WE ARE
CAHNRS

ACADEMICS

RESEARCH

EXTENSION

2016
Achievement Profile

College of Agricultural, Human, and Natural Resource Sciences
land-grant university

Since 1862, an institution of higher education focused on excellence in teaching, practical training, and pivotal research to provide transformational effects in people’s lives.

See: Washington State University.

The College of Agricultural, Human, and Natural Resource Sciences is a highly diverse college that includes 16 academic units, 13 subject matter centers, four research and extension centers, and one tribal and 39 county extension offices distributed across the state, with approximately 550 faculty, 700 staff, 2,300 undergraduates, and 609 graduate students.

CAHNRS fosters disciplines that serve at the interface of scientific discovery and its application to the advancement of society and improvement of the human experience. The CAHNRS leadership team is responsible for managing nearly $190 million in annual expenditures, including state (35%), federal grants (21%), non-federal grants (21%), and gift (7%) funds. Securing diversified funding sources is a key element to the fiscal well-being of the college.

CAHNRS translates research discoveries to improve quality of life regionally and globally. Our land-grant mission results in innovative future leaders who elevate stewardship of agricultural, environmental, and economic systems, and improve the well-being of individuals and communities in Washington and beyond.

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CAHNRS is agriculture and so much more—we are one of the largest, most diverse colleges at WSU. CAHNRS Cougs are making a difference in the well-being of individuals, families, and communities; improving ecological and economic systems; and advancing agricultural sciences.

An ideal CAHNRS learning experience has three major components: 1) a solid foundation of discipline-based content; 2) an application aspect that sets the context for bringing the content to life; and 3) opportunities for students to communicate and engage effectively around that content with industry professionals. This approach supports students with acquiring the full array of skills required for successfully navigating the college-to-career transition. Our intention is for our graduates to be the preferred employee choice because they have the knowledge base, the experience, and the interpersonal communication skills needed to truly make them “job ready, day one.”

The Center for Transformational Learning and Leadership cultivates and coordinates unparalleled career and networking opportunities for students through industry collaboration and internships. Supported by a nearly $3 million endowment, the CTLL serves as a gateway for students, faculty, alumni and industry partners to engage in high quality, holistic learning and leadership development, including:

- Success skills-building trainings, such as experiential courses, international immersion-based experiences, service learning activities, internships, workshops, and faculty-directed research;
- Collaborative opportunities for internship, mentorship, networking, customized recruitment for job placement, and industry-directed research;
- Tidal Leadership: Values-based leadership and life-skill enhancement through tailored online programming and customized training;
- Peer and professional exchanges of ideas, collaborative work, and learning through shared experiences.

CAHNRS is a highly diverse college that includes:
- 9 Undergraduate degree programs
- 24 Majors
- 19 Minors
- 27 Graduate programs

CAHNRS has approximately:
- 550 Faculty
- 700 Staff
- 2,300 Undergraduates
- 609 Graduate students

AWAKEN YOUR POTENTIAL

Tidal Leadership is a unique certificate program that helps participants build a personal platform for becoming effective leaders.
INTERDISCIPLINARY PROGRAMS

To meet the demands of today’s increasingly competitive global economy, companies and businesses require a highly skilled and intellectually flexible workforce. Our innovative partnerships with other WSU colleges and other universities provide a wider platform for students to learn on, modeling collaboration and marshaling resources to better prepare students to navigate life and careers in an age of global connectedness and competition.

A core set of interdisciplinary courses in each program gives students a solid foundation on which to build expertise in a specific discipline. Students are encouraged to participate as part-time employees in research programs and seek professional internships for applied learning experiences.

Agricultural and Food Systems
The AFS BS-degree curriculum is designed to expose students to a diverse array of scientific disciplines associated with agricultural and food production systems that will support graduates in being successful practitioners in these fields. The AFS program offers a BS degree in five majors:

- Agricultural Technology and Production Management
- Agricultural Education
- Organic Agriculture Systems
- Agricultural and Food Business Economics
- Agriculture and Food Security

Each major emphasizes gaining a solid background in the agricultural sciences, including learning to work with, and in, the complexity of agriculture and food systems. An internship related to one’s focus area is required.

Integrated Plant Science
The IPS BS-degree program emphasizes basic science and is designed to provide students with the depth and breadth of knowledge across plant science disciplines required for them to be successful professionals in these fields, and perhaps pursue graduate degrees. There are six majors to choose from:

- Agricultural Biotechnology
- Field Crop Management
- Fruit and Vegetable Management
- Landscape, Nursery, and Greenhouse Management
- Turfgrass Management
- Viticulture and Enology

In 2006, WSU became the first university in the nation to create an academic major in organic agriculture systems.

The Rainier cherry (named after Mount Rainier) was developed in 1952 by Harold Fogle for Washington State University’s breeding program. The fruit was released to the public in 1960. The mother tree which produced the very first Rainier fruits still grows in the same orchard five miles from the University station in Prosser, Washington.
Molecular Plant Sciences

The MPS doctoral program incorporates plant physiology, biochemistry, and molecular biology, and is considered one of the top programs in the world.

The interdepartmental curriculum is led by 43 faculty members from the CAHNRS Departments of Crop and Soil Sciences, Entomology, Horticulture, Plant Pathology, and the Institute of Biological Chemistry, as well as in the Departments of Biological Sciences, Chemistry, Molecular Biosciences, Electrical Engineering, and Computer Science.

Graduate students study with some of the best minds in America to understand the characteristics and mechanisms of plants. They use this knowledge to develop life-saving medicines, keep our food safe, and evolve agricultural systems to feed the world.

All MPS students receive financial support; many are Achievement Rewards for College Scientists Fellows.

ACADEMIC DEPARTMENTS & SCHOOLS

- 9 Departments
- 4 Schools

8 REGENTS PROFESSORS

13 ENDOWED CHAIRS

4 NATIONAL ACADEMY OF SCIENCES MEMBERS
The mission of the Animal Sciences (AS) department is to advance knowledge through research and innovation across a range of academic disciplines; extend knowledge through innovative educational programs to emerging scholars, fellow scientists, and stakeholders; and apply animal science knowledge to improve the quality of life for people and animals.

