

FOOD INNOVATION FOR HEALTH, MARKETS AND ACCESS

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SITUATION SUMMARY

The College of Agricultural Sciences (CAS) at Oregon State University is dedicated to rethinking food—how it is grown, processed, distributed and made as safe as possible for consumers. We apply a systems-based approach to food and agriculture that supports the long-term viability of our diverse food-based economy and the communities that rely on its success. We support resilient and safe food production and recognize that current food systems are not well prepared to adapt to rapid population growth and urbanization, growing wealth inequality, changing consumption patterns, technology innovation, regulatory intervention and globalization. We strive to address and mitigate the effects of climate change, pandemics and depletion of natural resources. We recognize that U.S. food systems must work toward being able to feed the future world population, deliver healthy diets, minimize greenhouse gas emissions and produce equal and equitable benefits. The challenges are vast and the need to provide sufficient, healthy and accessible food, with minimal environmental impact, is urgent.

CAS works with diverse stakeholders of all sizes, including farmers and ranchers, entrepreneurs, food processors, nonprofit and community-based food system organizations, home gardeners, specialty food manufacturers, niche marketers, and more. The Pacific Northwest region has tremendous diversity in agricultural and marine products, and a broad range of expertise within the food chains, from production and processing to marketing and outreach. CAS is in a strong position to support and develop a sustainable and safe food system that contributes to health, expands markets for Oregon products and improves access to food for Oregonians in need as well as access to integrated research, education and more for food producers. We believe that CAS can lead Oregon's agricultural sector into new markets in emerging economies and grow our trade and brand in existing markets.

CAS benefits from collaborative partnerships – for research, education and outreach – with other units of OSU, including Linus Pauling Institute (LPI), College of Public Health and Human Sciences (CPHHS), College of Pharmacy, College of Engineering, Family and Community Health (FCH) Extension program, the Office of Commercialization and Corporate Development, as well as external stakeholders. Together, they work on transdisciplinary approaches needed to address large and systemic challenges.

STRATEGIC OPPORTUNITIES

This theme of Food Innovation comprises five unique strategic opportunities/focus areas:

1. Sustainable Food Manufacturing and Packaging
2. Food Access and Markets
3. Health and Sustainable Nutrition
4. Education
5. Outreach

Under each focus area, two to five opportunity areas are identified, along with strategies and opportunities. Following this is a more detailed analysis of resources needed to deploy these strategies. The systematic wheel diagram, below, illustrates and connects the sectors and activities in sustainable food systems from farm to fork (Figure 1). It represents our vision for CAS, rather than providing detailed action steps.

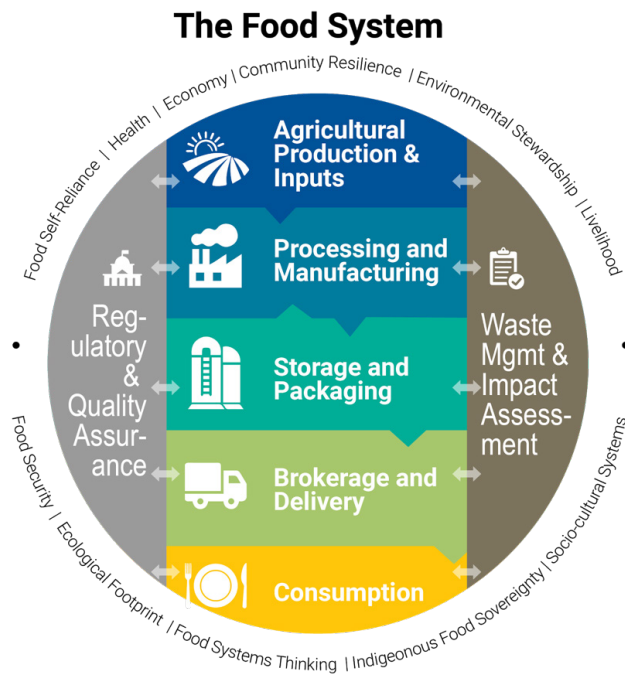


Figure 1. An illustrative diagram to connect the sectors and activities in the sustainable food systems from farm to fork.

