

Academic report of the dean, 2012-2013

College of Agricultural Sciences

Oregon State University

September 2013

Introduction

This report to the provost from the College of Agricultural Sciences makes no attempt to provide comprehensive documentation of the many activities and accomplishments of our faculty, staff, and students. Instead, in each of the categories specified by the provost, it offers examples of the ongoing work and the consequences for students, stakeholders, Oregon residents, and others. Because so much of the College's work is long-term, any report like this represents a point-in-time snapshot. Some programs we report here were part of last year's report and may well be a part of next year's as well.

Oregon State University has been recognized by QS World University Rankings as a world-class center in agriculture and forestry, ranking eighth in an international survey of more than 200 schools. This is the first year the service has compiled a list of agriculture and forestry institutions. As the state's Land Grant university, Oregon State's agricultural, natural resource, and forestry programs have been vital components of the school's mission since its founding in 1870. These programs have received national top-tier rankings from the Chronicle of Higher Education for research, with wildlife science and conservation biology ranking first, fisheries science second, botany and plant pathology and forest resources at fifth, and agricultural and resource economics seventh.¹

Key initiatives undertaken and noteworthy outcomes achieved

Student engagement and success

The College and the Oregon Agricultural Experiment Station are dedicated to excellence in education and experiential learning for a diverse student body. College of Agricultural Sciences enrollment increases reflect a national resurgence of interest in agricultural and natural resource studies, an emphasis on Science, Technology, Engineering and Math (STEM) studies within the College, and a College-wide dedication to increasing access to agricultural and natural resource studies for minorities and underrepresented populations.

Fall term enrollment in the College increased by almost 13 percent between 2011 and 2012, and by more than 31 percent from 2010 to 2012 for a total enrollment of 2210. Minority student enrollment increased over the same three-year period by more than 61 percent.

The College's Leadership Academy, initiated and administered by the Agricultural Education and General Agriculture Program, promotes the competitiveness of students in the workplace. The Leadership Academy was created in response to employer feedback that graduates have strong technical skills but inadequate leadership abilities. The first cohort completed training in June 2012. Eleven students made up the cohort during the 2012-2013 academic year; nineteen students have been accepted for the 2013-2014 academic year. The Academy is open to all students in the Division of Earth Systems Sciences.

Opportunities and Achievements

Diversity and inclusiveness are central values in the College and are advanced by a wealth of student opportunities.

¹ <http://agsci.oregonstate.edu/feature-story/cas-rank-8>.

Minorities in Agriculture, Natural Resources and Related Sciences (MANRRS) is a University-wide program, with the College remaining the financial sponsor and home for it. In 2013, OSU MANRRS was selected as National Chapter of the Year from among three regional finalists. MANRRS provides a framework for academic, professional, and social development of underrepresented students in the fields of agriculture, natural resources, and related sciences through leadership, community service, and professional development activities. MANRRS also supports networking and professional development opportunities for members. The College and other partners support student members in participating in a National MANRRS Annual Career Fair and Training Conference, where chapter members network with faculty, professionals, and fellow students from across the United States.

The College has increased its support for the Louis Stokes Alliance for Minority Participation (LSAMP), a National Science Foundation (NSF)-funded bridge program for incoming underrepresented minority students enrolling in STEM majors. The 2013 program will include five College participants who will benefit from the support of peer mentors in their studies as well as a diverse community of peer scholars. These are strong factors in student retention. Students receive financial, academic, social, and professional support in a coordinated effort to assist them in achieving their academic and professional goals.

Twelve BioResource Research (BRR) students have been awarded prestigious Multicultural Scholars Program scholarships. This program is funded by USDA-NIFA, and supports undergraduate students from diverse cultural backgrounds and first-generation college students who are interested in agriculture, natural resources, food science, or human health and nutrition. Recipients must pursue an undergraduate degree in BRR in the College of Agricultural Sciences, and participate in MANRRS.

Responding to the educational needs of students and stakeholders

Fermentation Sciences, a program within the Department of Food Science and Technology, promotes partnerships among faculty and students in such diverse College units as Crop and Soil Science, Horticulture, Animal and Rangeland Sciences, and Applied Economics. Fermentation Sciences applies microbial-driven processes to agricultural inputs and yields value-added products. Undergraduate enrollment in the program is currently more than 200 and has more than doubled since 2008. With one of the nation's two teaching breweries and an endowed chair in fermentation science, a dairy pilot plant, and a teaching vineyard and winery, Fermentation Sciences at OSU offers students the opportunity to learn the subtleties of chemistry and microbiology along with sustainable business practices. The pilot brewery has industry support. The dairy plant was established with in-kind gifts from the dairy industry and supports start-up dairy-related businesses. Students in viticulture and enology benefit from the knowledge of viticulturists, flavor chemists, and sensory scientists in the Oregon Wine Research Institutes (OWRI). Graduates from Fermentation Sciences are highly sought after by their respective industries after graduation. Read elsewhere in this report about OWRI-related efforts.

In related work, a suite of three related Fermentation Sciences offerings through OSU's Professional and Non-Credit Education has drawn highly favorable attention to the University. These courses, which include microbiology for the brewer, beer sensory analysis, and beer quality assurance, represent partnerships between College faculty and the industry. The first beer analysis course was held on the main campus, and drew 20 students from Canada, Australia, and throughout the United States. A fourth class, now being developed and again as a University-industry partnership, is Craft Brewery Startup, emphasizing the business of brewing.

