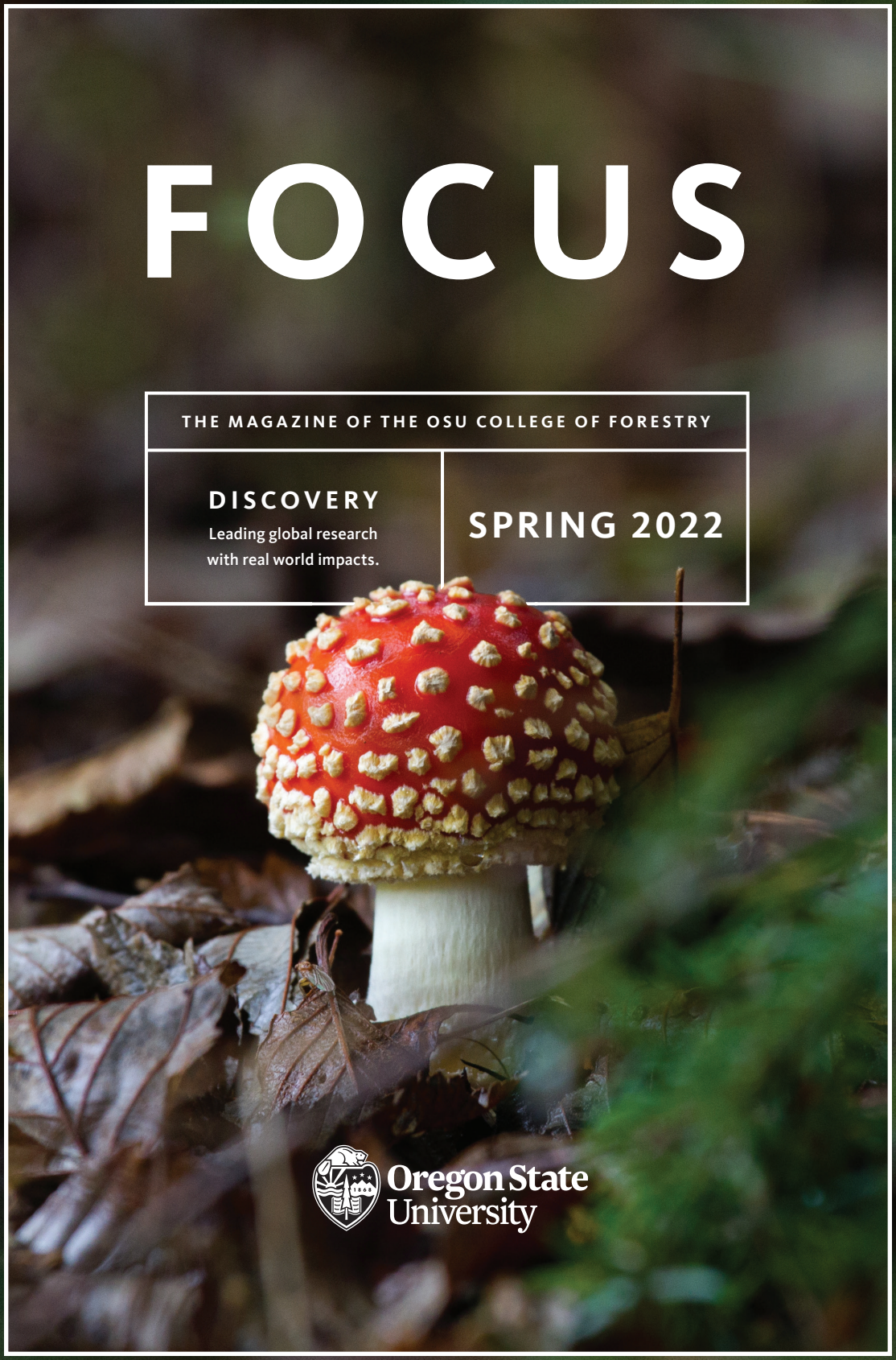
FOCUS

THE MAGAZINE OF THE OSU COLLEGE OF FORESTRY

DISCOVERY

Leading global research with real world impacts.

