2023 Annual Report

WASHINGTON STATE UNIVERSITY
Center for Sustaining Agriculture and Natural Resources

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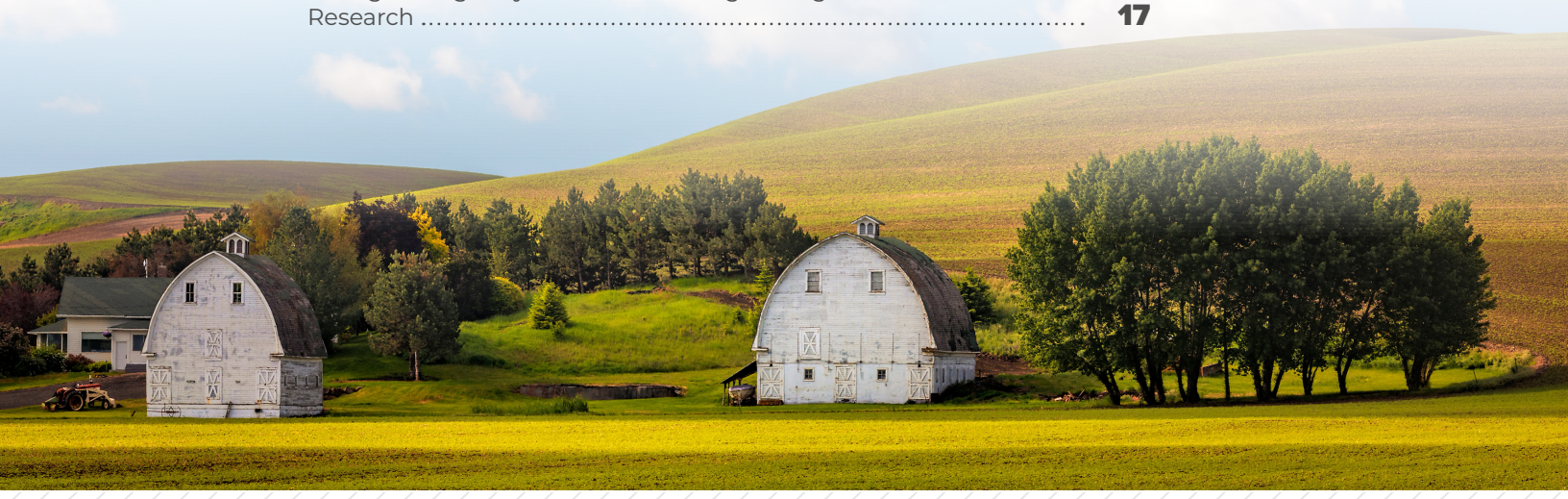

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Associate Director

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Adjunct Faculty

KIRSTEN BALL
Adjunct Faculty

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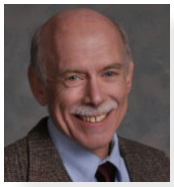
WaSHI Lead

KARIE BOONE
Research Associate

EMBREY BRONSTAD
Bioenergy Specialist

DOUG COLLINS
Extension Specialist

KATIE DOONAN
Extension Coordinator



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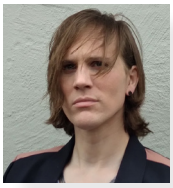
Research Associate

JORDAN JOBE
AgAid Project Manager



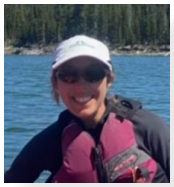
ALEX KIRKPATRICK
Science Communications Specialist

ANDREW MCGUIRE
Extension Agronomist

MOLLY MCILQUHAM
WaSHI Extension Coordinator

TEAL POTTER
Research Associate

NATHAN STACEY
Adjunct Faculty



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HELEENE TAMBET
Associate in Research

AARON WHITTEMORE
Associate in Research

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director's **MESSAGE**

> CSANR has long served as a research incubator and catalyst to engage partners in making a real-world difference in the sustainability of Washington's agriculture and food system.

I believe this is one of the key reasons that we have been sought out by partners and collaborators on so many projects, within WSU, with other academic institutions, and with external partners. In fact, more often than we'd like, we find ourselves turning down, deferring, or referring opportunities because we're too busy. Over the past few years we've grown substantially in staffing levels in an effort to meet emerging demands, and in 2023, CSANR is the largest it has ever been –a statement I've made several times over the past few years that is now becoming a trend.

We've always been good at tracking the 'easily countable' academic performance metrics (e.g. grant dollars, publications, affiliated faculty and students, etc.). For the record, in 2023, CSANR staff secured $2,169,064 in new extramural funding through grants and contracts awarded in 2023 that support work by CSANR and collaborators throughout WSU and beyond. Included in this was the Climate Analog Academy project – which was the top-rated proposal in USDA NIFA's AFRI Foundational Climate Change Extension program area. In addition, CSANR Affiliate Faculty (through BIOAg and the Washington Soil Health Initiative) leveraged more than $22 million in new extramural funding during 2023. The Center also added 11 new Affiliate Faculty from 8 different research units and 4 new Affiliated Grad Students. Staff and Affiliates published 20 new peer reviewed research or extension publications from CSANR funded work in 2023.

However, we've not always given enough attention to capturing and articulating the real world impact of the work and outputs. In 2023, we spent some focused time and attention working to capture this value, working alongside the CSANR Advisory Committee and Leadership Team. In the process, we learned about several impacts we didn't even know we'd had! On the next page, you can see the impact statements that we developed. The process has also generated some ongoing discussion about how we can develop methods for capturing more of the impacts from our work – and how we can continue to hone our work to achieve our intended impacts. This years' annual report also features impact stories that have likely flown under the radar from our lesser-known donor-driven programs, the Hickman Endowment and the Verle Kaiser Fund.

I hope you enjoy reading the annual report, and feel free to reach out.

