the Washington State Legislature. The responsibilities of the laboratory still include:

1. Evaluating regional requirements for minor crop registration through the federal IR-4 program:
2. Conducting studies on the fate of pesticides on crops and in the environment, including soil, air, and water;
3. Improving pesticide information and education programs; and
4. Assisting federal and state agencies with questions regarding registration of pesticides which are deemed critical to crop production, consistent with priorities established in section 8 of this act; and
5. Assisting in the registration of biopesticides, pheromones, and other alternative chemical and biological methods.

The laboratory is advised by a board appointed by the dean of the Washington State University College of Agriculture and Home Economics. The dean shall cooperate with appropriate officials in Washington, Idaho, and Oregon in selecting board members.

(1) The board shall consist of one representative from each of the following interests: A human toxicologist or a health professional knowledgeable in worker exposure to pesticides, the Washington State University vice-provost for research or research administrator, representatives from the state department of agriculture, the department of ecology, the department of health, the department of labor and industry, privately owned Washington pesticide analytical laboratories, federal regional pesticide laboratories, an Idaho and Oregon laboratory, whether state, university, or private, a chemical and fertilizer industry representative, farm organizations, food processors, marketers, farm labor, environmental organizations, and consumers. Each board member shall serve a three-year term. The members of the board shall serve without compensation but shall be reimbursed for travel expenses incurred while engaged in the business of the board as provided in RCW 43.03.050 and 43.03.060.

(2) The board is in liaison with the pesticide advisory board and the pesticide incident reporting and tracking panel and shall review the chemicals investigated by the laboratory according to the following criteria:

- (a) Chemical uses for which a data base exists on environmental fate and acute toxicology, and that appear safer environmentally than pesticides available on the market;
- (b) Chemical uses not currently under evaluation by public laboratories in Idaho or Oregon for use on Washington crops;
- (c) Chemicals that have lost or may lose their registration and that no reasonably viable alternatives for Washington crops are known; and
- (d) Other chemicals vital to Washington agriculture.

(3) The laboratory shall conduct research activities using approved good laboratory practices, namely procedures and recordkeeping required of the national IR-4 minor use pesticide registration program.

(4) The laboratory shall coordinate activities with the national IR-4 program.

Following is a list of the current members of the FEQL Advisory Board:

Matthew Keifer
PNW Agri Safety & Health Ctr.

University of Washington, Box 357234
Seattle, WA 98195

Position: Health Prof/Human Toxicologist
206-616-1452 voice mail/206-616-2687 fax
mkeifer@u.washington.edu

Barbara Morrissey
Washington State Dept of Health
P.O. Box 47825
Olympia, WA 98504-7825
Position: Department of Health
360-236-3368 voice mail/360-236-2257 fax
bfm0303@hub.doh.wa.gov

Austin Long
Food & Drug Adm., Pacific Regional Lab NW
22201 23rd Dr. SE
Bothell, WA 98201-4421
Position: Federal Regional Pesticide Lab
425-483-4901 voice mail/425-483-4996 fax
rlong@ora.fda.gov

Scott McKinnie
Far West Agribusiness Assoc.
111 E. Magnesium Rd, Suite C
Spokane, WA 99208-5968
Position: Chemical & Fertilizer Industry Rep
509-838-6653 voice mail/509-838-6685 fax
scott@fwaa.org

Marilyn H. Perkins
League of Women Voters of WA
606 N. Dennis Pl.
Kennewick, WA 99336
Position: Consumer
509-783-8610 home phone
perkinsjohn@msn.com

Royal Schoen
WA State Dept of Agriculture
21 N. 1st Ave., #106
Yakima, WA 98902-2663
Position: State Department of Agriculture
509-225-2621 voice mail/509-454-7699 fax
rschoen@agr.wa.gov

Gregg Möller
Univ. of Idaho
Dept. of Food Science & Toxicology
Moscow, ID 83844-2203
Position: Idaho & Oregon Laboratory
208-885-7081 voice mail/208-885-8937 fax
gmoller@uidaho.edu

Janet Kurina
Dept. of Labor & Industries

P.O. Box 44610
Olympia, WA 98504-4610
Position: Dept. of Labor & Industry
360-902-5478 voice mail/360-902-5483 fax
kuri235@lni.wa.gov
Paul Monahan
Yakima Valley Farm Workers Clinic
P.O. Box 190
Toppenish, WA 98948
Position: Farm Labor
509-865-5600 voice mail

Donald Abbott
WA Dept. of Ecology
15 W. Yakima Ave., Suite 200
Yakima, WA 98902-3401
Position: Department of Ecology
509-454-7838 voice mail/509-575-2809 fax
dabb461@ecy.wa.gov

Ann George
Administrator, WA Hop Commission
504 N. Naches Ave., #11
Yakima, WA 98901
Position: WSCPR Representative
509-453-4749 voice mail/509-457-8561 fax
hops1@bossig.com

Jeffrey Jenkins
Oregon State University
Weniger 331
Dept. of Envir. & Molecular Tox.
Corvallis, OR 97331-6502
Position: Idaho & Oregon Laboratory
541-737-5993 voice mail/541-737-5001 fax
jenkinsj@ace.orst.edu

Dave Winckler
Ironwood Orchard
5151 E. Glenwood Road
Eltopia, WA 99330
Position: Farm Organization
509-269-4953 voice mail/509-269-4941 fax
winckler@televar.com

Wally Ewart
NW Horticultural Council
6 So. 2nd St., Room 600
Yakima, WA 98901
Position: Marketer
509-453-3193 voice mail/509-457-7615 fax
ewart@nwhort.org

Peggy Adams
Palouse-Clearwater Env. Inst.
P.O. Box 8596
Moscow, ID 83843
Position: Environmental Organization
208-882-1444 voice mail/208-882-8029 fax
adams@pcei.org

John Peterson
Englar Food Laboratories
P.O. Box 1548
Moses Lake, WA 98837
Position: Private Pesticide Analytical Lab

Association of Agricultural Presidents

Presidents, CEOs, and Executive Directors of organizations and businesses associated in some way to the agricultural sector of the Washington state economy are volunteer members of the Association of Agricultural Presidents. Members of the organization provide advice to ARC and CAHE about agricultural issues and politically support the needs of CAHE in obtaining resources required to meet its mission.

Following is a list of the current membership:

Larry Albin, Director Washington State FSA Office	Fred Blauert, President Washington State Sheep Producers
John Anderson, President Washington State Council of Farmers Cooperatives	Gretchen Borck, Director Washington Assn of Wheat Growers
Liz Anderson, Chairman Washington Dairy Products Commission	Pat Boss, Executive Director Washington State Potato Commission
Steve Appel, President Washington State Farm Bureau	Loveta Boyce Washington Wool Growers Assn
Karin Argo, President Washington Women For Agriculture	Kyle Brewe Washington Cranberry Alliance
Eddie Armstrong, President Washington State Horse Council	Charlie Brown Cascade Government Affairs WSPC
Lynn Ausman, Chairman Washington State Barley Commission	Patti Brumbach, Exec. Director Washington State Beef Commission
Patricia Bailey Washington State Water Res. Assn	Michael Buckley, Chairman Washington State Alfalfa Seed Commission
Brian Baird Congressman 3rd District	Steve Bughi, Secretary Walla Walla Sweet Onion Growers Assn Steve Burns, Exec. Director Washington State Wine Commission
Patrick Batts, Admin. V.P. Washington State Farm Bureau	John Cedergreen, Chairman Washington Food Processors Council
Debbie Becker, Exec. Director Washington State Dairy Federation	Chris Cheney, Lobbyist WSDF; WGL; HGW
Jeff Bergh, President Washington Assn of Apple Growers Chris Bieker, Outreach Coordinator Washington State FSA Office	Gary Christensen, President Washington Mint Growers Assn
Henry Bierlink, Exec. Director Washington State Red Raspberry Commission	Rod Christensen, Executive Secretary Washington State Mint Commission
Don Bishop, President PNW Vegetable Assn	Larry Cochran, President Washington Assn of Conservation Districts

