

WASHINGTON STATE UNIVERSITY

**AUTUMN 2024 PROGRESS  
REPORT**

# Ravenholt Urban Forest Health Lab



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**[HTTPS://TREEHEALTH.WSU.EDU](https://treehealth.wsu.edu)**

PRINCIPLE INVESTIGATOR: DR. JOEY HULBERT

Cover Image: Fig, WSU Scientific Assistant, engaging with students from the Science and Math Institute in Tacoma.

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# Autumn 2024 Progress Report

## WELCOME

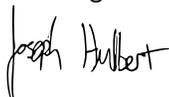
Dear Colleagues, Partners, and Supporters,

This Annual Progress Report is a celebration of the key achievements made possible by the generous support of the Albert Victor Ravenholt Fund. This vital support has enabled us to increase our research capacity, engage more communities, acquire new technology, and expand our team- making our program more inclusive while driving forward critical research on tree health issues in the Northwest.

**Support from the Albert Victor Ravenholt Fund has amplified our impact. With this enhanced capacity, we've informed decision makers, advanced knowledge in scientific and public communities, and changed the lives of many students and professionals.** In summer 2024, we linked redcedar tree health to urban heat, launched a long-term tree monitoring program in Point Defiance, and piloted an Equitable Urban Forests Internship Program to mentor students from four colleges in disadvantaged communities. These initiatives are strengthening community resilience by empowering individuals to help address environmental challenges.

We are deeply grateful for the support of the Albert Victor Ravenholt Fund and we look forward to the impacts we can achieve over the next year.

With gratitude,



Joey Hulbert

Principle Investigator,

WSU Ravenholt Urban Forest Health Lab



## JOEY HULBERT

PRINCIPAL INVESTIGATOR,  
RESEARCH ASSISTANT  
PROFESSOR

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# Executive Summary

REFLECTING ON THE PAST YEAR



Research Center Tour with Tacoma Community College Students, Spring 2024

Over the past year, the WSU Ravenholt Urban Forest Health Lab achieved significant progress in research, outreach, and education, all made possible by the support of the Albert Victor Ravenholt Fund.

We hosted a variety of impactful workshops, webinars, and tours, engaging local youth, tribal partners, and stakeholders, while expanding our mentorship efforts to support seven students from local community colleges. Additionally, our international collaborations, including organizing a session in the IUFRO World Congress in Sweden, underscored our global reach.

This report is a celebration of our major accomplishments in the growth of our team, advancements in research projects, and dedication to community engagement. It also highlights the leveraged funding and future goals made possible by the support from the Ravenholt Fund.

SERVICE FOR  
URBAN  
COMMUNITIES  
THROUGH  
RESEARCH,  
OUTREACH, AND  
EDUCATION.

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# Team Trees

## 2023/2024 GROWTH AND DEVELOPMENT



**FIG DEWITZ**  
SCIENTIFIC ASSISTANT



**ZAY MONTEJANO**  
OUTREACH COORDINATOR



**TAYLORMCNEES**  
PHD STUDENT



**SPENCER SANCHEZ**  
TACOMA COMMUNITY COLLEGE  
STUDENT INTERN

Our team grew in size, capacity, and our professions because of support from the Albert Victor Ravenholt Fund.

### Promotions

- Joey promoted to Research Assistant Professor.
- Taylor started PhD in the Department of Pathology at WSU.
- Fig promoted to Scientific Assistant (Full Time, Permanent).

### New Team Members

- Zay joined the lab as outreach coordinator.
- Spencer Sanchez started working part-time while studying at Tacoma Community College.
- Zarina Gallardo has agreed to join our lab a full-time Scientific Assistant in December.

### Professional Development

- Joey completed the Faculty Success Program in the National Center for Faculty Diversity and Development.
- Joey hosted international session ‘Public engagement to keep urban trees healthy’ at IUFRO World Congress in Stockholm, Sweden.
- Taylor submitted her first proposal to the NSF Graduate Research Fellowship Program.
- Taylor was mentored in new methodology by a visiting diagnostic clinic scientist.
- Fig attended an urban forest curriculum development workshop with Pacific Education Institute in Spokane.
- Fig and Zay coordinated and mentored seven interns during summer internship program.