Thanks, Chad

Improving the Carbon Footprint of Pacific Northwest Agriculture

Our work on quantifying the benefits of farming practices for carbon mitigation supporting implementation of the state's new Sustainable Farms and Fields program led in 2023 to an investment of $1.8 million towards supporting climate friendly farming for more than 650 producers and an estimated 188,000 acres. Projects provided an estimated 5,873 metric tons of CO2e in climate benefits in the first year. In 2023, the program received additional funding of $30m, with an expansion of scope. Hence, the full scope of Sustainable Farms and Fields in 2023 includes climate friendly farming, anaerobic digesters, alternative climate friendly manure management, and research on, or demonstration of, projects with greenhouse gas reduction benefits.

Climate Change Adaptation and Water Resources

To date as reported by the Department of Ecology's Office of Columbia River, the state of Washington has increased the amount of available irrigation water in Eastern Washington by 353,000 acre feet since 2006, supported extensively with analysis and extension support from our CSANR team and collaborators within and outside of WSU. The additional agricultural land rental value of this increased irrigation water is equivalent to more than $50m in annual value. The state has likewise developed 123,000 acre feet of instream water that supports salmonid species, of incalculable spiritual value to Native Nations of the Pacific Northwest, and of cultural importance to many throughout the region. These achievements and others have contributed to a less adversarial and more collaborative approach to planning for future water needs by those with different perspectives, an impact that is hard to quantify but highly valuable.

Facilitating the Circular Economy for Organics Management in Washington

Our work contributed to the passage in 2023 of new, one-time funding of $30m to the Sustainable Farms and Fields program (as described above), specifically to support expansion for funds to support anaerobic digesters, alternative climate friendly manure management, and research on, or demonstration of, projects with greenhouse gas reduction benefits. In addition, our work on circular economies and organics recovery has supported the Department of Commerce in investing $850,000 in 2023 in industrial symbiosis projects, with a focus on agriculture and natural resources. See https://choosewashingtonstate.com/why-washington/our-key-sectors/industrial-symbiosis/ for the project list. Our work on the AgSymbiosis Legislative Proviso helped the Department of Commerce understand that these businesses fit within the industrial symbiosis in agriculture and food category. Over the past two decades, our work to support installation of the first on-farm digester in Washington State, and ongoing research and extension efforts has supported digester project development in EPA Region 10 (WA, OR, ID, AK) totaling 25 AD projects, serving more than 143,000 dairy cows, with 11 diverting organics from landfills. Together these digesters generate more than 126 million kWh/year of renewable energy (EPA AgStar, 2023; at a conservative estimate of $0.02 per kWh, this represents $2.5 million in annual revenue).

$2 million
CSANR staff extramural leveraged funding

$22 million
affiliate faculty extramural leveraged funding

20
peer reviewed research and extension publications

Sustainable Grazing Starts with Good Forage Production Data Now Available with StockSmart

BY SONIA A. HALL, CENTER FOR SUSTAINING AGRICULTURE AND NATURAL RESOURCES AND TIP HUDSON, WASHINGTON STATE UNIVERSITY EXTENSION

> We recently released StockSmart, a free, online decision support tool that accesses remotely sensed forage production data (available for the last 40 years) and allows the user to easily define what is accessible to their livestock based on their fences, watering locations, the type of terrain their livestock will traverse and other parameters.

This effort brought together the University of Arizona's web development capabilities, the US Forest Service Rocky Mountain Research Station's ability to apply their remote sensing expertise to key issues like fire, drought and forage production, and our expertise in rangeland management and decision support tool development to serve the needs of our ranching and rangeland management clientele.

Why do we need this tool?

Managers' ability to maintain a healthy herd of cattle and healthy rangelands is affected by many factors, including their decisions on the timing, duration, frequency and intensity of grazing. Managing grazing of native rangelands across the western United States, as in other arid lands across the world, is also complicated by the fact that the production of forage can vary widely across the pasture and between years—a source of variation that is increasing as the climate changes. As if all this is not complicated enough, ranchers and other rangeland managers also need to figure out to what extent that forage is accessible to their cattle, to say nothing about how much of the forage is sustaining wildlife herds, like deer or elk. So even something as basic as determining how many head of livestock can be sustainably fed for a season by a particular rangeland area—the stocking rate—is hard to do and is generally based on inaccurate and inadequate forage production data.

Historically, managers have relied on general estimates of forage production based on the soil types in their pastures, developed as part of the US Soil Survey, or on sparse, one-time samples taken at a few locations within each pasture. Though the former provides a range of production, and the latter is based on field samples, neither approach—individually or in combination—adequately reflect the spatial and interannual variations in forage production that managers must work with, undermining their ability to effectively manage forage allocation and grazing pattern decisions.