Scot Cocking
Washington State Pork Producers

John Cornwall, President
Intermountain Grass Growers Assn

David Cottrell, Chairman
Washington State Cranberry Commission

Dan Coyne
Washington State Council of Farmer Co-op

Linda Crerar, Policy Assistant
Washington State Dept. of Agriculture

Patricia Davis, President
Washington Council On Int'l Trade

Norm Dicks
Congressman 6th District

Dwight Ditty, President
Washington-North Idaho Seed Assn

Jim Doornink, Chairman
Washington State Tree Fruit Research Commission

Perry Dozier, President
Washington Assn of Wheat Growers

Bruce Dunn, Chairman
Washington State Blueberry Commission

Jennifer Dunn
Congressman 8th District

David Dynes, Chairman
Washington Egg Commission

Matthew Ely, Vice Pres.
NW Hay Cubers Assn

Bernard Erickson, President
Columbia Basin Development League

Merri Erickson, President
Washington Cranberry Alliance

Richard Erickson, Secretary/Mgr
East Columbia Basin Irrigation District

Lee Faulconer, Policy Assistant
Washington State Dept. of Agriculture
Ed Field, President

Washington Cattle Feeders Assn

Dennis Fiess, Director
Spokane C of C, Ag Bureau

Merril Firestone
Washington State Red Raspberry Commission

Tom Fitzsimmons, Director
Washington State Dept. of Ecology

David Forsyth
Washington Wine Adv. Committee

Karla Kay Fullerton, Exec. V.P.
Washington Cattlemen's Assn

Roger Gamache, President
Washington Assn Of Wine Grape Growers

William Garvin
Washington State Farm Bureau

Ernie Gasseling, President
Hop Growers of Washington

Mike Gempler, Exec. Director
Washington Growers League

Ann George, Administrator
Hop Growers of Washington

Craig George, President
Washington State Hay Growers Assn

Steven George, Staff
Hop Growers of Washington

Goad Greg, President Pacific
NW Oilseeds Assn

Larry Gueck, Vice President
Washington Ag Forestry Foundation

Jim Haase
Washington State Grange

Jim Halstrom, Lobbyist
Washington State Horticultural Assn

Heather Hansen, Exec. Director
Washington Friends of Farm and Forests
Doc Hastings
Congressman 4th District

Sue Hatch, Director
Washington State Fryer Commission

Roger Hawley, Chairman
Washington State Seed Potato Commission

Jim Hazen, Government Affairs Director
Washington State Horticultural Assn

Tom Hulbert, President
NW Bulb Growers Assn

Terry Hunt, President
Washington State Grange

Jay Inslee
Congressman 1st District

Dave Jarzynka, President
Briggs Nursery

Vic Jensen, President
Washington State Dairy Federation

Jim Jesernig, Director
Washington State Dept. of Agriculture

Ron Jirava, Chair
Washington Canola/Rapeseed Commission

Norval Johanson, Mgr.
Washington State Strawberry Commission

Kirby Johnson, President
Puget Sound Seed Growers Assn

Linda Johnson
Washington State Farm Bureau

Steve Johnson, Exec. Director
Washington Public Utility Districts Assn

Leonard Jordan, State Conservationist
NRCS

Neil Kayser
Washington Cattlemen's Assn

Roger Knutson, Chairman
Washington State Bulb Commission

Rick Koplowitz
Washington State Fryer Commission

Paul LaCroix, Manager

Western Washington Farm Crops Assn

Lowell Lancaster, Chairman
Washington State Horticultural Assn

Mary Beth Lang, Policy Assistant
Washington State Dept. of Agriculture

Casey Lankhaar, Chairman
Washington State Beef Commission

Dale Lathim, Executive Director
Potato Growers of Washington

Dave Lawson, President
Washington Friends of Farms - Forests

Enid Layes, G.A. Consultant
WSHA and WABC

Monte Maberry, President
Washington State Red Raspberry Commission

Margaret Webring, Administrator
Washington State Asparagus Commission

Stephen Matzen, General Manager.
Washington State Dairy Products Commission

Ken Maurer, Exec. Secretary
Washington State Alfalfa Seed Commission

Shannon McDaniel, Secretary/Manager
S. Columbia Basin Irrigation District

Jim McDermott
Congressman 7th District

Jim McFerson, Manager
Washington State Tree Fruit Research Commission

Steve McGonigal, Executive Director
Washington State Nursery & Landscape Assn

Tim McGreevy, Administrator
Washington State Dry Pea & Lentil Commission

Scott McKinnie, Executive Director
Far West Fertilizer & Ag Chemical Assn

Lewis McMurrin, Gov't Relations Director
Washington Public Utility Districts Assn

Michael Hackett, President

WEASA

Tom Mick, CEO
Washington State Wheat Commission

David Miller, Position #1
Washington State Fryer Commission

Tony Moore, President
Washington Blueberry Growers Assn

Lee Morris, Chairman
Washington State Turfgrass Seed Commission

Patty Murray
US Senator

Cynthia Muse, Staff
Williams & Muse, Inc.

Thomas Myrum, Exec. Director
Washington State Water Res. Assn

Curt Nelson, President
Washington Poultry Industries Assn

Jerry Nelson, President
Western Washington Farm Crops Assn

Katie Nelson, Staff
Washington State Potato Commission
Rick Nelson, President
Washington Cattlemen's Assn

George Nethercutt
Congressman 5th District

Gary Nibler, President
Oregon-Washington Pea Growers Assn

Darryll Olsen
Columbia-Snake River Irrigators Assn

Judy Olson, Staff
Senator Patty Murray's Office

Alice Parker, Exec. Secretary
Columbia Basin Development League

Curtis Parrish, President
Washington-Oregon Asparagus Growers Assn

David Paul, Director
USDA/Risk Management Agency

Wendy Peay, Exec. Secretary
Washington State Hay Growers

Rick Plath, President/CEO
Washington State Apple Commission

Dave Reed, Secretary/Mgr
Yakima Growers-Shippers Assn

Kevin Riel, Chairman
Washington State Hop Commission

Carolyn Rinta, Editor
Washington Women for Agriculture

David Roberts, Staff
Washington State Dept. of Ecology

Betsy Robertson, Coalition Dir.
Washington Agricultural Export Alliance

Doris Roosma, Secretary
Washington State Seed Potato Commission

Michael Roozen, President
Washington Growers League

David Roseleip, President
Washington Ag Forestry Foundation

Mark Roy, Chairman
Washington State Fruit Commission

John Saven, Executive Director
NW Irrigation Utilities

Vicky Scharlau, Executive Director
Washington Assn of Wine Grape Growers

Ray Schmitten
Winter Pear Control Committee

Alan Schreiber
Washington State Commission on Pesticide
Registration

Ken Schutte, Chairman
Washington State Mint Commission

Mike Schwisow, Lobbyist
WWR; WPC; WCFA

Ken Severn, President

Washington State Fruit Commission

Ray Shindler, Lobbyist
Wheat/Asparagus/Cranberries/Potatoes

Adam Smith
Congressman 9th District

Randy Smith, President
Growers Clearing House

Bill Stauffacher, Lobbyist
Washington Christmas Tree Growers

Don Stevens, Staff
Pacific NW National Lab

Peter Stroosman, Secretary/Treasurer
Washington State Bulb Commission

Don Stuart
American Farmland Trust/Pacific NW Region

Bob Stump, President
Washington State Beekeepers Assn

Mary Sullivan, Administrator
Washington State Barley Commission

Dan Swecker ,Exec. Director
Washington Fish Growers Assn

Craig Teel, President
Washington Seed Council

Pat Tigges
EAT FIRST!