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# Community Engagement

In 2023 and 2024, we expanded our community engagement and outreach efforts. We hosted many workshops, webinars, and tours, engaging a diverse range of participants, including stakeholders such as leaders from the Department of Natural Resources Urban and Community Forestry team, local youth from community colleges, and partners like the Northwest Youth Corps. These engagement activities strengthened our partnerships and increased our recognition as an important program for education and service in many Northwest communities.

Many students were engaged throughout the Puget Sound region. Our hands-on tours provided valuable learning opportunities for many college classes and the first cohort of students in the Equitable Urban Forests Internship Program was a major success. We look forward to providing similar experiences for more students over the next year.

Overall, our outreach and collaboration with partners has strengthened ties between the academic community and local organizations, advancing public engagement in urban and forest health.



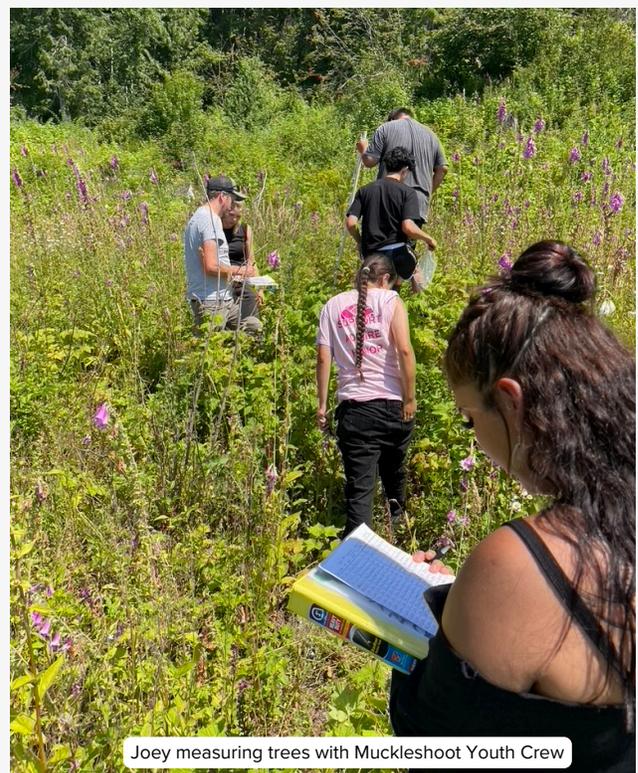
Fig presenting about urban heat and trees in Tacoma classroom

Above: we engaged youth from the Science And Math Institute to plant, tag and measure trees at Point Defiance.

Below: we visited the Muckleshoot Tomanamus Forest with a Tribal youth program to search for tree health issues and measure redcedar trees for a climate adaptation study with trees from Oregon and Washington seed.



Northwest Youth Corps at the Port of Tacoma Sentinel Tree Planting



Joey measuring trees with Muckleshoot Youth Crew

# Outreach

2023 & 2024

- **8 guest lectures** at institutions including Pacific University, Washington State University, Highline Community College, and the University of Puget Sound, covering forest health, urban forests, tree health, and community science.
- **4 workshops and webinars organized** on invasive species and urban forest health, including workshops for tribal audiences.
- **Presentations at 9 conferences**, including the IUFRO World Congress in Stockholm, Sweden, covering topics such as community engagement, forest pathology, tree health, and climate resilience.
- **13 invited talks** on topics like urban forest equity, biosecurity, tree health, and climate resilience, engaging with organizations such as the Canadian Phytopathological Society, Highline College, and the Washington Invasive Species Council.
- **7 public presentations** on forest health and community science to local and regional organizations, including the Tacoma Tree Foundation.
- **5 youth engagement activities** involving forest health walks, tree plantings, and educational events with schools and community groups.
- **4 outdoor public events** about forest health and ecology in collaboration with local organizations such as the Tacoma Tree Foundation and Issaquah Alps Trail Club.
- **11 promotional table** events at fairs and conventions, showcasing forest health and WSU research at venues like the State Fair and South Sound Sustainability Expo.
- **18 presentations for stakeholders** on invasive species, forest health, and community science at meetings with various stakeholders, including USDA APHIS and tribal organizations.
- **5 WSU Puyallup Center tours** for groups such as Northwest Youth Corps, Tacoma Community College, and Pacific Lutheran University.
- **3 Community Science Training Events** coordinated in partnership with Issaquah Alps Trail Club and MetroParks Tacoma on forest health and tree monitoring projects.