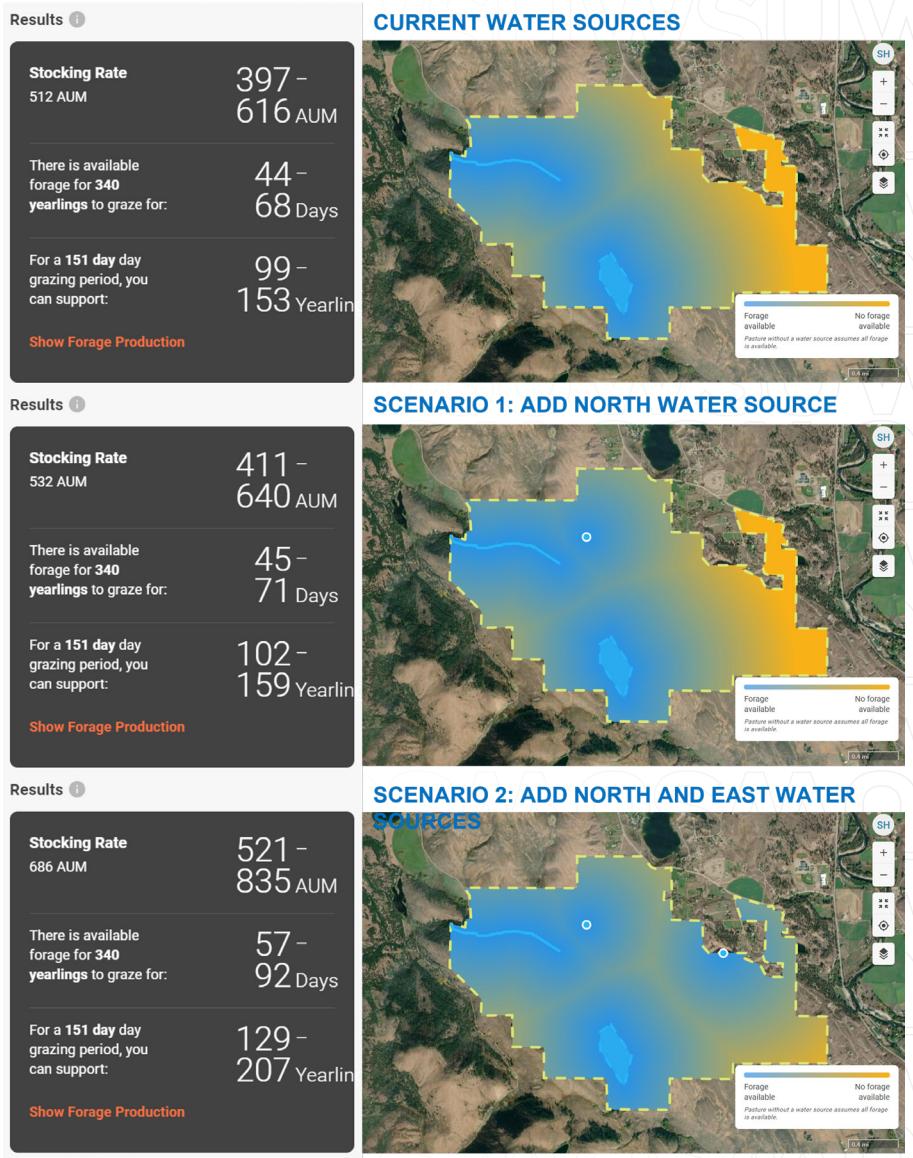
The value of a tool that helps managers use data that captures these variations in forage production across the landscape and between years was clearly articulated during three listening sessions with federal, state and Tribal rangeland managers and ranching association representatives that we hosted in 2020.

First, the forage production data

Advances in remotely-sensed data and enhanced access to these data by ranchers and public land managers offer opportunities for improved calculations of stocking rates across vast rangeland environments. The primary data that StockSmart uses emanate from the Rangeland Production Monitoring Service (RPMS; Reeves et al. 2021) and the Rangeland Analysis Platform (RAP; Allred et al. 2021). Based on the RPMS data, StockSmart computes the historical mean and standard deviation of total annual production from 1984 to 2022, giving one value for each 30x30m square (less than a quarter of an acre). It then uses the most recent Vegetation Cover data from the RAP to divvy up that total production into what is produced by shrubs, herbs (annual and perennial), and tree growth. This allows StockSmart to provide estimates of how much edible forage is available: annually, with average, dry, and wet years, as well as for each small square of your rangeland, showing both the spatial and interannual variations.

Second, the accessibility of the forage

To determine what forage is actually accessible to the animals grazing these rangelands, StockSmart corrects the forage production values based on tree canopy cover and terrain. Where remotely sensed estimates of understory forage are unreliable because of the interference of tree canopies, some basic linear models are used to estimate forage growing beneath the trees. All the edible forage is then corrected, accounting for how steep a slope your livestock will traverse, and how far from water they will disperse. After also adjusting the accessible forage using a harvest coefficient—the fraction of total forage produced that is assigned to grazing animals for consumption—and a shrub utilization fraction (some animals browse shrubs, some don't), StockSmart provides the user with a final number. This can be either the number of days your herd of cattle could graze, or the number of head of cattle that could graze there for a predefined length of time.



Screenshots from StockSmart, showing the change in stocking rate (left panels) and forage availability (maps on the right, where blues show forage available, oranges show no forage available) as two water sources are added (blue dots), in addition to the natural water sources (blue creek and lake) available in a pasture.

And third, the decisions StockSmart can inform

With access to accurate, spatially explicit historical forage production data, ranchers and other rangeland managers can fine tune grazing management decisions. StockSmart also allows the user to explore different scenarios. You can visualize what areas are too far away from water to be accessed by your cattle, or separated from water by a steep slope. You can then explore what happens to your stocking rate if you added a source of water in that part of your pasture. Or you can explore whether dividing pastures as well as developing water would make a big enough difference in terms of available forage to be worth the investment in fencing. If you create an account in StockSmart, you can easily save and compare different scenarios. StockSmart will not tell you when, how, and how much to graze. But it will provide robust estimates of how much forage is available with realistic parameters on where your animals will graze, and will provide clarity on how variable that forage is likely to be from year to year. When paired with careful grazing planning and monitoring of rangeland health, it provides a very useful additional tool in the rangeland manager's toolbox, to help understand and deal with the complexities of maintaining healthy herds and healthy rangelands, now and under a changing climate.

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New academy on climate resilience to connect specialty crop professionals

BY SETH TRUSCOTT, COLLEGE OF AGRICULTURAL, HUMAN, AND NATURAL RESOURCE SCIENCES

A team led by scientists at Washington State University's Center for Sustaining Agriculture & Natural Resources (CSANR) is establishing the Specialty Crop Climate Change Extension Academy to improve Extension and USDA professionals' capacity to support climate preparedness.

The new training academy is being funded by a $1.5 million Climate Hub grant from the USDA Agriculture and Food Research Initiative's Foundational and Applied Science Program. Its goal is to facilitate forward-thinking conversations about climate change resiliency among professionals in the fruits, vegetables, seeds, and other specialty crops industries.

"This new academy is about finding peers in specialty crop agriculture and making connections across regions," said Chad Kruger, CSANR director and lead investigator of the training project, titled "Analogs for Dialogs."