The College now hosts a double degree in sustainability to prepare graduates to communicate effectively, work collaboratively, and apply knowledge of economic, business, scientific, and sociological principles to a variety of career fields. The degree complements any University degree program. It is earned as a second bachelors degree, in addition to

a major area of study, upon completion of 36 hours of coursework, including a core curriculum that covers ecology, economics, sociology, and sustainability assessment. Electives are tailored to complement the primary degree and interests of the student. In an increasingly globalized business, organizational, and political environment, future leaders will be challenged to address climate change, suitability of traditional energy sources, water issues, and a growing demand for socially and environmentally responsible products and services. This double degree option prepares our graduates to assume leadership in these areas.

The degree is the result of a partnership among the colleges of Agricultural Sciences and Forestry, the Cascades Campus, and Ecampus, with participation from other colleges. It was designed with the input of academics, policy makers, and business leaders from throughout the state and is tailored to the economic needs of each region. Since the beginning of academic year 2012-2013, a full suite of courses has been offered. Ecampus offerings for the program have flourished. Inspiration for the degree came from the Cascades Campus.

Research and its impact

The Oregon Agricultural Experiment Station leverages each state dollar into \$2.30 of external research funding for a total of \$3.30 of direct research expenditures. The overall economic impact to the state is more than \$8 for each state dollar invested.

The President's Council of Advisors on Science and Technology issued a report² in December 2012 documenting that the United States receives \$10 in benefit for every \$1 invested in agricultural research. These benefits are reflected in new varieties; in discovery of solutions to production problems; and in enhancing crop yields and quality. OSU-bred wheat varieties are grown on 60 percent of the acreage planted to wheat in the Pacific Northwest. College plant breeders are working on hop varieties with custom flavor panels for the region's burgeoning brewing industry. In partnership with College of Veterinary Medicine researchers, College researchers provide strategies for addressing existing and emerging production problems in the region's oyster industry.

Living sustainably within the framework of natural systems

Genomic-scale data is transforming the study of the life sciences. The University's investment in a Computational and Genome Biology Initiative (CGBI) and the Center for Genome Research and Biocomputing (CGRB) has been repaid in collaborations, team efforts, international partnerships, and genomic assemblages and has attracted multimillion dollar grant awards. The strength of a partnership between the CGRB and the College is expressed by the extent of College faculty participation: more than 40 percent of the faculty associated with CGRB have an appointment in the College, and up to 60 percent of Center projects originate with College faculty.

Genotyping by sequencing enables rapid progress in plant breeding, by promoting identification of specific genes controlling expression of desirable traits. This new service offered by CGRB overtakes sequencing procedures requiring the purchase of expensive DNA "chips," which sent equipment- or personnel-constrained research groups to outside laboratories. The approach yields multiple amounts of data as compared to the technology it replaced. The service is made available in response to the University plant breeding community which met in 2012 to identify this and other common needs and resources. Two examples of CGRB-based collaborations that contribute to international outcomes are:

² http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_ag_release_20121207.pdf

- Faculty in the Department of Botany and Plant Pathology are characterizing the genome of the wild strawberry. This biological model has important implications for breeders because of its ability to duplicate its genome. This characteristic permits identification of markers for tolerance to such environmental changes as drought stress or salinization of soil. The work is funded by the NSF; colleagues at Tai Zhou University in China were funded in parallel by China's Natural Science Foundation. Each proposal had to be highly rated by both agencies for either to be funded; a first for these agencies.
- Other faculty in the Department of Botany and Plant Pathology have published comparative genomic networks of plant genes that regulate metabolic pathways and plant development.³ Two million visitors from 120 countries have accessed or downloaded open source data; this scheme aligns well with the U.S. Open Data Policy for grant-funded outputs. Plantontology.org is an NSF funded project to develop a structural vocabulary with computer-readable definitions, and establish standards for the description of plant anatomy and developmental stages. The resource permits researchers world-wide to communicate clearly and with precision.

In a closely related effort, the Department of Crop and Soil Science now offers a barley doubled haploid production service. The doubled haploid technique provides complete genetic homogeneity, stability, and uniformity in a single generation and bypasses the complications of field, greenhouse, or off-season inbreeding. The success and efficiency of this service have led to its being offered to external users. Service for wheat breeders will be added later this year.

Marine Mammal Institute faculty expertise is recognized internationally for:

- tagging endangered sperm whales in the Gulf of Mexico prior to the 2010 Deepwater Horizon oil spill and every year since then to evaluate environmental effects. This work uses advanced dive behavior tags to record foraging effort during dives a mile deep;
- applying advances in genomics and bioinformatics to the conservation of whales and dolphins around the world, especially Antarctic blue whales, the sperm whales, and the world's rarest dolphin, the Maui's dolphin;
- developing life-long history tags that monitor by satellite the diving, birth, and predation rates of endangered Alaskan Steller sea lions to clarify their competitive interactions with the largest U.S. commercial fishery.

In response to regulatory actions disallowing antibiotics in organic production, faculty in the Department of Botany and Plant Pathology have developed integrated, non-antibiotic fire blight control programs for organic pears and apples. The effort has improved understanding of 1) the dynamics of pathogen inoculum, 2) integrated control by crop load thinning, 3) the value of prebloom sanitation with copper bactericides, 4) the use of the biological products for organic fire blight control, and 5) integration of these biological products into programs providing excellent fire blight control.

