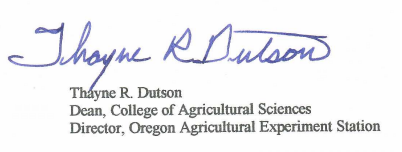
OREGON STATE UNIVERSITY
OREGON AGRICULTURAL EXPERIMENT STATION

Plan of Work

Annual Report of Accomplishments and Results

Oregon Agricultural Experiment Station
Oregon State University

Federal Fiscal Year 2001



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A. Planned Programs

Goal 1:

An agricultural system that is highly competitive in the global economy.
Through research and education, empower the agricultural system with knowledge that will improve the competitiveness in domestic production, processing, and marketing.

OVERVIEW

OUTPUTS:

Research on disease resistance and prevention in plants and animals during 2001 encompassed integrated pest management systems as well as new genetic technology. The focus was on minimizing harmful pesticides and preserving the environment while enabling the agricultural industry to maintain or increase profitability. Work in economics during the past year focused on the factors that affect productivity growth. Analysis was extended to the effects of trade and globalization on productivity growth and on the competitiveness of U.S. agriculture. The consequences of water curtailment during 2001 in much of the Klamath Irrigation Project has caused new interest in irrigation management alternatives and options for dry land situations.

Knowledge of the molecular mechanisms involved in plant host-pathogen interactions will make it possible to transfer naturally occurring resistance from one species to another without affecting the quality or quantity of the product. Genomic research focuses on both traditional plant breeding and newer genetic engineering technologies to develop new, more profitable cultivars.

In addition to an array of programs devoted to livestock health and the improved quality of meat products, several fisheries projects have been concerned with value-added production. Apiculture research is providing a better understanding of the biology of parasitic mites, which have increased colony mortality along with the costs of colony maintenance and pollination services.

OUTCOMES:

New vaccines have improved strategies for pest control and will become an effective means of controlling the spread of disease among the target population and in the general environment. This is especially true for aquatic animal vaccines.

Research has:

- Isolated genes that control the synthesis and/or secretion of a bioherbicide and arrest germination of grassy weed seeds.
- Deciphered the genomes in crop plants;
- Bred cultivars with enhanced pest resistance;
- Discovered new genes with potential for crop improvement;
- Developed biotechnology methods to utilize the new genes;
- Determined the potential for gene flow from herbicide resistant crop plants to weedy relatives.

IMPACTS:

- An avian sperm mobility assay that allows identification and elimination of low fertility sires is marketed by Animal Reproduction Systems of Chino, California and is used by the largest commercial breeder of poultry in the United States.
- A patented system that detects a potato pathogen with fluorogenic DNA probes is being used globally and is a part of the European Union protocol for detection of a world-wide, zero-tolerance pathogen for seed potatoes. The technology is available for use in all USA facilities that certify seed.
- A new industry, based on high hydrostatic pressure research, generated revenues of over $1 million in 2001 and resulted in three new value-added shellfish products. Annual cost savings of approximately $1.1 million per year were realized through energy/waste/productivity analysis in seafood plants.
- In fall 2001, approximately half of the winter wheat acreage in western Oregon was planted to three new wheat cultivars, increasing profitability an estimated $2 million this year alone.
- Research shows that under field conditions, wheat and jointed goat grass can cross, produce viable seed, and that self-fertility can be restored in backcross generations. If herbicide resistance genes move into weedy species, the potential cost to growers is immense for loss of weed control in crops, in fallow systems and in field borders.
- Apiculture research resulted in an estimated $300,000-500,000 in improved colony survival and pollination service.
- In western Oregon, the economic impact of grazing technology research is estimated to be about $1 million/year.

ASSESSMENT:

Current research is relevant to several agricultural crops and to the biotech industry. The pathology program has made excellent progress toward the goal of increasing global

competitiveness. Work on genome sequencing of different pathogens of agriculturally important plants and animals will help develop control strategies.

Strong partnerships with industry and other client groups and integrated and interdisciplinary approaches to solving problems strengthen the program. The most direct evidence of success is the adoption of research recommendations and information by the growers and producers in Oregon, the Northwest and elsewhere. Their confidence is confirmed by their continued financial support of research programs.

TOTAL EXPENDITURES: $25,056,282

Hatch- $1,046,258
State- $23,424,364
Multistate- $585,660

TOTAL FTE: 187

ACCOUNTABILITY:

Additional information regarding research programs conducted through the Oregon Agricultural Experiment Station may be found in *"Oregon Invests",* a research accountability database accessible on the web at:

http://oregoninvests.css.orst.edu

There are currently over 380 reports contained in the database, searchable by selected criteria. Each report undergoes systematic professional review with analysis of projected economic, environmental and social effects, as appropriate.

Examples of search topics for Goal 1: disease resistance, pest management, genetics, irrigation, plant pathogens, genomes, biotechnology, sperm mobility, seafood processing, wheat cultivars, and pollination management.

Key Theme: **Adding Value to New and Old Agricultural Products**

ISSUE OR PROBLEM

At the **Coastal Oregon Marine Experiment Station**, research with albacore tuna is investigating lipid content and omega-3 fatty acids for development of new products. Asian markets, for example, often prefer products with high fat content. Work with high pressure processing in oysters shows that this process can extend the shelf-life of shucked oyster meats. The upgrade of Pacific whiting surimi, which generates 70 percent of its solid by-products, from feed to food, is a major research area.

IMPACT

Based on work at the **Coastal Oregon Marine Experiment Station** demonstrating that safe, high-quality products can be produced with high pressure processing, Goose Point Oysters, a local processor, purchased equipment and is currently supplying products for several retail operations.

SCOPE OF IMPACT - State and national, and international

SOURCE OF FUNDING - State funds, NOAA, Sea Grant, commodity groups

Key Theme: **Agricultural Competitiveness**

ISSUE OR PROBLEM

Current research in the **Department of Agricultural and Resource Economics** includes investigation of productivity growth and foreign direct investment as factors in global and U.S. agricultural trade and the way they relate to the share of processed products in U.S. agricultural exports, which remains at 65 percent, significantly lower than that of other developed economies.

Research was performed at the **Columbia Basin Agricultural Research Center** during FY 2001 to determine if high populations of root lesion nematode cause economic damage to spring wheat in Oregon.

Current research at the **Coastal Oregon Marine Experiment Station** focuses on the limits on energy and water resources, coupled with waste disposal issues in coastal areas. Other work deals with product and market development and selective interdependencies with fishery management.

Researchers in the **Department of Horticulture** are working to improve the quality of deciduous plants for the Ornamentals/Green and tree fruit industries. Development of hazelnut cultivars resistant to Eastern Filbert Blight and suitable for production in Oregon and the Northwest is a current project, as is propagation of clonal rootstocks for pear, cherry and other fruits for small-scale commercial production. Methods are being studied to improve machine harvest efficiency of the Pacific Northwest blueberry crop.

IMPACT

The **Department of Agricultural and Resource Economics** work will have consequences for the debate on whether farm support (decoupled) payments or investments in research and development, extension and infrastructure improve social welfare (including the agricultural community).

At **Columbia Basin Agricultural Research Center**, several of the lesion nematode experiments indicated economic damage. In one study, 50 percent of the variability in spring wheat yield could be explained by combined damage from lesion nematode and Hessian fly.

Based on research at **Coastal Oregon Marine Experiment Station**, a Eugene, Oregon utility conducted ten energy/waste/productivity assessments of seafood plants in 1999. Of 84 total recommendations, 36 were implemented for an annual cost savings of $1,110,000. Based on COMES research, the fishery is managed by harvesting when fish are in optimal condition resulting in over $3 million in additional revenues for the Pacific whiting industry in 2001.

Department of Horticulture research that created and/or identified systems suitable for local and regional production of hazelnuts and cherries has been used to plant new orchards of both hazelnuts (500 - 1 ,000 acres annually over the last 5 years) and cherries (1,000 acres in 2000 and 2001). Rootstock/clone combinations, training systems and Low Input Viticulture and Enology practices for wine grapes are being used in existing and new vineyards (1000 acres annually in Oregon). Recently released hazelnut cultivars have improved resistance and are being planted into new orchards at the rate of 500 to 1000 acres annually. Growers have installed trellises in approximately 60 percent of machine-harvested blueberry fields, recovering an extra 1,600 lb of fruit/acre ($1,072/acre). Growers have planted about 800 acres of high-density plantings for a cumulative yield increase of 26,000 lb/acre or a net return to the blueberry industry to date of $2.5 million/year.

SCOPE OF IMPACT - State, national, and international

SOURCE OF FUNDING - Hatch, State funds, Smith-Lever, Specific Cooperative Agreement between Oregon State University and U.S.D.A.-Agricultural Research Service, commodity funds, OSU Foundation

Key Theme: **Agricultural Profitability**

ISSUE OR PROBLEM

Current research in the **Department of Agricultural and Resource Economics** updates and expands earlier work to estimate the value of farm equipment and depreciation functions. A project to bolster dairy producer profits and mitigate relocation adjustments is providing convenient access to relevant analytical tools, benchmark comparisons coupled with producer specific management advice, and timely production and management information.

Weed management tactics, such as new crop rotations, improved tillage practices, and use of newer, safer, chemical herbicides, combined with a better understanding of the biology of important weeds are being developed at the **Columbia Basin Agricultural Research Center**. Field research was conducted to develop more diversified crop management systems that will increase cropping options and grower profitability.

The **Department of Crop and Soil Science** work continues to develop meadowfoam, an oil seed crop, as a viable alternative to annual ryegrass on wet, clayey soils of the Willamette Valley. Other work seeks to identify new potato cultivars with improved agronomic performance, particularly with resistance to potato late blight disease. Research in support of Oregon's grass seed growers seeks to increase overall yields by investigating reproductive efficiencies, seasonal distribution of rainfall, spring nitrogen management, and phytochrome response to light quality of the growing environment. Studies of early-season weed emergence in snap beans and corn seek to improve agricultural profitability.

Work at the **Eastern Oregon Agricultural Research Center** seeks to identify and analyze the economic trade-offs of commodity and amenity resources, how they are influenced by upland and riparian area management, and the impacts of policy changes through development of a multi-year, linear programming ranch model, development of indicators for economic sustainability of rangelands, and an analysis of economic impacts of alternative uses of juniper

Researchers in the **Department of Horticulture** are developing practices to improve the quality of deciduous plants for the Ornamentals/Green and tree fruit industries to enhance their competitiveness nationally and internationally and to improve the profitability of producing deciduous plants.