This fall, team members will recruit a cohort of 20 Extension and USDA Climate Hub professionals in major centers of U.S. fruit and vegetable production to the academy. Recruits will learn about climate change factors and communication strategies, developing their ability to support grower preparedness.

A major focus of the project is fostering cross-regional connections through climate analogs: for each target region, an "analog" site will be chosen with a current climate that matches the target's expected future. Participants from paired sites will engage virtually and through site visits.

"Conversations that help growers get to know their counterparts, and what they're dealing with, will empower them more than us simply giving them information," said project manager Teal Potter, a postdoctoral researcher with CSANR. "We're looking for people who know there's a need to prepare for a changing climate, but don't really know what to do about it."

"Conversations that help growers get to know their counterparts, and what they're dealing with, will empower them more than us simply giving them information"

Collaborating with the grant team, Siddharth Chaudhary and Kirti Rajagopalan, scientists with WSU's Department of Biological Systems Engineering, study the value of analogs for cross-regional conversations on climate change adaption. Their recently published research in Scientific Reports characterized analogs for all specialty crop counties in the U.S., bringing together Extension professionals from paired locations to discuss regional practices.

"In a complex system like agriculture, climate change creates opportunities and risks, with multiple dimensions and tradeoffs," Rajagopalan said. "You need multiple iterations of interactive dialog to capture the nuanced insights that lead to climate preparedness for society. Who better than Extension professionals to create the bridge between research, Extension, and society?"

Team members represent WSU, the University of Florida, the University of Minnesota, and the Ag and Food Systems Institute, and work in partnership with six regional USDA Climate Hubs.

Academy participants were admitted in fall, with training beginning early in 2024.

Agricultural and Extension professionals can connect with CSANR to learn about opportunities for participation and further strategies for climate change adaptation.

SOILCON

Bringing the latest soil science research

BY MOLLY MCILQUHAM, CENTER FOR SUSTAINING AGRICULTURE AND NATURAL RESOURCES, WASHINGTON SOIL HEALTH INITIATVE

> During a listening session held across Washington state, a seemingly simple question was posed: where can one find regionally specific information about soil health?

However, the answer turned out to be much more complex than expected. Due to the diversity of cropping systems and agroecosystems across the state, general soil health improvement guidance falls short. So, to find commonalities and clarify differences in soil health in different regions and to fulfill a primary goal of the Washington Soil Health Initiative (WaSHI) of increasing awareness of soil health, SoilCon was born.

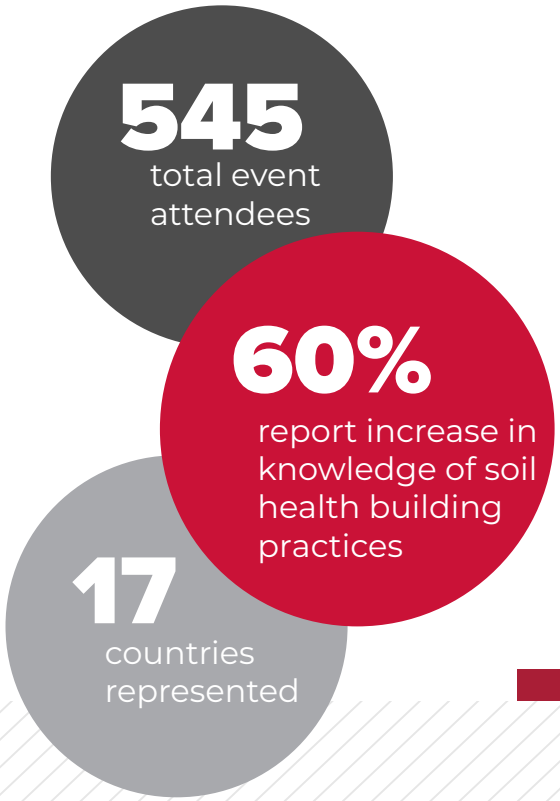
SoilCon has been an incredible resource for those interested in improving soil health across the globe. Over the past three years, the event has brought together 84 experts across the globe to share their expertise on a range of topics, including long-term research, soil biology, and Native American perspectives of soil health. Over three years, SoilCon has covered many subjects, providing something for everyone.

Thanks to generous sponsorship from Western SARE, SoilCon has been available to all attendees for free. The organizers from various Washington-based organizations invested countless hours in surveying the interests of agricultural professionals to ensure that the conference covered the most relevant topics. SoilCon has successfully featured various soil health-related topics, including policy updates, farmer perspectives, and research findings shared through concise lightning talks.

SoilCon has been a valuable resource for agricultural professionals, providing them with up -to-date information on soil health topics for free.
And SoilCon23 itself was no different, where the focus was taking soil health basic principles to practice with the most popular sessions, including the highly anticipated producer panel, the cover cropping academic roundtable, and University of Wisconsin's Randy Jackson's talk titled "Climate-Smart Agriculture and Healthy Soil Comes from Agroecosystems that Regenerate Soil Carbon Over Time."