SPRING 2022



Oregon State University

WELCOME

DISCOVERY • SPRING 2022

We live in a world with increasing global and regional challenges facing our forests and communities. From addressing the impacts of climate change to creating innovative, sustainable wood products to meet the demands of a growing population, science and education will play a critical role in helping ensure our forests and communities flourish.

At the Oregon State University College of Forestry, we take our role as an education, research and outreach leader seriously. We are dedicated to using sound science to prepare those committed to working in our forest landscapes and help inform future policies and decisions. In this edition of *Focus*, we share some of our efforts to address the challenges facing our forests, ecosystems, and communities.

In the summer of 2021, the Pacific Northwest heat dome event and its scorching effect on trees and leaves had scientists quickly working together to determine its impact. Led by professor of forest ecology **Christopher Still**, a team of researchers and citizen scientists gathered data related to the historic event to help determine what it might mean for the long-term health of trees.

As the college studies the impacts of one recent event, one of our longest-running research cooperatives celebrates 25 years of informing land managers about Swiss needle cast disease. Due to the work of the Swiss Needle Cast Cooperative, the disease native to Douglas-fir is perhaps the most well-studied foliage disease globally. Led by professor and forest health specialist **Dave Shaw**, the cooperative's knowledge about this disease is used to study other foliage diseases worldwide.

Our faculty are not the only ones who conduct research to inform a path forward. An undergraduate student majoring in forestry and

renewable materials, **Nathan Vega** utilized his free time between classes testing Sankofa Lumber's new line of reclaimed wood panel products known as "SecondStory." The work helped Sankofa Lumber determine how the panels compared to current products on the market.

Finally, **Caitlyn Reilley**, a graduate student studying sustainable forest management, is utilizing her research into socially vulnerable populations to support the implementation of Oregon's $220 million omnibus wildfire bill (Senate Bill 762). The work will help inform Oregon's efforts to modernize and improve wildfire preparedness.

This issue of *Focus* highlights how we aim to generate scientific knowledge that charts a path forward to benefit Oregonians and help serve the world. In an era where we face sustainability and climate crises primarily driven by society's rampant consumption of fossil fuels, the work by our researchers and collaborative partners is needed now more than ever.

Sincerely,

Tom DeLuca

Cheryl Ramberg-Ford and Allyn C. Ford Dean
Oregon State College of Forestry

SPRING 2022

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Focus is published by the Oregon State College of Forestry. Our goal is to keep our alumni, friends, faculty, staff and students informed about the college and its many events, activities and programs.

To receive additional news, notes and features from the College of Forestry, email forestrycommunications@oregonstate.edu.

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Caitlyn Reilley has worn many hats during her time at Oregon State University.

First, she was an undergraduate pursuing a career as a clinical dietician. Then, after realizing how heavily social, economic, and environmental factors influence individual health outcomes, she switched gears to focus on community-level health. She graduated with a bachelor's degree in public health in 2016, securing a job as an outreach coordinator for the Linus Pauling Institute, a nutrition research institute at OSU.

While working as the outreach coordinator, Reilley began eyeing opportunities to return to school to study environmental policy. She learned about the opportunity to join the College of Forestry as the coordinator for the Elliott State Research Forest project.

"The Elliott project coordinator role was such a unique opportunity to bring my skillset to a project situated at the intersection of public lands policy, natural resource management, and rural community well-being," Reilley says. "It was also fulfilling to help the College envision a path forward for the Elliott that benefits local communities while providing critical research into the best way to deliver the myriad of social, economic, and ecological values our forests provide."

All Paths Lead To OREGON STATE

According to Reilley, developing a proposal for a research forest was often messy and included many difficult conversations. Overall, however, it was a joyful experience for her and gave her confidence in the ability of humans to work together to solve complex natural resource issues.

It also confirmed her desire to study natural resources management. As a current graduate student in sustainable forest management with a concentration in economics and policy, Reilley is working with **Mindy Crandall**, assistant professor of forest policy and economics. Crandall's research focuses on the role that natural resources, especially forests, play in human well-being.

Together, she and Crandall are a part of a collaborative project studying the human dimensions of wildfire with researchers at the Forest Service Pacific Northwest Research Station. Her master's research explores community vulnerability to wildfire and the social drivers of human-caused fire ignitions.

