

WORKING AND NATURAL LANDSCAPES

Managing Sustainable Working and Natural Landscapes for Future Generations of Oregonians and the World

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SITUATION SUMMARY

Input for this white paper was gained from five separate sessions: 1) an initial retreat with the leadership team that established the four themes; 2) a breakout group of unit leaders addressing Working and Natural Landscapes (WNL); 3) a breakout group of faculty across the College of Agricultural Sciences that addressed WNL; 4) a group of thought leaders from CAS who were asked to consider the previous input and prepare a white paper that identified strategic advantages within the larger concept of WNL and opportunities that exist to capitalize on these advantages; and 5) a community town hall with 67 unit leaders, faculty, staff and members of the Dean's Office.

Our team recognized the unique advantage that CAS brings to understanding, conserving and bettering WNL. It is these advantages that create new opportunities for establishing a Center of Excellence for Working and Natural Landscapes. With some additional resources (primarily future cluster hires to replace retiring faculty) that can focus on data integration across multiple scales both temporal and spatial, as well as ensuring data security for our stakeholders, we have the capacity to become an important source of science and outreach to address issues surrounding WNL not just in Oregon, but across the nation and abroad.

Our expertise across multiple disciplines and our reputation as an objective source of answers to an array of difficult questions positions CAS well to increase our footprint by expanding our efforts to engage federal, state and local agencies, nonprofit groups and stakeholder groups as collaborators that work toward creating productive and sustainable Working And Natural Landscapes.

BACKGROUND

Oregon is one of the most geographically diverse states in the U.S., marked by volcanoes, abundant bodies of water, dense evergreen and mixed forests, as well as high deserts and semi-arid scrublands. At 11,249 feet (3,429 m), Mount Hood, a stratovolcano, is the state's highest point. Oregon's only national park, Crater Lake National Park, comprises the caldera surrounding Crater Lake, the deepest lake in the United States. The state is also home to the single largest organism in the world, *Armillaria ostoyae*, a fungus that runs beneath 2,200 acres (8.9 km²) of the Malheur National Forest.

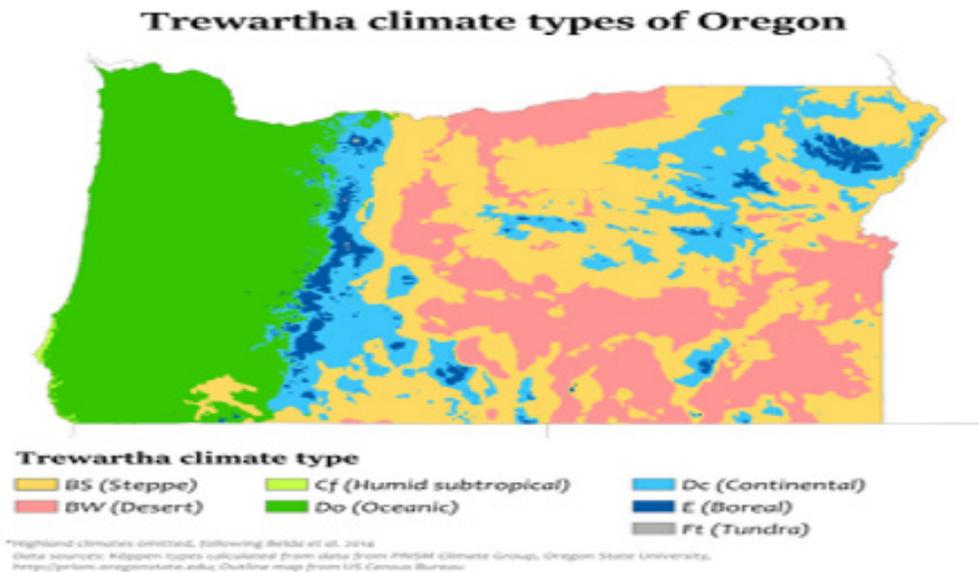


Figure 1. Trewartha Climate Type

The diversity of Oregon's landscapes is driven in part by its climate and precipitation (See Figures 1 and 2) and nearly 2,000 identified soils. Arid areas support much of the state's livestock production on a mix of private and public lands with winter feed provided through irrigated hay production. These same areas also support abundant wildlife and provide recreational opportunities. Boreal and Oceanic areas produce timber, wildlife and water, and also support livestock grazing and recreation. The Columbia River Basin and the land associated with the Columbia River's tributaries produce much of the state's agricultural commodities.