# 2024 Webinars

**UPCOMING WEBINAR**



**EMERALD ASH BORER  
IN THE WEST**

- EAB DETECTION IN VANCOUVER, BRITISH COLUMBIA
- COORDINATION UPDATES IN WASHINGTON
- UPDATE ON THE RESPONSE IN OREGON

**SAVE THE DATE**

**JUNE 11, 2024**  
**9:00-10:30 AM PDT**

Register at <https://treehealth.wsu.edu/eab>

- 141 Participants
- 14 participants received WSDA education credits
- 48 participants received ISA education credits



**MEDITERRANEAN OAK BORER WORKSHOP**

**SAVE THE DATE**  
**MAY 16TH**  
8 A.M. - 12 P.M. PDT

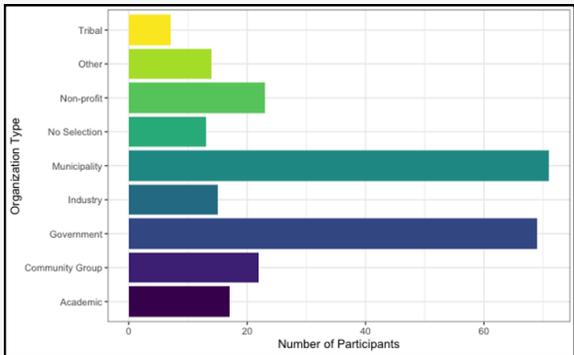
**ONLINE WORKSHOP**  
Mediterranean Oak Borer (MOB) is an invasive ambrosia beetle that infests living oak trees. Attend this workshop to learn about topics including: California's response, fungal associates, monitoring, preparing, reporting, and community science.

The workshop will also include time to discuss preparing and responding to MOB when it is found in Washington State.

Register Online at:  
<https://treehealth.wsu.edu/mob/>



- 251 Participants
- 31 participants received WSDA education credits
- 44 participants received ISA education credits
- 49 participants indicated they learned something that will change the way the manage or monitor oak



*"Thank you all very much for this webinar, very helpful and comprehensive"*  
- Bob Bailey, Arborist

*"I liked the variety of presentations from science to practice; good ideas for what we need to do next. Saanich is completing a new urban forest strategy and this is very timely"*  
- Kevin Brown, Forest Research Consultant

*"It exceeded my expectations"*  
- Michael Sanborn, Washington Department of Natural Resources, Urban and Community Forestry



# 2024 Internships

Support from the Albert Victor Ravenholt Fund was leveraged to secure a 5-year grant from the Forest Service Urban and Community Forestry Program to engage with 4 community colleges in Washington (Spokane, Tacoma, Highline, and Whatcom Community Colleges).

## Internships

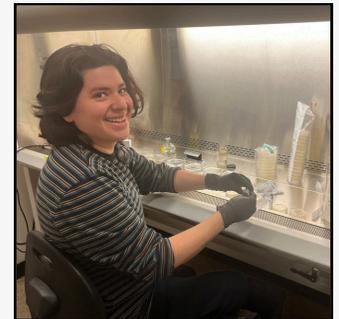
Seven students from three colleges completed the 10-week summer internship program in 2024, representing the first of five summer co-horts.