Helen Tomicic, Office Manager
Washington State Egg Commission

Jim Trull
Sunnyside Irrigation District

Ron Van Gundy
Roza Irrigation District

Glen Vanselow, Executive Director
PNW Waterways Assn

Dave Weber, Chairman
Washington State Dry Pea & Lentil Commission

Randy White, President

NW Turfgrass Assn

David Zepponi, Environmental Affairs Mgr.
NW Food Processors Assn

Jim Zimmerman, Director
Washington Fish Growers Assn

Administrator
NW Nursery Improvement Institute

President
Washington Citizens for World Trade

Administrator
Washington State Cranberry Commission

Washington State University Personnel
R. Lane Rawlins, President

James Zuiches, Dean
College of Agriculture & Home Economics

Pete Jacoby, Associate Dean
College of Agriculture & Home Economics

Ralph Cavalieri, Associate Dean, Research
College of Agriculture & Home Economics

Sandra Ristow, Associate Director
Agricultural Research Center
College of Agriculture & Home Economics

Chris Feise, Director
Ctr for Sustaining Ag & Natural Resources
College of Agriculture & Home Economics

Tom Lumpkin, Chairman
Dept. of Crop and Soil Sciences
College of Agriculture & Home Economics

Michael Tate, Dean and Director
Cooperative Extension

Warwick Bayley, Dean,
College of Veterinary Medicine

APPENDIX B

Implementation of Safe Food Initiative

The Safe Food Initiative began with agricultural producer organizations in the state of Washington expressing priority needs that they felt should be addressed by Washington State University. The focus was to obtain new base funding to expand WSU research and extension programs that could enhance profitability and food safety while protecting or improving natural resources and the environment. The WA legislature approved the \$7.5 M biennial funding package in 1999 as part of the WSU budget and was signed into law by Governor Gary Locke with funding to begin on July 1, 2000. The College of Agriculture and Home Economics received \$4.5 M (biennially) to hire and support 17 faculty and 13 technicians. The College of Veterinary Medicine received \$1.5 M, the College of Sciences received \$0.5 M, and the WA State Commission for Pesticide Registration received \$1.0 M. The measure drew widespread support from agricultural organizations across the state of Washington and endorsements from a number of regional newspapers.

A year after funding began, all but one of the faculty positions has been hired. These new faculty are in the process of initiating their programs and identifying key faculty who will become focused on team-based research that will seek to enhance the state's economy by \$100 M annually through improved agricultural practices and environmental stewardship.

SAFE FOOD INITIATIVE SEARCH STATUS

Today's Date: April 27, 2004 (Revised weekly) Questions, contact Rebecca Armstrong (509) 335-2822, armstro@wsu.edu

SEARCH TITLE	Rank	Salary	Appt	POS #	SEARCH #	CONTACT	LOCATION	STATUS	
CULTY SEARCHES									
ANIMAL SCI/BIO SYS ENG ry Nutrient Mgmt Specialist	3	up to \$90K	.50E .50R	84085 84156	2427	R. Kincaid	Mt. Vernon	1 applicant	Inter w/D
AGRONOMICAL SYS ENG mal Nutrient Mgmt.	2	\$70K	.25E .75R	84305 84304	2459	C. Stockle	Pullman		Jun
AGRONOMY & SOIL SCIENCES eal Chemist/Bio Chemist	2	\$45,000	100R	84151	2425	T. Lumpkin	Pullman, W. Wheat Quality Lab		Bra eff.
AGRONOMY & SOIL SCIENCES ed Scientist	2	\$55,000	100R	84042	2413	T. Lumpkin	Prosser		Ma eff.
AGRONOMY & SOIL SCIENCES l Fertility/Soil Quality	2	\$55,000	.40E .60R	84086 84152	2412	T. Lumpkin	Pullman Johnson Hall		Gre eff.
AGRONOMY Control Specialist	2	\$50,000	.30E .70R	83943 84009	2380	Gary Piper	Pullman Food Science Building		Wil eff.
AGRONOMY l Tree Fruit Entomologist	2	\$66,000	.33E .67R	83942 84010	2381	Betsy Beers	Wenatchee		Vin eff.

FOOD SCI/HUMAN NUTR Microbiology/Food Scientist	2	\$55,000	.40E .60R	83946 83956	2399	A. McCurdy	Pullman Food Science Building		Don 8/1
NATURAL RES SCIENCES Wetland Management	3	\$65,000	100E	84084	2414	L. Hardesty	Pullman Johnson Hall		Jan eff.
PLANT PATHOLOGY Tree Fruit Pathologist	2	\$55,000	.33E .67R	84078 84044	2403	Gary Grove	Wenatchee		Cha eff.
PLANT PATHOLOGY Vegetable Pathologist	2	\$55,000	.40E .60R	84077 84043	2404	D. Inglis	Mt. Vernon		Lin eff.
WASCO DISTRICT Wetland Crops Agronomist	2	\$52,000	100E	83947	2396	Ed Adams	Davenport (Wilke)		Der eff.
WASCO DISTRICT Small Scale/Urban Ag. Leader	2	\$54K	.80E .20R	84153	2426	Jim Kropf/ C. Feise	Puyallup		Ma eff.
WASCO DISTRICT Peststock	2	\$38,000	100E	83944	2398	D. Rumsey	Kittitas		Jus eff.
WASCO DISTRICT Peststock	2	\$36,000	100E	83945	2397	D. Rumsey	Grant/Adams		Sar
WASCO DISTRICT Molecular Geneticist	2	\$80,000	2.0	84088	2409	T. McElwain/ T. McGuire	CVM/VMP Pullman		Chr

COLLEGE OF VET MED Infectious Disease Epidemiology	2	\$65-85K	2.0	84090	2411	T. McElwain/ R. DeBowes	VCS Pullman		Role eff.
COLLEGE OF VET MED Molecular Epidemiology	2	\$75,000	2.0	84089	2410	T. McElwain/ T. McGuire	CVM/VMP Pullman		Doc

POSTSEARCHES

INFORMATION Media Relations Specialist	A/P	\$60,000	100E	84080	2430	S. Fedale/ T. Day	King County Extension (Renton)		Der eff.
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APPENDIX C

College of Agriculture and Home Economics

Multistate Research Projects

- Agricultural Research Center - Administrative Advisors
- FY2000 Multistate Research Fund Projects in Which WSU Faculty and ARS Cooperators Participated
- Multistate Research Funds Travel (October 1, 1999 - September 30, 2000)
Expenditures for WSU Participants (does not include coordinating committees)
- Faculty with Split Appointments or 100% Teaching or Extension
Appointments Attending Multistate Research or Coordinating Committee
Meetings, FY2000

**Agricultural Research Center
Administrative Advisors**

Associate Dean for Agricultural Research

James R. Carlson (10/1/99 to 03/31/00)

Ralph P. Cavalieri (04/01/00-09/30/00)

W-006, "Plant Genetic Resource Conservation and Utilization"

NRSP-5, "Develop & Distribute Deciduous Fruit Tree Clones That Are Free of Known Graft-Transmissible Pathogens"

WCC-021 (co-AA), "Revegetation and Stabilization of Deteriorated and Altered Lands"

WCC-043 (co-AA), "Management of Codling Moth and Related Moths in the Orchard Ecosystem"

WCC-092, "Beef Cattle Energetics"

From 04/01/00, Ralph Cavalieri was co-AA

Vicki A. McCracken, Director, Academic Programs

W-183, "Improvement of Rural and Agricultural Sample Survey Methods"

WCC-076, "The Impact of Immigration on Rural America"

WCC-084, "Community, Institutional Change and Migration in Rural America"

WCC-101, "Assessing the Chinese Market for U.S. Agricultural Products"

Ed DePuit, Chair Natural Resource Sciences

WCC-021 (co-AA), "Revegetation and Stabilization of Deteriorated and Altered Lands"

John Brown, Chair, Entomology

WCC-043 (co-AA), "Management of Codling Moth and Related Moths in the Orchard Ecosystem"