Coastal communities and the Pacific Ocean contribute substantially to the Oregon economy with a large saltwater commercial fishing fleet that lands nearly 210 million pounds of fish annually. Dungeness crab, pink shrimp and shellfish aquaculture add to the \$155 million annual contribution to the state's economy, generating an estimated \$544 million in household income. Ocean recreational fisheries generate an additional \$60 million annually.

Fresh water aquatic ecosystems provide critical habitat to a number of threatened and endangered species. Recovery of these species is an important part of the research conducted by CAS faculty and creates many opportunities for continued collaboration with state and federal agencies. These species also generate significant public interest and increased challenges to both create sustainable working landscapes and conserve natural landscapes.

Because of its diverse landscapes and waterways, Oregon's economy is largely powered by various forms of agriculture, fishing, and hydroelectric power. Oregon is also the top timber producer of the contiguous United States, the timber industry having dominated the state's economy in the 20th century.

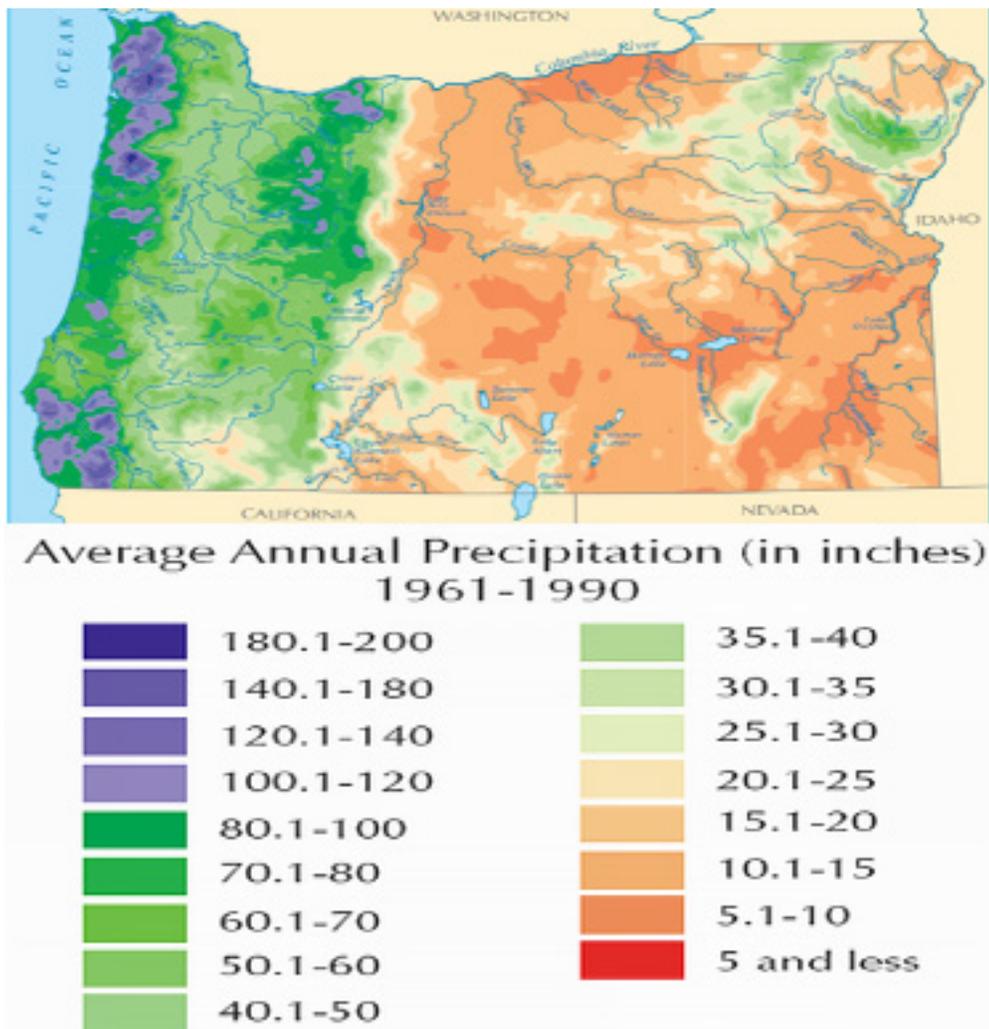


Figure 2. Precipitation Map of Oregon

Oregon's agriculture industry is highly diverse. Some 35,000 farms produce over 225 different products, including commodity crops, livestock, hay and specialty crops. A few of Oregon's signature specialty crops include hazelnuts, grass seed, greenhouse and nursery products, cranberries, Christmas trees, peppermint, pears, blueberries and cherries. Oregon is also a leader in producing high-quality beer and wine and has a growing distilled spirits industry.

The state's working landscapes produce products with a farm gate value of almost \$6 billion. According to a recent report by Oregon State University, the "economic footprint" of agriculture in Oregon accounts for over \$50 billion, or 13.2 percent of the state's economic activity. Associated jobs number over 326,617 or 13.8 percent of the state's employment.

Oregon's diversity of landscapes, cropping and grazing systems, and ocean environments have generated a wide range of opinions on how best to allocate and manage these resources. Conflicts continue to emerge about land use, endangered species, invasive species and grazing, to name just a few of the issues. Competition for water resources to support fisheries, provide water for agriculture and municipal needs, and generate hydropower results in a seemingly endless array of questions and concerns that must be answered to develop workable solutions to a host of social, economic and environmental issues.