## Student Projects

- **Tacoma Public Schools Tree Inventory**
  - Nelson Pham, Tacoma Community College
  - [Tacoma Public Schools Tree Inventory Project \(iNaturalist\)](#)
- **Trees For Auburn**
  - Giselle Martinez-Jacobo, Highline College
  - [Website](#), [Instagram](#)
- **Fungi Associated with Sooty Bark Disease in Big Leaf Maples**
  - Spencer Sanchez, Tacoma Community College
- **Examining Sapsucker Feeding in Big Leaf Maples and Western Redcedars**
  - Birdie Jine, Highline College
  - [Sapsucker Feeding project \(iNaturalist\)](#)
- **The Health and Equity of Bremerton's Urban Forest**
  - Blakely Smith, Tacoma Community College
- **Pine-ing for a Greener Future**
  - Emma Soderquist, Highline College
- **Birch Tree Health Survey for the Presence of Bronze Birch Borer in Bellingham, WA**
  - Kenyon Noelke, Whatcom Community College
  - [Birch Tree Health Watch project \(iNaturalist\)](#)

## Symposium Recordings

Students presented their independent projects during an online symposium at the end of the internship. Recordings of the presentations are available at <https://treehealth.wsu.edu/internships/symposium>.



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# Research Projects

## Tacoma Schools, Trees, and Heat

The lab completed a project to determine which Tacoma public schools would benefit the most from planting more trees. Schools were ranked based on data from five sources, including heat, existing canopy coverage, and environmental health disparities. The [storymap](#) was covered in the Tacoma News Tribune with a potential reach of 537k readers according to WSU.

## Western Redcedar Dieback

The lab has been exploring the factors associated with the dieback of western redcedar using data collected by community scientists on [iNaturalist](#). 862 people have joined the project and 367 individuals have shared observations of 2826 western redcedar trees. More information is available on the next page.

## Sooty Bark Disease

The lab has collected or received nearly 400 samples for sooty bark disease diagnostics. 112 samples were submitted by stakeholders such as city staff. These samples will be invaluable for Taylor's PhD project to explore the genetic diversity of the causal organisms and importance of drought for inducing disease.

## Port of Tacoma Sentinel Trees

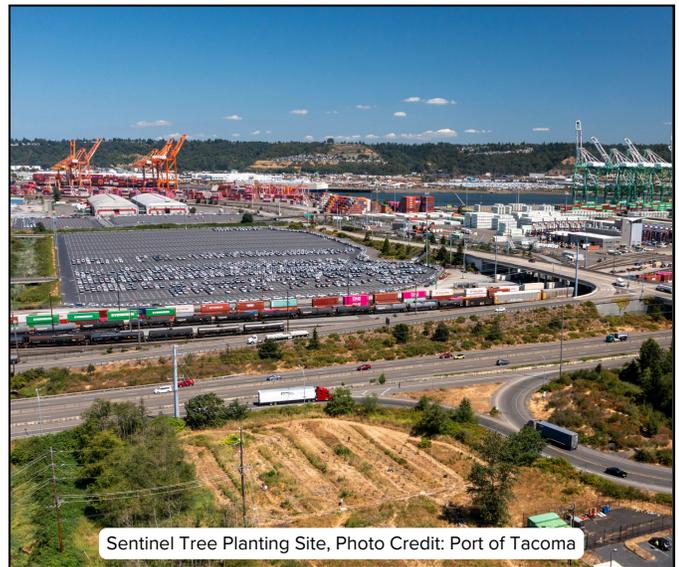
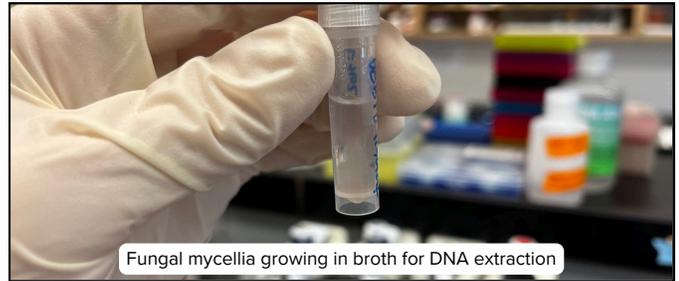
218 trees of 12 species were planted at the Port of Tacoma as an early warning system for the possible introduction of tree pests or diseases. Many partners have helped prep and steward the site and the lab is helping monitor the health of the trees.