Academics

**GRADUATE**
- Master of Science/Art
  - Animal Genetics/Genomics
  - Growth & Development
  - Nutrition/Environment
  - Reproductive Biology

**UNDERGRADUATE**
- Animal Management Option
- Science/Pre-Vet Option

Research: Discovery/Translational

The research conducted by faculty, staff, and graduate students in Animal Sciences ranges from that which is immediately applicable to farmers and ranchers to fundamental/discovery science that has implications in human and animal health and well-being. The grant portfolio in AS is broad and diverse including USDA, NSF, NIH and private industry funding targeting applied, translational, and fundamental research.

Highlights

Our career-ready graduates have 90% placement rates prior to graduation. AS faculty actively lead and participate in interdisciplinary research teams looking to solve important societal issues. Effective outreach programs target current areas of importance to our stakeholders.

Scholarship

The yearly scholarship includes book chapters, peer-reviewed publications, Extension publications, and many presentations at national and international scientific meetings. Faculty are also members of editorial boards, professional societies, and serve on grant panels.

Service and Outreach

Faculty, staff, and student volunteers make presentations to the public, schools, and senior care centers; Beef Counts Second Harvest Food Bank; Cougar Youth Weekend; and 4-H and FFA.

Intellectual Property & Commercialization

Every year the faculty in Animal Sciences obtain patents for discovery research that benefits human and animal well-being.

Impacts

We serve the residents of Washington by creating and delivering research-based knowledge and education. Documented impacts include: genomic tools to reduce the incidence of BRD; enhancing marbling; deriving a mouse model for use in uterine biology research; enhancing dairy cattle handling; food safety training; and creating environmentally sustainable production systems. Hands-on training with pigs (SSC), dairy (CUDS), and feedlot cattle (CCF) benefit our students.

Facilities

- Cattle Feeding Laboratory
- Cougar Quality Meats
- Knott Dairy Center
- Ensminger Beef Center
- Experimental Animal Laboratory
- Animal Feed Preparation Laboratory

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The Department of Apparel, Merchandising, Design and Textiles (AMDT) is the largest and most comprehensive 4-year apparel and textiles program in Washington. Our academic programs offer students all of the tools necessary to succeed in the textile, apparel, and retail industries. We have state-of-the-art classroom equipment, fully equipped apparel design studios, a program and curriculum aligned with the industry, and nationally and internationally recognized faculty. Students graduate with a thorough understanding of the industry, from concept to consumer.

Academics

**GRADUATE**
- Master of Science/Arts in Apparel, Merchandising & Textiles
- Doctor of Philosophy

**UNDERGRADUATE**
- Apparel Merchandising
- Apparel Design

Research: Discovery/Translational

As an industry-based program, funding agencies for research are focused on industry funding and trade associations/marketing companies. Past funded research projects have centered around the use of cotton in functional and sportswear apparel end uses; business promotion and marketing efforts focused on corporate social responsibility and business models in small- and medium-size retailers in the US sportswear market.

Scholarship

Research programs in AMDT focus on the University Grand Challenges as they apply to the textile and apparel industry: Textile and apparel product development in the areas of health and human well-being, sustainability and supply chain management, smart textiles, and the role of technologies in maintaining a sustainable supply chain.

Impacts

Faculty and students have developed post-bariatric surgical undergarments that reduce surface body temperature by two degrees, reducing skin infections and promoting faster healing. Applications beyond this market to other human and animal health applications are numerous with a patent pending.

AMDT researchers, in collaboration with Engineering faculty, are developing a flexible and highly energy-efficient, wearable cardiac monitoring system using textile nanofiber, 3-D printing technology, and low-cost and washable Na-ion batteries. This wearable monitoring system has potential impacts as part of everyday clothing and will provide continuous heart condition monitoring.

Facilities

AMDT relocated to newly renovated facilities over the summer of 2014. These new spaces include three new classrooms, two new product development studios with all new equipment, new computer labs, a functional apparel and textile teaching and research laboratory with a 3-D body scanner and textile testing equipment, and a new visual merchandising lab with a mock retail store.

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Biological Systems Engineering

Biological Systems Engineering (BSysE) faculty conduct research and outreach activities in four focus areas: land, air, water resources, and environmental engineering; food engineering; bio-energy and bio-product engineering; and agricultural automation engineering.

We generate knowledge and develop technologies for environmental stewardship, renewable energy, productive and sustainable agriculture, and safe and nutritious foods. Our department offers advanced degrees in biological & agricultural engineering and prepares students for successful careers in academia, industry, and government. Our graduate students receive world-class education and conduct cutting-edge research alongside post-doctoral researchers, scientific assistants, and visiting students and faculty.

Academics

Graduate

| Master of Science/Art |
| Biological & Agricultural Engineering |

Doctor of Philosophy

| Biological & Agricultural Engineering |

Research: Discovery/Translational

We develop innovative technologies and long-term solutions for food and agriculture, renewable energy, and water systems intended for solving state and global problems.

Highlights

We develop technologies for conversion of algal, forest, and agricultural wastes into liquid fuels and high-value materials; machine vision system and robotic arms and end-effectors for the tree fruit industry; novel and environmentally friendly processing and packaging technologies to produce safe food and reduce waste; and computer modeling systems for assessing economic and environmental impacts of agriculture productions.

Scholarship

Every year faculty and graduate students produce more than 150 peer-reviewed papers, books, and book chapters, and over 100 conference presentations. Our faculty members serve as scientific editors of many esteemed journals.

Service and Outreach

Faculty are engaged in service to professional societies and scientific organizations. They provide short courses and boot camps to benefit state and nation economy.

Intellectual Property & Commercialization

Faculty members have received more than 10 US patents and filed numerous invention disclosures over the last five years. Novel microwave sterilization and pasteurization technologies developed by our faculty have been accepted by FDA and USDA FSIS and licensed for global commercialization.

Impacts

We provide ideas and solutions in areas related to environmental impact assessment, productivity and sustainability of food-energy-water systems, food processing technologies, renewable energy and bio-products, and automation of agricultural production systems. Our graduates take positions in top universities, government, and multinational companies.