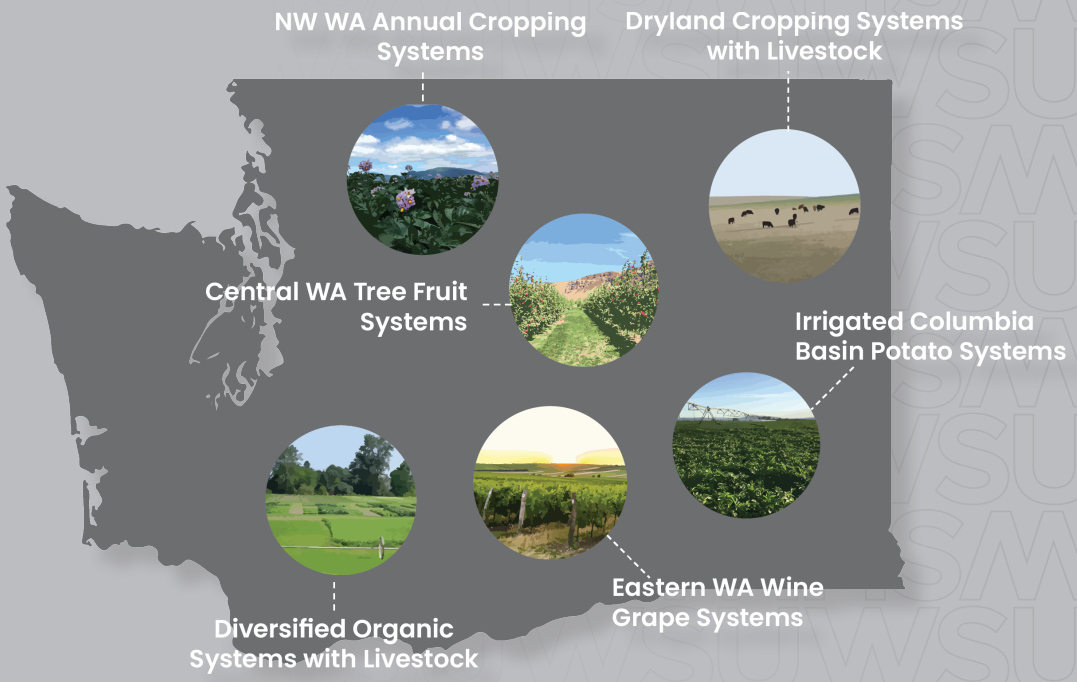
If you missed any year of SoilCon, don't worry. All sessions were recorded, and you can access them on WSU CSANR's YouTube channel (you can subscribe, too). And if you're overwhelmed by all the information in the videos, don't worry! The SoilCon23 resource roundup is here to save the day summarizing key talking points and providing links to resources mentioned in each talk.

SoilCon has become a valuable resource for those seeking regionally specific information about soil health. The event's broad range of topics and diverse speakers have provided attendees with a wealth of knowledge to apply to their agroecosystems.



Washington Soil Health Initiative's **Long-Term Agroecological Research and Extension Sites (LTAREs)**

The LTARE sites are the large investment that WSU makes in WaSHI's effort and are core to laying the foundation for future research and outreach activities. These six main experiments are designed to evaluate business as usual and compare variations, while representing commercial settings under respective environmental conditions.



Each site represents a major agroecological system found in Washington's diverse landscapes, but all sites perform a similar core of soil health assessments that are submitted to the same labs (if not done in-situ or at another WSU lab), which allows for common assessments across these systems. Additionally, many of the sites have common treatments as shown in the table (below) though the exact details of those treatments do vary across production systems.

Lastly, each site will have a similar economic analysis that evaluates the associated costs and returns of investment in the treatments. In time, this analysis will help agricultural decision makers implement economically grounded practices that maintain soil health in the long run.

Soil health practices used at LTARE sites

	Mount Vernon	Othello	Prosser	Puyallup	Wenatchee	Wilke
Cover Crop	✓	✓	✓	✓	✓	✓
Organic Matter Additions	✓	✓	✓	✓	✓	✓
Reduced Tillage	✓		✓	✓		✓
Livestock Integration				✓		✓
Leaving Plant Residue	✓		✓	✓	✓	✓

Partnering with Practitioners

Developing Improved Information Technologies for Water Management

BY GEORGINE YORGEY AND SONIA A. HALL, CENTER FOR SUSTAINING AGRICULTURE AND NATURAL RESOURCES

> In the semi-arid environment of eastern Washington, even a casual observer can see that water is essential to life.

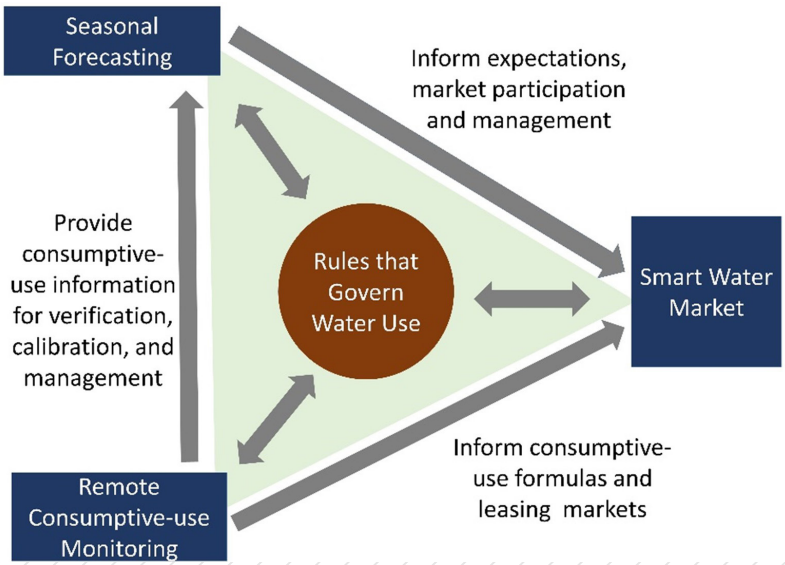
Water in streams and rivers, including the Columbia River, is used to generate plentiful, economical, and renewable hydroelectric energy. Water also supports salmonid species, of incalculable spiritual value to Indigenous people and Nations of the Pacific Northwest, and of cultural importance to many throughout the region. Water is the basis of irrigated agriculture, which forms the bedrock of the rural economy throughout eastern Washington. Water foundationally supports communities and a variety of growing residential and commercial needs.

Prioritizing Demand Amidst a Changing Supply

With precipitation mostly falling as snow and rain in the winter and spring, flows in streams tend to be higher in the late fall through early summer. In the late summer and early fall in particular, there tends to be less supply amid high water demands, such that there is not always enough water instream for all the important uses. Tradeoffs inherently exist with so many competing uses, especially during drought years when available water is limited. And given these tradeoffs, perspectives may vary between people about how to prioritize amongst different potential uses.