"The majority of fires in Oregon are started by people, and research into what drives these human-caused fires can help inform fire prevention strategies," Reilley says.

Reilley's research into socially vulnerable populations allowed her to support the implementation of Senate Bill 762 (SB 762), Oregon's omnibus wildfire bill allocating millions for landscape scale forest restoration and community wildfire preparedness projects.

"As a part of this project, we are identifying and mapping socially vulnerable communities to help allocate resources provided by SB 762," says Reilley. "Not all communities are equally equipped to prevent or respond to wildfire and it has been really encouraging to see how much interest there is in using this type of data to prioritize funding and support for communities that need it most."

When Reilley is not in front of her computer analyzing data, she is in the forest and enjoys long-distance running and mountain biking with her Australian shepherd pup **Ginger**.

"Thanks to a rigorous Ginger-driven training plan, I was able to complete my first Ironman triathlon last summer in Coeur D' Alene, Idaho," Reilley says. "I also recently started building live edge furniture. I love to hunt for unique slabs of wood and am slowly building my arsenal of power tools."

"I've learned so much from working with College of Forestry faculty these past three years. The Elliott project and implementation of SB 762 have provided incredible opportunities to see first-hand how the research informs real world management and policy decisions that promote healthy ecosystems and communities. Oregon communities are really at the heart of the work I've been able to be a part of here in the College, and I feel so fortunate for that."

As the recipient of two scholarships from the College of Forestry: the Hal Salwasser Fellowship and the Lu Alexander Graduate Fellowship, Reilley is looking forward to using her scholarships to present her research at conferences this spring. After graduating this summer, she plans to continue working in the wildfire policy realm and hopes that her future career path never takes her too far from her home here in Oregon.

Ginger and Reilley

SOILS: A CARBON STORAGE POWERHOUSE

The amount of carbon stored in soils is about three times that in living plants and double that in the atmosphere.

But, we often overlook soils' powerful ability to store carbon.

"Concern about rising atmospheric carbon dioxide concentrations has heightened interest in the role that forests play in carbon sequestration, storage and cycling," says **Jeff Hatten**, associate professor of soil science and head of the forest engineering, resources and management department at the Oregon State University College of Forestry. "Living trees sequester and store carbon, but we give less recognition to soils' role."

But what happens to the soil's carbon levels after forest harvests?

According to published research by OSU and Weyerhaeuser Company, conventional timber harvesting has no effect on carbon levels in the mineral soils of the western Pacific Northwest for at least three-and-a-half years after harvest.

Historic in its scope, a collaborative and long-term effort between Hatten and **Scott Holub** of Weyerhaeuser monitored nine managed Douglas-fir forest stands in Oregon and Washington before and after traditional timber harvest and replanting, analyzing more than 50,000 soil samples from 2700 sample points.

"Our original hypothesis that timber harvesting would decrease soil carbon in the short term was disproven," Hatten says. "Even where you have the highest soil temperatures and the highest soil moistures – the strongest environment for decomposition that releases carbon dioxide into the atmosphere – harvesting

doesn't seem to have an impact in the areas we studied."

Across all the sites combined, after harvest, the scientists found little change (+2%) in mineral soil carbon content and a 184% hike in forest floor carbon, the result of harvest residue.

"We should not overlook the importance of the 184% increase in forest floor carbon," says **Katherine McCool**, a master's student in Hatten's lab who is researching forest soil and watershed processes. "We can expect this increase because the branches, needles and bark that fall to the ground as harvest residue, in addition to the dead roots and stumps from harvested trees, will provide much of the future carbon that will infiltrate into the soil."

The study, the most extensive sampling ever conducted to determine if harvesting has an impact on soil carbon, is essential because of soil's ability to store carbon to mitigate and prevent increased greenhouse gases and maintain a stable carbon balance in the soil for sustainable forest management.

"Soil carbon also is useful in establishing a suitable microbiome for plant and fungal growth," says McCool. "Without ample soil carbon, new seedlings in post-disturbance areas will not be able to grow."