Facilities

Laboratories: Water Quality and Waste Analysis, GIS and Agricultural Systems Modeling, Bio-products, Sciences and Engineering; Centers: Analytical Chemistry, Precision, and Automated Agricultural Systems; Food Processing Pilot Plant.

People

| 8.5 | 15 | 9 | 1 | 11 | 72 |
| Staff | TT Faculty | NTT Faculty | Regents Professors | MS/MA students | PhD students |
The Department of Crop and Soil Sciences (CSS) serves WSU’s land-grant mission by offering nationally competitive undergraduate and graduate education programs, conducting discovery and translational plant and soil research, and extending the science of our disciplines to serve the public.

Academics

- **GRADUATE**
  - Master of Science/Art
    - Crop Science
    - Soil Science
    - Agriculture
  - Doctor of Philosophy
    - Crop Science
    - Soil Science
    - Molecular Plant Sciences

- **UNDERGRADUATE**
  - Agricultural Food Systems
  - Integrated Plant Sciences

Research: Discovery/Translational

CSS’s diverse and accomplished faculty are committed to using cutting-edge techniques to discover and translate principles of crop and soil sciences that consider the human dimensions influencing the application of these principles to integrated agricultural systems.

Highlights

- Consistently ranked #1 in CAHNRS in extramural funding received, research expenditures, endowed faculty positions, and graduate students advised.
- Home to the first-in-the-US Organic Agriculture Systems undergraduate major.
- Integrate and support scientists from three USDA-ARS research units.
- Maintain a statewide presence with faculty in Pullman and 3 of the 4 Research & Extension Centers.

Scholarship


Service and Outreach

CSS faculty actively engage in outreach, leading the dryland small grains extension team and individual outreach programs in cropping systems, agronomy, weed science, forages, and soil science. Faculty serve their disciplines in professional society leadership positions, in journal editor and reviewer roles, and as grant panel members.

Intellectual Property & Commercialization

CSS patents 2 to 3 new cereal varieties each year. Active commercialization of these varieties generated nearly $1 million in royalty income in 2015. Faculty are actively identifying new genes controlling plant traits, developing new sources of crop herbicide resistance, and dynamic decision tools to improve management at the farm level.

Impacts

Cereal varieties developed by CSS faculty are grown on nearly 50% of the wheat acres planted each year in Washington.

Facilities

CSS manages five dryland research farms, core facilities including the wheat doubled haploid lab and advanced instrument service centers, and a full complement of field equipment.

People

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The Department of Entomology comprises a multi-disciplinary program with campuses located in Pullman, Mount Vernon, Prosser, Puyallup, Tri-Cities, and Wenatchee. Our faculty, students, and staff study insects and their relationship to humans, the environment, and other organisms and contribute to an array of fields including agriculture, biology, chemistry, human and animal health, molecular science, and forensics. The department provides an intensive graduate experience for students with research conducted under the mentorship of leading Entomology faculty.

Academics

- **GRADUATE**
  - Master of Science/Art
    - Entomology
  - Doctor of Philosophy
    - Entomology

- **UNDERGRADUATE**
  - Minor in Entomology
  - Agricultural Food Systems
  - Integrated Plant Sciences

Research: Discovery/Translational

Entomology serves as the basis for advancements in biological diversity, biological and chemical pest control, epidemiology, food and fiber production, and other fields of science. Our faculty are consistently well-funded in research and Extension, providing world-class opportunities for graduate and undergraduate training.

Highlights

Entomology is the study of insects and their relationship to humans, the environment, and other organisms. Entomologists contribute to such diverse fields as agriculture, chemistry, biology, genetics, human/animal health, molecular science, epidemiology, and forensics.

Scholarship

Entomology faculty contribute extensively to scientific journals, produce and distribute outreach materials, and provide training opportunities to student and stakeholder audiences. Our faculty and graduate students are members and leaders of professional and scholarly organizations and serve on editorial boards of leading journals in the field.

Service and Outreach

We provide national leadership through the esteemed Pesticide Education Program (PEP), providing certification training to over 7,000 participants a year. The honey bee disease and pest diagnostic center provides services to Washington beekeepers to improve colony health in managed pollinators. The M.T. James Museum houses over 1.25 million curated insect specimens, shared with leading researchers worldwide.

Intellectual Property & Commercialization

The WSU Tree Fruit Decision Aid System (DAS) provides time-sensitive information for management in Washington tree fruit and internet courses in pre-license and pesticide re-certification training.

Impacts

Impacts include substantial savings to agricultural production, including tree fruits, alfalfa, hops, beekeeping, and seed crops. Contributions to improved integrated pest management in both organic and conventional agriculture serve to increase sustainability and improve human health.

Facilities

Digital classrooms and laboratory training, research orchard and greenhouses, M.T. James Museum, Honey Bee Disease Lab, Pest Diagnostic Center, and Food and Environmental Quality Laboratory.

People

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The Department of Horticulture is world renowned for its excellence in research, teaching, and Extension. Horticulture has been part of the Washington State University curriculum since its founding over 125 years ago, and the department is internationally recognized in the areas of tree fruits, vegetables, viticulture and enology, and small fruits. Faculty members possess a diverse array of expertise in areas such as genomics, bioinformatics, breeding, physiology, metabolism, molecular biology, and sustainable production. Faculty, students, and staff are based at the Pullman and Tri-Cities campuses as well as at the four Research & Extension Centers in Mount Vernon, Prosser, Puyallup, and Wenatchee.

Academics

- **GRADUATE**
  - Master of Science/Art
    - Horticulture
    - Agriculture
  - Doctor of Philosophy
    - Horticulture
    - Molecular Plant Sciences

- **UNDERGRADUATE**
  - Fruit & Vegetable Management
  - Viticulture & Enology
  - Landscape, Nursery, and Greenhouse Management
  - Ag Biotechnology
  - Integrated Plant Sciences
  - Agricultural Food Systems

Highlights

Department faculty conduct basic and applied research in diverse areas including signaling, genomics, and DNA-informed breeding. Tree fruit researchers are developing new varieties and state-of-the-art orchard training systems for cherries, apples, and pears that can increase yield while decreasing production costs. Researchers are involved in releasing new potato varieties with improved qualities. Faculty are also involved in sustainable agriculture and urban horticultural research.