1. Sustainable Food Manufacturing and Packaging

OSU's College of Agricultural Sciences contributes to the eco-sustainable development of agriculture and food systems through direct and indirect impacts. We will collaborate with industry to ensure a future with sustainable food systems that includes more efficient and environmentally friendly food processing technologies and process integration, together with minimal food waste (or conversion of food waste to energy) and use of food byproducts in the food processing chain. We envision and support a future with sustainable food manufacturing anchored within a resilient supply chain, from farm to fork, while anticipating the complexity of how consumers access food. We also envision an food systems that are agile and can withstand crisis, such as climate change and pandemics.

- **Opportunity Area 1: Sustainable Processing and Lean Manufacturing**
 We will research and enhance technology transfer in sustainable food processing and lean manufacturing, including environmentally friendly food processing technologies, lean manufacturing, waste management (including conversion to energy), water and energy efficiency, life cycle assessment (LCA) in food processing, innovation in plant-based foods, and novel value-added utilization of food processing byproducts. We acknowledge that sustainable food systems require a science-based focus on food safety. CAS supports the possibility of establishing urban sustainable food manufacturing centers.
- **Opportunity Area 2: Food Informatics**
 We will prioritize research in enhanced AI-driven innovations in food manufacturing, from raw materials/ingredients, food quality and safety, to processing efficiency for greater sustainability. This research will focus on significant opportunities for optimizing efficiencies in food manufacturing systems and supporting integrative data science that leverages a multidisciplinary approach. Nationally, there are few competing programs, which will create significant opportunities for CAS.
- **Opportunity Area 3: Sustainable Food Packaging**
 We will expand research in sustainable food packaging (compostable, recyclable, and/or biodegradable packaging). Lack of sustainable food packaging has been a visible problem for sustainable food systems even before Covid-19. Packaging is uniquely important due to its multiple functions – food safety, distribution stability and its impact on consumer purchase and post-purchase behavior. Packaging materials are also highly integrated with packaging processing, adding another dimension of opportunities and challenges.

2. Food Access and Markets

An integral part of the university's land and sea grant missions is to generate and disseminate knowledge that supports the study of food accessibility and affordability, whether that food comes from the land or the sea. Consumer choices about food spending and diet are influenced by the accessibility and affordability of the goods available across sales channels. Income, race, transport limitations, information, sales location, access to digital technologies and the internet, plus high prices constitute important barriers that can limit access to healthy and affordable food. The College of Agricultural Sciences works with other OSU colleges, such as the College of Public Health and Human Science as well as people and organizations in the state and around the world, to support research and outreach that address food accessibility and affordability challenges. We do this by supporting the sustainable production of food, as well as policies and programs that improve everyone's ability to access healthy food sources.

- **Opportunity Area 1: Helping Producers Bridge the Gap in Food Accessibility and Affordability**
Producers require technology, at all levels of the supply chain, to reduce costs, while maintaining the quality of food and agricultural goods and getting them to consumers in Oregon, across the United States, and around the world. This opportunity area puts the spotlight on the creation of tools to facilitate innovation that leads to greater coordination across food systems, higher profits for producers, and more variety (at lower prices) for consumers.
- **Opportunity Area 2: Supporting Access to Healthy Food Choices by Consumers**
Consumer access to healthy food choices requires increasing consumer purchasing power, presenting healthy choices, and giving people the knowledge to choose food products that support wellness. According to the Oregon Food Bank, the rate of food insecurity in Oregon is nearly 15%, which is over half a million food insecure Oregonians. Two-thirds of the world's population live on less than \$10 per day, and one in 10 on less than \$2 per day. Simultaneously, 30% of Oregon adults are obese, a challenge that is also increasing worldwide. This opportunity area will provide research, training and outreach aimed at supporting access to healthy foods in the state and across the globe.
- **Opportunity Area 3: Breaking Down Accessibility and Affordability Barriers through Leadership in Community Development**
Community development involves tying together efforts to support producers and consumers, as well as building on and expanding existing efforts. This opportunity area will unify efforts to foster community development through the Agricultural Experiment Stations, Extension Agents, community colleges, and the many nonprofit organizations involved in this work in all regions of the state. It also will coordinate with international research centers to both take knowledge from OSU to the world as well as bring innovations from the world back to OSU. In an era of decreasing resources, leveraging multiple efforts to support communities can minimize duplication, increase impact and save resources.
- **Opportunity Area 4: Supporting Access to Emerging International Markets and Continuing Export of Oregon Agriculture**
Oregon agriculture is global agriculture. With 40% of Oregon products being exported overseas, it's more important than ever to support growers and entrepreneurs in pursuing international markets. Oregon and CAS are well-positioned to engage with emerging markets, particularly in the Pacific Rim countries, where demand for high-quality, safe products is rising rapidly. Across the globe, consumers and markets are demanding more attention to sustainable practices throughout the supply chain. CAS has a timely opportunity to expand its global profile and engage diverse stakeholders to extend its research in support of Oregon agriculture and the state's economy, as well as to model environmental stewardship efforts and learn from our partners.