Hatten had plans to resample these research sites in coming years and decades to look at the longer-term impacts. Then the 2020 Holiday Farm fire occurred, tearing through some of the research sites near Eugene, Oregon, and dramatically altering the forest landscape. The research continues, but now Hatten and McCool are also studying the role and effect of fire on soil carbon dynamics, examining one of the nine research sites which burned and assessing how soil changes after a severe wildfire in a harvested stand.

"The existence of this preestablished soil carbon site provides an excellent opportunity to study the difference between pre- and post-fire soil carbon, which is often hard to come by due to the spontaneity of wildfire," says McCool.

Hatten and McCool found a 97% decrease in forest floor carbon within the research site, which equates to 14-times less forest floor carbon than in the pre-harvest stand. The fire's impact on the mineral soil carbon is still undetermined, but given that 90% of the soil's carbon lies below the forest floor, the results will have big ramifications for the total carbon budget of the site.

"These initial results show that disturbances like fire can reduce carbon sequestration progress," says McCool. "Therefore, management activities need to include a focus on fire-safe landscapes if we want to prioritize carbon containment."

HATTEN

McCOOL

25 YEARS OF GLOBAL LEADERSHIP

AND IT STARTED IN OUR OWN BACKYARD

Swiss needle cast, a foliage disease specific to Douglas-fir resulting in needle loss and reduced growth, is perhaps the most well-studied foliage disease globally. Knowledge about this disease, caused by the native pathogenic fungus *Nothophaeocryptopus gaeumannii*, is used to study other foliage diseases worldwide.

This is due to the influence of the Swiss Needle Cast Cooperative at Oregon State University.

SHAW

"Since 1996, the cooperative has been focused on research and management of Douglas-fir in zones where Swiss needle cast occurs," says professor and forest health specialist **Dave Shaw**, the current director of the cooperative.

Now, a quarter of a century later, the cooperative has published an article in the *Journal of Forestry*, summarizing their current understanding of Swiss needle cast based on twenty-five years of research.

Swiss needle cast, considered one of the top threats to Douglas-fir plantation health and productivity in western Oregon, Washington and SW British Columbia, was first identified on Douglas-fir growing in Switzerland in the early 20th century. Forest pathologists in North America found the fungus was common in native Douglas-fir stands but was not causing problems.

The disease emerged in Christmas tree plantations in Washington and Oregon in the 1970s, and by the 1990s, it had intensified in coastal Oregon and Washington Douglas-fir plantations. In January 1997, in response to the disease epidemic, the Swiss Needle Cast Cooperative was formed by private forest landowners, federal and state agencies, and the Oregon State University College of Forestry to conduct research and address management practices.

"The more we learn, the better we will be able to sustain the productivity of our forests," Shaw says. "However, this is a native disease that has a role here in the PNW, and we have some ability to manage forests effectively in the presence of the disease."

Swiss needle cast symptoms include chlorotic, yellowish foliage, low needle retention,

Pseudothecia on two year foliage.

Ritokova uses a hand lens to look at needle pathogens.

Swiss needle cast symptoms from the air, near Tillamook, Oregon. Photography by Rob Flowers, ODOT.

thin crowns and reduced tree growth. The fungus occurs wherever its only host, Douglas-fir, is grown. Disease, however, is only expressed when the fungus causes significant defoliation of two- and three-year-old needles.

This, says Shaw, is an essential point for managers. The fungus may be present and yet have no effect on Douglas-fir productivity.

The fungus lives inside the needles of Douglas-fir. It only impacts needle function when fungal fruiting bodies called pseudothecia emerge into and plug the stomates, or air pores, on the underside of the needle, blocking gas exchange. When too many stomates on a needle get plugged, the needle dies and is cast, or dropped, from the branchlet.

Even after twenty-five years of research, Shaw says the science can still be surprising.

"We recently found that Swiss needle cast is distinctly a young tree disease, and older stands, except in extreme examples, are not as affected. There is something unique about young stands that makes the disease more prevalent," Shaw says. This work was based on collaborations between graduate student **Sky Lan**, Shaw, and scientists from the Environmental Protection Agency who climbed mature and old-growth trees over two hundred feet tall to get samples and measure microclimate.