Research conducted by faculty in the Department of Biological and Ecological Engineering revealed that while hydropower is a clean, renewable energy source that can reduce greenhouse gas emissions, it has an impact on habitat and biodiversity, including cultural diversity. The five-year study, a first of its kind, suggests that the cumulative impact many small hydropower projects can equal or exceed the impact of a single large dam. This work characterized dam impacts on southwest China's Nu River, which is designated as a UNESCO World Heritage site. Study authors recommend that seemingly negligible small-scale hydroelectric projects be given equal oversight as large dams.

³ <http://gramene.org>

The Oregon Wine Research Institute (OWRI) was restructured in order to reduce administrative overhead and enhance research engagement between the University and industry, allowing core OWRI faculty to develop long-term research projects with industry support. One such project, a Statewide Crop Load Project, is a large-scale, nine-year, on-site research trial spanning Oregon's diverse climates, vineyards, and seasons. Under the guidance of OWRI faculty, industry participants will contribute to the understanding of vine balance as a key issue in fruit yield and quality that links the vineyard to wine production and sensory evaluation. Current estimates suggest that an additional 0.25 to 0.50 tons per acre of yield with a value of \$500-\$1000 per acre may be possible. There are approximately 20,000 acres of wine grapes in Oregon.

Spotted wing *Drosophila* (SWD) and brown marmorated stink bug (BMSB) are two invasive insect species with the potential to have notable economic impacts on Oregon's agricultural sector. Two USDA Specialty Crops Research Initiative grants allow entomology faculty to research biology and management strategies for each. SWD has had economic impact on stone-fruit and berry production statewide since its arrival and a multi-state partnership facilitates control of this pest. BMSB does not yet have economic impact, but is well-established through the state and can feed on many more crops than SWD. Promising management approaches including alternative controls such as beneficial arthropods and microbial controls are in development.

Living to ensure health, wellness, and quality of life

Applied science seeks to resolve practical problems in a sustainable manner. Impacts resulting from the work of College researchers are applied to emerging challenges in ways that sustain health, wellness, and a quality of life. Here we cite a few examples:

The Oregon State University Superfund Research Program, hosted by the Department of Environmental and Molecular Toxicology, received \$12 million four years ago from the National Institute of Environmental Health Sciences and an additional \$15.4 million for the coming five years. The goal of this multi-disciplinary, multi-institutional research program is to develop technologies to assess polycyclic aromatic hydrocarbons (PAHs) found at many of the nation's Superfund sites, including the Port of Portland, and to assess the risk these persistent chemicals pose to human health. PAH exposure is linked to cancer, impediment to normal development, and threats to neurological and reproductive systems.⁴

Faculty in the Department of Environmental and Molecular Toxicology use zebra fish embryos to model the potential toxicity of silver nanoparticles, a common anti-microbial in consumer products. This work provides a novel *in vivo* approach to evaluation of this particle-size class of engineered materials. Preliminary findings indicate that nanoparticles in low ionic strength media remain dispersed and are readily taken up by rapidly growing embryos. Thus, the environment in which these materials are found is a key predictor of their impact on living systems.

Faculty in the Department of Biological and Ecological Engineering received external support to implement the generation of electricity from industrial wastewater. The application has implications for resource-constrained regions globally. Brewery wastewater, the specific target of this research, contains an ideal mix of organic materials to power microbial fuel cells, while the power generation process contributes to decomposition of organic materials. Clean water exiting the energy generation process can be reused for industrial processes within the brewery. The annual savings

⁴ <http://superfund.oregonstate.edu/>

from the diversion of 70,000 gallons of water per day from municipal treatment from a major Oregon brewery could be as much as \$400,000 per year.

Faculty in the Department of Animal and Rangeland Sciences have demonstrated that dairy cows fed flaxseed produce milk containing significantly more omega-3 fatty acids and less saturated fat than cows fed traditional dairy ration mixtures, with no reduction in volumes of milk produced. Diets rich in these fatty acids have the potential to reduce the risk of heart disease. Colleagues in the Department of Food Science and Technology tested study-derived milk in butter and cheese, evaluating these products for texture, and nutritional composition. Products enriched with omega-3 can attract a market premium.

Researchers in the Department of Crop and Soil Science are partners on a four-year, \$1.6 million USDA grant to explore the potential for quinoa production in diverse Northwestern agro-ecozones. Global demand for quinoa has doubled its price in the past decade, offering an economic opportunity to growers. Little is known about quinoa's commercial viability in U.S. markets; most quinoa consumed domestically is imported from South America. Quinoa is gluten-free and contains higher levels of protein, calcium, iron, fiber and vitamin B than those in rice, wheat, or barley.

Faculty in the Department of Horticulture released 'Wepster,' a hazelnut variety fully-resistant to eastern filbert blight and well-suited to the confection industry. Hazelnuts provide an alternative crop to grass seed growers, whose markets continue to be depressed from the 2008 housing downturn.

Advancing economic and social well being

Sustainable systems require applications that promote public good and economic benefit. Below are a few examples of impacts from research applications to emerging challenges to enhanced social integrity and economic well-being.

The College's Center for Agricultural and Environmental Policy is partnering with UC Davis' Agricultural Issues Center to advance research in critical public policy issues in agriculture, food systems, natural resources, rural communities, and the environment. The partnership is one of the five agricultural and resource policy centers funded by the U.S. Department of Agriculture.