3. Health and Nutrition

As the College of Agricultural Sciences, we will emphasize activities and stakeholder engagement on growing and developing foods that increase health and wellness and promote nutrition across diverse populations. Consumers are demanding more healthy options, including alternative proteins, plant-based foods, clean-label products and minimally processed foods. At the same time, the demand to

help a growing population feed itself and the pressure of agriculture on the environment necessitate innovative approaches to solve complex problems. The nexus between a healthy diet, food security and sustainable food production and processing will require multi-faceted and interdisciplinary approaches, with the potential to yield significant benefits.

- **Opportunity Area 1: Creating Healthy Foods with Oregon's Agricultural Bounty**
We will leverage the high quality of Oregon's produce to create healthy foods for diverse populations across Oregon and beyond. Our vision is to expand our work in plant breeding for nutrition and functionality, animal husbandry and aquaculture (including plants and algal products), as well as value-added processing to develop food and beverage products that provide healthy dietary options and support Oregon's food producers and processors. Food safety must be ensured for the unique challenges posed by minimally processed agricultural products (e.g., produce) and innovative food and beverage products.
- **Opportunity Area 2: Identifying Bioactive and Functional Properties of Food and Other Natural Products for Health and Disease**
The recognition of the role of food in promoting health and reducing the risk of disease has greatly pushed the boundaries and significance of food and nutritional science. Our vision is for Oregon to become a national leader in identifying and evaluating bioactive and functional properties of natural foods and dietary components, especially specialty crops, seafood derived from the Pacific Northwest, and other bioactive natural products. Similarly, we aim to understand food (and other agricultural consumer products) as a route for environmental exposure to pollutants. This opportunity area will span from analytical characterization of novel compounds, application and integration of high-throughput omics technologies (genomics, transcriptomics, proteomics, and metabolomics) for connecting food components, diets, health, and diseases to translational research in communities to achieve health and wellness impacts.
- **Opportunity Area 3: Improving Sustainable Nutrition through Resource Innovation**
The current practices of food resource harvesting, processing and consumption generate substantial discards, byproducts and waste that lead to the loss of valuable dietary resources that are nutritious for human health, and also generate environmental impacts. Our vision is to put significant research emphasis on tackling the waste of dietary resources by revealing nutritional value and developing innovative dietary applications for discarded materials during food harvesting and processing. Illuminating the nutritional value of underused materials will provide opportunities for food production sectors to stimulate better resource utilization and add value to otherwise minimally valued or wasted resources. Furthermore, this type of innovation can play a role on improving the nutritional status of disadvantaged people and a growing global population.

4. Education

At the College of Agriculture Sciences, we create and cultivate opportunities to provide a world-class education for our students by enhancing our commitment to sustainability, experiential learning and student success. Together, we can leverage what we have to create what we need, Beaver leaders who graduate from the college are equipped with technical knowledge, leadership skills, practical experience, the ability to connect with people, and the passion to create a better world.

- **Opportunity Area 1: Sustainable Agriculture and Food Systems and Management**
Our vision is to expand and strengthen student opportunities by facilitating integration of CAS units' sustainability coursework with the university-wide and CAS-based Sustainability double degree and minor (SUS). We plan to grow SUS to span research, Extension work and teaching. Concurrently, we plan to utilize this growth to identify and integrate faculty and students across OSU who are united by the desire to rethink how food is produced. We will train future food and agricultural business management leaders to lead innovation in the sector and sustainability of the food system.