Both research and stakeholder partners have been working on this challenge over the last six years through the *Technology for Trade* project (T4T), led by Jon Yoder at WSU's State of Washington Water Research Center, with partners at WSU, UW, Aspect Consulting, ERA Economics, University of Idaho, and UC Merced. The project has extended the development and application of three promising and complementary emerging technologies that provide more reliable information relating to water: improved seasonal forecasting, remote measurement of crop water consumption, and computer-aided 'smart' water markets. In addition, the project has been exploring legal, regulatory, and contractual constraints and innovations that might either prevent or allow water users to use these technologies effectively while protecting the water rights of others (Figure 1).

While these technologies and institutional innovations have the potential to be relevant across the Western U.S. and beyond, our focus in this project has been on four diverse watersheds in the Columbia River Basin where water is in economic demand, and water security is of concern: the Methow, the Okanogan, the Yakima, and the Walla Walla (Figure 2).



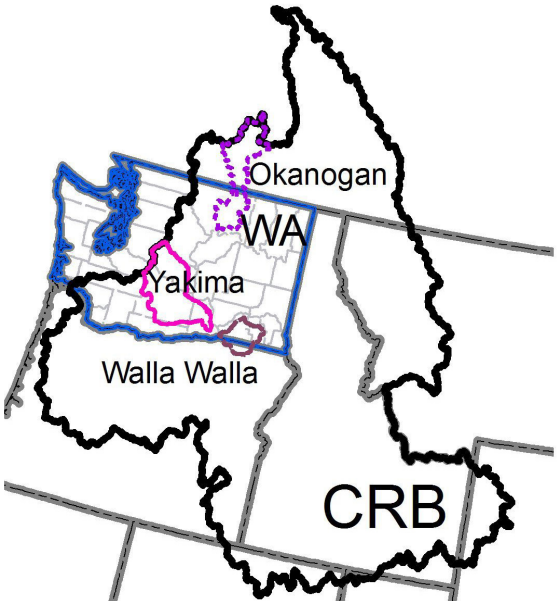


Figure 2. The main focal areas of the project include the Yakima, the Walla Walla, the Methow, and the Okanogan. watersheds in the Columbia River Basin (CRB).

Gathering Perspectives

CSANR staff and faculty have played a key role in the project, helping the faculty, students, and staff working on Technology for Trade better understand the many different perspectives on water supply-related issues. At the outset of the project, we held a series of half day listening sessions across the Columbia River Basin in early 2019. Participants worked at government agencies (Tribal, federal, state), conservation districts, irrigation districts (more senior, more junior), non-profits (environmental, agricultural), and on farms (hay, alfalfa seed, vegetable row crops).

During listening sessions in Okanogan, Walla Walla, and Yakima, we asked small, diverse groups of roughly 5-15 people to talk about their thoughts and priorities relating to water. We also asked them to share their initial ideas and questions about the three technologies the team was working on: remote estimation of consumptive use, improved seasonal forecasting, and water markets. A final listening session was hosted with individuals working on these issues across the breadth of eastern Washington. The conversations were used as a springboard for refining existing ideas and prompting new ideas for work that could be carried out within *Technology for Trade*. The full listening session process and results are described a technical report, Lessons Learned from the *Listening Sessions for the Technology for Trade Project*.

Throughout the project, an advisory committee—including many who had participated in the listening sessions—continued to give the project team advice and share their perspectives. Project team members were also hosted by advisors and other representatives working on the ground in Walla Walla, Yakima, and Colville, to discuss particular water-related issues in more depth. As one example, the team was hosted by the water master in Walla Walla, learning about the ins and outs of managing water rights during water short years. During that same visit, the group took a trip along the Touchet River and talked with Bill Warren — a longstanding CSANR advisory board member and irrigated fruit producer — about his broader interactions and collaborations with others in support of stream restoration, and about how he manages on-farm water challenges as a junior water rights holder.

Practitioner Perspectives Spark New Ideas and Guide Work

Conversations with the advisory group were not always easy, but they were rich, and very impactful to the project's work. For example, when the team was preparing the water management survey fielded in late 2020 and early 2021, the advisory team discussed which questions they found most interesting, helped phrase the questions in ways that would be meaningful to respondents, and critically, advised us about how to design an outreach strategy that would help people feel comfortable responding.

The survey results helped the research teams understand current knowledge and attitudes relating to seasonal forecasting, remote estimation of consumptive use, and water markets, and also provided important insight into regional attitudes towards other water policy questions. As discussed in more depth elsewhere, the results showed that there was varying support for mandatory price disclosure for water transactions. And water users across the region view water as having some characteristics of a public good, and some characteristics of a private good.