The College of Agricultural Sciences welcomes this challenge. CAS encompasses a large, collaborative network of OSU researchers and teachers (academic, Extension Service and others) with broad and deep expertise in almost all areas of agricultural and natural resources research and outreach across the state and beyond. Faculty, staff and administrators are well-connected to practitioners (growers, users and land managers, as well as state, federal and local agencies and NGOs). OSU's strong ties to stakeholders, communities and agencies enable us to skilfully collaborate on identifying problems and contributing to scientifically informed solutions.

STRATEGIC OPPORTUNITIES

The theme of working and natural landscapes comprises three unique opportunities/focus areas:

- 1. Collaboration on Diverse Working and Natural Landscapes**
- 2. Innovation in Distance Learning and Ecampus**
- 3. Integrating Research, Extension and Academics**

1. Collaboration on Diverse Working and Natural Landscapes

- CAS has Branch Experiment Stations and faculty located in each agro-ecosystem across the state. This footprint provides us with a unique perspective on the different managed and natural landscapes relative to precipitation, elevation and population gradients. The diversity of expertise ranges from fruit pathologists to sage grouse habitat biologists and virtually every discipline in between. Our "deep bench" of facilities and personnel coupled with an outstanding reputation for objectivity across competing perspectives and positions, positions us as a source for good science, good decision-making tools, and convener of alternative approaches and ideas for problem resolution.
- In collaboration with other colleges at OSU, CAS has the capacity to tackle large-scale, real-world challenges, including the intersection of opinions surrounding conservation of diverse natural and sustainable managed landscapes. Oregon's climate, waters and soils that comprise our diverse landscapes provide CAS researchers with considerable expertise that can be applied to similar ecosystems of national and global relevance.
- CAS faculty are recognized nationally and internationally for expertise in: 1) the science and engineering of water resources provision, quality and conservation; 2) interdisciplinary spatial and temporal work in ecological and agricultural concerns; 3) complex socioeconomic and environmental problems related to land use, regional development, environmental protection, and matters related to the interface of landscapes (e.g., suburban centers-farmland, rural communities-fire, human-wildlife conflict, etc.); 4) soil health, plant and microbial sciences (both native and cultivated), livestock production systems, restoration ecology and conservation biology, range and wildlife ecology, water safety and sustainability; and 5) integration of multiple disciplines that support unique organizational and structural arrangements to meet the diversity of demands on working and natural landscapes.