Research activities at **Klamath Experiment Station** are focused on improved profitability of row crop production. KES serves as a cooperating site for Oregon and western regional variety development efforts for potatoes, and as the site of first generation field evaluation of breeding lines for the OSU spring barley breeding project. In response to curtailment of irrigation water in 2001, cereal grain species and varieties were evaluated for erosion protection efficacy and forage and grain production potential under dry land conditions.

At **Malheur Experiment Station**, research has been conducted to identify effective management strategies to control weeds in row crops and rangeland with specific focus on weeds of greatest economic importance to local production systems.

IMPACT

Eight dairy producers and six study coordinators from Oregon, Washington and Idaho were benefited by the priority list of dairy management information needs provided by the **Agricultural and Resource Economics**.

Improved management of weeds, decreased use of herbicides, less herbicide drift, and fewer problems with soil persistence of herbicides along with reduced environmental problems from soil erosion and over-use of herbicides in Oregon dry land wheat, and irrigated turf grass seed production result from **Columbia Basin Agricultural Research Center** research that demonstrated the benefits of newer, safer, chemical herbicides for managing weeds in these crops. An average 1 percent yield increase for winter wheat is expected, which translates to a $1.5 million/year increase, as farmers adopt these methods.

In 2001, the **Department of Crop and Soil Science** released the potato cultivar Wallowa Russet, with the potential to add $5,000,000 to current agricultural profits, and produced over

1000 pounds of certified, pre-nuclear mini-tubers, a potential annual economic value estimated in excess of $5,000,000.

The ranch model developed at the **Eastern Oregon Agricultural Research Center** is being applied to adjustments in Bureau of Land Management forage allocations for sage grouse management and is being tested in Oregon, Idaho, Nevada, New Mexico, Utah, and Wyoming. Through the Sustainable Rangelands Roundtable, current research is being applied on identifying indicators of sustainability.

Harvesting costs of bare root deciduous plants in the Northwest, California and other states has been reduced by more than 25percent through use of practices developed by the **Department of Horticulture** research.

The Oregon potato variety development program at **Klamath Experiment Station** released three new varieties in late 2000 and one in early 2001. A 1999 Oregon release, Umatilla Russet, ranked 9th in seed acreage in the U.S. in 2001 and is widely grown for French fry processing.

Malheur Experiment Station estimates that the impact of registration of Dual Magnum to control yellow nutsedge in onions is $5,589,500 annual savings to growers.

SCOPE OF IMPACT - State, national, and international

SOURCE OF FUNDING - State funds, commodity groups, Competitive regional grants, Hatch Act Funds, Fund for Rural America, Policy Analysis Center for Western Public Lands, OSU Foundation, ARF accounts

Key Theme: **Animal Health**

ISSUE OR PROBLEM

Current research in the Department of Animal Sciences includes: Progstin metabolism in the pregnant mare, fetus and newborn foal.

IMPACT

Savings in treatment costs of approximately $4 each day per mare can be realized by stopping progesterone therapy after 90 days, as indicated by Department of Animal Sciences studies.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - Hatch

Key Theme: **Animal Production Efficiency**

ISSUE OR PROBLEM

Current research in the **Department of Animal Sciences** includes beef production systems and end-product quality; dietary polyunsaturated fatty acid metabolism in poultry: strategies to regulate gene expression in skeletal muscle and to determine the role of calpains in myofibrillar protein degradation and muscle growth control; heritability and basis of a new reproductive trait in male poultry; fat cell development and differentiation in pork; increased reproductive efficiency of prolific sheep; genetic factors that influence the lethal embryonic condition referred to as chick edema; molecular, cellular and endocrine mechanisms that limit or control reproductive efficiency in domestic ruminants; action of prostaglandin F2 in promoting regression of the bovine corpus luteum.

Projects undertaken at the **Eastern Oregon Agricultural Research Center** address the issue of winter feed costs, seeking to lower these costs while improving utilization of low-quality forage.

IMPACT

Animal Reproduction Systems of Chino, California marketed the sperm mobility assay developed by researchers in the Department of Animal Sciences during federal fiscal year 2001. The primary customer, Hy-Line International, is the largest primary breeder of egg-type birds in the U.S.

Work accomplished in fiscal year 2001 at the **Eastern Oregon Agricultural Research Center** shows that supplementing protein once every six days, decreases the costs of beef production more than 83 percent, a savings of approximately $550/month for the average producer.

SCOPE OF IMPACT - National, and international

SOURCE OF FUNDING – Hatch funds, State Matching Funds

Key Theme: **Apiculture**

ISSUE OR PROBLEM

Current research in the **Department of Entomology** is providing a better understanding of the biology of parasitic mites that have increased colony mortality and costs of colony maintenance and pollination services.

IMPACT

Estimated net benefits during 2000-01 of work in the **Department of Entomology** on parasitic mites were $300,000-500,000 in improved colony survival and pollination service.

SCOPE OF IMPACT - Regional

SOURCE OF FUNDING - Hatch funds

Key Theme: **Aquaculture**

ISSUE OR PROBLEM

A major focus of the aquaculture program at **Coastal Oregon Marine Experiment Station** is improvement in commercial production of Pacific oysters through genetic selection of high-yielding broodstock.

IMPACT

Oyster seed from selected broodstock developed in the **COMES** program, if planted extensively, may increase commercial oyster production on the West Coast by 10 percent with a annual value of $6.8 million.

SCOPE OF IMPACT - Alaska, Washington and Oregon

Key Theme: **Biotechnology**

ISSUE OR PROBLEM

Current research in the **Department of Botany and Plant Pathology** includes a project concerned with the molecular mechanisms of the closterovirus transport inside infected plants. Other projects have worked with pathogenicity genes from a fungal pathogen of barley, developed a rapid, highly sensitive and specific detection system for the causal agent of bacterial ring rot in potatoes, and developed a bioherbicide for control of grassy weeds in grass seed cropping systems. Studies are underway to understand changes in a plant host when microbial infection results in disease resistance or susceptibility. Research is identifying genes involved in

disease development in tan spot of wheat, as well as host specificity and mechanisms of susceptibility and resistance.

Work in the **Department of Agricultural and Resource Economics** concerned the increasing privatization of bioscience research in U.S. universities, both in terms of funding and use of results, either in the form of university-patented technology or of publications that guide the development efforts of biotech firms. Findings indicate that the single most important factor in biotechnological advancement appears to be university bioscience.

Research in the **Department of Horticulture** on the molecular biology of plant response to environmental changes focused on tomato genotypes, most of which suffer chilling injury when exposed to temperatures below 10 degrees C. A project to facilitate targeted changes in crop plants, isolates genes and determines mechanisms that control hormone-mediated growth and development. Another project aims to elucidate mechanisms regulating the metabolism of cytokinins. Researchers have isolated a group of compounds called bruchins that stimulate cell division on pea pods. Work is also in progress on molecular genetic mechanisms that govern interactions between Botrytis cinerea, the causal agent of gray mold, and tomato.

IMPACT

A patented system developed in the **Department of Botany and Plant Pathology** that detects a potato pathogen with fluorogenic DNA probes is being used globally and is a part of the European Union protocol for detection of a world-wide, zero-tolerance pathogen for seed potatoes. The technology is available for use in all USA facilities that certify seed.

Although results of the **Department of Agricultural and Resource Economics** privatization study have not yet been published, they imply that public expenditures on university research have very strong positive impacts on the rate of innovation, and thus on the economic health, of the agribusiness sector. Because the data employed in this study have never been analyzed before, we believe the study results will have an impact on the public debate over bioscience funding in public universities.

The most striking result of research in the **Department of Horticulture** on transgenic tomato plants is that after one week of chilling at about 2 degrees C during the flowering stage, the plants still have satisfactory fruit set. The cytokinin project has impacted breeding programs of crops such as corn, where genes identified by the work are being tested for effect on germination and kernel development.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - National Institutes of Health, and the National Science Foundation, a Fulbright grant, USDA Special Grants Program, State funds, Hatch Act funds, commodity groups

Key Theme: **Diversified/Alternative Agriculture**

ISSUE OR PROBLEM

Preliminary research in the **Department of Horticulture** indicates that hardy kiwifruit shows promise as an alternative berry crop in Oregon, where growers have historically diversified to improve the chance of economic success in any given year and to spread out their risk.

IMPACT

The **Department of Horticulture** research coupled with an extended educational program of publications and workshops has been partially responsible for development of a hardy kiwifruit industry that has grown from an estimated 5 acres in 1990 to over 100 acres in 2001 with a current gross production/sales value of about $400,000 annually.

SCOPE OF IMPACT - Regional and international

SOURCE OF FUNDING - Hatch Act funds, Smith-Lever Act funds

Key Theme: **New Uses for Agricultural Products**

ISSUE OR PROBLEM

Work at the **Central Oregon Agricultural Research Center** concerns management of verticillium wilt of peppermint with cultural controls and control of white rot caused by Sclerotium cepivorum in garlic and onions.

IMPACT

Producers and crop consultants are utilizing the information provided by the **Central Oregon Agricultural Research Center** to increase profitability and stand persistence.

SCOPE OF IMPACT – Oregon

SOURCE OF FUNDING - Commodity groups, State funds

Key Theme: **Ornamental/Green Agriculture**

ISSUE OR PROBLEM

Current research in the **Hermiston Agricultural Research & Extension Center** focuses on evaluation of mechanisms for control of grass seed diseases and weeds in the Pacific Northwest.

The **Department of Horticulture** researchers are developing practices to improve the quality of deciduous plants for the Ornamentals/Green and tree fruit industries to enhance their competitiveness nationally and internationally and to improve the profitability of producing deciduous plants.

IMPACT

As a result of work at the **Hermiston Agricultural Research & Extension Center**, weed seed in grass seed produced for lawn seed has been reduced and yield has been increased by control of diseases.

Harvesting costs of bare root deciduous plants in the Northwest, California and other states has been reduced by more than 25 percent through use of practices developed by the **Department of Horticulture** research.