Ray Wright, Chair Animal Sciences

WCC-092 (co-AA since 04/01/00), "Beef Cattle Energetics"

FY 2000 Multistate Research Fund Projects in Which WSU Faculty and ARS Cooperators Participated

PROJ	TITLE	MRF #	TERM DATE		LEADERS
0261	Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety	NC-062	09/2002	1	Besser, T.E.
0261	Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety	NC-062	09/2002	2	Gay, C.C.
0261	Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety	NC-062	09/2002	3	Hancock, D.D.
0261	Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety	NC-062	09/2002	4	Gay, J.M.
0929	Management Systems for Improved Decision Making and Profitability of Dairy Herds	NC-119	09/2002	1	Cady, R.A.
0913	Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation	NC-131	09/2005	1	Dodson, M.V.
0913	Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation	NC-131	09/2005	2	Byrne, K.M.
0467	Improvement of Thermal and Alternative Processes for Food	NC-136	09/2005	1	Barbosa-Canovas, G.V.
0467	Improvement of Thermal and Alternative Processes for Food	NC-136	09/2005	2	Powers, J.R.
0467	Improvement of Thermal and Alternative Processes for Food	NC-136	09/2005	3	Cavalieri, R.P.
0467	Improvement of Thermal and Alternative Processes for Food	NC-136	09/2005	4	Swanson, B.G.
0467	Improvement of Thermal and Alternative Processes for Food	NC-136	09/2005	5	Tang, J.
0452	Rootstock and Interstem Effects on Pome and Stone Fruit Trees	NC-140	09/2002	1	Barritt, B.H.
0119	Regulation of Photosynthetic Processes	NC-142	09/2002	1	Okita, T.W.
0119	Regulation of Photosynthetic Processes	NC-142	09/2002	2	Edwards, G.E.
0862	Metabolic Relationships in Supply of Nutrients for Lactating Cows	NC-185	09/2002	1	McNamara, J.P.
0128	Marketing and Delivery of Quality Cereals and Oilseeds	NC-213	09/2003	1	Baik, B.K.
0797	Postharvest Physiology of Fruits	NE-103	09/2003	1	Fellman, J.K.
0797	Postharvest Physiology of Fruits	NE-103	09/2003	2	Kupferman, E.M.
0709	Mastitis Resistance to Enhance Dairy Food Safety	NE-112	09/2002	1	Fox, L.K.
0709	Mastitis Resistance to Enhance Dairy Food Safety	NE-112	09/2002	2	Davis, W.C.
0154	Environmental and Economic Impacts of Nutrient Management on Dairy Forage Systems	NE-132	09/2004	1	Harrison, J.H.
0998	Rural Economic Development: Alternatives in the New Competitive Environment	NE-162	09/2002	1	Holland, D.W.
0301	Private Strategies, Public Policies, and Food System Performance	NE-165	09/2001	1	McCluskey, J.J.
0990	Technology & Principles for Assessing & Retaining Postharvest Quality of Fruits & Vegetables	NE-179	09/2002	1	Hyde, G.M.
0990	Technology & Principles for Assessing & Retaining Postharvest Quality of Fruits & Vegetables	NE-179	09/2002	2	Cavalieri, R.P.
0990	Technology & Principles for Assessing & Retaining Postharvest Quality of Fruits & Vegetables	NE-179	09/2002	3	Pitts, M.J.
0990	Technology & Principles for Assessing & Retaining Postharvest Quality of Fruits & Vegetables	NE-179	09/2002	4	Tang, J.
0990	Technology & Principles for Assessing & Retaining Postharvest Quality of Fruits & Vegetables	NE-179	09/2002	5	Fellman, J.K.

	Postharvest Quality of Fruits & Vegetables				
0156	Multidisciplinary Evaluation of New Apple Cultivars	NE-183	09/2004	1	Barritt, B.H.
0230	Commodities, Consumers, and Communities: Local Food Systems in a Globalizing Environment	NE-185	09/2002	1	Jussaume, R.A.
0122	Field Support for Registration of Minor Use Pesticides Under the IR-4 Program	NRSP-4	09/2003	1	Walsh, D.B.
1262	Develop & Distribute Deciduous Fruit Tree Clones that are Free of Known Graft-Transmissible Pathogens	NRSP-5	09/2002	1	Eastwell, K.C.
1262	Develop & Distribute Deciduous Fruit Tree Clones that are Free of Known Graft-Transmissible Pathogens	NRSP-5	09/2002	2	Howell, W.E.
1262	Develop & Distribute Deciduous Fruit Tree Clones that are Free of Known Graft-Transmissible Pathogens	NRSP-5	09/2002	3	Cavalieri, R.P.
0806	Fruit and Vegetable Supply-Chain Management, Innovations, and Competitiveness	S-222	09/2003	1	Schotzko, R.T.
0794	Food Demand, Nutrition and Consumption Behavior	S-278	09/2002	1	Price, D.Z.
0794	Food Demand, Nutrition and Consumption Behavior	S-278	09/2002	2	Mittelhammer, R.C.
0794	Food Demand, Nutrition and Consumption Behavior	S-278	09/2002	3	Armstrong Shultz, J.
1134	Plant Genetic Resource Conservation & Utilization	W-006	09/2001	1	Lumpkin, T.A.
1134	Plant Genetic Resource Conservation & Utilization	W-006	09/2001	2	Clement, S.L.*
1134	Plant Genetic Resource Conservation & Utilization	W-006	09/2001	3	Hannan, R.M.*
1134	Plant Genetic Resource Conservation & Utilization	W-006	09/2001	4	Johnson, R.C.*
1134	Plant Genetic Resource Conservation & Utilization	W-006	09/2001	5	Dugan, F.M. *
1134	Plant Genetic Resource Conservation & Utilization	W-006	09/2001	6	Cavalieri, R.P.
0470	Pesticides and Other Toxic Organics in Soils and Their Potential for Ground and Surface Water Contamination	W-082	09/2000	1	Felsot, A.S.
0136	Control of Animal Parasites in Sustainable Agricultural Systems	W-102	09/2004	1	Jasmer, D.P.
7996	Multistate Research Coordination, Western Region	W-106	09/2029	1	Cavalieri, R.P.
7996	Multistate Research Coordination, Western Region	W-106	09/2029	2	Ristow, S.S.
0957	Reproductive Performance in Domestic Ruminants	W-112	09/2001	1	Reeves, J.J.
0198	Microirrigation Technologies for Protection of Natural Resources and Optimum Production	W-128	09/2004	1	Evans, R.G.
0215	Freeze Damage and Protection of Horticultural Species	W-130	09/2003	1	Hummel, R.L.
0691	Benefits and Costs of Resource Policies Affecting Public and Private Land	W-133	09/2002	1	Wandschneider, P.R.
0905	Nutrient Bioavailability - A Key to Human Nutrition	W-143	09/2002	1	Shultz, T.D.
0560	Genetic Improvement of Beans (<i>Phaseolus vulgaris</i> L.) for Yield, Disease Resistance, and Food Value	W-150	09/2005	1	Swanson, B.G.
0702	Evaluation and Improvement of Barley for Food and Feed	W-166	09/1999	1	Froseth, J.A.
0702	Evaluation and Improvement of Barley for Food and Feed	W-166	09/1999	2	Ullrich, S.E.
0647	Family and Work Linkages	W-167	09/2000	1	Price, D.Z.
0647	Family and Work Linkages	W-167	09/2000	2	Bailey, S.J.
0647	Family and Work Linkages	W-167	09/2000	3	Hendrickson, C.M.
0664	Seed Biology, Technology, and Ecology	W-168	09/2003	1	Warner, R.L.
0690	Chemistry and Bioavailability of Waste Constituents in Soils	W-170	09/2004	1	Kuo, S.
0706	Germ Cell and Embryo Development and Manipulation for the Improvement of Livestock	W-171	09/2004	1	Wright, R.W.
0764	Enhancing the Global Competitiveness of U.S. Red Meat	W-177	09/2002	1	Wahl, T.I.
0764	Enhancing the Global Competitiveness of U.S. Red	W-177	09/2002	2	Busboom, J.R.