The OSU Plant Clinic is a regional contributor to the nation's biosecurity interests. It is an essential educational service to Oregon growers and is highly regarded at state and national levels for its expertise in plant disease and insect identification and management. It is a resource for western states participating in a National Plant Diagnostic Network, receiving 31 percent of the samples processed in 2012 from out-of-state. Faculty detected nine new diseases in 2012, and five new diseases to date in 2013. Plant Clinic faculty have developed unique bacterial diagnostic tools that reduce diagnosis time for bacterial pests from two weeks to one hour. Detection of a fungal pathogen of economic importance to the nursery industry, previously unknown in the United States, prevented distribution of 7000 infected plants.

Unmanned Aerial Vehicles (UAVs) provide improved monitoring and data collection for researchers and practitioners of applied science, such as those in the colleges of Agricultural Sciences, Forestry, Engineering, and Earth, Ocean and Atmospheric Sciences. According to Vice-President for Research Rick Spinrad, UAVs "will be for agriculture in the 21st century what tractors were at the beginning of the 20th century." This technology is especially appropriate for applications that are dull, dirty, or dangerous; it is being developed and adopted with sensitivity for issues of privacy and safety. A partnership among Hermiston Agricultural Research and Extension Center (HAREC) faculty, private industry, and federal research units uses UAVs outfitted to detect stress signals in crops, allowing early intervention. A UAV demonstration was featured at the June 2013 Potato Field Day at HAREC.

Another technology under evaluation by College researchers in partnership with other Land Grant institutions is “smart” sprayers for nursery production. Research and Extension faculty at North Willamette Research and Extension Center have tested laser or ultrasonic sensors that detect plant presence, size, volume, density, and equipment travel speed and trigger variation in the flow of pesticides. In field tests, disease and insect pest control was not different from conventional spray equipment, although the smart sprayer used 55 percent less pesticide spray volume compared to the conventional sprayer. Additional savings accrue from reduced labor costs, fuel, pesticide drift, and soil compaction. The technology is suitable for other agricultural production systems.

A Northern Organic Vegetable Improvement Collaborative has been hosted in the Department of Horticulture since 2009. The participatory four-state project includes a “farmers’ choice” pepper trial that has resulted in regional chefs requesting peppers by varietal name, and including that information on their menus. Growers benefit from market demand for a niche product, and a local vegetable breeder has seen seed sales for ‘Stocky Red Roaster’ quadruple in 2012 over the previous year. Two nationally known seed companies now carry his peppers in their catalogs. Originally supported by the USDA Organic Agriculture Research and Extension Initiative, this plant-breeding effort has been extended by specialty block grants in Oregon and Washington. Future efforts will improve overwintering vegetables for organic production.

The success of the Small Fruits Program hosted by the Department of Horticulture is in part due to strategic partnerships and effective collaborations with plant breeders at the USDA-ARS (Corvallis). Innovative production systems and quality plant materials underscore Oregon State University’s reputation as the international leader for small fruits research. Research and Extension programs on berry crop production systems have an estimated annual impact of \$11 million in Oregon. Additional impacts accrue in many production regions worldwide.

Outreach and engagement world wide

Worldwide outreach and engagement are key components of the Land Grant mission. Representative examples include:

The College’s International Activity Profile as of fall term 2012 revealed 91 international students enrolled in College departments; graduate and professional students outnumbered undergraduates by two to one. Ten students with declared majors in the College enrolled in an international degree; three were graduated; alumni with an international degree now number 23. The College sent 79 faculty international scholars to research institutions outside the United States, and ranks second in the University for such exchanges.

In support of the University’s Asia Strategy, nine College faculty traveled to China or Taiwan to meet with representatives of three agricultural universities, Nanjing Agricultural University, Chinese Agricultural University, and Chinese Academy of Agricultural Sciences. The purpose of these visits was to increase collaborations between OSU researchers and their Chinese counterparts, to expand the breadth of a 2+2 program, and to increase opportunities for student exchange. Possibilities for increased faculty and student exchange are being explored; the delegation recommended that we routinely work with Chinese graduate students now on campus to strengthen the person-to-person communication so valued in Chinese culture.

An Agricultural Model Intercomparison and Improvement Project (AgMIP) is an international collaborative effort to enhance the understanding of climate change’s impacts on the agricultural sector. Project-sponsored research teams work in sub-Saharan Africa and South Asia to integrate region-wide assessments of crop productivity and related outcomes. Faculty of the Department of Applied Economics hosted a third annual workshop in May 2013, gathering

researchers from developing countries in Corvallis to expand their skills with these tools. Similar trainings were held in April 2013 in Dubai.

An innovative partnership among the College, OSU's Open Campus, and Klamath Community College (KCC) will permit students holding associate degrees in agricultural sciences to complete bachelor of science degrees through Ecampus courses, face- to-face experiential learning opportunities, and cohort-scale mentorships. An agreement between KCC and the College increases Klamath Basin Agricultural Research and Extension Center faculty presence on the KCC campus. The program was developed with input from stakeholders of both institutions. Other Open Campus programs benefit learner communities in Coos, Crook, Curry, Jefferson, Hood River, and Tillamook Counties by linking community-based partners with the University to address local learning needs.