SCOPE OF IMPACT - Local and regional

SOURCE OF FUNDING - Hatch Act Funds, state matching funds, commodity funds

Key Theme: **Plant Genomics**

ISSUE OR PROBLEM

The **Department of Crop and Soil Science** research is using genomics tools to locate genes that determine quality, productivity, and biotic and abiotic stress resistance in wheat, barley, sunflower, meadowfoam, and cuphea and developing new cultivars with desired traits that will lead to increased profitability through reduced input use or higher value in niche markets. Genomics technology also is being used to investigate the transfer of genes between crops and weeds, and the potential for survival of such transgenic crops, a critical understanding as we increase use of crops with herbicide resistance and other traits that may have profound effects on plant ecosystems.

IMPACT

Winter barley cultivars and germplasm with quantitative and qualitative resistance gene pyramids show resistance to a new, very virulent race of stripe rust in Peru. The collective

impact of these findings is estimated at $1,000,000 in Oregon alone annually. Certified seed of three new wheat cultivars was available in quantity for the first time this past growing season. Approximately half of the winter wheat acreage in western Oregon was planted to this cultivar in fall 2001. Increased profitability through use of these new cultivars is estimated at over $2 million to Oregon wheat growers in FY 2001. Weed science research has shown that wheat and jointed goat grass can cross under field conditions, produce viable seed, and that self-fertility can be restored in backcross generations. If herbicide resistance genes move into weedy species, the potential cost to growers is immense.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - National Institutes of Health, and the National Science Foundation, a Fulbright grant, USDA Special Grants Program, competitive national and regional grants and commodity commission support

Key Theme: **Plant Germplasm**

ISSUE OR PROBLEM

At **Central Oregon Agricultural Research Center** a cooperative program seeks to develop new potato varieties for the Pacific Northwest potato industry to overcome quality problems and the need to capture new markets.

Current research at the **Hermiston Agricultural Research & Extension Center** includes development of improved potato varieties for the Pacific Northwest.

Current research in the **Department of Horticulture** includes collecting and characterizing hazelnut germplasm from around the world. A vegetable breeding program breeds new germplasm and cultivars of all types of vegetables adapted to the Pacific Northwest. Another project evaluates sweet corn varieties for suitability in the Willamette Valley. Other research seeks to develop biochemical and biophysical methods for the efficient screening of diverse germplasm.

IMPACT

At the **Central Oregon Agricultural Research Center**, the Oregon Variety Development Team has released six potato varieties in the last six years. Release documents for a chipping variety have been completed and will be submitted in 2002 pending production of adequate supplies of commercial seed.

Current research at the **Hermiston Agricultural Research & Extension Center** on improved potato varieties will take up to five years for results, however, if these varieties survive production conditions, their value to the industry will exceed $1,000,000,000 annually.

As a result of the **Department of Horticulture** research, four new hazelnut pollinators have been released to nurseries that are resistant to Eastern Filbert Blight. The vegetable breeding research program released a new tomato cultivar marketed by one seed company in 2001 for $13,000 in sales. As a result of berry crop research, three new red raspberry cultivars were released in 2001 for an estimated impact of $480,000 to $840,000 per year. A recently released blackberry cultivar is now planted to about 300 acres with an annual impact of $1.9 million.

SCOPE OF IMPACT - Regional and international

SOURCE OF FUNDING - USDA CSREES**,** Hatch Act Funds, state matching funds, commodity funds

Key Theme: **Plant Health**

ISSUE OR PROBLEM

Current research in the **Department of Botany and Plant Pathology** includes a project that addresses the efficacy of two tactics for management of the seed-borne phase of the disease Phytophthora infestans, which can lead to introduction of late blight within a planting of potato seed pieces infected with the disease.

Current research at the **Hermiston Agricultural Research & Extension Center** includes control of common smut for commercial sweet corn production and processing in the Pacific Northwest and control mechanisms for Integrated Pest Management of virus, aphid, Colorado potato beetle, wireworm and mites of potato.

IMPACT

Control of late blight on potato tubers with the combined techniques developed by the **Department of Botany and Plant Pathology** of seed treatment and banding a curative fungicide at emergence has been successfully used as a new integrated pest management approach resulting in an overall reduction in fungicide applications.

Based on the research from the **Hermiston Agricultural Research & Extension Center**, growers and processors of sweet corn in the Columbia Basin have made a major shift in varieties for processing. Two new insecticides registered for potato use in 2001 provide the potato industry with products that are very effective against green peach aphid and Colorado potato beetle while being safer for handlers and more ecologically friendly in the environment.

SCOPE OF IMPACT - Pacific Northwest and National

SOURCE OF FUNDING - National Institutes of Health, and the National Science Foundation, a Fulbright grant, USDA Special Grants, industry grant funds

Key Theme: **Plant Production Efficiency**

ISSUE OR PROBLEM

At the **Central Oregon Agricultural Research Center,** screening of products is an ongoing effort to identify pesticides that protect crops from disease, weeds, and insects and prevent field contamination due to cross-pollination.

Current work at the **Hermiston Agricultural Research & Extension Center** includes improving fertilizer utilization for Columbia Basin potato production.

IMPACT

In 2001, four pesticide products identified by the **Central Oregon Agricultural Research Center** were approved for use, allowing producers to increase quality and maintain competitive production of 2,160 acres of carrot seed with a farm gate value of $5,608,468.

Results of work at the **Hermiston Agricultural Research & Extension Center** showed that timing application of potassium for lay-by application improved crop utilization. Implementation will substantially increase yields while reducing overall use of potassium fertilization for PNW potato production.

SCOPE OF IMPACT - State and regional

SOURCE OF FUNDING - Local grower groups, State funds, Hatch Funds, OSU Foundation, ARF accounts

Goal 2:

A safe and secure food and fiber system. To ensure an adequate food and fiber supply and food safety through improved science-based detection, surveillance, prevention, and education.

OVERVIEW

OUTPUT:

Research activities are underway to develop new analytical methods and extraction procedures to measure the composition and post-harvest quality of fruits and vegetables, to measure and incorporate natural colorants and pigments, optimize wine yeasts, and develop natural protein-based anti-microbial preservatives. Other research addresses the effects of airflow on the quality of stored fruit.

OUTCOMES:

Three patents were approved relating to work on:
- Prevention of undesirable browning;
- Incorporation of nutraceutical compounds and natural colorants in foods;
- The use of natural lysoyme antimicrobial agent in brewing.

In other developments:
- A genetically modified laboratory yeast that uses arginine, a major nitrogen source in grapes, may reduce the incidence of incomplete fermentations in wine.
- Stored fruit maintains optimum quality through proper stacking patterns, which also minimize energy expenditures.

ASSESSMENT:

Research programs define the relationships between the molecular and functional properties of foods, which are technical enablers that ensure effective delivery and formulation of improved food products to meet the specific food quality, safety, and security needs of U.S. consumers.

TOTAL EXPENDITURES: $1,495,384
Hatch- $102,444
State- $ 1,252,871

Multistate- $140,069

TOTAL FTE: 10

ACCOUNTABILITY:

Additional information regarding research programs conducted through the Oregon Agricultural Experiment Station may be found in *"Oregon Invests",* a research accountability database accessible on the web at:

http://oregoninvests.css.orst.edu

There are currently over 380 reports contained in the database, searchable by selected criteria. Each report undergoes systematic professional review with analysis of projected economic, environmental and social effects, as appropriate.

Examples of search topics for Goal 2: fiber, food system, food quality, and food safety

Key Theme: **Food Quality**

ISSUE OR PROBLEM

Current research in the **Department of Food Science and Technology,** emphasizes anthocyanin pigment and polyphenolic composition of fruits and vegetables as affected by cultivar processing and post-harvest storage. Antioxidant properties are of particular interest because of their possible relationship to health benefits. Activity concerning the characterization and improvement of wine yeasts involved continuing studies on arginine and sulfur metabolism in yeast, and yeast biofilm formation.

IMPACT

Two patents relating to the **Department of Food Science and Technology** work on nutraceuticals and natural colorants were approved. The discovery that HSP12 gene is essential for yeast biofilm formation will be useful in understanding seemingly unrelated processes because this yeast gene has close relatives in plants and in the pathogenic fungus Candida albicans.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - Northwest Center for Small Fruit Research; USDA Germplasm Repository; USDA Human Nutrition Laboratory; Northwest Center for Small Fruit Research; commodity groups

Key Theme: **Food Safety**

ISSUE OR PROBLEM

Researchers in the **Department of Food Science and Technology** are investigating the use of protein-based antimicrobial compounds to protect foods and beverages against pathogenic and spoilage microorganisms. At the **Coastal Oregon Marine Experiment Station,** work with high pressure processing in oysters shows that this process can extend the shelf-life of shucked oyster meats.

IMPACT

The **Department of Food Science and Technology** research has led food processors to evaluate the use of protein-based antimicrobials as a substitute for conventional preservatives. Based on work at the **Coastal Oregon Marine Experiment Station** demonstrating that safe, high-quality products can be produced with high pressure processing, Goose Point Oysters, a local processor, purchased equipment and is currently supplying products for several retail operations.

SCOPE OF IMPACT – National

Goal 3:

A healthy, well-nourished population. Through research and education on nutrition and development of more nutritious foods, enable people to make health promoting choices.

OVERVIEW

OUTPUT:

Research activities are developing methods to extract and measure natural colors in foods, which are also natural antioxidant agents, to meet continuing consumer demands for more natural and health-promoting products. Continuing research focuses on vitamin B-6 and the role this particular nutrient plays in human health. Work also continues on the importance of fluoride on bone health and the amount of fluoride consumed in food products containing chicken. The inclusion of certain types of polyunsaturated fatty acids into the diets of laying hens and broiler chicks is being tested to incorporate these health-enhancing fats into egg and poultry meat products.

Technologies are being explored that improve detection, enhance degradation, and reduce exposure to environmental contaminants. Other projects increase understanding of basic biological processes and dietary constituents, especially phytochemicals, that reduce cancer risk.

OUTCOMES:

Research findings include the following results:

- Best management practices significantly reduce surface water concentrations of persistent contaminants.
- Work on mismatch repair enzymes during DNA replication identified a sensitive monitor for environmental mutagens.
- Work measured the relative antioxidant activity for various varieties and fractions of fruits and vegetables.
- Conjugated linoleic acids can be increased in eggs to provide as much as 360 mg of the polyunsaturated fat in a single egg.
- Poor dietary intakes of bone nutrients, especially in children and young adults, are contributing to high rates of osteoporosis in older adults. Ongoing work in fluoride is necessary to determine if fluoride supplements will enhance drug therapy for individuals with osteoporosis.