	Meat				
0942	Improvement of Rural and Agricultural Sample Survey Methods	W-183	09/2001	1	Dillman, D.A.
0942	Improvement of Rural and Agricultural Sample Survey Methods	W-183	09/2001	2	McCracken, V.A.
0954	Biogeochemistry and Management of Salts and Potentially Toxic Trace Elements in Arid-Zone Soils, Sed	W-184	09/2001	1	Peryea, F.J.
0121	Biological Control in Pest Management Systems of Plants	W-185	09/2002	1	Piper, G.L.
0185	Genetic Variability in the Cyst and Root-Knot Nematodes	W-186	09/2003	1	Santo, G.S.
0152	Characterization of Flow and Transport Processes in Soils at Different Scales	W-188	09/2004	1	Flury, M.
0152	Characterization of Flow and Transport Processes in Soils at Different Scales	W-188	09/2004	2	Wu, Q.J.
0153	Natural Products Chemistry as a Resource for Biorational Methods of Insect xxx	W-189	09/1999	1	Ryan, C. A.
0160	Agricultural Water Management Technologies, Institutions and Policies Affecting Economic Viability and Environmental Quality	W-190	09/2004	1	Huffaker, R.G.
0276	Factors Influencing the Intake of Calcium Rich Food Among Adolescents	W-191	09/2002	1	Peck, L.W.
0227	Rural Communities and Public Lands in the West: Impacts and Alternatives	W-192	09/2001	1	Holland, D.W.

**Multistate Research Funds Travel (October 1, 1999 – September 30, 2000)
Expenditures for WSU Participants (does not include coordinating committees)**

MRF	Title	Total
NC-062	Enteric Diseases of Swine and Cattle: Prevention, Control and Food Safety	\$268.00
NC-131	Molecular Mechanisms Regulating Skeletal Muscle Growth and Differentiation	882.48
NC-136	Improvement of Thermal and Alternative Processes for Food	1370.56
NC-185	Metabolic Relationships in Supply of Nutrients for Lactating Cows	798.56
NE-103	Postharvest Physiology of Fruits	270.48
NE-112	Mastitis Resistance to Enhance Dairy Food Safety	987.49
NE-179	Technology & Principles for Assessing & Retaining Postharvest Quality of Fruits & Vegetables	996.45
NE-185	Technology & Principles for Assessing & Retaining Postharvest Quality of Fruits & Vegetables	787.92
S-222	Fruit and Vegetable Supply-Chain Management, Innovations, and Competitiveness	685.68
S-278	Food Demand, Nutrition and Consumption Behavior	810.32
S-278	Food Demand, Nutrition and Consumption Behavior	972.29
S-278	Food Demand, Nutrition and Consumption Behavior	1069.46
W-6	Plant Genetic Resource Conservation & Utilization	1259.86
W-6	Plant Genetic Resource Conservation & Utilization	1076.07
W-6	Plant Genetic Resource Conservation & Utilization	1076.07
W-102	Control of Animal Parasites in Sustainable Agricultural Systems	698.65
W-106	Multistate Research Coordination, Western Region	651.26
W-106	Multistate Research Coordination, Western Region	674.51
W-106	Multistate Research Coordination, Western Region	1168.05
W-112	Reproductive Performance in Domestic Ruminants	411.00
W-112	Reproductive Performance in Domestic Ruminants	427.40
W-128	Microirrigation Technologies for Protection of Natural Resources and Optimum Production	230.00
W-133	Benefits and Costs of Resource Policies Affecting Public and Private Land	1762.51
W-143	Nutrient Bioavailability - A Key to Human Nutrition	825.66
W-167	Family and Work Linkages	1242.65
W-170	Chemistry and Bioavailability of Waste Constituents in Soils	503.66
W-183	Improvement of Rural and Agricultural Sample Survey Methods	875.99
W-186	Genetic Variability in the Cyst and Root-Knot Nematodes	1415.58
W-188	Characterization of Flow and Transport Processes in Soils at Different Scales	621.83
W-190	Agricultural Water Management Technologies, Institutions and Policies Affecting Economic Viability and Environmental Quality	746.70
W-191	Factors Influencing the Intake of Calcium Rich Food Among Adolescents	174.20
W-191	Factors Influencing the Intake of Calcium Rich Food Among Adolescents	231.20
W-192	Factors Influencing the Intake of Calcium Rich Food Among Adolescents	530.63
	Total	\$26,503.17

**Faculty with Split Appointments or 100% Teaching or Extension Appointments
Attending Multistate Research or Coordinating Committee Meetings**

FY 2000

MRF #	R/T	Ext	Attendee
NCR-170	0.88	0.13	Alldredge, J. Richard
WCC-043	0.83	0.17	Brown, John J.
WCC-043	0.83	0.17	Brunner, Jay F.
W-106	0.75	0.25	Carlson, James
WCC-092	0.75	0.25	Carlson, James
WCC-092	0.75	0.25	Carlson, James R.
NCR-193	0.84	0.16	Chastagner, Gary
NCA-013	0.50	0.50	Cook, Annabel
WCC-084	0.60	0.40	Cook, Annabel
WCC-021	0.83	0.17	DePuit, Ed
NCR-194	0.30	0.70	Duft, Kenneth
WCC-091	0.60	0.40	Fransen, Steve
WCC-091	0.00	1.00	Griggs, T. C.
NE-185	0.75	0.25	Jussaume, Ray
W-6	0.75	0.25	Lumpkin, Thomas
W-6	0.75	0.25	Lumpkin, Thomas
WCC-101	0.75	0.25	Lumpkin, Tom
WCC-023	1.00	0.00	Salusso, Carol
S-222	0.00	1.00	Schotzko, Tom
WCC-103	0.00	1.00	Stevens, Robert
WCC-077	0.25	0.75	Yenish, Joe
Total FTEs	14.21	8.80	

R/T = Teaching and/or Research Appointment
Ext = Extension Appointment

APPENDIX D

College of Agriculture and Home Economics

Multistate Coordinating Committees

- Current Multistate Coordinating Committees in Which WSU Faculty and ARS Cooperators Participated FY2000
- Attendees to Coordinating Committees and Information Exchange Groups From Washington State University and ARS Cooperators FY 2000

Current Multistate Coordinating Committees in Which
WSU Faculty and ARS Cooperators Participated
FY 2000

<u>Committee</u>	<u>WSU/ARS Participant</u>	<u>Title</u>	<u>Term Date</u>
IEG-70	R. Huffaker	Economics and Management of Risk in Agriculture and Natural Resources	9/04
NCR-022	P. Moore	Small Fruit and Viticulture Research Committee	9/01
NCR-059	D. Bezdicek J. Halvorson	Soil Organic Matter	9/01
NCR-131	R. Newberry	Animal Care and Behavior	9/02
NCR-134	T. Wahl H. Wang	Applied Commodity Price Analysis, Forecasting and Market Risk Management	9/02
NCR-170	R. Alldredge	Research Advances in Agricultural Statistics	9/01
NCR-174	J. Harsh	Synchrotron X-ray Sources in Soil Science Research	9/02
NCR-180	W. Pan B. Frazier	Site Specific Management	9/01
NCR-189	L. Fox J. Forseth	Air Quality Issues Associated with Animal Facilities	9/01
NCR-193	G. Chastanger	Maintaining Plant Health: Managing Insect Pests and Diseases of Landscape Plants	9/01
NCR-194	K. Duft	Research on Cooperatives	9/02
NCR-XXX	Charles Gaskins	Implementation & Strategies for National Beef Cattle Evaluation	
NCT-181	D. Young P. Barkley	Socioeconomic and Resource Management Implications of Agricultural Land Use Changes	9/01