Great impact may be achieved when faculty inform policy. Here are two examples:

- Faculty in the Small Farms Program informed the writing of legislation and administrative rules passed by the Oregon state legislature in 2011 that created a direct-market opportunity for small-scale poultry producers. The "Poultry Bill," is modeled after a 1000-bird exemption in the federal Poultry Products Inspection Act. Faculty conducted workshops in regions of greatest need, and wrote and published an online *Best Practices Guide to Open Air Poultry Slaughter*.⁵ This work supports niche market opportunities and a safe, local food supply.
- IPPC faculty advised a legislative subcommittee and provided input into drafting a school Integrated Pest Management (IPM) law that became effective in July 2012. Under the law, public and private K-12 schools, Oregon pre-kindergarten or federal Head Start programs, and community colleges must implement an IPM plan. A 2010 online survey of schools now falling under the law showed that 4 percent of school districts had an IPM plan at the time whereas 75 percent now have and use an IPM plan. Ninety-four percent of schools report using non-chemical pest solutions compared with 66 percent in 2010. Eighty percent use a low-impact pesticide list, compared to 37 percent in 2010.

Other notable outreach activities

Networks of county-based Extension faculty, growers, state agencies and other stakeholders exemplify outreach and engagement as they practice watershed-scale IPM with Integrated Plant Protection Center (IPPC) support. Broad-scale adoption of specific practices has reduced pesticide detection in streams since 2004. This watershed-scale IPM program has benefitted from more than \$7 M in extramural funding; only 5 percent of programming costs come from state funds. Here are some outcomes of note for this program:

- No chlorpyrifos insecticide residue has been detected in the Hood River for the past four years, despite a long history of high-level detections. Concentrations in the Walla Walla River were 90 percent lower in 2012 than in 2006 when monitoring began. No chlorpyrifos residue has been detected in Zollner Creek in Marion County since 2008, despite high prior pesticide loadings.
- Median malathion detections dropped 82 percent in the Wasco watershed between 2010 and 2012 despite higher use owing to the presence of spotted wing *Drosophila*.

⁵ http://smallfarms.oregonstate.edu/sites/default/files/bestprxopenairpoutryslaughter_september_2012.pdf

Like malathion, chlorpyrifos is an organophosphate insecticide widely used in tree fruit production. Through IPPC efforts and with strong support of the Oregon Department of Environmental Quality pesticide monitoring program, farmers have significantly improved their capacities in pesticide management and have gained access to sophisticated pest mapping websites, climate and weather-based decision aids, and pesticide risk assessment tools.

Community and diversity enhancement initiatives

Milton and Freewater Oregon were incorporated as one city in 1950, yet distinctive divisions between the two are still evident, and nowhere more so than between the downtown shopping districts, that are plagued by vacant store fronts. Walla Walla, just eight miles to the north, draws much of the commerce, and its tree-lined downtown district is an active social center. Faculty from the Umatilla County OSU Extension Office in Milton-Freewater joined the board of a downtown alliance formed in 2011 by concerned citizens and business owners. Building improvements with Urban Renewal Agency funds and public landscaping will thematically and visually unite the divided business districts. The Alliance actively works to engage the public and gauge their reactions to proposed changes. The re-shaping of established landscape trees that had been severely pruned and had become landscape hazards provided the opportunity to educate the public on landscape maintenance and resulted in a newspaper article about root-shoot ratios and their role in shade tree growth and health.

Other efforts by Small Farms Program faculty engaged county- and state-level officials and more than 150 farmers in a one day Oregon Agritourism Summit. The intent of the summit was to improve the environment for agritourism within Oregon. Common themes among the post-conference evaluation comments addressed land use, regulation, and policy. Agritourism is seen as one strategy to sustain farming by providing a supplemental income stream, and a positive way to preserve working landscapes, while connecting urban dwellers to farming traditions. Federal funds have been secured for OSU to train faculty peers in Washington, Idaho, and Montana in establishing women's farming networks. Three of these regionally-based networks have been established in Oregon, with a total of 300 participants. Considered national leaders in this work, Small Farms Program faculty published *A Tool Kit for Creating Vibrant Farm Communities*⁶ in 2013.

Other initiatives

Hands-on, experiential learning opportunities continue to be a hallmark of the fully-integrated Department of Animal and Rangeland Sciences, through their network of land-based living laboratories. Outdoor learning opportunities contribute to the engagement of students in units from Anthropology to Zoology, and spill over into the broader community. The innovative Oldfield Animal Teaching Facility, in use since the fall term of 2012, provides classroom space and wet lab facilities while bringing life into the classroom for 500 on-campus undergraduates in the Department. The unit has implemented efficiencies to carry out its three-fold mission while using existing departmental resources. Reduction of the dairy farm's herd size, transition to Jersey cows, and herd management consistent with industry practice lend themselves to linkages with other units' efforts, such as *Beaver Classic* cheese production in the Department of Food Science and Technology. Artisanal cheeses require the higher-fat content milk produced by Jersey cows, which thrive on a forage-based, rather than a grain-based diet. Management of the resources for other animal species has been similarly streamlined. For example, forage production and demand have been coordinated across all animal production units. A merger of the departments of Animal Science and Rangeland Ecology and Management has increased synergies and contributed to the unit's efficiency and success.