Washington state is becoming globally recognized for its Viticulture & Enology Program. Outside funding for basic and applied research has increased substantially in recent years.

Scholarship

Department faculty are highly successful in competing for extramural grants, publishing in high-impact journals, obtaining patents, and garnering royalties generated through breeding programs.

Impacts

Former graduate students are successful teachers and scientists at diverse institutions and are industry leaders around the world. Horticulture researchers have developed the Cosmic Crisp apple, which has received global attention, and contributed to the development of potato varieties now accepted by McDonald’s for their French fries.

Washington’s expanding wine industry is saving 30% water thanks to viticulture research. A real-time cold hardiness model deployed on the Internet is helping the wine industry mitigate winter cold damage to vineyards.

Patented products for control of sunburn in apple and sprouting during storage of potatoes are now being used commercially. Horticulture faculty have secured many patents, some of which are generating royalties.

Facilities

At all locations, there is access to world-class laboratories, greenhouses, field sites, and classrooms.

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Human Development

Using Science to Promote Healthy Development

Human Development faculty study how children, youth, adults, and families develop, change, and navigate challenges throughout the lifespan.

Academics

- **GRADUATE**
  - Master of Science/Art
    - Prevention Science
  - Doctor of Philosophy
    - Prevention Science

- **UNDERGRADUATE**
  - Early Childhood Education
  - Adolescence
  - Gerontology
  - Family and Consumer Sciences
  - Family Studies
  - Human Services Case Management

Research: Discovery/Translational

Our research funding spans basic to translational projects and has increased steadily over the past five years, to almost $4 million in 2016. Faculty have major grants from National Institutes of Health and USDA as well as private foundations and state agencies.

Current funded projects include: development and testing of a family-based obesity prevention program; effects of human-animal interaction; use of acupuncture to relieve lumbar pain in pregnancy; aging out of foster care; development of healthy emotional and physiological regulation in early life; testing effects of a handbook for parents of first-time college students.

Scholarship

In the 2015–2016 biennium to date, our faculty have produced more than 50 peer-reviewed publications and over 120 presentations at national conferences. A third of our presentations include graduate students as authors and co-presenters. Our work is published in top-tier journals and cited in local and national press. In 2016, our faculty were invited to testify in front of state and national congresses on foster care, marijuana legalization, and prevention program funding.

Service and Outreach

One-third of our tenure-line faculty have full or partial Extension appointments and several of our classes have strong service learning components. We work with the state Division of Behavioral Health and the Office of the Superintendent of Education. Our research is collaborative and community focused.

Impacts

Within a year of graduation, 75 percent of our undergraduates have jobs in our field.

Through research, programming, and Extension, we promote the health of thousands of people in Washington state, resulting in increased productivity and cost savings to society in the millions of dollars (program benefit-cost analyses from the Washington State Institute of Public Policy).

People

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Dedicated to broad-based investigations of plant metabolism and biochemistry, the Institute of Biological Chemistry is internationally renowned for discoveries that underlie many of the advances being made in the biology and biotechnology of plants used for production of food, materials, and biofuels. With more than 120 undergraduate, graduate, and postdoctoral researchers, the Institute provides a rich environment for scientific discovery and experiential learning. Undergraduate and graduate students come to the Institute from many different departments and programs, including in molecular plant sciences, chemistry, and the School of Molecular Biosciences.

Academics

**GRADUATE**

Doctor of Philosophy
- Molecular Plant Sciences
- Biochemistry
- Chemistry

**UNDERGRADUATE**

- Each year, more than twenty undergraduates complete a total of 250–300 hours of directed research and laboratory experience in the Institute.

Research: Discovery/Translational

Extramural funding averaging $5 million per year supports researchers conducting both discovery science and translational biotechnology.

![Graph showing research funding]

Highlights

- Eminent faculty and research programs
- Breakthrough discoveries in novel plant products, plant defense, energy, and nutrient acquisition
- Outstanding record in extramural funding
- Intellectual property portfolio underpins translational research and spin-off companies

Scholarship

Each year, Institute researchers publish more than 60 primary research papers, invited commentaries and reviews, and chapters in textbooks and specialty research publications. Faculty are editors for more than five scientific journals and review departments and programs at institutions across the US and overseas. Five present and former faculty have received the honor of being elected to the US, or another, national academy of sciences.

Service and Outreach

Institute faculty and students are strongly engaged in outreach efforts. Focus initiatives include ones designed to attract Native American and other minority high school students into undergraduate programs.

Intellectual Property & Commercialization

Institute faculty have been issued more than 20 patents and engage in research and consulting agreements with biotechnology companies. Six start-up companies have been formed by Institute faculty and alumni. Many graduates join biotechnology companies as research scientists.

Impacts

Institute discoveries have led to improved growth and health of crops and advances in food, materials, and biofuels made from plants, improving rural economics and the quality of life for the people of Washington and elsewhere. Institute research is often highlighted in newspaper, magazine, radio, and television articles.

Facilities

Institute faculty manage the Murdock Metabolomics Laboratory, the WSU Phenomics Facility, and the Tissue Imaging and Proteomics Laboratory.

People

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Plant Pathology

A department of scientists with diverse backgrounds but a common mission of research, instruction, and Extension in all aspects of plant diseases, including causes, protection, prevention, and control as they affect commercial crop and landscape plants in Washington and worldwide.

Academics

- **GRADUATE**
  - Master of Science/Art
    - Plant Pathology
  - Doctor of Philosophy
    - Plant Pathology Molecular
    - Plant Sciences

- **UNDERGRADUATE**
  - Integrated Plant Sciences
  - Agricultural and Food Systems

Research: Discovery/Translational

Faculty and graduate students focus research on discoveries and translational solutions relevant to regional and global problems. Recent examples include: the discovery of a new fungicide-resistant strain of *Pythium* in eastern Washington causing seed and seedling rot in peas and other pulse crops and subsequent identification of a new seed treatment that will control the problem; and identification of genes in rust fungi that are essential for pathogenicity and their characterization as targets for engineering rust-resistant cereals.