- CAS expertise in agricultural/rangeland economics and socioecological/hydrological systems helps expand local and regional collaborations through integrated resource management in local and regional economies. Examples include utilization of pastures, rangelands, and agroecosystems in energy production (e.g., hydropower, bioenergy, wind, solar), and technology transfer and development in the farms of the future (e.g., robotics, precision agriculture, and agrovoltatics).
- CAS faculty are nationally and internationally recognized for their research in aquatic, wetland and riparian systems— research that seeks to restore important ecological function and water quality that can lead to the recovery of threatened and endangered species while simultaneously supporting important drivers of Oregon’s economy.
- Several threatened or endangered species are associated with provisioning water for agricultural, industrial and municipal needs. In order to sustain these needs and these important species, new collaborative approaches as well as the use of the “best available science” will be required.
- CAS faculty are viewed externally and view themselves internally as “convenors.” This particular strategic advantage stems from our reputation as objective observers and purveyors of good science. Decisions based on political expediency or anecdotal evidence rather than proper application of scientific method result in bad decisions that may alienate some and reward others. When a crisis demands scientific intervention to present a logical, informed and workable compromise, CAS scientists have always been the “go-to” source of informed consent around “wicked” problems. These scientifically informed resolutions to issues of biodiversity, generational landscape sustainability, and the intersection of landscape uses and demands are promoted by all of our stakeholders and the public at large.

2. Innovation in Distance Learning and Ecampus

- CAS departments and faculty are experts in distance education including unparalleled experience delivering online, hybrid and experiential learning. Our Ecampus program leads the nation, and offers B.S. degrees in Agricultural Sciences, Botany, Crop and Soil Sciences, Horticulture, Fisheries & Wildlife Science, Rangeland Sciences and Sustainability, as well as an online PACE program in Urban Agriculture. CAS generates new and emerging research/teaching/outreach opportunities (e.g., agroecology, precision agriculture/ecosystem technological applications, clean energy). CAS distance learning and Ecampus could expand teaching and education for social justice, DEI, and cultural richness in agricultural practices and settings.

3. Integrating Research, Extension and Academics

- Oregon is known for its diverse landscapes that include forests, farmland, coastline, mountains, high desert, extensive federal lands, and large and small population centers. A diverse landscape often creates land-use conflicts, such as – irrigation water diversion vs. instream flow for salmon; timber harvesting vs. endangered species conservation; and urban development vs. farmland protection. Land-use conflicts create opportunities for land-use research and outreach efforts. CAS has a long history of established, trusted, scientifically informed research in working and natural landscapes at all spatial scales. Impartial outreach and engagement networks translate research findings of unbiased fundamental knowledge into practical applications and solutions. Our Extension faculty work closely with stakeholders and the public to utilize “citizen science” and volunteers to create informed consent around a host of pressing problems.
- As a fast-growing state, Oregon will experience increasing population and suburbanization inevitably encroaching on natural and working landscapes. Urban encroachment will create both challenges and opportunities for all of our stakeholders. Developing science-based information and solutions to the challenges of urbanization and population growth will create opportunities for research, teaching and outreach activities. CAS resources and expertise are strategically positioned throughout the state to focus on a broad range of food, environmental and natural resource issues that encompass research, Extension involvement and

education. Integration of our research, teaching, Extension and branch Experiment Station system strengthens communication between the areas and informs stakeholders across the state.

- CAS can address concerns of sustainable working and natural landscapes, and we have the ability to demonstrate the dependence of marine and terrestrial systems with natural resource management. CAS can address concerns at ecosystems and landscape scales to address social and environmental concerns around biodiversity and functional ecosystems. CAS can address how landscape changes impact communities, and serve as an unbiased source of scientific information, provide answers, solutions on matters of sustainable landscapes and landscape interfaces conflicts.