While Shaw and others do not yet know why this disease affects younger trees more often, they hypothesize the difference may be due to temperature dynamics within the canopy.

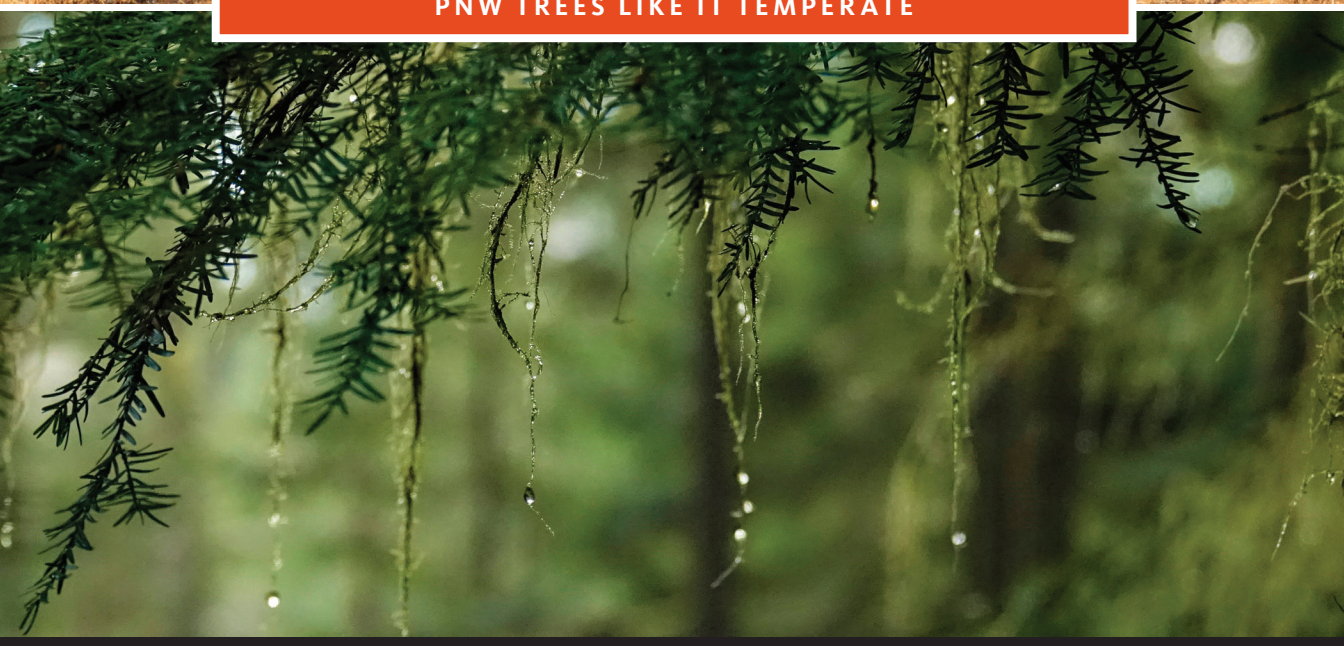
According to Shaw and **Gabriela Ritokova**, the associate director of the cooperative and a forest pathologist with the Oregon Department of Forestry, the management of Swiss needle cast is nuanced and site-specific. A "Guide to the Silviculture of Swiss Needle" is available on the Swiss Needle Cast Cooperative website.

Shaw explains that future challenges include understanding how climate change will influence the disease.

"Epidemiology-wise, winter temperature, and late spring-summer leaf wetness control disease," Shaw says. "As we continue to increase winter warming, we may see the disease spread from the core areas now impacted to higher elevations and the western Cascades."

SOME LIKE IT HOT

PNW TREES LIKE IT TEMPERATE



Christopher Still, a professor at the Oregon State University College of Forestry, studies forest ecology and the physiology of trees. His research spans from a singular leaf on a tree to entire ecosystems. He also studies carbon cycling and forest-climate interactions.

So, when the temperatures rose to unprecedented levels in the summer of 2021 and a heat dome descended upon Oregon, Still knew the scorching heat and intense energy from the sun would stress the trees, scorch the foliage and impact Oregon's forests. Especially after two years of state-wide drought. But at what scale? And what would that mean for the long-term health of the trees?