- **Opportunity Area 2: Experiential Learning**

- ▶ To better prepare our students to impact the world, we will provide relevant, high impact learning experiences designed to:
- ▶ Strengthen students' leadership skills through participation in the College of Agricultural Sciences Leadership Academy as well as a capstone FST-based, industry-focused sustainability assessment program.
- ▶ Leverage a multitude of stakeholder contacts and partnerships and systematically develop internships, innovation experiences, and undergraduate and graduate research opportunities.
- ▶ Expand international experiences, such as our current partnership with Agroecology at Institut Supérieur d'Agriculture et d'Agroalimentaire Rhône-Alpes (ISARA) in France, to promote diverse, life-altering learning opportunities.

- **Opportunity Area 3: Student Success**

We will continue to promote inclusivity and access through the development of additional Ecampus courses, including the integration of courses, such as nano certificates in Sustainability, for sustainable food manufacturing, sustainable food systems, etc. We will identify philanthropic sources to support students who delay graduation in order to pursue opportunities to study sustainable food and agriculture along with leadership and international experiences. We will also integrate the best practices of inclusive pedagogy into coursework and advising across the college, taking advantage of programs offered by the Office of Institutional Diversity and the Social Justice Education Initiative.

5. Outreach

Through its historic presence in all geographic communities in the state and a commitment to have a presence in all communities, including those traditionally underserved and disadvantaged, CAS is strategically positioned to apply the assets of a major university to enrich communities, the economy and Oregonians' lives through partnerships that emphasize collaboration and reciprocity. We will support the long-term sustainability of farmers, ranchers and food businesses locally, regionally and globally through an intensified outreach focus informing research-based decisions and expanding our impact on education and training outside our walls. The collective impact will be an effective and cohesive application of outreach resources targeted at stakeholder-aligned priorities.

- **Opportunity Area 1: Extension Service**

- ▶ Enhance engagement for identifying collaborative and reciprocating opportunities.
- ▶ Focus on community and stakeholder-driven priority development for research and education for small, medium and large-scale farm and food businesses.
- ▶ Establish "Oregon Food Ambassadors/Coordinators" in Extension – to focus on food access, promoting Oregon grown and processed foods via all channels linking producers to CAS resources.

- **Opportunity Area 2: Science-based Information for Diverse Stakeholders**

- ▶ Serve as a food industry hub for the exchange of ideas and knowledge; identify challenges and opportunities that drive new collaborative opportunities and research projects; and identify funding resources. The impact will be a 'shared voice' across stakeholders to drive change in partnership with regulators and policymakers.
- ▶ Deliver consumer-oriented, science-based food system sustainability information via multiple platforms (e.g., FST's Farm 2 Fork webinars).
- ▶ Engage international stakeholders to become part of the solution to solving global problems around sustainable agriculture, natural resources and food security.

- **Opportunity Area 3: Workforce Development**
Expand the capacity and focus of PACE to include SFS topics leveraging capability in E-campus to evolve PACE. Implement targeted partnerships with nonprofits working on sustainability skill building, advocacy, policy and innovative technologies. Interface with industry to develop/provide industry learning opportunities for students and entrepreneurs. Engage Open Campus and support community colleges to develop transfer programs in sustainable food systems.
- **Opportunity Area 4: K-12 Connectivity**
Collaborate to create and deliver education around food systems, science, advocacy, and policy as future consumers, scientists and leaders. Leverage existing programs (e.g., Food Hero, Farm to School, Oregon Agriculture In the Classroom) to promote food science and Oregon agriculture to K-12 educators and kids.
- **Opportunity Area 5: Urban and Rural Food-Based Economic Development**
Elevate community expertise in research choices, local/regional market development, and fresh and processed food product development. Engage with traditionally underserved and disadvantaged communities to determine special needs and demands for culturally identified foods and food product development. Support Equitable Food-Oriented Development (EFOD) efforts. Engage in policy development to improve the business environment for local community farm and food businesses. Incentivize local and regional market development.