Committee	WSU/ARS Participant	Title	Term Date
NEC-063	D. MacKenzie	Research Committee on Commodity Promotion Programs	9/02
NEC-102	G. Thorgaard	Genetic Mapping of Aquaculture Species	9/02
WCC-001	Charles Gaskins	Beef Cattle Breeding in the Western Region	9/01
WCC-011	William Johnston Gwen Stahnke P. Backman G. Chastagner E. Miltner	Turfgrass Research	9/04
WCC-020	K.C. Eastwell	Virus and Virus-Like Diseases of Fruit Crops	9/01
WCC-023	Carol Salusso	Textile and Apparel Research Coordination	9/04
WCC-027	Robert Thornton Richard Knowles	Potato Variety Development	9/05
WCC-037	Dan Mayer	Maximizing the Effectiveness of Bees as Pollinators of Agricultural Crops	9/04
WCC-040	Linda Hardesty	Rangeland Ecological Research and Assessment	9/01
WCC-043	Jay Brunner John Brown, AA	Management of Codling Moth and Related Moths in the Orchard Ecosystem	9/01
WCC-055	Dave Scarnecchia	Rangeland Resource Economics and Policy	9/01
WCC-058	Charles Johnson Rita Hummel	Production, Transition Handling, and Reestablishment of Perennial Nursery Stock	9/04
WCC-060	John Dunley	Science and Management of Pesticide Resistance	9/01
WCC-066	William Turner Keith Pike	Integrated Management of Russian Wheat Aphid and Other Cereal Aphids.	9/01

Committee	WSU/ARS Participant	Title	Term Date
WCC-067	David Granatstein David Bezdicek Christopher Feise	Western Coordinating Committee for Sustainable Agriculture	9/05
WCC-069	Ray Huffaker G. Long L. Tanigoshi D. Walsh 6/14/00	Coordination of Integrated Pest Management Research & Extension/Education Programs for the Western United States and the Pacific Basin Territories	9/05
WCC-072	Y. Duval	Agribusiness Research Emphasizing Competitiveness	9/04
WCC-076	Richard Carkner	The Impact of Immigration on Rural America	9/01
WCC -077	Alex Ogg, Jr. Frank Young J. Yennish A. Kennedy ARS	Biology and Control of Winter Annual Grass Weeds in Winter Wheat	9/04
WCC-081	Kimberlee Kidwell Craig Morris	Systems to Improve End-Use Quality of Wheat	9/01
WCC-084	Annabel Cook	Community, Institutional Change and Migration in Rural America	9/01
WCC-086	Stephen Drake ARS Lisa Neven ARS J.D. Hansen ARS Juming Tang (10/5/99)	Postharvest Technology and Quarantine Treatments for Insect Control in Horticulture Crops	9/01
WCC-089	Dennis Johnson Stephen Wyatt	Potato Virus Disease Control	9/01
WCC-091	Steven Fransen T. C. Griggs	Improving Stress Resistance of Forages in the Western United States	9/04
WCC-092	Kristen Johnson Ray Wright	Beef Cattle Energetics	9/04

WCC-093	Alan Busacca	Western Region Soil Survey and Inventory	9/04
	WSU/ARS		Term
Committee	Participant	Title	Date
WCC-095	Gary Witmer	Vertebrate Pests of Agriculture, Forestry and Public Lands	9/04
WCC-097	Timothy Murray	Research on Diseases of Cereals	9/05
WCC-099	K.K. Chew	Broodstock Management, Genetics and Breeding Programs for Molluscan Shellfish	9/01
WCC-101	R. Tichy T. Lumpkin T. Wahl	Assessing the Chinese Market for U.S. Agricultural Products	9/05
WCC-102	Mary Hattendorf	Climatic Data and Analyses for Applications in Agriculture and Natural Resources	9/01
WCC-103	Robert Stevens	Nutrient Management and Water Quality	9/01
WCC-109	Scott Matulich Ron Mittelhammer	Seafood Marketing and the Management of Marine and Aquacultural Resources	9/01
WCC-110	Mark Nelson	Improving Ruminant Use of Forages in Sustainable Production Systems for the Western U.S.	9/04
WCC-200	Margaret Young	Housing and Related Issues for Enhancing Independence and Quality of Life for Community Populations	9/02
WCC-201	S. Ullrich J. Froseth	Enhanced Use of Barley for Feed and Food	9/04
WCC-203	Ron Kincaid	Animal Utilization of Products from Processing Agricultural Commodities	9/05
WCC-204	Ruth Newberry	Animal Bioethics	9/05

WCC-205

R. Simmons

Integrated Water Quality Research and
Extension Programs for the Western United

9/05
States

**Attendees to Coordinating Committees and Information Exchange Groups
From Washington State University and ARS Cooperators
FY 2000**

		Committee				
		R/T				
		Ext				
PI	Travel Expenditures					
		Total				
		R/T				
Ext						
NCR-170	0.88	0.13	Alldredge, J. Richard	\$1,097.73	\$960.51	\$137.22
NCR-059	1.00	0.00	Bezdicek, David	925.03	925.03	0.00
WCC-043	0.83	0.17	Brown, John J.	1,306.83	1,084.67	222.16
WCC-043	0.83	0.17	Brunner, Jay F.	869.58	721.75	147.83
WCC-093	1.00	0.00	Busacca, Alan	1,567.94	1,567.94	0.00
WCC-092	1.00	0.00	Carlson, James	786.39	786.39	0.00
WCC-092	1.00	0.00	Carlson, James R.	380.00	380.00	0.00
NCR-193	0.84	0.16	Chastagner, Gary	702.79	590.34	112.45
NCA-013	0.50	0.50	Cook, Annabel	0.00	0.00	0.00
WCC-084	0.60	0.40	Cook, Annabel	397.20	238.32	158.88
WCC-021	0.83	0.17	DePuit, Ed	597.65	496.05	101.60
NCR-194	0.30	0.70	Duft, Kenneth	592.94	177.88	415.06
WCC-020	1.00	0.00	Eastwell, Ken	189.65	189.65	0.00
WCC-091	0.60	0.40	Fransen, Steve	431.45	258.87	172.58
WCC-100	1.00	0.00	Gaskins, Charles	665.96	665.96	0.00
WCC-091	0.00	1.00	Griggs, T. C.	397.95	0.00	397.95
WCC-102	1.00	0.00	Hattendorf, Mary	748.40	748.40	0.00
WCC-058	1.00	0.00	Hummel, Rita	524.41	524.41	0.00
WCC-092	1.00	0.00	Johnson, Kristen	994.20	994.20	0.00
WCC-081	1.00	0.00	Kidwell, Kim	863.69	863.69	0.00
WCC-101	0.75	0.25	Lumpkin, Tom	422.25	316.69	105.56
WCC-011	1.00	0.00	Miltner, Eric	455.27	455.27	0.00
NCR-022	1.00	0.00	Moore, Patrick P.	1,045.79	1,045.79	0.00
WCC-097	1.00	0.00	Murray, Tim	838.71	838.71	0.00
WCC-066	1.00	0.00	Pike, Keith	827.23	827.23	0.00
WCC-023	1.00	0.00	Salusso, Carol	1,071.33	1,071.33	0.00
WCC-103	0.00	1.00	Stevens, Robert	974.52	0.00	974.52
WCC-092	1.00	0.00	Szabo, Kathylu	812.93	812.93	0.00
WCC-086	1.00	0.00	Tang, Juming	990.59	990.59	0.00
WCC-101	1.00	0.00	Wahl, Thomas	652.94	652.94	0.00
SERAIEG31	1.00	0.00	Wong, Holly	1,062.05	1,062.05	0.00

WCC-077	0.25	0.75	Yenish, Joe	645.11	161.28	483.83	
Total				\$23,838.51	\$20,408.86	\$3,429.63	
R/T = Teaching and/or Research Appointment							E
xt = Extension Appointment							