"The 'heat dome' led to numerous reports of foliage scorch and leaf drop in westside forests of the Coast Range and Cascades," Still said. "Western hemlock and western red cedar seemed to be impacted the most, but Douglas-fir and various alders and maples were affected, too. Notably, trees and saplings with direct solar exposure and on south-facing slopes seemed to suffer the worst foliage scorch."

With help from citizen scientists, researchers like Still spent months documenting the heat dome's effects on Oregon's trees. Using a website created by the Oregon Department of Forestry, community members and researchers reported their observations to map and analyze the foliage scorch.

Still then organized a symposium to share information and begin piecing together what the heat dome event might mean for the long-term health of trees.

"Researchers do not know what the near- and long-term physiological causes and consequences of foliage scorch and heat stress will be, at either leaf or tree scales. The impacts could range from impaired metabolism on surviving leaves, to reduced stem diameter growth, to eventual tree mortality," Still says.

The symposium served as a central place for tree experts like foresters, silviculturists and botanists to meet and discuss their findings and plan for the next steps to monitor the impacts of the heat dome.

"I think there are many challenges for forest management. The challenges range from trying to help forests become more resilient to climate change impacts, to working on assisted migration and planting of new genotypes and identifying species that can better handle a warmer and drier climate in the future," Still says.

Still says we should expect more intense heatwaves in the future, and we should all work urgently to lower our carbon footprint to mitigate future climate change.

However, he said the data shows there is much to learn about heat stress physiology and how different genotypes, species and forest types will respond to future heat and drought extremes.

"I think the scale of the impacts - both the spatial scale and the range of species and forest types affected - was surprising. I think the resilience shown by some species and forests was also a pleasant surprise," Still says.

STILL

ADVANCING THE CIRCULAR ECONOMY

Nathan Vega, an undergraduate student double majoring in renewable materials and forestry, has always had an interest in the fields of renewable energy and forest-based bioenergy.

"I am especially interested in biochar for its potential to help with wildfire prevention, energy production and agricultural management," Vega says.

Biochar is a carbon-rich, charcoal-like substance made by burning organic material, like agricultural or forestry waste, at low oxygen levels in a process called pyrolysis. Biochar can be used as a soil enhancer or as a way to sequester carbon. The energy or heat created during the conversion can also be captured and used as clean energy.

"Biochar is part of something called the circular economy," Vega says. "And the foundation of this economy is a transition to renewable energy and materials."

An alternative to the traditional linear economy, the circular economy is restorative or regenerative by design. It seeks to reduce waste and material use, recover resources at the end of a product's life, and channel them back into production, significantly reducing pressure on the environment.

VEGA

Vega jumped at an opportunity to work within the circular economy, assisting **Scott Leavengood**, Director of Oregon Wood Innovation Center, in testing Portland, Oregon, based Sankofa Lumber's new line of panel products known as "SecondStory."

"SecondStory" panels are unique in that they are composed of reclaimed structural building materials, including lumber, oriented strand board (OSB) and plywood. Sankofa refers to these panels as architectural surfaces and advises using them for purposes like flooring, casework and wall cladding. "SecondStory" panels are currently installed in the Oregon State women's gymnastics facility locker room.

Leavengood and Vega tested the panels to determine qualities like hardness, bond and bending strength and moisture performance. They measured the panels' performance based on comparable products like particleboard, medium-density fiberboard (MDF) and hardwood plywood. The Cascadia CleanTech Accelerator, powered by VertueLab and CleanTech Alliance, funded the testing.

"For entrepreneurs working with any kind of new material or new product, the first question they always get from potential customers is 'what's it like?' or in other words, how does the product compare to what's on the market now?' says Leavengood. "We were able to help Sankofa Lumber answer these questions since Nathan put the product through a workout."

Bond strength is critical for composite products. Leavengood and Vega found the strength excellent

even after products were exposed to high humidity and water submersion for several days.

Focusing on his classes and assisting Leavengood with his research projects provided Vega with support and something to focus on during the pandemic.