IMPACTS:

Recent findings on vitamin B-6 have been instrumental in establishing the newly published Recommended Daily Intakes (RDI) for this nutrient. Research done at OSU and in collaboration with Washington State University may show that the current RDIs for vitamin B-6 are not adequate to keep homocysteine levels within optimal ranges for the prevention of cardiovascular disease.

ASSESSMENT:

Information on environmental chemistry and toxicity of pollutants and pesticides reaches the public in large numbers. Programs at Oregon State University provide fundamental and applied research in food chemistry, sensory science, fermentation science, value-added foods, and food processing to support the needs of the Oregon and Pacific Northwest fruit, vegetable, dairy, and wine industries.

TOTAL EXPENDITURES: $1,836,691
Hatch- $165,210
State- $1,586,850
Multistate- $84,631

TOTAL FTE: 12

ACCOUNTABILITY:

Additional information regarding research programs conducted through the Oregon Agricultural Experiment Station may be found in *"Oregon Invests",* a research accountability database accessible on the web at:

http://oregoninvests.css.orst.edu

There are currently over 380 reports contained in the database, searchable by selected criteria. Each report undergoes systematic professional review with analysis of projected economic, environmental and social effects, as appropriate.

Examples of search topics for Goal 3: human health, and human nutrition.

Key Themes: **Human Health**

ISSUE OR PROBLEM

Current research in the **Department of Animal Sciences** includes: Dietary polyunsaturated fatty acid metabolism in poultry: Nutritional and health implications

Research in the **Department of Environmental and Molecular Toxicology** focused on technologies that improved detection, enhanced degradation, and reduced exposure to environmental contaminants and on increased understanding of basic biological processes and dietary constituents, especially phytochemicals, that reduce cancer risk.

The **Department of Food Science and Technology** research focuses on anthocyanin pigments and polyphenolics and their possible health benefits. Antioxidant properties are of particular interest because of their possible relationship to health benefits.

Food analyses were done in the **College of Health and Human Sciences** to define the extent to which foods made with mechanically separated chicken can contribute to total fluoride intake. This type of food includes infant food, chicken sticks for toddlers, luncheon meats, and canned meats. Calcium-fortified products, including orange juice, vegetable juice, dry drink mixes, and butter substitute were also collected to determine the extent to which this practice contributes unintended phosphate intake. The major form of calcium salt for the products mentioned is tricalcium phosphate. Research is being conducted to evaluate factors that affect vitamin B-6 bioavailability, requirements and metabolism in adults.

IMPACT

After best management practices were identified by the **Department of Environmental and Molecular Toxicology** and implemented for organophosphate insecticide applications in Hood River fruit tree orchards, monitoring indicated significant reduction of surface water concentrations.

The **Department of Food Science and Technology** work contributed to development of better analytical methods for analyzing anthocyanin pigments and polyphenolics.

The **College of Health and Human Sciences** research on vitamin B-6 requirements has shown that extreme endurance exercise increases metabolism and need for this vitamin.

SCOPE OF IMPACT - State and nation

SOURCE OF FUNDING - State, Hatch and regional, USDA

Goal 4:

Greater harmony between agriculture and the environment. Enhance the quality of the environment through better understanding of and building on agriculture's and forestry's complex links with soil, water, air, and biotic resources.

OVERVIEW

OUTPUTS:

Natural resource and environmental issues are of critical concern to Oregon's agricultural sector and the Agricultural Experiment Station has a long history of research on these issues including work relating to land use; weather and climate change; endangered species and biodiversity; and water quality and allocation.

Work is directed toward control of nitrogen application and of irrigation water to prevent groundwater pollution. Research is enhancing environmental quality through better understanding of soil processes and the complex ecosystem interactions among soil, water, air, and biotic resources. Fundamental and applied research is related to soil process-groundwater quality interactions.

Biological control of invasive weeds by insects is being integrated with herbicides, fire, flooding, tilling and mowing to improve prediction of insect appearance and timing of pest management activities. Current research includes options to control invasive exotic organisms in semi-permanent wetlands, and recognition of potential health risks to wildlife from introduction of aquatic invasive species.

OUTCOMES:

Primary success is represented by new collaborations within the agricultural community, the development and adoption of new Integrated Pest Management technologies, and the discovery of new environmentally safe products.

- Work on water quality has led to reduced nitrate values in Willamette Valley ground water.
- Winter cover crops in western Oregon conserve and recycle nitrogen and reduce the leaching of nitrogen to groundwater.
- Both cover crops and biosolids have been found to improve soil quality.
- Based on research at OSU, the U.S. Forest Service implemented selective harvest and understory thinning throughout Pacific Northwest forests as non-chemical alternatives to reduce insects, pathogens and fire.

IMPACTS:

- Research on improved weather forecasts is being used by Mexico and other Latin American governments under the coordination of the InterAmerican Development Bank to design an early warning system for agriculture and by NOAA to redesign their climate and weather forecast systems.
- Water quality was maintained near sediment standards set for most anadromous fish in the Umatilla, Dechutes and John Day River basins, all tributaries of the Columbia River.
- New techniques to identify Spring Chinook provide California with information to manage and sustain salmon stocks, improving water management in major state river systems.
- A stock assessment model for Dover sole allowed management agencies to revise quotas and rebuild fish stocks to maximize harvests and economic benefits.
- Understanding the interactions of cultured and wild salmon provides information to agencies in North America and Europe for improved management.
- Shipping lanes in the Bay of Fundy were changed to minimize damage to right whales, an endangered species.
- Winter cover crops in western Oregon vegetable row crops, conserve and recycle nitrogen and reduce nitrogen in groundwater.
- Net savings to row crop growers from reduced fertilizer inputs are estimated at $100,000 per year.
- Biological control of tansy ragwort using a combination of insect herbivores and granivores is estimated to save Oregon $5 million annually in reduced pesticide costs and livestock losses.
- Organophosphate levels found in surface water in 2000 and 2001 were lower than those in 1999, even though Best Management Practices were only partially implemented and were not mandatory,
- The weed management program has been implemented on 100,000 acres with an average long term benefit of $2 million/year.
- In western Oregon, the economic impact of grazing technology research is estimated to be about $1 million/year.
- Production cost per acre has been reduced by $265 where growers follow Integrated Pest Management practices.

ASSESSMENT:

Biological control can provide alternatives to antibiotic applications. As understanding of organisms in the nitrogen cycle increases, so will the ability to manage the consequences of intensive agricultural production and to ensure improved water quality. Much research is

directed toward identification, culture and establishment of biological control agents for invasive weeds and agricultural pests. Integrated Pest Management provides focus to improve food safety and environmental quality by reducing pesticide use.

A wide variety of initiatives improve marine resource management and rebuild biodiversity and endangered marine organisms. This area is a strong part of the Station's program and is expected to continue to grow over the next decade in response to increasing focus on protecting and better managing the marine environment.

TOTAL EXPENDITURES: $6,594,718

Hatch- $468,312
State- $6,068,496
Multistate- $57,910

TOTAL FTE: 58

ACCOUNTABILITY:

Additional information regarding research programs conducted through the Oregon Agricultural Experiment Station may be found in *"Oregon Invests",* a research accountability database accessible on the web at:

http://oregoninvests.css.orst.edu

There are currently over 380 reports contained in the database, searchable by selected criteria. Each report undergoes systematic professional review with analysis of projected economic, environmental and social effects, as appropriate.

Examples of search topics for Goal 4: environment, waste management, biological control, biodiversity, endangered species, forest resources, climate change, integrated pest management, soil quality, sustainable agriculture, wildfire, and water quality.

Key Theme: **Agricultural Waste Management**

ISSUE OR PROBLEM

Current research in the **Hermiston Agricultural Research and Extension Center** focuses on the practical use of water waste from vegetable processing plants.

IMPACT

The **Hermiston Agricultural Research and Extension Center** initiated a "Reuse Water Consortium" to foster communication and reduce conflict between growers, processors and

governmental agencies. Though early in the effort, several meetings resulted in dramatically improved communications.

SCOPE OF IMPACT - Oregon and Washington

Key Theme: **Biological Control**

ISSUE OR PROBLEM

Much of the **Department of Entomology** research is directed toward identification, culture and establishment of biological control agents for invasive weeds and agricultural pests, especially pests of grass seed, wheat, nursery plants, small fruits and tree fruits.

Researchers in the **Department of Fisheries and Wildlife** are evaluating the relationship between diets of invasive bullfrogs. Some native amphibian species essentially disappear from sites successfully colonized by bullfrogs. A similar problem in Hawaii of predation upon dark-rumped petrals by feral cats can impose severe mortality on petral chicks. Understanding the unanticipated impacts of natural resource and land management activities on aquatic vertebrates is a fundamental step in resolving issues related to the decline in biodiversity and to using natural resources in a sustainable manner.

IMPACT

The **Department of Entomology:** Biological control of tansy ragwort using a combination of insect herbivores and granivores is estimated to save Oregon $5 million annually in reduced pesticide costs and livestock losses.

The **Department of Fisheries and Wildlife** studies identify strategies for preservation of native species that are under severe pressure from invasive organisms.

SCOPE OF IMPACT - Oregon and Hawaii

SOURCE OF FUNDING - USDA Western Region Integrated Pest Management Grants; USDA STEEP; Department of Energy, Hatch funds, U.S. Environmental Protection Agency, U.S. National Park Service, U. S. Forest Service, Oregon Department of Fish and Wildlife, and commodity groups

Key Theme: **Biodiversity**

ISSUE OR PROBLEM

Major projects in the **Department of Entomology** explore the consequences of changes in biodiversity resulting from alternative forest harvest practices and altered water quality.

Researchers in the **Department of Fisheries and Wildlife** developed empirical models for estimating the status of fish and aquatic invertebrate communities in all second to fourth-order streams throughout the Willamette River basin. The models predict fish and invertebrate status as a function of physiographic, land use/land cover and streamflow variables, with the latter two sets of variables subject to change under alternative historical and future scenarios of human development.

Studies of introduced trout indicate that they appear to reduce abundance and eliminate larval salamanders and crustacean zooplankton in high lakes. Understanding the unanticipated impacts that natural resource and land management activities have on aquatic vertebrates is a fundamental step in resolving issues related to the decline in biodiversity and to using natural resources in a sustainable manner.

IMPACT

During 2000-01 work in the **Department of Entomology** helped Congress and land management agencies change policy to protect biodiversity, including implementation of selective low-impact harvest practices to protect diversity of arthropods, as well as other taxa.