⁶ <http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/36639/pnw638.pdf>

Status of key initiatives undertaken

What worked

The OSU Foundation now accepts managed properties as gifts, making the College an appropriate steward in sustaining donor intent for the property and personal values. By successfully raising more than \$10 million, the College's annual philanthropic goal of \$8 million has been exceeded by 25 percent. The College received \$3.7 million in private grants bringing the total for fiscal year 2013 to more than \$13.7 million. This year's fundraising totals have allowed the College to surpass our \$100 million goal within the Campaign for OSU, one and one-half years before the formal campaign completion date.

An endowed professorship in urban and community horticulture was established in 2012, with a \$1.2 million estate pledge. This gift catalyzed an additional estate pledge of \$1.8 million, to be evenly divided among the Mid-Columbia Agricultural Research and Extension Center, the statewide Master Gardener program, and the College of Business. The initial gift also inspired a county-level Master Gardener Association to make a \$25,000 pledge, payable over five years. Plans for development efforts among other county chapters are in process.

With a commitment to provide five years of funding for a College of Agricultural Sciences' Global Experiences Fund, a College alumnus and long-time supporter has established a means by which students and faculty may gain global experiences related to food and agriculture. Securing an endowment to underwrite this fund is a College goal.

In May 2013, the Department of Agricultural and Resource Economics officially became the Department of Applied Economics.

Areas for improvement

The lack of a transparent and predictable funding model for on-campus teaching is the area in greatest need of improvement.

The University's difficulty in routinely and automatically assigning credit to the instructor(s) involved in cross-unit teaching and supervision of students continues to be a disincentive to the development of courses taught within or across divisions. In the current paradigm, student credit hours are credited to the organizational code of the course. It should be possible to assign those student credit hours to the academic homes of faculty who actually teach the courses. At this time, calculation and transfer of student credit hours must be done manually, creating difficulty in confirming that the transfer has occurred.

A graduate program in Applied Economics now is administered by the Department of Applied Economics, rather than the Graduate School. The program, which is challenged by the dispersed nature of the economics faculty, attracts strong enrollment, but adequate mentoring will soon be in short supply as five faculty in the department who teach graduate courses approach retirement. In the short term, faculty resources are conserved by encouraging the majority of masters-level students to conduct a project and write a project paper, rather than a research-based thesis. Another strategy may be to hire temporary faculty and increase teaching assistantships with salary savings that accrue from retirements.

Major barriers

- Dramatically increasing undergraduate enrollment without concomitant funding of teaching FTE.
- Owing to deferred maintenance, the current state of the economy, and lack of funds for research infrastructure, we conduct 21st century science in 19th and 20th century facilities. The absence of air conditioning in many biological

research laboratories shortens equipment life and results in lost research productivity.

Despite barriers and the challenge of limited resources, the College continues to advance with energy and optimism, and has maintained a notable performance in securing extramural funding, exceeding \$50 million in new awards for a fourth straight year.

Major faculty and student awards

For a sampling of major faculty, staff, and student awards within the College, please see Appendix 1.

Initiatives to leverage resources and introduce efficiencies

Principal base resources for the College are state funds directed to the Oregon Agricultural Experiment Station for its research mission and to the Agricultural Sciences and Natural Resources Program through the OSU Extension Service. Secondary base resources are federal formula grants such as Hatch and Smith-Lever Act funds. One of the Experiment Station's state performance metrics is external funds leveraged per dollar of state funding. In fiscal year 2013, this metric continued at a record pace of 1 to 2.3 as \$26.4 million in state appropriations were leveraged by faculty to generate \$60.6 million in external fund expenditures.

Summaries of grant awards posted on the Research Office website indicate a total for the College of Agricultural Sciences at \$53.1 million in FY 2013. Eight units exceeded \$2 million in awards for the year; two of those exceeded \$10 million.

Appendix 1: Major faculty and student awards

Faculty

- Kim Anderson, Department of Environmental and Molecular Toxicology, received a Best Paper Award from the journal *Environmental Toxicology and Chemistry*.
- Jeffrey Chang, Department of Botany and Plant Pathology, has been named a Phi Kappa Phi Emerging Scholar.
- Bob Anthony and Katie Dugger of the Department of Fisheries and Wildlife, with research partners from federal and state agencies, are recognized as U.S. Fish and Wildlife Service Recovery Champions for their contributions to the Spotted Owl Recovery Plan and the Spotted Owl Critical Habitat network.
- John Antle, Department of Applied Economics, received a Quality of Research Discovery Award from the *American Journal of Agricultural Economics*.
- Susan Capalbo, Department of Applied Economics, was named Western Agricultural Economics Association Distinguished Scholar.
- Lynda M. Ciuffetti, Department of Botany and Plant Pathology, received the 2013 Distinguished Agriculture Alumni Award from Purdue University College of Agriculture.
- Tim Deboodt, Agricultural Education and Agricultural Sciences, received the Society of Range Management Outstanding Achievement Award for 2013.
- Valerian Dolja, Department of Botany and Plant Pathology, has been named a fellow of the American Academy of Microbiology.
- Faculty in the Integrated Plant Protection Center received the International IPM Award from the 7th International IPM Symposium.
- Penny Diebel received the Western Agricultural Economics Association Award for Ten Years or More Excellence in Undergraduate Teaching.
- Dan Edge received two national teaching awards: the Wildlife Society's 2012 Excellence in Wildlife Education Award, and the University Professional and Continuing Education Association's 2012 Excellence in Teaching Award.
- Rolf Färe, Department of Applied Economics, received the W. W. Cooper Lifetime Contribution Award from the Data Envelopment Analysis Society.
- Eric Forsman, Bob Anthony, Katie Dugger, Betsy Glenn, Steve Ackers, Steve Andrews, and Stan Sovern, Department of Fisheries and Wildlife received the Wildlife Society Book Award for their book, *Population Demography of Northern Spotted Owls*.
- Pankaj Jaiswal, Department of Botany and Plant Pathology, was named a Phi Kappa Phi Emerging Scholar.
- Kenneth B. Johnson, Department of Botany and Plant Pathology, has been named a Fellow of the American Phytopathological Society.
- Gail Langellotto, Department of Horticulture, with former graduate student Abha Gupta, received an Education Publication Award from the American Society of Horticultural Sciences.
- B. Starr McMullen, Department of Applied Economics, received the Transportation Research Forum's Herbert O. Whitten Service Award.
- Jim Myers, Department of Horticulture, received a Cross-Commodity Publication Award from the American Society of Horticultural Sciences.
- David Noakes, Department of Fisheries and Wildlife, received the American Fisheries Society's highest award for scientific achievement—the 2012 Award of Excellence.
- Bruce Sorte, Department of Applied Economics, was awarded the Western Agricultural Economics Association's Outstanding Extension Program Award for Career Efforts.
- Bernadine Strik, Department of Horticulture, received an Extension Publication Award from the American Society of Horticultural Sciences.
- Desiree Tullos, Department of Biological and Ecological Engineering, received an NSF funded Research Experience