## Sword Fern Dieback

Sword ferns have been observed dying in pockets throughout the Puget Sound. The cause remains a mystery, but a root disease is probable. In 2023 and 2024, we collected soils and roots from unhealthy sword ferns and are investigating the possible role of oomycetes.

## Western Redcedar Climate Adaptation

The lab has completed a second year of measurements on redcedar trees planted from Oregon or Washington seed. A 5th site was established at Tacoma Community College. A [blog post](#) about the study was recently published by the Tacoma Tree Foundation.



# Western Redcedar Dieback

## Tree health and urban heat

The poster on the right was presented at the International Union of Forest Research Organizations World Congress in Stockholm, Sweden. The analyses indicated the probability of dieback increased with urban temperatures. These models were applied to street tree inventories to provide cities with information about vulnerable tree locations.



## Redcedar root disease

Soil samples were collected beneath 267 redcedar trees. 124 of those samples were collected during group hikes and another 37 were submitted by community scientists. Eleven *Phytophthora* species were recovered in the samples, but is unclear if they are causing much disease. 1000 redcedar trees have been ordered for green house studies starting Spring 2025.

## Long-term volunteer monitoring

Metro Parks Tacoma 'Park Watch Volunteers' and SAMI students have tagged and measured 155 trees at Point Defiance to start a long-term monitoring project. The project is in its early stages as the park is estimated to contain more than 2000 redcedar trees.

**REDCEDAR HEALTH AND URBAN HEAT**  
PRELIMINARY ANALYSIS

**MORE THAN 80% OF PEOPLE LIVE IN CITIES AND RELY ON HEALTHY, FUNCTIONING URBAN FORESTS.**

Urban trees provide critical services for keeping communities healthy, such as mitigating the impacts of heat waves, but these benefits are not equally distributed.

Planting trees is widely recognized as a method to mitigate these environmental health disparities. However, some tree species may 'feel the heat' more than others.

Western redcedar is an important component of urban forests in western North America, but increased levels of dieback have been observed and linked to consecutive longer and hotter droughts (Andrus et al 2024, J Biogeography).

**HYPOTHESIS**

Given the vulnerability of redcedar trees to longer and hotter droughts, redcedar will be less healthy in hotter areas of northwestern North American cities.

Tacoma urban heat island map and urban redcedar dieback.

**COMMUNITY ENGAGEMENT**

Community scientists in the Forest Health Watch program participated to test this hypothesis through two approaches:

**iNaturalist**

Mass Participation  
Anyone, anywhere could participate on iNaturalist.

Trained Participation  
Trained cohort of community scientists visited randomly selected street trees in Portland.

357 community scientists shared 2,650 observations in the Western Redcedar Dieback Map (WRDM) project.

More information is available at <https://foresthealth.org/map>.

Community scientist dashboard at <https://foresthealth.org/analysis>.

**TACOMA**

343 observations of redcedar trees were shared in Tacoma Washington by 24 participants.

No relationship was found between tree health and temperature in Tacoma.

**URBAN HEAT AND TREE HEALTH**

Air temperatures were extracted for each tree from NOAA NIHHIS Urban Heat Island (UHI) Mapping Campaign data (<https://heat.gov>).

1,258 trees were shared in areas with UHI data: Portland, Tacoma, and King County.

Redcedar trees shared from urban areas with afternoon UHI data.

Analyses with urban heat data from all three cities were standardized because each UHI mapping campaign was completed on different days.

There was strong evidence for a relationship between standardized afternoon temperatures and whether a tree was categorized as healthy or unhealthy.