Highlights

Our internationally recognized scientists work side-by-side with MS and PhD students to solve threats to the world’s food supply. We study ALL major groups of pathogens that cause diseases in plants—fungi, bacteria, viruses, and nematodes—using a variety of methods including genomics, proteomics, and applied ecology.

Scholarship

All departmental faculty are actively engaged in both research and presenting their results to stakeholders. On average, faculty publish five peer-reviewed journal articles each year in addition to presenting information through other channels, such as seminars, presentations, book chapters and Extension publications.

Service and Outreach

Our department provides services to the agriculture industry, homeowners, and the scientific community through several service centers. The Plant Pest Diagnostic Clinics and the Clean Dahlia Center provide diagnoses of potential plant pest and disease problems. The Northwest Clean Plant Center provides virus-free planting stock to the fruit tree, grapevine, and hop industries. The Shaw Mycological Herbarium maintains and distributes samples of 70,000 fungal species to researchers worldwide.

Impacts

We serve Washington and US residents through delivery of research-based materials and information to the community. In 2016 we: 1) generated and distributed thousands of virus-free stocks of fruit tree buds, grapevine cuttings, and green hop cuttings for nurseries and growers across the US to safeguard new plantings from viral epidemics; and 2) reduced incidence of the PVY virus in Western Washington potato fields by more than 50 percent by identifying several new management options.

Facilities

Plant Pathology manages a research farm and the Shaw Mycological Herbarium in Pullman; Plant Pest Diagnostic Clinics in Pullman and Puyallup; and the Northwest Clean Plant Center in Prosser.

People

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<th>5</th>
<th>16</th>
<th>17</th>
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<th>36</th>
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<tbody>
<tr>
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<td>TT Faculty</td>
<td>NTT Faculty</td>
<td>MS/MA students</td>
<td>PhD students</td>
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</table>
The School of Design and Construction (SDC) offers an integrated, hands-on, educational and research community that fosters innovation, application, leadership, and diversity in the fields of architecture, interior design, landscape architecture, and construction management.

SDC is committed to producing graduates who are highly skilled in the collaborative work environments crucial to the delivery of the built environment that exceed standards for time, money, and performance; and for research that demonstrates the value of integration within the professions.

Academics

- **GRADUATE**
  - Master of Science/Art
    - Interior Design
    - Architecture

- **UNDERGRADUATE**
  - Interior Design
  - Landscape Architecture
  - Architectural Studies
  - Construction Management

Research: Discovery/Translational

Faculty and students pursue research and creative scholarship about green construction, building optimization, computational design, virtual environments, cultural landscapes, and engagement.

Highlights

SDC’s four professionally accredited degrees produce job-ready graduates and near-100 percent employment within six months of graduation.

Scholarship

SDC faculty produce approximately 10 peer-reviewed works of creative scholarship; publish approximately 20 refereed articles, chapters, and books; and deliver approximately 50 presentations or posters at conferences, meetings, and gatherings, per year.

Service and Outreach

Engagement with the public, design professions, and construction industry is essential. Students and faculty participate in study tours and travel the Pacific Northwest to meet industry leaders and participate in critiques. SDC is also involved in community projects regarding the improvement, understanding, and preservation of the built environment. Per year, the average numbers are:

- **450 People**
- **12,000 Hours**

Impacts

Our impacts are measured by the professions and industry that champion our graduates’ job readiness.

A strong alumni network provides more than 100 student scholarships and more than $20,000 annually for school-wide initiatives.

Facilities

The SDC is headquartered in Carpenter Hall on the Pullman campus, with six approximately 5,000-square-foot well-lit studios; six seminar rooms; a gallery and seating area for rotating design shows and impromptu study; four classrooms/lecture halls; the state-of-the-art Kiewit Construction Management Classroom; the SDC “Virtual Laboratory” for remote presentations; a student lounge; and faculty, staff, and administrative offices.

Daggy Hall features two fabrication laboratories and a materials library, as well as additional faculty offices, auxiliary classrooms, studio space, and storage.

People

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<tr>
<th>8</th>
<th>31</th>
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<tbody>
<tr>
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<td><strong>NTT Faculty</strong></td>
<td><strong>Undergraduate students</strong></td>
<td><strong>MS/MA students</strong></td>
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</table>
The WSU School of Economic Sciences (SES) is a unified general, applied, and agricultural economics program committed to the land-grant heritage and tradition of discovery, education, and service to society. Our mission is threefold: to advance economic knowledge through creative research and scholarship; to extend economic knowledge through effective educational programs where graduates assume roles of leadership, responsibility, and service to society; and to apply economic knowledge through local and global engagement that will improve quality of life and enhance the economy of the state, nation, and world.

Academics

Graduate
- Master of Science/Art
  - Applied Economics
- Doctor of Philosophy
  - Agricultural Economics
  - Economics

Undergraduate
- Business Economics
- Economics, Policy, and Law
- Agricultural Economics
- International Economics and Development
- Financial Markets/Quantitative Economics
- Environmental and Resource Economics

Research: Discovery/Translational

Highlights
SES faculty lead: IMPACT Center, Freight Policy Transportation Institute, Western Center for Risk Management Education, and Washington Water Research Center.

Scholarship
SES pursues excellence in both foundational and strategic areas of economics to deliver nationally and internationally recognized teaching, research, and outreach programs. The foundational areas of microeconomics, macroeconomics, and quantitative methods are essential and support contributions in the focus areas. Strategic focus areas include: agricultural and consumer economics, health economics, international and development economics, transportation economics, and environmental and natural resource economics.

SES faculty regularly publish in top general and specialty field journals, win prestigious grants and funding, participate in and lead large multidisciplinary collaborations and centers, serve as editors and co-editors of journals, and serve as officers in national and international associations. Faculty have been honored as Fellows in the American Association for the Advancement of Science, the Agricultural and Applied Economics Association, the Journal of Econometrics, and the Washington State Academy of Sciences.

Impacts
SES faculty and students work to find answers to important problems facing the state, region, nation, and world in areas including: global climate change, transportation, healthy living choices, sustainability and environmental quality, efficient water management, stormwater issues, and enhancing profitability of local and global firms and businesses.