for Undergraduates Award.

Student

- Ann Bernert, Bioresource Research Program, won the Entomological Society of America Plant-Insect-Ecosystems Student Award.
- Leah Chibwe, Department of Environmental and Molecular Toxicology, received a KC Donnelly Externship award from the National Institute of Environmental Health Sciences.
- Ed Davis, Department of Botany and Plant Pathology, received a 2013 NSF Graduate Research Program Fellowship.
- Andy Larkin, Department of Environmental and Molecular Toxicology, received a Student and New Investigator Travel Award for 2013 from the Environmental Mutagenesis and Genomics Society.
- Dabao Sun Lu, Department of Botany and Plant Pathology, received a Fulbright Fellowship.
- Erin Madeen, Department of Environmental and Molecular Toxicology, received a K.C. Donnelly Externship award from the National Institute of Environmental Health Sciences and a travel award from the Society of Toxicology.
- Carlos Manzano, Department of Environmental and Molecular Toxicology, received the 2012 Student Paper Award from the American Chemical Society.
- Bianca Martins, Department of Crop and Soil Science was awarded second place in the International Weed Science Society student paper contest.
- Elizabeth McWilliams, Department of Botany and Plant Pathology, received travel grants from the Botanical Society of America and the National Science Foundation.
- Kimberly Melendez-Rivera, BioResource Research Program, received an honorable mention for outstanding undergraduate research.
- Oleksii Motorykin, Department of Environmental and Molecular Toxicology, received the 2013 Graduate Student Award in Environmental Chemistry from the American Chemical Society and an Oak Ridge Institute for Science and Education Fellowship from the Centers for Disease Control and Prevention, National Center for Environmental Health and a 2013 Graduate Student Paper Award from the American Chemical Society.
- Steven O'Connell, Department of Environmental and Molecular Toxicology, received a K.C. Donnelly Externship from the National Institute of Environmental Health Sciences Superfund Research Program.
- Beau Olen, Department of Applied Economics, received the American Agricultural Economics Association's Outstanding Masters Thesis Honorable Mention Award.
- Alisha Owensby, Department of Botany and Plant Pathology, received an NSF Doctoral Dissertation Improvement Grant and a Visiting Scientists Award from the Lab of Excellence ARBRE, INRA-Nancy, France.
- Lin Qin, Department of Applied Economics, received the American Agricultural Economics Association's Outstanding Doctoral Dissertation Award.
- Federico Sinche, Department of Environmental and Molecular Toxicology, received a travel award from the Hispanic Organization of Toxicologists.

Appendix 2: College metrics

Metrics provided by the Office of Institutional Research are presented on the following three pages, abstracted from that office's University-wide report.

Oregon State University
College of Agricultural Sciences
 Annual Academic Program Review 2012-13

PART 1

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	% Change '11 - '13
Faculty FTE														
Professional	247.8	288.9	295.6	261.6	258.2	267.7	256.4	254.2	232.0	231.0	231.2	251.6	262.2	13.4%
Non-Professional	223.7	270.7	293.1	291.4	267.3	296.9	298.5	317.5	317.6	315.3	320.3	329.8	314.4	-1.8%
Total Faculty FTE	471.5	559.6	588.7	553.0	525.5	564.6	554.9	571.7	549.6	546.3	551.5	581.4	576.6	4.6%
E&G Tenured/Tenure Track	-	-	28.8	23.6	23.6	35.1	23.4	29.7	23.5	28.3	26.5	37.4	30.8	16.2%
Faculty Headcount														
Professional	283	304	307	277	273	279	269	285	244	246	246	271	283	15.0%
Non-Professional	254	297	313	311	306	316	317	336	337	339	346	354	340	-1.7%
Total Faculty Headcount	537	601	620	588	579	595	586	621	581	585	592	625	623	5.2%
E&G Tenured/Tenure Track	-	-	29	24	25	36	25	31	25	29	27	40	39	44.4%
SCH (Academic Year)														
Undergraduate	25244	26040	24607	25340	25246	25342	24529	23833	24741	27220	28479	33983	34677	21.8%
Lower Division	6504	6513	6362	6870	7735	7634	7731	7327	8659	8912	8596	11277	11460	33.3%
Upper Division	18740	19527	18245	18470	17511	17708	16798	16506	16082	18308	19883	22706	23217	16.8%
Graduate	9619	10189	10274	10277	10571	9907	9213	8685	9809	9599	10267	11404	12295	19.8%
First Professional	0	0	0	0	0	0	0	0	0	0	0	0	0	-
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	-
TOTAL SCH	34863	36229	34881	35617	35817	35249	33742	32518	34550	36819	38746	45387	46972	21.2%
Fall Enrollment by Major														
Undergraduate	1109	1145	1158	1123	1140	1129	1141	1061	1104	1209	1496	1793	2019	35.0%
Graduate	295	304	331	328	339	320	289	280	266	251	253	328	352	39.1%
First Professional	0	0	0	0	0	0	0	0	0	0	0	0	0	-
TOTAL Enrollment	1404	1449	1489	1451	1479	1449	1430	1341	1370	1460	1749	2121	2371	35.6%