Individual analyses in each urban area were also completed to explore the relationships between afternoon heat and the probability of top-dieback.

**PORTLAND**

341 observations of redcedar trees were shared in Portland, Oregon by 45 participants.

There was strong evidence for a relationship between tree health and afternoon temperatures in Portland.

The probability of top-dieback increased with afternoon temperatures.

Redcedar trees in areas of Portland with afternoon temperatures above 88.5 F had a probability of >0.1 for having a dead-top.

**KING COUNTY**

420 observations of redcedar trees were shared in King County, Washington by 66 participants.

There was strong evidence for a relationship between tree health and afternoon temperatures in King County.

The probability of top-dieback increased with afternoon temperatures.

Redcedar trees in areas of King County with afternoon temperatures above 87.8 F had a probability of >0.1 for having a dead-top.

**INVENTORIED TREE HEALTH PREDICTIONS**

Air temperatures were extracted for redcedar trees in Seattle and Portland inventories.

Redcedar trees in Seattle and Portland.

Inventoried trees were then categorized based on their predicted probability of having a dead-top.

- Low concern (0 - 0.025)
- Moderate concern (0.025 - 0.1)
- Most concern (0.1 or higher)

**URBAN HEAT DISPARITIES**

Western redcedar trees are vulnerable to afternoon heat. The probability of losing the benefits of redcedar is higher for communities in urban heat islands.

Given the relationship between redcedar health and urban heat, unhealthy redcedar trees may indicate where communities are most vulnerable to heat waves.

Redcedar with a dead-top.

For more information visit <https://treehealth.wsu.edu/> or contact Joseph Hulbert at [hulbe@wsu.edu](mailto:hulbe@wsu.edu)

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# Technology and Infrastructure Upgrades

## Enhanced lab capacity

Support from the Albert Victor Ravenholt Fund allowed us to purchase a Oxford Nanopore Minion Sequencer. It also covered the costs of a visit from a diagnostician to help us learn new diagnostic techniques with qPCR. Together this training and new tools have enhanced the capacity for our program to conduct ‘state of the science’ molecular research.



## ‘New’ surveillance van

The lab received an 2000 Ford E350 van through the government surplus system. It was previously a surveillance van for assessing disability claims. After some minor updates made possible with Ravenholt funding, it is now a key piece of infrastructure in the lab and we consider it our ‘biosurveillance van’. We use it to deliver trees, collect samples, and carry equipment for outreach events.



# Program Advising

OUR ACHIEVEMENTS WOULD NOT BE POSSIBLE WITHOUT THE SUPPORT OF THESE KEY INDIVIDUALS



**TODD MURRAY**  
CENTER DIRECTOR



**MARIANNE ELLIOTT**  
FACULTY MENTOR



**GARY CHASTAGNER**  
FACULTY MENTOR



**LINDSEY DU TOIT**  
DEPARTMENT CHAIR

# Looking Forward

WE ARE EXCITED ABOUT THE FUTURE BECAUSE OF THE ACHIEVEMENTS WE'VE MADE WITH THE SUPPORT OF THE ALBERT VICTOR RAVENHOLT FUND



The recent growth and promotion of our team was only possible because of the generous support of the Albert Victor Ravenholt Fund. It has changed our lives, helped our careers, and given us a stronger foundation to address many of the pressing environmental challenges facing urban communities in the Pacific Northwest.

Looking ahead, we aim to complete some of our current projects, expand our research to explore diseases affecting other species such as western hemlock, find more opportunities for youth engagement, and continue building novel collaborations between WSU and urban partners. Together we will keep trees and communities healthy.



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WASHINGTON STATE UNIVERSITY

# Ravenholt Urban Forest Health Lab



WE ARE GRATEFUL FOR THE  
REMARKABLE SUPPORT WE  
RECEIVE FROM THE ALBERT  
VICTOR RAVENHOLT FUND TO  
ESTABLISH, GROW AND SUSTAIN  
THE WSU RAVENHOLT URBAN  
FOREST HEALTH LAB.

Joey Hulbert

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