Faculty work closely with various industries and clientele groups in the state, providing economic research products and educational programs focused on improving economic knowledge and management and enhancing societal outcomes. Examples include:
- Best management practices for specialty crops,
- Education programs for Hispanic producers,
- Irrigation and water management practices,
- Understanding food deserts and improving access to fresh fruits and vegetables,
- Risk management strategies in commodity marketing,
- Economic impact assessment, and
- Export drivers of regional economic growth.

People

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<td>Endowed positions</td>
<td>MS/MA students</td>
<td>PhD students</td>
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The School of the Environment (SoE) was established in 2012 as a multidisciplinary unit to achieve research, scholarship, and learning that enable better understanding of global and local environments. SoE resides both in the College of Agricultural, Human, and Natural Resource Sciences and the College of Arts and Sciences and has graduate and undergraduate degree programs in each college. Faculty are distributed among the Pullman, Tri-Cities, and Vancouver campuses and at the Puyallup Research & Extension Center and Wenatchee Tree Fruit Research & Extension Center.

Academics

- GRADUATE
  
  Master of Science/Art
  - Geology
  - Environmental Science
  - Natural Resource Science

- Doctor of Philosophy
  - Geology
  - Environmental and Natural Resource Sciences

- UNDERGRADUATE
  
  - Earth Science/Geology
  - Environmental and Ecosystem Sciences
  - Forestry
  - Wildlife Ecology and Conservation Sciences

Research: Discovery/Translational

Highlights

Geologist Jeff Vervoort has been recognized as a fellow of both the Geological Society of America and the American Geophysical Union for his contributions to understanding the origin and evolution of the continental crust. Environmental scientist John Harrison, along with other authors in the book *Seeds of Sustainability*, received a Sustainability Science Award from the Ecological Society of America in 2012.

The WSU Bear Research, Education, and Conservation Center is one of the few research facilities worldwide that provides access to captive grizzly bears, and research at the center has resulted in significant findings about the physiology of these charismatic animals.

SoE contributes significantly to general education goals at WSU, currently ranking 10th among units at the university in total annual student credit hour production on the Pullman campus.

Scholarship

Tenure track faculty produced 380 peer-reviewed publications (mean = 2.8 per faculty member per year), 17 book chapters, 38 technical reports or Extension publications, and five published geological maps in the period 2011–2015.

Service and Outreach

Eight faculty served on editorial boards of 12 professional journals (2011–2013) and one serves as the executive director of a major professional society.

Impacts

SoE research serves our state and nation by providing foundational knowledge, policy, and economic evaluations and management plans on global change, landscape ecology, geology, forests, wildlife, and water.

Facilities

Aquatic Ecology Laboratory (Vancouver); Bear Research, Education, and Conservation Center; Geoanalytical Laboratory; Endangered Species Laboratory; Jacklin Culver Rock Museum; Large Carnivore Conservation Laboratory; Steffen Center (field research and teaching; glasshouses; wild ungulate facility); Watershed Biogeochemistry Laboratory; Wildlife Habitat Laboratory.

People

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The School of Food Science (SFS) is a joint program between the University of Idaho (UI) and Washington State University (WSU). We have 5 signature areas:

- Improving food safety locally, nationally, and globally
- Developing healthy and sustainable foods
- Advancing fundamental approaches to enhance food quality
- Providing food security, ensuring that the US is self-sufficient in food production (emphasizing the need to ensure all have enough healthy food)
- Assisting the food industry to be economically sound, sustainable, and competitive

### Academics

**GRADUATE**
- Master of Science/Art
  - Food Science
  - Ag Food Science & Mgmt.

**Doctor of Philosophy**
- Food Science

**UNDERGRADUATE**
- Food Science—General
- Food Science—Fermentation
- Certificate: Food Science

### Research: Discovery/Translational

With a network of national and global collaborators, our faculty are recognized experts in food science, technology, and food safety. We conduct fundamental and applied research in chemistry, microbiology, applied nutrition, engineering, and sensory science.

### Highlights

The School of Food Science is a joint program between WSU and UI. We have been collaborating for over a decade on undergraduate and graduate education, research, and outreach.

### Scholarship

Our internationally recognized faculty include three Fellows of the Institute of Food Technologists. We have funding from USDA, NIH, and industry and commodity commissions, supporting collaborations across the region and nation.

### Service and Outreach

Faculty and students provide service to the community, promoting the profession and ensuring people everywhere have an adequate, safe, and wholesome food supply.

![People](13)

**Intellectual Property & Commercialization**

We provide technical assistance to companies with formulation, labeling, and product safety, assisting with the launch and market development of dozens of products per year. Our faculty submit invention disclosures on food processing technologies, devices, and diagnostics for the food industry.

### Impacts

SFS has global impact through its graduate education, international collaborations, and outreach programs.

### Facilities

Our students and staff produce the famous Cougar Gold cheese, plus many other fine cheeses and award-winning ice cream at Ferdinand’s. We have pilot plants at WSU and at Caldwell, Idaho, and small-scale facilities for production of fermented products and laboratories for food chemistry, microbiology, and engineering at both WSU and UI campuses.

### People

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<thead>
<tr>
<th>People</th>
<th>WSU</th>
<th>UI</th>
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<td>NTT Faculty</td>
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<td>MS/MA students</td>
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<tr>
<td>PhD students</td>
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CAHNRS is a leading driver of research at WSU, contributing to more than 40 percent of the university’s extramural funding budget. CAHNRS research and extension faculty brought in more than $81 million in FY2015 and $83 million in FY2016, from competitive extramural funding sources including federal agencies, Washington State commodity commissions, and other nonfederal agency grants.

We contribute to a sustainable future through the powerful combination of both discovery and translational research designed to address the grand challenges of the 21st century—regionally and globally.

We discover, develop, and transfer knowledge that contributes to a safe and abundant food supply; promotes sustainability of agricultural and economic systems; supports energy innovations; encourages careful stewardship of natural resources and ecological systems; and enhances the well-being of individuals, families, and communities.