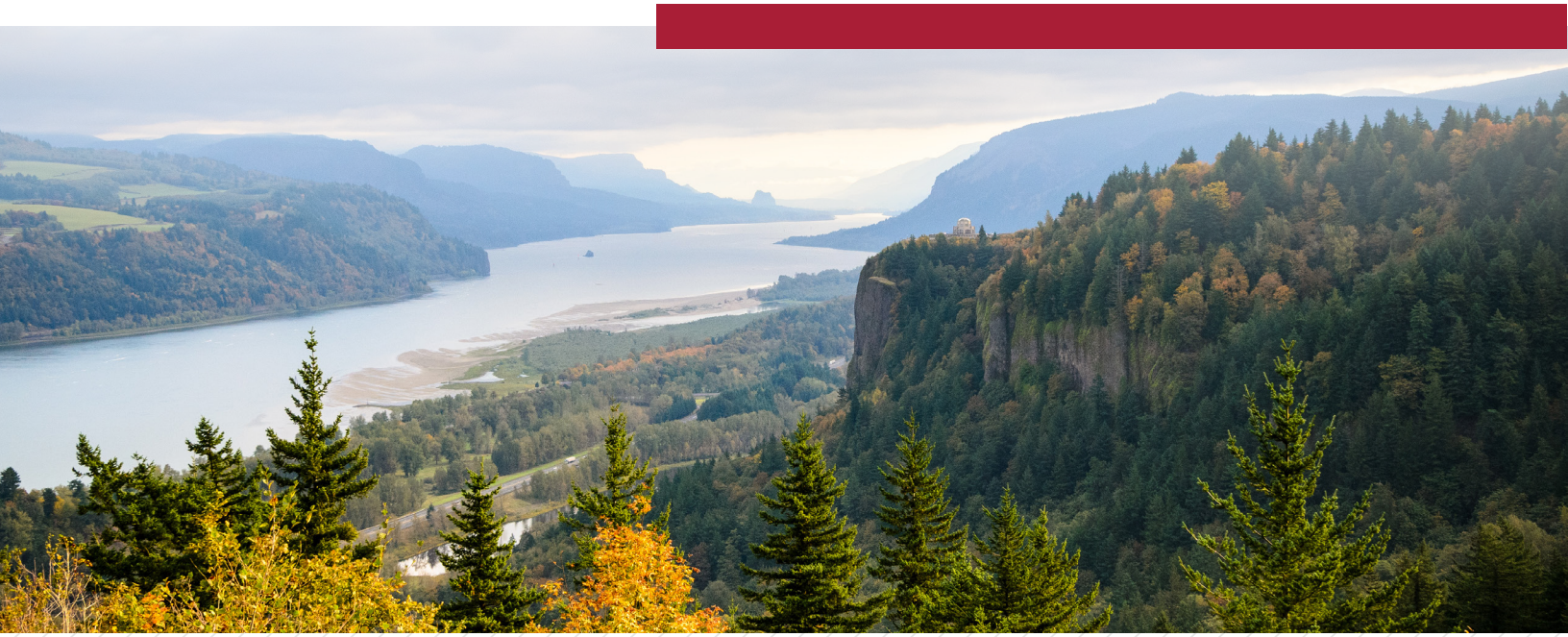
The questions and priorities raised by our external partners also helped spark specific cross-project work. When we wrote the proposal, many project scientists were already interested in exploring the potential of "partial leasing," the possibility that water users might choose to lease part of their water through water markets, rather than their whole water right. At the time, we were thinking of this as "part of the water right over the whole season." Several external partners and advisors raised a variation on this theme: whether growers might be willing to lease their entire water right for a week or two, creating "pulse flows" that could benefit fish, ideally without large detrimental impacts on crop yields and quality. This work is being explored by the team, with results that are described in the article, Technology for Trade Research Highlights.

During the listening sessions and elsewhere, we also heard from many about what is formally called "diminishment" and sometimes more informally called the "Ecology haircut," the idea that when a water user does something that triggers state level review of their water right, the amount of water in the right may be reduced through that review. Diminishment has the potential to disincentivize people from taking actions that trigger state review. These observations contributed to the team thinking about whether there were ways to explore how much diminishment has happened historically, and whether there have been particular patterns in diminishment. Ultimately, the team focused on understanding the data available through Ecology's database, and are currently engaged in a deeper dive into these data to answer these questions; this work is still ongoing.

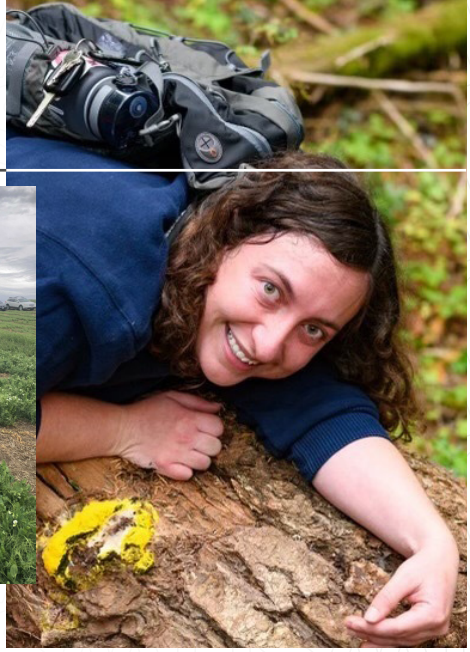
These are just three examples of how deep conversations with water managers and other practitioners across eastern Washington engaged in helping to manage water and solve water issues have prompted the team towards specific work. There are many more. These examples highlight how many people across the region gave generously of their time and knowledge to help us think through some of these issues. It also illustrates how many facets of our work have been influenced by their contributions. We are grateful to each of our advisors and those that have shared perspectives over the last five years to develop improved technologies for Washington's water landscape!

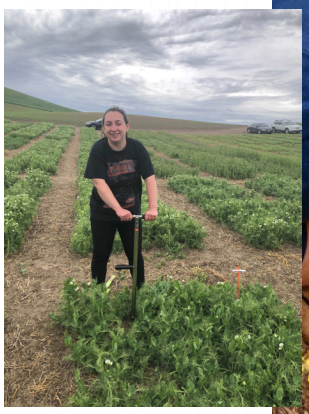
Reference

Yorgey, G. & Hall, S.A. (2024). Partnering with Practitioners in Developing Improved Information Technologies for Water Management. In C.E. Fabbri & A. Whittemore (Eds.), Technology for trade research highlights. State of Washington Water Research Center.



Lawrence Hickman **Graduate Fellowship**





In late 2019, Ellen Hickman Williams made a significant donation to WSU CSANR to establish a graduate fellowship in honor of her father Lawrence Earl Hickman to promote conservation and sustainable agriculture throughout dryland farming systems. CSANR is happy to announce the recipient for 2023 — Janice Parks, Molecular Plant Sciences.

Janice Parks

Growing up in the Willamette Valley, I was surrounded by both an abundance of natural beauty and agriculture. As a result, I was educated about the importance of sustainable agriculture to preserve natural landscapes, natural resources, and soil health. This led me to pursue my B.S. in Biology from Pacific University originally thinking I would pursue a medical career due to the lack of exposure I had to scientific research career paths. I was able to participate in undergraduate research where I started doing research on Wolbachia, a microorganism that infects insects, arthropods, and nematodes. Through this experience I learned how significant the impact of microorganisms can be on multicellular life and thus began my journey into microbial ecology. I then did research on the efficacy of commercial microbial inoculants for agriculture which showed me that we were just hitting the tip of the iceberg of possibility for incorporating microorganisms into agriculture. From here I was inspired to pursue a career path where I could explore how microorganisms could be used in agricultural settings to improve their sustainability and environmental impact. This led me to pursue my Ph.D. in Molecular Plant Sciences through the Plant Pathology department at WSU under the mentorship of Dr. Maren Friesen.