Oregon State University
College of Agricultural Sciences
 STRATEGIC PLANNING METRICS 2012-13

PART 1

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	College Targets 2012-13
Goal 1. Provide Outstanding Academic Programs 2004-05 Themes: Increase research and outreach. Increase diversity.												
1.2 Invention Disclosures	13	6	9	13	10	15	6	13	14	12	14	
1.3 % of Faculty, Staff, Students Comfortable with Climate for Diversity.	-	82.7%	-	-	-	-	-	-	-	-	-	
1.4 % of US Minority Students of Total Enrollment	5.4%	5.8%	6.2%	6.5%	7.0%	7.2%	8.7%	9.4%	12.0%	14.2%	14.4%	
Goal 2. Improve the Teaching and Learning Environment 2004-05 Themes: Improve student success and retention. Increase diversity.												
2.1 First Year Retention Rate (College/University)	71.4/ 84.4	74.1/ 84.4	76.3/ 82.7	71.3/ 81.8	72.4/ 82.7	70.5/ 83.6	71.4/ 81.0	71.5/ 82.1	73.9/ 83.9	70.9/ 83.1		
2.2 6-Year Graduation Rate (College/University)	51.3/ 70.7	58.2/ 69.7	46.2/ 62.6	50.9/ 64.8	53.1/ 73.5	53.7/ 70.7	57.0/ 68.9	53.2/ 69.2	43.7/ 59.2	44.2/ 57.7		
2.5 Seniors Participating in Student Engagement Activities (% /Respondents)	-	93.3/ 15	84.8/ 46	-	76.2/ 101	-	-	80.0/ 79	-	-	-	
2.6 Student to Faculty FTE Ratio (Primary Majors/ Course)	23.5/ 15.7	24.9/ 17.9	24.7/ 17.5	21.7/ 16.0	24.9/ 18.9	22.1/ 16.1	23.6/ 18.3	24.1/ 19.0	23.4/ 17.3	21.3/ 15.7	21.7/ 16.2	

Oregon State University
College of Agricultural Sciences
 Annual Academic Program Review 2012-13

PART 2

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	% Change '11 - '13
Resources (Fiscal Year)														
E&G - Initial Budget (\$)	5,376,858	5,427,706	5,672,891	5,877,153	6,929,913	7,354,665	7,545,825	8,205,891	8,393,812	8,064,310	8,163,744	10,884,480	14,752,659	80.7%
Total R&D Expenditures (\$)														
1.1			62,647,329					70,084,034	81,050,466	81,687,349	89,526,889	92,423,017	Feb_2014	-
Awards from Grants and Contracts* (#) 3.1	482	603	555	668	614	669	608	475	427	560	517	492	417	-19.3%
Awards from Grants and Contracts (\$) 3.1	25,630,037	38,985,126	29,368,256	35,834,483	35,891,976	37,982,268	34,185,285	37,600,692	44,463,817	55,039,078	59,751,760	53,872,819	53,138,070	-11.1%
Private Giving (\$) 3.2	1,416,678	1,053,940	1,168,796	1,827,412	2,246,571	5,618,015	8,630,223	9,460,980	4,399,905	10,466,936	5,311,623	11,443,406	9,080,308	71.0%

Strategic Planning Metrics 2012-13

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	College Targets 2012-13
Goal 1. Provide Outstanding Academic Programs 2004-05 Themes: Increase research and outreach. Increase diversity.												
1.1 Total R&D Expenditures	see APR data above											
1.x.1 External Funds Generated per State Dollar Invested in Statewide Public Services (AES)	1.29	1.41	1.51	1.51	1.45	1.30	1.54	1.63	2.5	2.5	2.3	
Goal 3. Increase Revenues												
3.1 Awards from Grants and Contracts (# / %)	see APR data above											
3.2 Annual Private Giving	see APR data above											

* From 2000-01 to 2007-08, the number of grant/contract awards is based on the accounting transactions from the College's award index, rather than the actual number of awards received by the college.
 Before 2005-06, awards affiliated with both a campus department and OSU Extension Service were reported under the department's college. Starting in 2005-06 these were considered part of Extension Service and are not reported in the department's college.
 College of Agricultural Sciences award metrics include Agriculture Experiment Station (AES)