Research at CAHNRS is as diverse as the communities, businesses, agriculture systems, natural resources, and landscapes of the state of Washington.

We maintain a strong and nimble research engine to help feed a growing global population; protect the natural resources we rely on for food, water, and energy; and respond to change with a greater capacity for resilience.

Our goal is to improve economic prosperity, environmental sustainability, community resilience, and quality of life for the people of Washington and beyond.

More than 60 percent of CAHNRS Research and Extension extramural funding is from federal sources.

Federal sources include USDA, National Science Foundation, Dept. of Health and Human Services, Dept. of State, Dept. of Interior, Dept. of Defense, NASA, and flow-through subawards.

Non-federal sources include commodity commissions, Washington State, private foundations, businesses, local governments, foreign sponsors, liquor board, individual associations and clubs, other state governments.

The first wheat variety developed by WSU was released in 1905. Jasper marks the 100th variety, released in 2015. Otto, released in 2011, is the most widely grown variety in Washington.
DISCOVERY

Discovery research is fundamental to answering complex questions. More than 70 percent of the CAHNRS research portfolio, which is fueled by competitive extramural funding, supports discovery research.

Premier research program areas

- Animal genomics and reproductive biology
- Basic plant molecular biology, genomics, and plant breeding
- Biofuels and bioproducts
- Agricultural markets and trade
- Diverse food production systems including organic, conservation, and sustainable agriculture
- Food quality, safety, engineering
- Health and wellness
- Natural resources
- Water supply and quality

Research funding: WSU among top in the nation

For the last four out of five years, CAHNRS has been among the top six universities in the nation for total dollars awarded from USDA National Institute of Food and Agriculture competitive grant funding.

Core research facilities

Our capacity for research is strengthened by state-of-the-art facilities and an extensive network of research farms throughout the state (see next page). With the aid of USDA-ARS and National Science Foundation grants, CAHNRS is investing in equipment to expand our capacity for phenomics, high-power computing, and data handling and analysis.

WSU aquatic ecotoxicologist Jenifer McIntyre is discovering new ways to mitigate the lethal effects of stormwater runoff. Her recent work is helping to guide ongoing improvements in stormwater management.

The WSU Center of Excellence for Food Safety Using Microwave Energy is advancing technologies to meet growing consumer demand for safe, high quality, additive-free packaged foods. Microwave-assisted thermal sterilization (MATS), left, and pasteurization (MAPS) technologies were developed at WSU by Regents Professor Juming Tang, far left, and patent rights are exclusively licensed by 915 Labs.

The Washington Grains Plant Growth Facility, located on the Pullman campus, will provide major benefits to Washington wheat and barley growers. The $15 million state-of-the-art facility is the result of a partnership between the Washington Grain Commission, the USDA-ARS, and WSU.
CAHNRS & Extension Centers
- Agricultural Weather Network
- Center for Environmental Research, Education & Outreach
- Center for Precision Automated Agricultural Systems
- Center for Sustaining Agriculture and Natural Resources
- Center for Transformational Learning and Leadership
- Clean Plant Center
- Composite Materials and Engineering Center
- Division of Governmental Studies and Services
- Food and Environmental Quality Lab
- IMPACT Center
- Ste. Michelle Wine Estates WSU Wine Science Center
- Metropolitan Center for Applied Research and Extension
- Washington Stormwater Center
- William D. Ruckelshaus Center

The Bread Lab combines science, art, and curiosity to research and breed grain diversity, expand the availability of regional grains, and explore innovative applications and techniques for improving wholegrain milling, baking, cooking, and malting.

The Bread Lab has moved into a 12,000-square-foot facility with an expanded bread laboratory, a milling lab, professional kitchen, and state-of-the-art baking classroom. Supporters and collaborators include the Port of Skagit, Skagit County, and King Arthur Flour.

Research and Extension facilities
Four Research and Extension Centers (page 16) and a network of research farms are located throughout the state.

RESEARCH FARMS
- Lind Dryland Research Station
- Othello Irrigated Research Station
- Pullman: Cook and Spillman Agronomy Farms, Eggert Family Organic Farm, Tukey Orchard, Turfgrass and Agronomy Research Center, Knott Dairy, Palouse Conservation Field Station, and Ensminger Beef Center
- Davenport: Wilke Research and Extension Farm

TRANSLATION AND DEVELOPMENT
Our translational research puts discoveries and development to work for the people, businesses, and industries of Washington, the region, the nation, and the world. At least 30 percent of the CAHNRS research portfolio in competitive extramural funding supports translational research.

With an estimated 3.5 million trees ordered by Washington growers in the first three years, Cosmic Crisp is the most widely and rapidly adopted apple variety in the history of the Washington apple industry. The new apple was developed at the WSU Tree Fruit Research and Extension Center and launched commercially in partnership with Proprietary Variety Management of Yakima.

Commercialization Success, FY 2015

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<tr>
<th></th>
<th>CAHNRS</th>
<th>TOTAL WSU</th>
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<tbody>
<tr>
<td>Invention disclosures(^1)</td>
<td>37</td>
<td>111</td>
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<tr>
<td>Intellectual property filings(^2)</td>
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<td>82</td>
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<tr>
<td>New startups</td>
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<tr>
<td>Gross royalties of IP licenses</td>
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<td>New outgoing material transfer agreements</td>
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</table>

\(^1\) Includes utility patents, plant patents, plant variety patents, trademarks

\(^2\) Includes foreign, domestic utility patents, PCT filings, continuations, provisional filings, plant patents, plant variety patents, trademarks
People and Partnerships
Our strength derives from world-class faculty and strong industry partnerships.

FACULTY
The CAHNRS research environment is designed to recruit high-quality faculty and ensure that they are successful.

The Faculty Research Advisory Council, Plant Growth Facility Advisory Group, and Organic Committee engage faculty in the governance of existing facilities, soliciting input on new initiatives and managing internal competitive grant programs such as Emerging Research Issues (ERI).

INDUSTRY PARTNERS
We engage the people, businesses, and industries that have a stake in research we conduct. We rely on our stakeholders for all aspects of research, including planning and assessment, advisory capacity, and financial support.