APPENDIX E

Washington State University

Equal Employment Opportunity/Affirmative Action Policy

Washington State University

Equal Employment Opportunity and Affirmative Action Policy

Washington State University, (WSU), is an equal opportunity employer committed to providing equal opportunity to applicants and employees without regard to race/ethnicity, creed, color, national origin, religion, gender, sexual orientation, age, marital status, the presence of any sensory, mental or physical disability, use of a trained guide dog or service animal by a disabled person, disabled veteran or Vietnam-era veteran status. WSU has made, and will continue to make, every effort to eliminate barriers to equal opportunity encountered by these protected group members and to improve opportunities available to underutilized groups. The following are specific goals within this policy:

- WSU does not discriminate on the basis of race/ethnicity, color, creed, religion, national origin, gender, sexual orientation, age, marital status, the presence of any sensory, mental or physical disability, use of a trained guide dog or service animal, disabled veteran or Vietnam-era veteran status in its administration of educational policies, programs or activities, or other University administered programs or employment.
- WSU will continue to recruit, hire, train, and promote individuals in all job classifications based upon their qualifications and ability or potential ability to carry out the duties of the job, and shall consider race/ethnicity, color, creed, religion, national origin, gender, sexual orientation, age, marital status, the presence of any sensory, mental, or physical disability, use of trained guide dog or service animal, disabled veteran or Vietnam-era veteran status only when consistent with the law.
- The University is committed to take affirmative action to increase the employment of American Indians/Alaskan Natives, Asians/Pacific Islanders, Blacks/African Americans, Hispanics, women, persons age 40 and over, persons with disabilities, disabled veterans, and Vietnam-era veterans where there is underutilization. Numerical goals are set for affected class members in those job groups or areas where the University has determined that underutilization exists. The University will make every good faith effort consistent with the law to meet these goals and will review progress on an annual basis.
- All other personnel actions such as compensation, benefits, layoffs, return from layoffs, terminations, university-sponsored training, education, tuition waivers, and social and recreational programs will be administered without regard to race/ethnicity, color, creed, religion, national origin, gender, sexual orientation, age, marital status, the presence of any sensory, mental, or physical disability, use of a trained guide dog or service animal, or whether a disabled veteran or Vietnam-era veteran.

The President, Dr. V. Lane Rawlins, has overall responsibility for assuring that the Equal Employment Opportunity/Affirmative Action Policy is administered effectively at the WSU Pullman campus, Tri-Cities, Vancouver, and Spokane campuses. The President of WSU has charged the Center for Human Rights with the responsibility of monitoring the University's EEO/AA program and policies. Each college and division head is responsible for ensuring that their respective unit/college meets its EEO/AA obligations. Each college and division will be evaluated annually on their progress. The Center for Human Rights, has been charged with overseeing the daily activities of the University's equal opportunity and affirmative action programs and developing the university's affirmative action plan. The director can be contacted at the Center for Human Rights, French Administration Building, Room 225, Pullman, Washington 99164-1022. The telephone number is (509) 335-8288. It is incumbent upon each member of the WSU administration, faculty, and staff to make every good faith effort in the execution of this policy.

APPENDIX F

College of Agriculture and Home Economics

Agricultural Research Center

Strategic Plan
1997-2002

**COLLEGE OF AGRICULTURE AND HOME ECONOMICS
Agricultural Research Center**

**STRATEGIC PLAN
1997-2002
September 26, 1997**

INTRODUCTION

The Agricultural Research Center (ARC) utilizes state and federal funds and extramural support from a variety of sources to fulfill its research mission. State, federal, and university priorities guide allocation for research programs. Federal goals identify the subject areas of emphasis for the expenditures of federal funds. University goals identify approaches to teach students throughout the state and to develop and extend knowledge through research and extension programs. The ARC will focus on two university areas of emphasis related to (1) strengthening selected graduate/professional/research programs and (2) integrating accountability and performance measures into the planning and allocation process. These approaches will be applied to the College of Agriculture and Home Economics (CAHE) areas of emphasis which meet state and federal needs.

PROCESS

Over the past several months, the Dean, Directors, Associate Directors, Superintendents, and Unit Heads/Chairs met to discuss the strategic plan of the CAHE. Unit administrators were requested to involve faculty and develop strategic plans for each of their units. The College plan was then developed, with coordinated but separate areas of emphasis across teaching, research, and extension functions (due to separate budgets). In addition, the College obtained input from stakeholders concerning needs through the current Pro-Agri-Food Initiative. The plans in the ARC are closely linked to efforts that were initiated during the summer of 1996 in which units/departments submitted 1-year and 5-year budget plans as a result of budget reductions/reallocations.

The process for developing and refining the Strategic Plan is sequential and dynamic. The goals, objectives, and strategies will be refined and prioritized by continuing input from stakeholders through the Pro-Agri-Food Initiatives and from departments.

ENVIRONMENTAL SCAN

In 1996, raw agricultural products exceeded \$5.8 billion, food processing added \$7.7 billion, and forestry products added another \$9 billion to the economy of Washington. These renewable-resource industries employed more than 200,000 people, and related industries

employ more. Washington state ranks first or second nationally in the production of approximately 20 crops, and more than 200 major and minor crops sustain the economies of rural communities. For many commodities, Washington producers and agribusinesses are increasingly dependent for their survival on export markets.

Rich soils, plentiful water resources, and unique climates underpin Washington's dynamic and highly productive agricultural and forestry industries. The state's economy is driven by innovative management, specialized cropping systems, and a food- and wood-processing sector that adds value and distributes food and fiber products worldwide. Such complexity in agriculture and the environment requires a research program comprised of scientists with numerous areas of expertise.

Historic public investments in research and education have been repaid many fold to ensure continued growth and productivity in the public good. Many national studies have shown an annual return on investment of 30-50% for agricultural research. And while we are experiencing times of rapidly increasing costs of conducting research, state and federal expenditures on agricultural research are stable or declining. A recent study conducted by the University of Arkansas Division of Agriculture indicates that, among all states, Washington now ranks 44th in state support for agricultural research and extension, providing approximately \$5.13 for every \$1,000 of (agricultural) cash receipts. The average for all states, \$17.11 for every \$1,000 of cash receipts, is more than three times the Washington figure. Given the agricultural diversity in Washington compared to most other states, it is clear that resources are inadequate to address many important issues.

ACCOMPLISHMENTS

The College of Agriculture and Home Economics is highly competitive for extramural grants. A new record of \$27 million in grants was awarded to the College for teaching, research, and extension in 1996-97. This success recognizes the quality and productivity of CAHE faculty, which includes four National Academy of Sciences members (one of whom is a USDA-ARS employee who works in the College of Agriculture and Home Economics but will soon be joining the WSU faculty). Many other faculty have received national, international, and university awards and recognition.

State and federal scientists working in Washington's research and extension facilities have had nationwide and even global impacts, as the following examples testify:

6. Semi-dwarf wheat contributed to the global green revolution and increased the productivity of the Northwest's wheat industry.
7. Controlled-atmosphere storage of apples provides year-round availability of high-quality fruit for domestic and foreign markets. This postharvest technology played a substantial role in making apples the largest agricultural crop in Washington.

8. The development of grape varieties suitable for Washington's environment made the state's wine industry possible and helped the industry earn its worldwide reputation for quality.
9. The development of rapidly growing, hybrid poplar trees created a new source of fiber for the forest-products industry.
10. 'Madsen' wheat, a variety resistant to the fungal disease foot rot, is currently grown on 25-30% of the wheat acreage in Washington. Over \$7 million has been saved in reduced fungicide application.
11. New technologies to control losses from pests have saved millions of dollars for potato, raspberry, vegetable seed, hops, and asparagus growers.
12. Development of biocontrol and Integrated Pest Management approaches for tree fruits and other crops provides effective pest control with environmental benefits.
13. New discoveries in fundamental research promise new levels of achievement in agriculture.