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:

Collaboration on Diverse Working and Natural Landscapes

- Expertise in combined landscape ecology and systems-thinking integration could be used to further interdisciplinary collaboration leading to transdisciplinary approaches to address complex societal and ecological issues (e.g., pandemics, climate change, ecosystem complexity and species adaptation/migration). The similarity of Oregon's natural environment to natural environments in other countries and continents could create opportunities for more international research or international researchers' involvement in our research. We should pursue potential U.S. partners/collaborators who can help CAS access international opportunities.
- Development of the new Cattle Strategic Plan affords numerous opportunities to work with producers across the state to improve sustainability, improve range and pasture management, create new sustainable food systems throughout the value chain for livestock and dairy production, and ensure that the integration of ecosystem services benefits from livestock production systems.
- We need to create partnerships with OSU's other land management colleges such as CoF and CEOAS to address climate change issues that directly impact CAS constituencies. We should increase the commitment and involvement of CAS toward science-based support of collaboratives addressing complex natural resource and environmental challenges. Some examples:
 - ▶ Invasive species
 - ▶ Rangeland restoration
 - ▶ Human-wildlife conflict
 - ▶ Endangered species
 - ▶ Water (both surface and ground waters)
 - ▶ Climate change
 - ▶ Fire
 - ▶ Soil health
- We need to expand our management and research questions to include those that exist at the intersection of traditional fields and those that exist in urban settings.

Innovations in the data sciences and interdisciplinary research

- We see an opening for a big-data leader in the western U.S. Having a "big data center" at OSU would be less helpful than finding a way to integrate data from

multiple locations across Oregon to address problems. To do this requires investments of hardware and software, but mostly technical personnel (e.g., data security and backup) across the state. There is a greater opportunity for being the “integrator” of data rather than the data repository. If we can democratize big data, there are many clear applications of “big data” (in its various forms) to help develop solutions to the challenges facing working and natural landscapes. A powerful use of this information is to make it readily available and usable by the full range of stakeholders.

- We need to operationalize “landscape management”. Many of the challenges and issues facing working and natural landscapes, such as climate change and water management, operate at landscape scales. The solutions to these challenges need to operate at those scales as well. For instance, how do we translate a climate corridor map into actual on the ground climate corridors? There are a number of practical constraints to doing that, such as private versus public ownership, stakeholders having conflicting goals, etc. OSU has been an early leader in developing some approaches to overcoming those constraints (e.g., Willamette Water 2100), which puts CAS in a good position to do more.
- We see the new water cluster hire and emerging water programs being developed by several state agencies providing an opportunity to create research and management plans to more efficiently utilize water resources, improve water quality, explore options for water reuse, reduce toxins and nutrients in groundwater, ensure aquatic systems (including wetlands and riparian areas) can accommodate restoration of threatened and endangered species, and also provide for human health concerns.
- A new or existing center of excellence can be used to better integrate the current expertise in the college and other OSU colleges through a business incubator/ technology park concept to help address transformational knowledge challenges affecting natural and working landscapes in Oregon and beyond (e.g., fire, water, climate, economy).
- Support and expand development of precision management strategies (technologies) and tools that allow for economically efficient and environmentally sustainable food production.

Ecampus and Academics

- We need to continue to expand our online education program as online learning becomes increasingly popular. CAS should leverage what we know from Ecampus to develop distance learning that can be provisioned across the state for non-student learners, professionals and stakeholders. OSU will be training 21st century professionals. We could develop more cross-disciplinary courses, realign graduate education to train for diverse professional jobs (e.g., natural resource professionals for state, national and international agencies; NGOs; and private industries) not just academics, and leverage our strengths in distance education and professional training (e.g., PACE) in innovative ways.
- CAS has a wide range of expertise for solving complex socioeconomic and environmental problems related to land use, regional development and environmental protection. Many of the college’s natural resource programs are highly ranked, which will facilitate attracting funding, students and high-caliber researchers to OSU.

Food Systems and Emerging Issues

- We can reimagine our food systems. Much of the environmental impact of agriculture is influenced by the broader food systems that connect producers to consumers. The design of these systems often reflects goals and challenges of the last century, not this one. They also are often shaped primarily by near-term economic factors instead of other social considerations such as environmental impact. There are many proposals to modify our current food systems (e.g., more regionalized systems, urban ag, etc.), but the relative merits, issues and constraints of such proposals have so far not been well tested. CAS has the BES and many cooperators on working and natural landscapes to begin to address this research and find ways to deliver the information through Extension.