The focus of my research is how soil microorganisms are contributing to the success of a pea-canola intercropping system (peaola) within the Palouse. Peaola experiences a 65% increase in productivity compared to monoculture pea and monoculture canola grown within the same land area. This impact is maximized when minimal synthetic inputs are used, pesticides and nitrogen fertilizer, indicating a potential role for microbes. Not only does this decrease the environmental impact of our agricultural system, but it also allows for increased profit margins for growers considering the rising costs of fertilizers.

Growers and agronomists had long thought that microorganisms were responsible for peaola's success, but research demonstrating this was nonexistent. Their hypothesis came from the knowledge that peas form a relationship with bacteria (rhizobia) that can transform atmospheric nitrogen into a biologically usable form and arbuscular mycorrhizal fungi which improve plant drought tolerance, nutrient uptake, and allow for nutrient transfer between plants. Canola is not able to form a relationship with these microorganisms on its own, but it could benefit from the relationship that pea has with them due to their proximity in the peaola intercropping system. Knowledge on how microorganisms are contributing to the success of this intercropping system under minimal inputs will allow us to alter other cropping systems across the Palouse through showing a new way microbial communities can be manipulated. This will have significant impacts on agricultural sustainability and productivity by helping us reduce our need for synthetic inputs.

To explore how microorganisms have led to yield increases in peaola, I collected biological samples from field trials planted by agronomists and growers (Dr. Isaac Madsen and Mark Greene) across the Palouse. This work was supported by a graduate student grant from Western Sustainable Agriculture Research and Education (WSARE). Thus far we have found there are changes to specific groups of microorganisms between peaola and monoculture pea and monoculture canola. These results show that soil where peaola is grown contains microorganisms found in pea monoculture and canola monoculture soils, but there are also microorganisms only found in soil where peaola is grown. This shows that peaola could be creating a unique soil environment. Additionally, predictions about the functionality of these soil microorganisms show that there are more bacteria with the ability to provide nitrogen to plants near the roots of canola when it is intercropped with peas.

These findings are important because they show that it is possible to recruit microorganisms that can provide nitrogen to plants through intercropping, showing a new way we can manipulate microbial communities in agricultural systems on the Palouse. Currently, I am performing experiments funded by the Washington Oilseed Commission that will allow us to confirm if nitrogen is being provided to canola by pea and by which microorganisms this is being facilitated (rhizobia and/or arbuscular mycorrhizal fungi). This information has been shared with growers across the Palouse and beyond through presentations at WA SoilCon and the WSU Farmer's Network Soil Health Coffee Hour.

After earning my Ph.D., I plan to continue to do research on how microorganisms can be used in agriculture to improve sustainability and how they are contributing to overall plant health and yield. As a result, I intend to pursue a career at the United States Department of Agriculture where I will continue to explore the importance of microorganisms to the productivity and sustainability of agricultural systems. In pursuing this important scientific question, I have been able to work closely with agronomists, growers, and conservation professionals on the Palouse. This experience has helped me learn how to better communicate scientific research findings to a diverse audience with varying levels of background knowledge. It has helped me learn more about the modern challenges faced by growers in this region which will ultimately allow me to better focus my future research questions in a way that will best serve this community and others. I intend to continue to facilitate the communication of relevant scientific findings with growers so we can work together to find more sustainable and effective systems using knowledge of microorganisms. Ultimately, my goal is to serve as a bridge between scientists, conservationists, and growers so we can all work together to protect our natural resources, environmental health, and futures.

Verle Kaiser
Conservation Endowment

Much of Verle Kaiser's 39 years of service with the Soil Conservation Service was devoted to the study of erosion problems on the Palouse. After his death, friends and colleagues established the Verle Kaiser Conservation Endowment with the WSU Foundation to promote the conservation ethic through conservation and natural resource education. Through CSANR, the Conservation Endowment awards funding to projects that promote and demonstrate conservation practices targeting soil erosion to students throughout the Inland Pacific Northwest.

2023 Kaiser Funded Projects

Blue Mountain Resource Conservation & Development Environmental Education for Rural Regional 6th Graders at Camp Wooten

Palouse Conservation District Cultivating Conservationists: A Whitman County Partnership for Conservation Education

Stevens County Extension Technology Meets Precision Agriculture and Soil Conservation

420 students that benefitted from soil health programming

8 hands-on experiences supported

Photo courtesy of Palouse Conservation District

BIOAg

Biologically-Intensive and Organic Agriculture Research

BIOAg is the flagship Grant Program of the WSU Center for Sustaining Agriculture & Natural Resources. The goal of the BIOAg solicitation is to engage WSU faculty to advance the development, understanding, and use of biologically-intensive, organic and sustainable agriculture in Washington State.

2023 BIOAg Funded Projects

Comparison of disease resistance among heritage chicken breeds J. Owen, M. Konkel

Compost teas for enhanced nutrient cycling L. Carpenter-Boggs, M. Friesen, C. McFarland

Integrating drones into weed management on the Palouse A. Fremier, D. Auerbach, I. Burke

A smartchip for pathogenic and beneficial microbes underlying soil health M. Friesen, X. Li

Mapping Colorado potato beetle to promote proactive management in potato D. Crowder, G. Zhu

Improving soil health in diversified agroforestry and silvopasture systems of NE Washington T. Sullivan, A. Perleberg

$240 thousand in funding awarded

$8 million in leveraged funding

6 new affiliate faculty

4 graduate students supported

3 journal publications

WASHINGTON STATE UNIVERSITY

Center for Sustaining Agriculture and Natural Resources