Although full restoration of fish and invertebrate communities comparable to 1850 conditions cannot be expected, the improvement predicated by the **Department of Fisheries and Wildlife** of 9-24 percent in biotic status indicators over status quo or increased human development from 2000-2050, should be weighed against any advantages from the non-conservation scenarios.

National Park Service managers will use the results of a **Fisheries and Wildlife** study suggesting that introducing trout into relatively productive lakes where they can reach high densities could adversely affect food webs in high lakes in the North Cascades National Park Service Complex to develop fish management plans.

SCOPE OF IMPACT – National

SOURCE OF FUNDING - Hatch, U.S. Environmental Protection Agency, National Science Foundation, U.S. National Park Service, U. S. Forest Service, Oregon Department of Fish and Wildlife

Key Theme: **Endangered Species**

ISSUE OR PROBLEM

Current research in the **Agricultural and Resource Economics Department** includes the optimal design of green payments and environmental stewardship programs, the optimal allocation of conservation funds, the slippage effect of conservation programs, the environmental and distributional impacts of alternative conservation targeting strategies, mandatory vs. voluntary environmental regulations, and voluntary agreements for the protection of endangered species.

Current research in the **Coastal Oregon Marine Experiment Station** includes infectious diseases in populations of cultured and wild fishes, especially salmonids and endangered salmonid species in the western US, and how they are initiated and spread between populations of wild and cultured salmonids. New research addresses potential impacts on salmonid fish populations of molluscan shellfish culture in estuaries. Related issues include the role of estuaries in the life history, population biology and resilience of salmonid populations; interactions between cultured and wild salmonids; and the life history, ecology and behavior of exploited marine fishes to improve the sustainable management. The goal of the OSU Marine Mammal Program is to identify and characterize the critical habitats of endangered whales to minimize the impact of human activities on the recovery of these species.

An understanding of recruitment and early, life-history ecology of two endangered suckers in Upper Klamath Lake is fundamental to assessing population declines and potential recovery of these species. The impacts of the operation of the Klamath Project on these two species were examined by the **Department of Fisheries and Wildlife.**

IMPACT

As a result of the **Department of Agricultural and Resource Economics** study, a cumulative effect bonus has been included in Oregon's Conservation Reserve Enhancement Program. This bonus, which encourages landowners to make coordinated efforts for habitat enhancements, has been regarded by USDA as an innovative idea.

The **Coastal Oregon Marine Experiment Station** work on infectious diseases in fish will provide a new paradigm to evaluate the mechanisms and impact of diseases of fishes. Data on right whale movements in the Bay of Fundy will change shipping lanes in Canadian waters to reduce whale mortalities.

Work done by the **Department of Fisheries and Wildlife** on the endangered suckers in Upper Klamath Lake was used by US Bureau of Reclamation and US Fish & Wildlife Service in preparing their management proposals.

SCOPE OF IMPACT - Oregon, national**,** and international

SOURCE OF FUNDING - Hatch Act, U.S. Environmental Protection Agency, National Science Foundation, U. S. Bureau of Reclamation

Key Theme: **Forest Resource Management**

ISSUE OR PROBLEM

When Oregon state Department of Fish and Wildlife biologists identified the need for a greater understanding of black-tailed deer fawn ecology and demography as crucial for understanding deer population declines in western Oregon, OSU's **Department of Fisheries and Wildlife** faculty research contributed to a general understanding of wildlife population response to forestry practices.

IMPACT

As a result of this **Department of Fisheries and Wildlife** project, the state wildlife agency has adopted the use of vaginal implant transmitters to study the effects of cougar predation on elk calf survival.

SCOPE OF IMPACT - Oregon, and national

SOURCE OF FUNDING - Hatch Act Funds, State Matching Funds, Forest Service - Pacific Northwest Research Station, Agricultural Research Foundation, U. S. Bureau of Land Management, Oregon Department of Fish and Wildlife

Key Theme: **Integrated Pest Management**

ISSUE OR PROBLEM

Weed management tactics such as new crop rotations improved tillage practices, and use of newer, safer, chemical herbicides, combined with a better understanding of the biology of important weeds are being developed at the **Columbia Basin Agricultural Research Center**.

The **Department of Entomology** evaluates insects, mites and nematodes as biological control agents for invasive weeds and for crop, nursery and forest pests. Biological control of invasive weeds by insects is being integrated with herbicides, fire, flooding, tilling and mowing to improve prediction of insect appearance and timing of pest management activities. Biotechnology research addresses the mechanisms by which timer genes regulate circadian rhythms and phenology of pest insects.

Research in the **Hermiston Agricultural Research and Extension Center** implements commercial utilization of environmentally friendly insecticides for control of Colorado potato beetle, green peach aphid and potato leafroll virus.

Research in the **Horticulture Department** helps identify management tools for the control of weeds, including chemical, tillage, and row cover. Integrated pest management in Oregon vegetable production systems focuses on corn root rot, a devastating disease in processed sweet corn and on cabbage root fly (cabbage maggot), a major pest of cruciferous crops.

Work proceeds in the **Southern Oregon Research & Extension Center** to optimize the effect of naturally occurring biological control agents, and implement available Integrated Pest Management technology in on-farm demonstration blocks. New control products are being tested for their effects on target and non-target organisms. Other studies concern post-harvest fungal decay in pears, and the biology of post-harvest pathogens and practical control measures. Training orchard scouts to monitor pests in orchards and implementation of a soft pear pest management program are on-going projects.

IMPACT

Improved management of weeds, decreased use of herbicides, less herbicide drift, and fewer problems with soil persistence of herbicides, along with reduced environmental problems from soil erosion and over-use of herbicides in Oregon dryland wheat, and irrigated turfgrass seed production result from **Columbia Basin Agricultural Research Center** demonstrating the benefits of newer, safer, chemical herbicides. An average 1 percent yield increase for winter wheat is expected, which translates to a $1.5 million/year increase, as farmers adopt these methods.

The **Department of Entomology** developed biological controls for tansy ragwort, saving Oregon $5 million annually in pesticide cost and livestock losses; reduced mite parasitism of honey bee colonies, worth $300,000-500,000 in improved colony survival and pollination service. As a result of studies by the Department, the U.S. Forest Service implemented selective harvest and understory thinning throughout Pacific Northwest forests to reduce incidence of insect, pathogen and fire

Education efforts by the **Hermiston Agricultural Research and Extension Center** assisted potato growers in the Pacific Northwest accomplish a major transition to environmentally friendly insecticides.

Systems of weed control developed in the **Horticulture Department** minimize impact on the environment, reduce production costs, and avoid potential development of resistance to chemical control measures. Results are being used by Oregon growers. Preliminary evidence shows that raw and composted dairy manure amendments and cover crops can reduce corn root rot severity. Preliminary data suggests that rotation of fields in space and time for cruciferous crops could significantly reduce damage from cabbage root fly.

About 50 percent of the local tree fruit acreage implemented mating disruption based on demonstration projects conducted by the **Southern Oregon Research & Extension Center**.

Studies indicate that IPM technologies result in a net savings to the grower of $210 per acre. The orchard scout-training program educates orchardists and their employees to evaluate trees for pest populations and control needs. This program has saved southern Oregon growers about $650,000-$975,000 annually in pesticide expense. Scouted orchards reduce pesticides in the environment by up to 57 percent.

SCOPE OF IMPACT - Regional, national and international

SOURCE OF FUNDING - Hatch Act funds, Smith-Lever Act, USDA Western Region Integrated Pest Management Grants, USDA STEEP, Department of Energy, State funds, commodity groups

Key Theme: **Land Use**

ISSUE OR PROBLEM

A project in the **Department of Agricultural and Resource Economics** examined the impact on land zoned for exclusive farm use of the $80,000 income requirement for building homes. Other work addressed policies to govern private uses of land that will ensure environmental benefits; the causes of urban sprawl and its socioeconomic and environmental impacts; and the interactions between land use changes and land use regulations in five western states as they affect public finance.

IMPACT

Results of the **Department of Agricultural and Resource Economics** studies were shared among policymakers in Oregon interested in the land use issue. Effects of public conservation lands on employment growth and net migration were widely quoted in newspapers and other popular press outlets and, thus, influenced the public lands policy process.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - State funds, Hatch funds, U.S. Environmental Protection Agency, National Science Foundation

Key Theme: **Natural Resources Management**

ISSUE OR PROBLEM

Current research in the **Agricultural and Resource Economics Department** included analyses of the value of weather forecasts to farmers in the U.S. and Mexico; the benefits of removing invasive plant species from rangelands in Oregon; the economic efficiency of improvements in riparian habitat and stream flows in Oregon; and the effects of using higher scale resolution models in integrated modeling of climate change impacts.

Coastal Oregon Marine Experiment Station work deals with reduced error in molecular genetic identification of spring run chinook at California's Central Valley water diversion sites. Genetic characterization of Pacific Northwest native oysters as a tool for restoration addresses the issue of ecosystem and water quality improvement in estuarine environments. Other work concentrated on the design of incentive-based regulations and development of training programs for fishery managers to improve performance and realign policy with environmental and economic goals. Current research also includes infectious diseases in populations of wild and cultured fishes, especially endangered salmonid species in the western US. New research addresses potential impacts of molluscan shellfish culture in estuaries on salmonid fish populations. Related issues include the role of estuaries in the life history, population biology and resilience of salmonid populations; interactions between cultured and wild salmonids; and the life history, ecology and behavior of exploited marine fishes to improve the sustainable management.

Studies in the **Department of Fisheries and Wildlife** of introduced trout indicate that they appear to reduce abundance and eliminate larval salamanders and crustacean zooplankton in high lakes. Trout populations that reach high densities more adversely affect both larval salamanders and zooplankton than trout at low densities. Understanding the unanticipated impacts that natural resource and land management activities have on aquatic vertebrates is a fundamental step in resolving issues related to the decline in biodiversity and to using natural resources in a sustainable manner.

IMPACT

Coastal Oregon Marine Experiment Station research on incentive-based fishery regulation led to discussions of specific regulatory change in west coast fisheries to address problems of bycatch and discards. An international workshop on training fishery managers stimulated federal funding for follow-up activities in the United States. Work on infections diseases in fish will provide a new paradigm to evaluate the mechanisms and impact of diseases of fishes. The stock assessment for Dover sole estimated that the biomass had been depleted considerably lower than the level supports the largest sustainable harvests.