- Oregon is one of the fastest-growing states in the country. Increasing population and suburbanization will inevitably encroach on natural and working landscapes. Such changes will create both challenges and opportunities for agriculture and rural communities. The recent growth in public interest in outdoor recreation, public lands, natural resource management and agriculture, will create new challenges for conventional approaches to land and resource management and further divide public perceptions of how we provide food security while preserving the environment. This means we must maintain flexibility to respond to large-scale unforeseen problems.

Diversity, Equity and Inclusion

- CAS must continue to lead on diversity, equity and inclusion. The history of DEI in the various areas that encompass working and natural landscapes needs substantial improvement. Oregon's history exemplifies this. Our present also exemplifies many of the issues and challenges: a largely white population, stark political divides, stark social-economic divides between the owners of agricultural businesses and their workers, etc. Those challenges create an opportunity to innovate solutions.

GOALS, NEEDS AND OUTCOMES

- Become the “go to” place in the nation for knowledge and objective analysis of critical issues related to working and natural landscapes.
- Develop solutions to the challenges facing working and natural landscapes.
- Support a central thrust of OSU's Strategic Plan: Advancing the Science of Sustainable Earth Ecosystems.
- Work closely with our stakeholders and industry to establish new funding sources to extend research, Extension, and education beyond the normal grant life cycle.
- Continue to pursue cluster hires in areas of need to achieve a critical mass of expertise that will improve grant opportunities and expand our knowledge base.

OTHER STRATEGIES AND RESOURCES

- Identify the existing strengths in CAS and allocate resources to enhance existing capacities for research, education and Extension related to working and natural landscapes.
- Create a “Center of Excellence” focusing on working and natural landscapes.
- Provide a venue in which OSU natural and social scientists can collaborate, share data, and integrate models to address complex questions from multiple perspectives and at multiple scales (e.g., field scale, landscape scale) and interfaces (e.g., urban-ag, rangeland-forest).
- Integrate big data to develop solutions to the challenges facing working and natural landscapes.
- Educate graduate and undergraduate students and provide a place for them to conduct research.
- Train 21st century professionals and natural resource managers for state, national and international agencies, NGOs and private industries.
- Involve stakeholders in setting research agendas and communicating findings to decision makers and stakeholders (e.g., with dedicated workshops aimed at transdisciplinary research.)
- Develop a comprehensive investment strategy to attract external funding from multiple public entities (e.g., NSF, NIH, USDA, USAID, Oregon Legislature), private and nonprofit sources (e.g., Kellogg Foundation, Commodity Groups) to help fund the Center of Excellence and cluster hires around specific topics of interest (e.g., agroecology, landscape ecology and evolution).

OTHER NEEDS

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

- Integrate the current expertise in the college and other colleges through a Center of Excellence for Working and Natural Landscapes to help address transformational knowledge challenges affecting natural and working landscapes in Oregon and beyond (e.g., fire, water, climate, economy).
- Draw on stakeholder relationships (e.g., state and federal agencies) with whom we collaborate, to refine our assessment of transformational knowledge challenges, through workshops aimed at transdisciplinary and trans-agency collaboration. Make new investments in hardware and software and technical personnel (e.g., data security and backup) through cluster hires of tenured faculty.
- Develop a “training grant” style program to recruit outstanding graduate students from diverse backgrounds. One approach could be to recruit cohorts of students representing different skill and disciplinary areas.
- Maintain or increase the proportion of Ecampus and PACE revenue streams that go directly to faculty and programs, as these resources are critical for maintaining graduate education (e.g., through GTA support) and high-quality instruction.
- Expand and enrich undergraduate research and internship programs. These can build on existing models such as the Multicultural Scholars Program and the Big Data Internship program. Potential areas to develop could include more integrated collaborations with local resource management agencies and developing other funding sources in addition to federal grants. A strong OSU Ecampus platform should offer unique opportunities to integrate existing curricula with new undergraduate and graduate curricula around interdisciplinary work in sustainable earth systems subjects.
- OSU Foundation can be a resource to help organize a targeted campaign to fund some of these initiatives (e.g., through endowments, fellowships, technology park, Center of Excellence)
- Provide support and resources for greater engagement of Branch Experiment Stations (BES) as living laboratories to complement and work with on-campus programs. BES represent a broad range of ecosystems, agricultural commodities, and food systems with capacity to expand the impact of all three legs of the Land Grant Mission.