EXTERNAL ADVISORY GROUPS
Our external advisory groups ensure relevance and aid in implementation of external initiatives. They include:

- CAHNRS Food and Agriculture Advisory Council (FAAC)
- Cereal Variety Release Committee
- Tree Fruit Licensing Committee
- Wine Science Center Advisory Committee
- Four variety licensing advisory groups
- Three advisory groups for the Clean Plant Center–Northwest

COMMODITY COMMISSIONS
Our partnerships with agricultural commissions allow us to attract world-class leaders and develop cutting edge research facilities. Commissions contributed $50 million to CAHNRS research in the last five years through direct support of research and endowments, and support for infrastructure like the Washington Grains Plant Growth facility.

Key commissions include:

- Washington Grain Commission
- Washington Hops Commission
- Washington Potato Commission
- Washington State Commission on Pesticide Registration
- Washington Tree Fruit Research Commission
- Washington Wine Commission
WSU Extension engages people, organizations, and communities through programs to advance knowledge, economic well-being, and quality of life by fostering inquiry, learning, and the application of research.

For over 100 years, Extension has served as the front door of WSU, providing non-credit educational, personal, and professional development opportunities to people and communities throughout the state, expanding the capacity of individuals, organizations, businesses, and communities, and empowering them to find solutions for local issues and improving their quality of life.

WSU Extension is a partnership with federal, state, tribal, and county governments and various private-sector entities.

WSU Extension programs are grouped broadly into three categories:

- Agriculture and Natural Resources
- Community and Economic Development
- Youth and Families (including 4-H, parenting, and nutrition programs)

Each category includes diverse programs designed to meet the needs of local families, community partners, and businesses.

Extension Volunteer Contributions

5,600 426,000 $11.3 M
ONLINE RESOURCES
WSU Extension serves the residents of Washington state by creating and delivering targeted research-based knowledge and education. It’s a mission the organization and its dedicated specialists have refined over the past century. Part of that process is communicating results.

Impact Reports provide accounts of how Extension programs empower participants to better their lives. The reports are meant to inspire viewers to participate in Extension courses or events, share their own story, or provide feedback. Community involvement helps Extension improve responsiveness and reach more individuals.

Impact Reports—extension.wsu.edu/impact

The Learning Library houses 400+ peer- and non-peer reviewed publications created by CAHNRS and Extension faculty. The purpose is to bring scientific information and research results to the public in a format that is easily accessible and understandable.

Extension Learning Library—extension.wsu.edu/learn

Extension Program Areas

Agriculture and Natural Resources
Animal Agriculture
Beach Watchers
Cereal Variety Testing
Columbia Plateau PM10 Project
Food Processing
Forestry
Gardening in Washington State
Hortsense
Livestock Nutrient Management
Master Gardeners
Oilseed Cropping Systems
Organic Agriculture
Pesticide Information Center Online
Plant and Pest Diagnostic eNetwork (PPDEN)
Plant Pathology
Plant Pest Diagnostic Services
Potato Variety Testing and Production Management
Puyallup Plant and Insect Diagnostic Lab
Small Farms and Community Food Systems
Sudden Oak Death Education
Tree Fruit
Turfgrass Science
Urban Integrated Pest Management (IPM) and Pesticide Safety Education
Vegetable Production
Veterinary Medicine
Viticulture and Enology
Water Quality
Wheat and Small Grains

Youth and Families
4-H Positive Youth Development
Child and Family Research Unit
Consumer Food Safety
SNAP-Ed
Food Preservation
Navigating Difference: Cultural Competency Training
Nutrition, Health, and Wellness Education
Parenting
Strengthening Families

Community and Economic Development
Agricultural Marketing and Trade
Broadband and Digital Inclusion
Community and Regional Economics
Composite Materials and Engineering Center
Division of Governmental Studies and Services
Latino Community Studies and Outreach
Metropolitan Center for Applied Research and Extension
The William D. Ruckelshaus Center
WSU operates four main Research and Extension Centers (RECs) that develop sound science, instruction, and outreach to meet local and regional needs and provide practical solutions with immediate economic impact.

The Puyallup REC spans more than 30 program areas and is home to WSU’s Stormwater Center and low impact development research and extension programs. The Puyallup REC has a cutting-edge diagnostic laboratory for avian health, leveraging WSU’s knowledge strength in veterinary medicine and animal systems. It also delivers programs in dietetics, urban integrated pest management, ecotoxicology, environmental horticulture, and more.

The Tree Fruit Research and Extension Center (TFREC) in Wenatchee serves the needs of one of the largest fruit-producing regions in the world, as Washington leads the nation in the production of apples, cherries, and pears. Started 70 years ago by the state legislature, TFREC programs include plant breeding, entomology, physiology, pathology, and postharvest storage practices of tree fruit. The TFREC also hosts the Decision Aid System (DAS), an advanced set of online tools linking research models on pest and plant development to real-time weather data, improving management decisions for this important industry.

The Irrigated Agriculture Research and Extension Center (IAREC) at Prosser supports the state’s high-value irrigated agriculture industry. IAREC also hosts staff and scientists from the Washington State Department of Agriculture (WSDA) and the USDA Agricultural Research Service (ARS). Programs include AgWeatherNet (AWN), a statewide network of weather stations; enology, viticulture, and grape virology programs; tree fruit physiology and cherry breeding programs; and the Clean Plant Network, one of just 16 centers nationwide to test and develop disease-free germplasm for tree fruit, grapes, and hops.

The Northwestern Washington Research and Extension Center (NWREC) in Mount Vernon, supports agriculture and horticulture research that enriches the local community at the rural-urban interface. Programs include entomology, wheat and barley plant breeding, small fruit and vegetable horticulture, vegetable and vegetable seed pathology, weed science, and more. It is home to the WSU Bread Lab, which develops and tests artisan grains grown in the unique terroir of western Washington.
CAHNRS Administration Team

RON MITTELHAMMER
Dean

RICH KOENIG
Associate Dean; Director, WSU Extension

JIM MOYER
Associate Dean for Research; Director, Agricultural Research Center

RICHARD ZACK
Interim Associate Dean of Academic Programs