"Everyone at the College of Forestry was very welcoming and friendly," Vega says, "Plus, this job was a great part of the last year-and-a-half as it let me get out of the house and listen to music while I did the experiments."

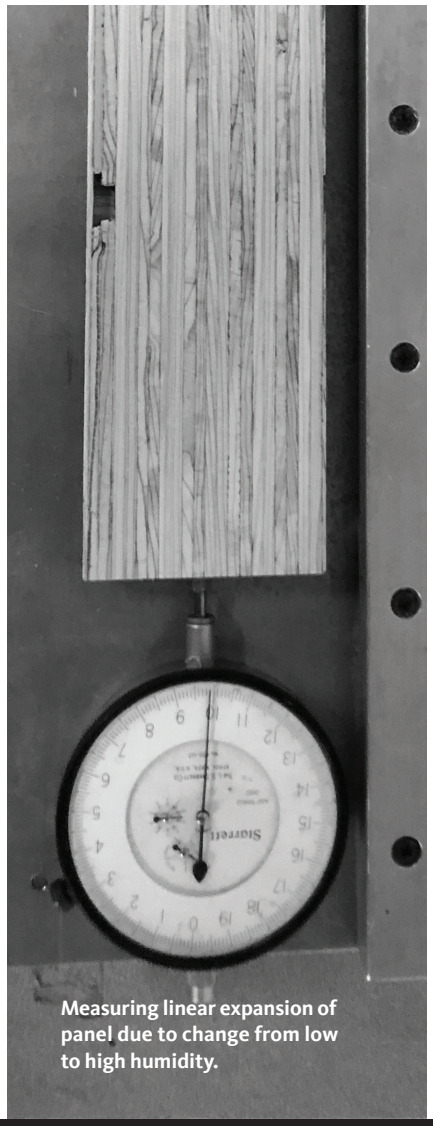
Vega is a recipient of the Friends of Renewable Materials Seneca Scholarship, Powers Scholarship, and Presidential Scholarship from the College of Forestry. He said receiving the scholarships has been essential to ensuring his success at Oregon State.

"These scholarships have allowed me to pursue my education without distraction or worry," Vega says. "It's been such a relief to find that I am so supported."

When Vega is not studying, he likes to spend his free time reading, gardening, cooking, listening to music, hiking and playing the drums. He also likes to spend his time with his friends and family and he recently joined the college's logging sports team.

After graduation, Vega wants to work in bioenergy, specifically biochar production from forest biomass as a carbon-negative energy source.

Testing surface hardness.

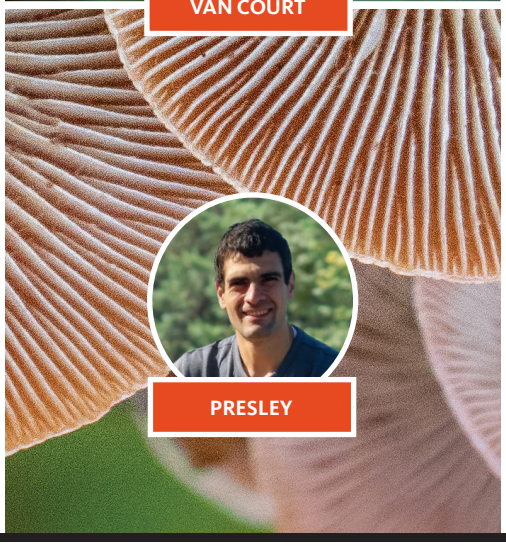


Measuring linear expansion of panel due to change from low to high humidity.

LEAVENGOOD

Panels submerged in a water soak tank and later measured to assess thickness swell.

VAN COURT



PRESLEY

MORE TO MUSHROOMS *than meets the eye*

No one loves mushrooms as much as **Ray Van Court** loves mushrooms.

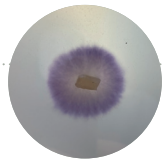
Their favorite food? Matsutake mushrooms. Their favorite hobby? Mushroom hunting. Their favorite time of the year? Mushroom season.

In fact, Van Court loves mushrooms so much they quit their corporate job to pursue ways to make the world a better place through fungi.