Introduced trout appear to reduce abundance and eliminate larval salamanders and crustacean zooplankton in high lakes. National Park Service managers will use the results of a **Department of Fisheries and Wildlife** study to develop fish management plans. Work on the life history of trout in the Lake Billy Chinook System and on the genetics of long-toed salamanders in the North Cascades have crucial implications for the management of high-elevation amphibian populations worldwide. Research on the ecology of parasitic infections in

Oregon cautions managers worldwide to consider the ways that pathogen-free exotic species may affect the dynamics of endemic parasites and diseases.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - Hatch Act funds, Regional funds**,** USDA-funded competitive grants, U.S. National Park Service, U. S. Forest Service, Oregon Department of Fish and Wildlife

Key Theme: **Nutrient Management**

ISSUE OR PROBLEM

Research in the **Horticulture Department** on the physiology of growth and development of woody plants designs methods for ensuring maximum nitrogen storage in seedlings and minimizing nitrogen in the environment. Because current systems of overhead and container application of controlled release fertilizers result in gross excess and misapplication, with consequent pollution of surface and ground waters, research is investigating plant-governed movement of water and fertilizer ions into the root medium. Production system research and physiology of berry crops, especially efficiency of nitrogen fertilization in some crops like trailing blackberries (our leading berry crop) is being studied to minimize risk of ground water contamination with nitrates and to reduce grower cost.

IMPACT

Horticulture Department studies on woody plants suggest that new shoot growth throughout the growing season might be promoted by soil N application, while fruit quality with minimizing shoot growth would benefit from foliar N application. Loss of nitrogen to the soil and ground water can be reduced significantly by using foliar N application. More growers are now basing their N fertilization of trailing blackberry on plant needs and saving about $75,000/year.

SCOPE OF IMPACT - Local, state, and national

SOURCE OF FUNDING - Hatch Act Funds, state matching funds, commodity funds, USDA, EPA

Key Theme: **Pesticide Application**

ISSUE OR PROBLEM

Weed management tactics such as new crop rotations improved tillage practices, and use of newer, safer, chemical herbicides, combined with a better understanding of the biology of important weeds are being developed at the **Columbia Basin Agricultural Research Center**.

Current research in the **Horticulture Department** on the effect of alternative orchard floor management on the flowering, growth, development and yield of hazelnut crops evaluates soil quality and biology, N uptake, utilization, and distribution while also considering pests and economics.

The **Southern Oregon Research and Extension Center** designs and develops educational materials and programs for regional farmers, commercial and public pesticide applicators, pesticide consultants and pesticide dealers.

IMPACT

Improved management of weeds, decreased use of herbicides, less herbicide drift, and fewer problems with soil persistence of herbicides along with reduced environmental problems from soil erosion and over-use of herbicides in Oregon dry land wheat, and irrigated turf grass seed production result from **Columbia Basin Agricultural Research Center** research that demonstrated the benefits of newer, safer, chemical herbicides for managing weeds in these crops. An average 1 percent yield increase for winter wheat is expected, which translates to a $1.5 million/year increase, as farmers adopt these methods.

As a result of the **Horticulture Department** study of hazelnut crops, soil biology has changed in response to tree row amendments and orchardists are beginning to use a blend of conventional and Alternative Orchard Floor Management Systems.

Local pesticide applicator classes provided through the **Southern Oregon Research and Extension Center** trained over 439 people in pesticide use and safety. Through bilingual pesticide safety training and license preparation classes, over 1559 Spanish-speaking farm workers and field representatives have been trained over the last eight years.

SCOPE OF IMPACT - Local and regional

SOURCE OF FUNDING - USDA-CSREES STEEP III Program, Smith-Lever Act, Hatch Act Funds, state matching funds, USDA-SARE

Key Theme: **Riparian Management**

ISSUE OR PROBLEM

Current research in the **Agricultural and Resource Economics Department** includes the optimal design of green payments and environmental stewardship programs, allocation of conservation funds, the slippage effect of conservation programs, the environmental and distributional impacts of alternative conservation targeting strategies, mandatory vs. voluntary environmental regulations, and voluntary agreements for the protection of endangered species.

Current research in the **Coastal Oregon Marine Experiment Station** includes how infectious diseases are initiated and spread in populations of wild and cultured fishes, especially endangered salmonid species in the western US, and how they are initiated and spread between populations.

IMPACT

As a result of the **Department of Agricultural and Resource Economics** study, a cumulative effect bonus has been included in Oregon's Conservation Reserve Enhancement Program. This bonus, which encourages landowners to make coordinated efforts for habitat enhancements, has been regarded by USDA as an innovative idea.

Coastal Oregon Marine Experiment Station work on infections diseases in fish will provide a new paradigm to evaluate the mechanisms and impact of diseases of fishes.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING – Hatch Funds; State Matching Funds, Pacific Northwest Research Station, Forest Service

Key Theme: **Soil Erosion**

ISSUE OR PROBLEM

At the **Columbia Basin Agricultural Research Center**, research was conducted to identify strategies to reverse long-term soil loss, improve soil, water, and air quality, diversify cropping systems and improve rural economies. This included strategies for nutrient management, soil and water conservation, planting of alternate crops and arrangements for farm leases.

IMPACT

Because of work done at the **Columbia Basin Agricultural Research Center,** soil loss was reduced by 1-2 tons ($10/ton) on 1 million acres of cropland for an annual saving of one to two million dollars. Water quality was maintained near sediment standards set for most anadromous fish in the Umatilla, Deschutes and John Day River basins. Cropping patterns were diversified on more than 100,000 acres.

SCOPE OF IMPACT - Oregon and Pacific Northwest

SOURCE OF FUNDING - USDA funded competitive grants, commodity commissions

Key Theme: **Soil Quality**

ISSUE OR PROBLEM

Current research in the **Horticulture Department** on the effect of alternative orchard floor management on the flowering, growth, development and yield of hazelnut crops evaluates soil quality and biology, N uptake, utilization, and distribution while also considering pests and economics.

IMPACT

As a result of the **Horticulture Department** study of hazelnut crops, soil biology has changed in response to tree row amendments and orchardists are beginning to use a blend of conventional and Alternative Orchard Floor Management Systems.

SCOPE OF IMPACT - Local and regional

SOURCE OF FUNDING - Hatch Funds, state matching funds, USDA-SARE

Key Theme: **Sustainable Agriculture**

ISSUE OR PROBLEM

Work in the **Department of Botany and Plant Pathology** includes research on Columbia root-knot nematode and tobacco rattle virus, which is vectored by stubby-root nematodes and causes internal quality defects that make potato tubers unmarketable

The **Malheur Experiment Station** is working on accumulation of nitrate and Dacthal residues in groundwater. Pending issues involve the effects of farming and ranching on the nutrient, fecal bacteria, and sediment losses to surface waters, and other factors influencing stream quality and aquatic specie survival. This project identifies economically viable alternatives to current practices to protect water quality and simultaneously lower costs or increase productivity.

IMPACT

Research in the **Department of Botany and Plant Pathology** on Columbia root-knot nematode and tobacco rattle virus reduced the amount of fumigant by 22 percent and the cost to growers by 40 percent. In addition to the reduction of pesticide exposure to the environment, annual cost savings to growers exceed $500,000 in Oregon and are even greater in Washington and Idaho.

Work at the **Malheur Experiment Station** resulted in a drop in the average groundwater concentration from 111 to 38 ppb in the most contaminated parts of the aquifers in northeastern Malheur County. Subsurface drip irrigation has been adopted for onion bulbs and alfalfa seed on over 1000 acres in Malheur County. Alfalfa "seed screenings", a by-product of alfalfa seed production and cleaning, have been redirected from landfills mushroom production.

SCOPE OF IMPACT - Local and regional

SOURCE OF FUNDING - USDA Western Region Integrated Pest Management Grants; USDA STEEP, State funds, Hatch Funds, Special projects, ARF accounts

Key Theme: **Water Quality**

ISSUE OR PROBLEM

Current research in the **Agricultural and Resource Economics Department** includes analyses of the value of weather forecasts to farmers in the U.S. and Mexico; the benefits of removing invasive plant species from rangelands in Oregon; the economic efficiency of improvements in riparian habitat and stream flows in Oregon; and the effects of using higher scale resolution models in integrated modeling of climate change impacts. Other work analyzes the impact of green payments and climate changes on farmers' adoption of conservation practices in the Mississippi River basin and the impact on nitrogen loadings and hypoxia in the Gulf of Mexico.

Current research in the **Department of Bioengineering** concerns pollution of groundwater from nitrogen applications to crops and over-irrigation. The department is developing tools that will interpret and analyze spatially explicit datasets and incorporate diverse stakeholder goals into resource management.

Current core research at the mass spectrometer facility of the **Department of Chemistry** includes identification and characterization of prenylflavonoid compounds found in hops and present in beer that are potent antioxidants and effectively trap free radicals that cause cancer. Another project is focused on understanding how proteins fold in vitro.

Fundamental research in the **Department of Crop and Soil Science** involves work to determine limits of seepage in unsaturated fractures and theoretical work to develop a new mathematical model to predict the potential and extent of preferential transport through macropores. Applied research involves ways to minimize leaching of nitrogen to groundwater.

Water quality monitoring by the **Klamath Experiment Station** during 1998-2000 provided data on nutrient loading of surface waters in the upper Klamath Basin indicating that agricultural contributions are less than predicted from previous studies.

IMPACT

Mint producers in the Willamette Valley have reduced their nitrogen application as a result of the **Bioengineering Department** study on water quality. As a result, nitrate values in the ground water are lower.

At the mass spectrometer facility of the **Department of Chemistry,** the development, patenting, and commercial production of instrumentation for an electron monochromator-mass spectrometer (EM-MS) system for the analysis of environmental compounds and pesticides, promises a powerful tool for detection and identification of trace amounts of environmental chemicals.

The **Department of Crop and Soil Science** research shows that winter cover crops in western Oregon vegetable row crops conserves and recycles nitrogen and reduces leaching of nitrogen to groundwater. Net savings to row crop growers from reduced fertilizer inputs are estimated at $100,000 per year.