ADDITIONAL RESOURCES + STRATEGIES

To maximize the opportunities for success, the following additional resources and strategies have been identified to address current capacity issues and potential external partnerships:

- CAS works with large to small, urban to rural, local to international agriculture and food systems. We will leverage these diverse relationships to facilitate research and technology transfer for maximum impact and accelerate the transition to sustainable food systems, while securing ongoing funding for these initiatives. CAS will act as a hub or catalyst to drive/enable innovation in local/regional processing capabilities through shared resources and different business models.
- We will leverage OSU's strength in integrative data science technologies along with AI and machine learning to aid decision making. Traditional silos between manufacturing and industrial engineering and food science programs have slowed research on continuous optimization tools (e.g., lean manufacturing) in food processing. We will erase these obstacles and collaborate with all major colleges across OSU to augment our productivity and provide maximum service to our stakeholders.
- There are significant opportunities to help producers bridge the gap by providing foundational research in food policy and sustainable production practices, coordinated with state and federal governments and international research institutions like the Consortium Group for International Agricultural Research (CGIAR). We will also support knowledge exchange via multiple platforms, leveraging existing formats like enterprise budget planning for producers and training videos through Pace, as well as creating new opportunities for information exchange for vendors large and small, using OSU platforms and engaging with state and local government efforts in this area.
- We will support consumer access to food at all levels, ranging from securing government funding to assess existing supports for food purchasing, ranging from the Oregon Food Bank to the Supplemental Nutrition Assistance Program (SNAP). There are significant opportunities for public and private collaborations to map out the current food system, identify gaps, and engage with food entrepreneurs in Oregon and beyond in collaborative work on the development and marketing of healthy food options.
- Re-invigorating and pivoting programs provided to communities by the Agricultural Experiment Stations, Extension programs and community college connections will help break down barriers to community development regionally and complement

broader efforts to identify and promote alleviation of poverty and economic growth internationally. Greater flow of information between research/teaching and Extension faculty is likely to pay large dividends for this opportunity area.

- Through programs in plant breeding, animal sciences, data analysis, product development, food safety, nutrition and sensory evaluation, CAS has the depth of knowledge to address systemic and emerging challenges in nutrition and produce healthy foods for consumer wellbeing, while supporting Oregon's agricultural economy. Ultimately, the success of our vision will manifest in a reduced burden of chronic disease associated with an unhealthy diet, greater access to high- quality foods, and solutions for global markets seeking to advance public health and dietary nutrition in their populations.
- Ongoing support for sustainability initiatives, including degree/program based, as well as future priority staffing requests.
- Research collaboration assistance with nutrition faculty in the College of Public Health and Human Sciences.
- Commodity or grower support; while Oregon's diversity of specialty crops provides many opportunities, they also present a challenge in how to allocate staffing/resources across broad and distinct crops.
- We will implement strategic plans outlining a path of growth for both the Leadership Academy and FST. Given the new SUS leadership structure, we are well-positioned to further collaborate. Financial constraints do limit student accessibility to experiential learning, international experiences, and student success initiatives and thus we advocate for strategic inclusion of these areas in our college's capital campaign and development plan.
- We will leverage existing relationships to strategically grow experiential learning opportunities and create real-time feedback systems, as well as clear academic and program paths that link directly with current industry standards. Enhanced connection with industry and stakeholders will enable us to provide connected and relevant content to students, thereby increasing student success.
- We'll fulfill our vision by leveraging our significant strengths, including strong relationships throughout the agricultural ecosystem, an established Extension organization that directly connects OSU with communities using diverse communication channels, collaborative relationships with pre-college organizations like 4H, Juntos, MANRRS (junior and senior high school), FFA and Open Campus programs and expertise that reflect the current diversity of our stakeholders and ones that strategically expand upon them.

OTHER NEEDS

Other needs required to maximize the impact of these opportunities and strategies include:

Internal Support

- Faculty training, infrastructure and FTE for coordination of consumer messaging.
- Faculty training in diversity, equity and inclusion, and forms of engagement with traditionally underserved communities.
- Additional faculty of color and cultural diversity.
- Funded fellowship programs for partners from traditionally underserved communities.
- Faculty FTE and coordinating infrastructure PACE/Ecampus.
- FTE K-12 coordination and linkage with K-12 partners (e.g., schools, ag youth programs)
- Collaborative faculty infrastructure across food systems plus stakeholder communities.

External Support

- Legislative support for concepts that benefit and provide opportunities across farm and food businesses of varying scale and types.
- Leveraged partnerships with foundations that value local and regional-based sustainable farming and food systems and have access to traditionally underserved communities.
- Non-traditional donors engaged to enhance outreach and reciprocal partnerships within traditionally underserved communities.
- Access to government and foundation grant programs.