All of these advances resulted from past investments in basic and applied research and from transfer of technology to growers and processors. Their rapid adoption by the private sector has resulted in new jobs, new markets, better quality products, and increased profits.

MISSION STATEMENT AND VALUES

Recognizing its unique land-grant research mission to the people of Washington and the state's increasing global involvement, the ARC provides leadership in discovering and accessing knowledge through high-quality research that contributes to a 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.

The ARC values distinguish the Center as a leader in providing quality research programs. These values include:

1. **Quality and Excellence:** The ARC is committed to maintaining rigorous standards in research.
2. **Relevance:** Priorities are set and resources are allocated to address important problems.
3. **Responsiveness:** The ARC targets research resources to the changing needs of stakeholders.
4. **Timeliness:** The ARC strives to address research in a timely manner.
5. **Diversity:** The ARC values and supports diversity in its faculty and staff and in its clientele.
6. **Efficiency:** The ARC allocates and utilizes resources in a manner to reduce redundancy and waste.
7. **Multidisciplinary-Team Approach:** Research problems addressed by scientists are complex, frequently requiring teams composed of individuals from multiple disciplines.
8. **Contributions to the Teaching Program:** Research contributes to the teaching of undergraduate and graduate students primarily through participation in creation of new knowledge and through inclusion of new research findings in the curriculum.
9. **Collaborative Efforts:** Develop partnerships with domestic and international scientists to address regional, national, and global issues.
10. **Accountability:** The importance of documenting research impacts and communicating results to stakeholders and customers is acknowledged.

GOALS

The primary goal will be to strengthen the quality and improve the visibility of research programs, with areas of selected excellence. The goals for the ARC are to conduct research programs that are:

1. High-quality
2. Productive
3. Competitive for extramural funds
4. Relevant
5. High in impact

OBJECTIVES

The ARC is the formal research function of the College of Agriculture and Home Economics. Departments and units within the College conduct the research activities, and many of these efforts are funded through competitive grants, which is a tribute to the quality and competitiveness of the faculty. In fiscal year 1996, the ARC expended over \$17.4 million from grants and an additional \$3.7 million from gifts and other income to conduct research. This represents 48% of the total research expenditures for the year, compared to 42.7% of total research expenditures from extramural sources in 1991. Grants awarded in 1997 were 9% higher than in 1996.

At the present time approximately 79% of faculty with research responsibilities serve as the principal investigator on an extramural grant and generate an average of over \$110,000 per year in research resources. Many faculty also serve as cooperators on these grants coming to the Agricultural Research Center.

The Agricultural Research Center conducts research directed at discovery of new knowledge and application of knowledge to address issues for the benefit of citizens in the state and nation. Strong programs require a critical mass of expertise and focused effort to be successful. With limited state and federal allocations to ARC, it is necessary to prioritize programs to assure quality.

The ARC can have the greatest impact by building on existing strengths and by emphasizing research related to food and fiber systems. This approach includes basic research as well as research directed toward food and fiber production; disease and pest control; natural resource management and protection; the quality, safety, and processing of products; economics and marketing; nutrition and health of consumers; and community issues related to food and fiber systems. These efforts cut across all of the emphasis areas suggested by advisory groups, and they are consistent with previous Century 2 priorities of the College and with current trends in federal priorities.

The specific objectives for ARC research are:

1. To increase quality and recognition
2. To increase peer-reviewed research contributions.
3. To increase the level of extramural funding.
4. To improve relevance.
5. To increase impact.

STRATEGIES

The Agricultural Research Center will emphasize program quality and build on existing strengths to achieve excellence and national prominence in selected areas. The strong tradition of excellence in plant science (including plant biochemistry, plant breeding, physiology, and protection) will continue. We will work toward national and international prominence in plant biochemistry. Unique opportunities also exist to further develop tree-fruit research as an area of selected excellence in the College. Cropping systems for dryland and irrigated crops (including precision farming and the impact of improved farming systems on the environment) will be strengthened. The College will continue emphasis on international marketing through the IMPACT Center.

Additional resources will be required to strengthen programs in Animal Sciences to develop genetic mapping of desirable traits and animal identification systems using DNA testing. Additional funds are also needed to enhance food-processing and value-added programs carried out by the Departments of Biological Systems Engineering, Food Science and Human Nutrition, and other units.

Effective research programs need adequate infrastructure to support the research activities. The ARC needs enhanced resources to properly carry out its mission, since reductions in base support have been the trend over the past several years. Critical gaps in faculty expertise and infrastructure currently exist. An initiative to secure additional resources is currently being developed in collaboration with the agricultural industry and other stakeholders. Securing these added resources is the highest priority goal for the next biennium. Until this effort is successful, we must deal with reduced allocations in the ARC budget. This requires continued downsizing and reallocation which will further narrow the focus and contributions of the ARC.

Guidelines for reallocation are as follows:

1. Preserve and enhance infrastructure and support for high-quality, productive, and high-impact programs that are relevant to the ARC's area of emphasis.
2. Downsize, primarily in faculty FTEs, in order to provide adequate infrastructure and support.
3. Expand faculty and staff retraining opportunities to meet changing job requirements.
4. Encourage College and departmental/unit heads to allocate resources (such as laboratory space, technical assistance, and operations funds) on the basis of productivity, quality, relevance, and impact.
5. Initiate external peer-review process for departments and units.
6. Initiate a modest competitive funding program to address emerging and urgent issues and to encourage interdisciplinary efforts. This cannot occur until additional resources are obtained or until downsizing in faculty FTEs can generate sufficient funds.
7. Develop improved processes for economic analysis, impact assessment, and communication of research funding to stakeholders.

OUTCOME MEASURES

A variety of measures are needed to accurately assess the quality and impact of research programs. Traditional measures (such as the number of scholarly scientific papers, extramural support, and professional awards and recognition) quantify productivity, scientific competitiveness, and reputation. In addition to these measures, it is important to evaluate the relevance and impact of the work. Some of these are impossible to measure annually and must be evaluated over a longer period of time. Performance measures that will be used by the ARC are as follows:

1. Productivity: Peer-reviewed publications and other appropriate outlets for research results will serve as an indication of effectiveness and productivity. Ninety percent of the faculty are expected to have a peer-reviewed contribution annually. The ARC expects to surpass the University guideline of one refereed publication annually in the sciences and one every 2 years in the social sciences.
2. Extramural Support: Extramural support recognizes and validates the competitiveness of faculty to secure grant funds for program expansion. This should lead to greater impact, but it is recognized that not all programs require the same level of funds to be effective. Ninety percent of the faculty are expected to serve as a principal investigator on an extramural support grant(s). We expect that the trend of increasing extramural support will continue.

3. Awards, Recognition, Editorial Boards, Service on Major Scientific Peer Review Panels: These are indicators of professional reputation.
4. External Reviews: External peer reviews will be conducted on a rotational basis for units/programs emphasizing quality, productivity, and impact. Reports will be used as a component of the budget allocation process. A selected number of reviews (2-3) will be conducted each year.
5. Economic Benefits of Research: Periodic economic assessments of the benefits of the ARC research program will be conducted. On an occasional basis, the economic benefits of selected major areas of work will be evaluated.

RESOURCE REQUIREMENTS

The Agricultural Research Center has been required to reduce programs by about 2% per year over the last 6 years. We have reprioritized and focused programs and downsized in faculty, staff, infrastructure, and operations. With the progressive and complex agriculture in the state, many gaps exist in expertise, critical mass, and ability to respond to existing problems and emerging issues. If these trends continue, the Agricultural Research Center will not be able to fulfill its mission to the citizens of Washington.

The College of Agriculture and Home Economics is working closely with stakeholders and faculty to develop a plan for enhanced resources for its agricultural research and extension programs. This effort is critical to the success of ARC since it will increase the ability to develop excellence and to solve urgent agricultural and environmental problems in the state.