Research at the **Klamath Experiment Station** indicated that water allocation policies established by Federal agencies were not justifiable based on available science and irrigation water should not have been denied to agriculture in 2001. This was consistent with the findings of a later NAS preliminary report.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - Hatch funds, State, USDA Western Region Integrated Pest Management Grants, USDA STEEP, Department of Energy, USDA funded Competitive grants, industrial commodity commission support

Key Theme: **Wildfire Science and Management**

ISSUE OR PROBLEM

Current research in the **Eastern Oregon Agricultural Research Center** includes a descriptive analysis on the role of fire in pinyon and juniper woodland expansion; a chronology of western juniper woodland expansion; effects of fire and woodland expansion on plant

community structure, composition and diversity and on avian populations, and environmental factors influencing shrub establishment following fire.

IMPACT

Eastern Oregon Agricultural Research Center work involving fire history has been incorporated into long-range fire management plans by the BLM, US Forest Service, and National Park Service. Work describing the development and affects of juniper woodlands was used to develop juniper control programs by both federal and private landowners. Results have also identified old growth woodlands and moved woodcutting and juniper control projects out of old growth stands into post settlement stands.

SCOPE OF IMPACT - National and international

SOURCE OF FUNDING - Hatch Funds, State Matching Funds, Joint Fire Science, National Park Service, US Forest Service, Bureau of Land Management, US Fish and Wildlife, National Wildlife Federation

Key Theme: **Wildlife Management**

ISSUE OR PROBLEM

Researchers in the **Department of Fisheries and Wildlife** are evaluating the relationship between diets of invasive bullfrogs and availability of a number of potential food items. A similar study is underway in Hawaii of predation upon dark-rumped petrals by feral cats. Faculty used research on black-tailed deer fawn demography to contribute to a general understanding of the population response of wildlife to forestry practices.

IMPACT

Impacts from all of the **Department of Fisheries and Wildlife** studies have to do with preservation of native species that are under severe pressure from invasive organisms. As a result of the project on black-tailed deer, the state wildlife agency has adopted the use of vaginal implant transmitters to study the effects of cougar predation on elk calf survival.

SCOPE OF IMPACT - Oregon, Hawaii, and regional

SOURCE OF FUNDING - Hatch Act, U.S. Environmental Protection Agency, U.S. National Park Service, U. S. Bureau of Land Management, Oregon Department of Fish and Wildlife

Goal 5:

Enhanced economic opportunity and quality of life for Americans. Empower people and communities, through research-based informtion and educaton, to address economic and social challenges facing our youth, families, and communities.

OVERVIEW

OUTPUTS:

Research projects analyzed:

- The Bureau of Reclamation's decision to reduce irrigation water to the Klamath Project in 2001;
- The structure and diversity of the Corvallis/Benton County economy;
- The Personal Responsibility and Work Opportunity Reconciliation Act of 1996 and its efficacy in moving impoverished rural people toward self-sufficiency.

Other activities include retrospective pre-test methods useful for both program and community initiative; strategies and methods for tracking outcomes for community child care programs; and measurable outcomes of community-wide mobilization initiatives in support of children and families.

OUTCOMES:

Research and extension efforts actively support development of a multidisciplinary Rural Studies Initiative and also include a multi-disciplinary effort to assess the economic, social and environmental impacts of the Klamath water allocation decision.

Five categories of measurable outcomes have been defined for community childcare programs and for initiatives in support of children and families. Related qualitative and quantitative measures are being identified, developed, and pilot tested.

IMPACTS:

The Oregon Department of Housing and Community Services is using a simulation model developed at OSU to study poverty and welfare policy. Congressional staff and policy analysts were briefed on the barriers to work that face low-income adults in rural areas and on the different impacts of welfare reform in rural and urban areas.

Results of research are the basis of performance measurement policies and practices for the Oregon Commission on Children and Families. The model has been adapted for use by the University of Illinois Champaign; US Child Care Bureau; National Association of Child Care Resource and Referral Agencies; and Untied Way agencies in several states.

ASSESSMENT:

By almost any measure, rural people and rural economies do not fare as well as their urban and suburban counterparts. Historically, however, very little funding has focused on rural economic issues. Faculty at OSU are making important contributions in describing the way rural poverty differs from urban poverty and the implications for welfare policies. Understanding how successful interventions and programs work is essential to the well being of communities and research can identify valid outcomes.

TOTAL EXPENDITURES: $562,298
Hatch- $15,300
State- $478,984
Multistate- $68,014

TOTAL FTE: 3

ACCOUNTABILITY:

Additional information regarding research programs conducted through the Oregon Agricultural Experiment Station may be found in *"Oregon Invests",* a research accountability database accessible on the web at:

http://oregoninvests.css.orst.edu

There are currently over 380 reports contained in the database, searchable by selected criteria. Each report undergoes systematic professional review with analysis of projected economic, environmental and social effects, as appropriate.

Examples of search topics for Goal 5: rural, low-income families, community development, and employment.

Key Themes: **Impact of Change in Rural Communities**

ISSUE OR PROBLEM

The **Department of Agricultural and Resource Economics** economists were approached to provide estimates of the impact of irrigation shutoff on the Upper Klamath Basin. Options for local economic diversification in Benton County and Corvallis were provided for local business leaders by the **Department of Agricultural and Resource Economics** faculty. The Oregon Legislature approached AREC for assistance estimating the size and progressivity of any major change in tax law. Two research projects examine the success in the labor market of low-income workers and the impact of job creation policies on the state poverty rate. A **Department of Agricultural and Resource Economics** project stimulated and summarized research on the rural dimensions of welfare reform.

IMPACT

As a result of the **Department of Agricultural and Resource Economics** study, farmers and their representatives have a better understanding of the economic implications of the decision not to supply water for the Klamath Irrigation Project. Business leaders and development professionals in Corvallis better understand the structure of their local economy and some options for economic diversification.

The **Department of Agricultural and Resource Economics** helped develop the Oregon Tax Incidence Model used by the legislature to analyze tax proposals and assess the distribution of the tax burden. A major tax proposal in the 2001 session was redesigned because of OTIM estimates. The Legislature is currently working with the **Department of Agricultural and Resource Economics** to revise the model for the next Legislative session in 2003.

Through conversations with Senate Finance Committee staff, as well as interaction with analysts at Brookings Institution, Urban Institute and Mathematica Policy Research, it is clear that congressional staff and policymakers better understand some of the barriers to work that face low-income adults in rural areas and the differential impacts of welfare reform in rural and urban areas.

SCOPE OF IMPACT - Local, statewide and national

SOURCE OF FUNDING - State funds

Key Themes: **Children, Youth, and Families at Risk**

ISSUE OR PROBLEM

College of Health and Human Sciences Across Oregon and the nation, communities face increasing demands for accountability in programs for children, youth and families, especially those at risk of poor outcomes. A prior research project resulted in a state and nationally implemented model for tracking the outcomes of prevention programs to larger social goals and

benchmarks. The current project expands this earlier work to (1) identify valid and reliable outcome measurement strategies for program and community initiatives for children, youth, and families, especially those used in rural communities; and (2) examine factors associated with level of implementation of outcome-focused accountability in initiatives serving children, youth, and families.

IMPACT

College of Health and Human Sciences results accountability model and related resources are the basis of the performance measurement policies and practices for the Oregon Commission on Children and Families and all 36 county commissions, the Oregon statewide planning processes for children, youth and families under SB555 (2000 Oregon Legislative Assembly); the Oregon Child Care Bureau; and the Oregon Tobacco Prevention and Cessation Program (Oregon Health Division). The model has been adapted for use by the University of Illinois Champaign; US Child Care Bureau; National Association of Child Care Resource and Referral Agencies; and Untied Way agencies in several states.

SCOPE OF IMPACT - National

SOURCE OF FUNDING - Hatch; B.E. Knudson Endowment for Family Policy; sub-contract from the Oregon Child Care Research Partnership funded by the USACF Child Care Bureau

Key Themes: **Community Development**

ISSUE OR PROBLEM

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SCOPE OF IMPACT - National

SOURCE OF FUNDING - Hatch; B.E. Knudson Endowment for Family Policy; sub-contract from the Oregon Child Care Research Partnership funded by the USACF Child Care Bureau

Key Themes: **Jobs/Employment**

ISSUE OR PROBLEM

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SCOPE OF IMPACT - Local, statewide and national

SOURCE OF FUNDING - State funds

B. Stakeholder Input Process

Actions Taken to Seek Stakeholder Input and Encourage Their Participation: At Oregon State University, College of Agricultural Sciences, there are several formal avenues for soliciting stakeholder contributions. These include:

1. Dean's Advisory Council - This is a small advisory council composed of industry, consumer, and environmental representatives. It is advisory to the dean of the College of Agricultural Sciences.
2. Dean's Legislative Advisory Council - This is usually a sub-group of the Dean's Advisory Council providing input as legislative budgets are prepared for submission to state government.
3. Advisory Councils of each department and branch station - These groups are advisory to the departments and branch stations and include membership drawn from the discipline or relevant region.
4. Advisory Councils of each county extension office - These advisory groups are more broadly based and relate to all Extension program areas in a county or region. Agriculture is one of the Extension program areas.
5. Board on Agriculture of the Oregon Department of Agriculture (i.e., the State Department of Agriculture) - This is a statewide advisory board for agriculture and is appointed by the governor. The dean is a permanent appointee to this board.

These councils meet regularly to aid in the direction and guidance of our programs. Leaders from each industry and commodity group are typically invited to serve on the Advisory Councils. We also seed community, consumer and environmental representatives.

In addition to formal advisory councils, unit leaders in the departments, branch stations and counties maintain regular contacts with stakeholders throughout the year.

This past year, OSU's College of Agricultural Sciences and the Oregon Department of Agriculture (ODA) sponsored a two-day event in Corvallis in October 2001 for a cross-section of leaders from Oregon agriculture, "Foundations for the Future: Conversations About Oregon Agriculture." Along with representatives of ODA and OSU, the group examined forces that will influence the future, such as changing consumer demands, globalization, and environmental issues. Before the session concluded, participants committed to taking action on a number of matters important to the future of Oregon agriculture. The complete report of "Foundations for the Future," including the action plans, is available in a Portable Document Format (PDF) file at <http://agsci.orst.edu/admin/foundations_report.pdf>. It is clear from this report that the action plans were formulated from the ideas collected in this meeting. These plans are being implemented following the time table established during the meeting. We believe in soliciting stakeholders' inputs, and this represents an important factor in establishing our program priorities. Partnership with our stakeholders to identify emerging issues relevant to the Oregon Agriculture is a key to our success in the past, and will continue to play a critical role in the future.