As a PhD candidate in wood science and graduate research assistant, Van Court is working on a project with assistant professor of forest-based bio-products **Gerald Presley**. Together, they use ectomycorrhizal fungi to bioremediate heavy metal-treated wood waste.

"Preservatives are critical to retaining the structural integrity of wood, but disposal of treated wood is problematic," Van Court says. "Wood treated with

MEET THE MUSHROOMS



Laccaria amethysteo-occidentalis, shown above in the wild (left) and again as a culture (right), is easily recognized by its deep purple cap and stem.

metals including arsenic and copper is disposed of in landfills, often unlined, where these toxic metals can move into the environment. Preventing the migration of these metals, and potentially recovering them, could reduce the ecological impact of these contaminants."

Certain species of ectomycorrhizal fungi are known to tolerate high metal environments, and initial work has shown that they may reduce metal toxicity. These mechanisms include binding them, transporting them, and producing compounds that stabilize the metals. Introducing fungi particularly adept at immobilizing metals in contaminated sites could reduce the environmental impact of toxic metal migration. The resulting retention of bound metals may also allow for reclamation.

This, says Van Court, represents a long-term solution to the problem of treated wood waste with little required inputs – all ectomycorrhizal fungi need is trees to associate with.

To test this idea, Van Court and Presley are performing a multi-stage lab experiment, screening 20 different species of ectomycorrhizal fungi in plate culture against three toxic metals.

"This screening will identify which species best tolerate and uptake metals used in wood preservatives and is an enormous increase in species and metals compared to previous research," says Van Court.

In the second stage of the research, trees will be inoculated with the best performing fungi and planted in heavy metal-treated mesocosms, controlled containers that replicate natural environments. Trees and fungi will grow together in the metal contaminated system for a few months, after which their effect on metal will be measured. This initial work will test the effectiveness of the fungal system and pave the way for future field research.

While doing the research, Van Court was surprised by the scarcity of technologies related to ectomycorrhizal fungi and the limited knowledge on fungi growth. The fungi are usually in symbiosis with trees and for many species very little is known regarding how to replicate what the tree or other organisms in the ecosystem typically provide to the fungus.

"Admittedly, they are much harder to grow and maintain than decay fungi, but they represent a lot of untapped potential," Van Court says. "As all kinds of products – from medicines to packaging material – have come from decay fungi, what new sustainable products might come from ectomycorrhizal ones? With new analytical and genetic tools, I think we are poised to learn much more about these fungi, and I am excited to see where this research and other projects can go."

FLY AGARIC
Amanita muscaria

WESTERN MATSUTAKE
Tricholoma murrillianum

DEAD MAN'S FOOT
Pisolithus tinctorius

BLOODY BRITTLEGILL
Russula sanguinaria

BITTER OYSTER
Panellus stipticus

DONATE TO THE COLLEGE OF FORESTRY DURING DAM PROUD DAY

Once a year, Beavers from around the globe come together for Dam Proud Day, an annual 24-hour online fundraising event dedicated to building a better, stronger, more influential Oregon State University.

Funding gathered during this event directly supports College of Forestry students, who have the highest reliance on self-help loans when paying for tuition and basic needs while at OSU.

During last year's Dam Proud Day in 2021, the university raised more than $1,138,000 from approximately 4,000 donors, including $64,745 from over 80 donors to the College of Forestry. These funds helped support transformative educational experiences, life-changing research, and other vital programs.

This year's Dam Proud Day will be on **April 27th, 2022**. During the event, you will have the ability to give directly to College of Forestry scholarships.

A donation to the College of Forestry will help our students afford a world-renowned education. Your gift will ensure they graduate with the skills and knowledge necessary to improve our forests, ecosystems and communities.

For more information about Dam Proud Day and how to donate to the College of Forestry, please visit **osufoundation.org**.

IN MEMORIAM

The Oregon State College of Forestry mourns the loss of these alumni, friends of the college and former faculty. We wish peace and comfort to their family and friends.

Furthermore, we recognize that many people within the college and college community have lost loved ones during these challenging times. We offer sincere condolences to all who are grieving.

Elizabeth "Betty" Augusta Norris
Friend of the college
Dec. 22, 1934 – Jan. 25, 2022