Process Used for Identifying Stakeholders and Approach Used to Collect Input From These Groups: Oregon has approximately 30 statutorily appointed commodity commissions and grower organizations. Most of these have research committees. The membership of these groups provide a rich source of engaged individuals from the natural resources community. Oregon has active environmental, consumer, and community organizations including the Isaac Walton League, Oregon Environmental Council, the Nature Conservancy, Defenders of Wildlife, the Sierra Club, the Food Alliance, Oregon Tilth, and other organizations. The university has a minority Board of Visitors to advise the university and its component colleges on minority affairs. The college also has student governance through the Agricultural Executive Council. This is a very active student council with representatives from over 30 student organizations representing a broad base of students. Included are MANRRS (which hosted the 2002 national MANRRS meeting in Portland with over 900 participants), and the Organic Agriculture Student Association. These groups add breath to more traditional student groups expected in a college of agriculture. These organizations provide a broad perspective for input to the management of the college. An example of how input is used can be found in the "Foundations for the Future" conversation described above. Note the reference to the web page.

How Input was Considered: Input is solicited from the various advisory groups on a regular basis and is advisory to the dean and unit leaders of the college in our strategic planning process.

C. Program Review Process

There have been no significant changes in our program review processes since our 5-Year Plan of Work was submitted.

D. Evaluation of the Success of Multi and Joint Activities

The Oregon Agricultural Experiment Station currently has 130 scientists who contribute to 73 multistate projects under the five National Goals. Each of these multistate projects submits a report on their activities, accomplishments and plans for the future each year. The OAES makes no attempt to evaluate any of these multistate research activities as that is accomplished through the efforts of the scientists and administrative advisors in each of those programs. The Western Research Coordination and Implementation Committee is responsible for evaluating each new or revised proposal for projects, and the AES directors approve or disapprove them based on the recommendations from the RCIC.

The Oregon Agricultural Experiment Station contributes to forty-eight multistate projects:

- National Goal #1 (W-006, W-106, W-112, W-128, W-130, W-133, W-147, W-150, W-168, W-171, W-185, W-186, W-192, WCC-011, WCC-027, WCC-037, WCC-039, WCC-043, WCC-055, WCC-058, WCC-060, WCC-067, WCC-069, WCC-072, WCC-077, WCC-081, WCC-089, WCC-093, WCC-097, WCC-099, WCC-101, WCC-109, WCC-204, NC-142, NC-214, NCR-097, NCR-173, NE-185, NE-124, NE-132, NE-162, NE-183, NEC-063, S-278, S-290, S-1000, NRSP-3, and NRSP-6).
- National Goal #2 (W-122, W-150, and WCC-023),
- National Goal #3 (W-122, W-143, WCC-027, WCC-103, NC-136, NC-219, NC-1001, and NEC-101),
- National Goal #4 (W-045, W-128, W-130, W-133, W-147, W-150, W-170, W-185, W-186, W-187, W-190, WCC-037, WCC-040, WCC-043, WCC-058, WCC-060, WCC-077, WCC-081, WCC-089, WCC-091, WCC-097, WCC-099, WCC-102, WCC-103, WCC-205, NC-140, NC-214, NCR-173, NE-103, NE-132, S-285, S-1000, NRSP-3, NRSP-4),
- National Goal #5 (W-128, W-167, W-183, W-192, W-193, W-194, WCC-055, WCC-058, NC-223, NC-1001, and NE-185).

OAES is actively encouraging our scientists to participate in multistate activities. We continue to monitor our progress in these activities.

Oregon State University has a unique organizational approach that integrates research, extension and credit education programs. All faculty in the statewide campus have an academic

home in a department. They are full members of the department faculty and are fully enfranchised in the departments, colleges and university. For example, extension faculty stationed in a county hold academic appointment in a department and fully participate in promotion and tenure activities of the department. They hold tenure track and professorial positions. They are fully represented in the Faculty Senate of the university. They plan and implement education (both academic and extension) and research programs in a fully integrated fashion.

Oregon, Idaho, and Washington have a long tradition of cooperation in the region we call "Cascadia." The region is topologically complex with agri-ecological zones crossing state boundaries and include:

1. The Treasure Valley includes Eastern Oregon and Southern Idaho,
2. The Palouse wheat growing area of Washington extends into Northeastern Oregon and Northern Idaho,
3. The nursery crop and small fruit growing regions of Western Oregon and Washington (Vancouver BC to Eugene, Oregon)
4. The tree fruit growing regions of Hood River/The Dalles, Oregon and Wenatchee, Washington,
5. The hop growing regions of Oregon, Washington and Idaho

Increasingly this concept is being extended to Montana (particularly for potatoes), California (particularly in the Klamath Basin dealing with water management), and the Great Basin states of Utah and Nevada (wildland/rangeland management). This allows improved programming.

The multistate programming is particularly evident in cooperative efforts with the ARS/USDA and includes special projects like STEEP (sustainable dry-land agriculture research and education), the Grass Seed Cropping Systems for Sustainable Agriculture, the Northwest Center for Small Fruits Research, the Northwest Nursery Research Center, the Great Basin Rangeland Management Program.

We also have active initiatives with the Confederated Tribes of the Warm Springs and the Confederated Tribes of the Umatilla. These include a broad array of programs in education and research. These and other tribes participate in undergraduate teaching in the college particularly in developing a multicultural understanding of natural resource management. OSU degree programs in Natural Resources and General Agriculture are available at Warm Springs. The university has a long standing memorandum of understanding and cooperation with the Confederated Tribes of the War Springs that as been mutually beneficial and includes extension, academic teaching and research.

The college operates education programs which focus on Hispanic populations of the region. Hispanics play a major role in the agriculture of the Pacific Northwest. Areas of emphasis have been in the nursery crop and tree fruit crop growing regions of the state.

There are many other examples where there is a long history of planned effort addressing critical issues to the region (Cascadia). Increasingly, these programs are reaching underserved populations with the best examples being the tribes of the region.

E. Integrated Research and Extension Activities

In 1993 Oregon State University integrated the land-grant functions by:

- elevating *Extended Education* (now *OSU Statewide)*, including the OSU Extension Service (OSUES), to University-wide status;
- integrating OSUES field- and campus-based faculty into academic departments across the University;
- charging academic Deans with leadership responsibility for Extension programs;
- developing P&T guidelines that recognize and reward all three mission areas of the university -- teaching, research, and extension -- through one process;
- defining scholarship to include the integration and application of knowledge as creative intellectual work; and
- creating a unique position description for every OSU faculty member by the joint effort of the faculty member and his/her supervisor and department head.

During 2001 OSUES commissioned a study of the impacts of the above changes on extension programs and faculty. The study revealed that extension faculty, both campus- and field-based, believe there has been significant advances in integration of research, extension, and teaching in terms of the:

- closeness of the working relationship between on- and off-campus faculty,
- degree of integration of research and extension,
- degree to which academic units are implementing extension as part of the fundamental missions,
- degree to which research, instruction, and extension have equal status and importance, and
- extent to which scholarship activities carried out by extension faculty are enhancing extension programs.

Joint appointments in research and extension are the norm in the departments of the College of Agricultural Sciences. Twelve faculty located at research and extension centers and branch research stations have partial or full extension appointments. All multidisciplinary working

teams include both extension and research faculty. Many of the Oregon representatives to Regional Research and Coordinating Committees have joint appointments with extension.

The impacts of integrated programs in the western region are highlighted in the "Best of the West" website http://www.ag.unr.edu/wri/index.html.

Examples of integrated Research and Extension programs that relate to the IR-4 Pesticide Registration Program for Minor Crops, Integrated Pest Management, Landscape Plant Introduction, and Berry production Systems follow:

- A center for expediting the registration of pest management substances of minor crops was established at the North Willamette Research and Extension Center. The center identifies promising pest control materials, conducts field studies, secures samples for pesticide residue analysis, and helps develop petitions for new registrations of materials. These new pesticides are effective, safer for the environment and human health, and provide economically important tools for farmers. The center has participated in more than 25 pesticide registrations for vegetable, small fruit, tree fruit, and nut crops.
- Integrated Pest Management systems for cranberries are being developed which include weed, nutrient, and water management. These improved practices are being adopted by producers and have economic benefits to the rural communities where cranberries are grown. In addition, the potential for surface water pollution is reduced.
- Weed, insect, and disease control needs are being integrated with cover crops in ways that minimize soil erosion and promote improved soil and crop health for vegetables, berries, nursery crops, and orchards. Producers are adopting improved practices.
- Pesticide applicators are trained on a continuous basis through demonstration/research plots, workshops, and seminars that offer instruction on the proper use of pesticides, alternatives to pesticides, disposal of containers, and safe handling and application methods. Training results in high success rates for applicators passing certification tests and provides continuing education credits for recertification of pesticide applicators' licenses.
- Varieties of *Ceanothus sp.* that are suitable for Oregon conditions are being identified and will be released for the public through commercial nurseries. Evaluations include assessment of cold hardiness, flowering time, growth habit, and overall suitability as a landscape plant.
- Machine harvesting methods are being developed and implemented that will minimize fruit loss and maintain quality of blueberries, raspberries, and blackberries.
- Producers are improving the profitability of blueberries through the utilization of research and Extension programs that promote early cropping (harvest from new plantings rather that delaying harvest for several years), high-density plantings, and reduced pruning.

U.S. Department of Agriculture
Cooperative State Research, Education, and Extension Service
Supplement to the Annual Report of Accomplishments and Results
Multistate Extension Activities and Integrated Activities
(Attach Brief Summaries)

Institution: Oregon Agricultural Experiment Station
State: Oregon

Check one: ____ Multistate Extension Activities
__X__ Integrated Activities (Hatch Act Funds)
____ Integrated Activities (Smith-Lever Act Funds)

Title of Planned Program/Activity	Actual Expenditures		
	USDA Goal	OSU Program	Hatch
Plant and animal improvement and new agricultural product development	1	1	$ 72,793
Systems for producing, processing and marketing agricultural products	1	2	$181,232
Safe and effective management of pests	1	3	$ 7,540
Food safety and quality	2	4	$ 25,611
Human health and nutrition	3	5	$ 41,302
Agricultural and environmental quality	4	6	$117,078
Rural and community development	5	7	$ 3,825
Total			$449,381

J R Dutson
Director

4-24-02
Date