**2025 Andrews Forest LTER GRA Support Award Proposal**

**“Quantifying Growth of Scorched Western Hemlocks Following the 2021 Heat Dome”**

**Principle Investigator:** Chris Still, Professor

**Department:** Forest Ecosystems & Society

**College:** OSU College of Forestry

**Graduate Research Assistant:** Gabhriel John, PhD Student

**Department:** Forest Ecosystems & Society

**College:** OSU College of Forestry

Application Deadline: Friday, January 24, 2025, by 5 PM, PST

The Andrews will award four Graduate Student GRA terms of funding support. Each of the four awards will provide full graduate-student support (stipend and tuition for MS or PhD) for one term at OSU. A faculty member, not a current or prospective student, must submit the application.

Selection Criteria:

1. Alignment with LTER8. Proposed research and activities must support the goals and research activities in the LTER8 proposal. Please make specific mention of how the proposed research relates to LTER8 goals (below), and to relevant LTER8 research activities found in the proposal.

• Goal I: To understand how disturbance legacies interact with environmental change to influence ecosystems.

• Goal II: To understand how species interactions influence population and community responses to environmental change.

• Goal III: To understand how interactions of science, values, and ecological conditions influence land-use decisions.

2. Focus on fire: Research could incorporate regional datasets or perspectives. Connection to long-term datasets is encouraged.

3. Enhancement of LTER community. We look to enhance the Andrews Forest research community – based on the past and likely future contributions of the PI and the student to the Andrews Forest Program. We welcome proposals that support our commitment to diversity, equity, and inclusivity.

4. Student support. Explain how this term of GRA funding would enable new effort beyond existing plans. Applicants are invited to briefly mention if, and in what ways, this award would be leveraged with other existing funds and projects. Extra consideration will be given to students whose work was impacted negatively by closures to the HJA site in 2023 and 2024 due to wildfire; please explain if and how the student has been impacted by site closures and wildfire at research locations.

2. Proposal. In not more than two pages, total:

a. Explain how the proposed work and activities support selection criteria listed above.

b. Describe, briefly, what the student will do during the period of funding, and what you expect the student to accomplish.

c. Specify the term of support being requested (e.g., Spring 2025 term).

d. Indicate a timeline for the proposed activities including when products will be presented/published.

3. Send to Lina DiGregorio (lina.digregorio@oregonstate.edu) by the application deadline.

At the end of the funding period, the awardee will be asked to provide a report on how the funds were used and the benefits gained from the activities.

Awardees will be expected to present their work at an Andrews Forest LTER Monthly Meeting.

Applications materials should be sent to Lina DiGregorio ([lina.digregorio@oregonstate.edu](mailto:lina.digregorio@oregonstate.edu)).

***Overview of the proposed project and graduate student***

A paper produced as a result of LTER8 funding explains the widespread and dangerous effects of the 2021 Heat Dome on plant health in the Pacific Northwest (Still et al., 2023). Evidently, such extreme weather conditions in places like the Andrews Forest necessitate more research to provide better predictions for future ecophysiological responses to climate conditions that are unprecedented yet likely to return. Such is a mission of LTER8, and such has been the work of Gabhriel John to date. John began her master’s degree at Oregon State University in the fall of 2023 with LTER8 funding. Over the last year, John’s project has identified more questions than she can answer within two years. Thus, as she changes her degree to a PhD, this proposal is an opportunity to fund additional work for her at the Andrews.

Presently, John’s work is using LTER8 funds to analyze tree cores and high-resolution data from automated dendrometers at the Andrews so she may understand the extent to which Douglas-fir (*Pseudotsuga menziesii*) and western hemlock (*Tsuga heterophylla*) growth is affected by heat waves and drought. Such research is imperative and timely as both phenomena are increasing over time and threaten the capacity for Pacific Northwest forests to store carbon (Davis et al., 2023; Duarte et al., 2016). Specifically, John is focusing on the potential residual effects of the 2021 Heat Dome on tree growth based on dendrometer records of stem diameter expansion.

Through this work, John has uncovered adjacent research questions that can be seamlessly integrated into her degree program with sufficient time and funding. For example, with the help of John’s co-advisor and Andrews Forest Director Mark Schulze, John has identified a stand of western hemlock trees at the Andrews varying levels of sun exposure through gaps in the surrounding canopy of Douglas-firs. These gaps resulted in a unique and clear gradient of foliar scorch following the 2021 Heat Dome.

Therefore, receipt of this award will allow Still and John to explore the following research questions at the Andrews Forest:

1. How did the degree of foliar scorch affect growth of western hemlock?
2. Is the proportion of scorched crown volume and growth rate related?
3. Did growth significantly differ among scorched vs. non-scored western hemlocks?

***How the proposed project achieves LTER8 goals***

The proposed project builds upon knowledge and analysis acquired over the last year and directly supports the mission of LTER8 to provide quantifiable evidence of ecological responses to unprecedented climate. Consequently, this proposed project best supports Goal I of LTER8. The future of plant-carbon dynamics, forest modeling, and forest management depends on a thorough understanding of how those plants respond to climate disturbances. The Heat Dome represents a clear instance of extreme environmental change with profound and perhaps long-lasting impacts. High temperatures expedite the process of foliar damage, which affects a tree’s ability to photosynthesize (Teskey et al., 2014).

***Fire impacts on student’s work to date***

For the microclimate analyses needed to contextualize growth patterns at the Andrews, John has relied on long-term remote sensing data procured from the Andrews Provisional Data Portal. The Lookout and Ore Fires caused partial data losses during the summer, which is disproportionately important for John’s analyses since the summer months are when heat wave and drought impacts are most prominent. The Ore Fire also delayed John’s ability to conduct field work and communicate with Andrews faculty who were coordinating fire response efforts.

***Proposed methodology for the student to complete during the funding period***

If selected for this award, we request that John be supported for the fall 2025 quarter. During this time, she will build upon the skills she has already learned and practiced for her current project. These include the ability to locate, download, analyze, and visualize raw microclimate data from an online repository such as the Provisional Data Portal. Similarly, she will collect additional tree cores from the scorched hemlocks as well as unscorched hemlocks in the surrounding area. Paired with dendrometry records, these methods will convey long-term growth patterns while contextualizing post-Heat Dome growth.

New skills that John is expected to develop for the proposed project include the application of an allometric equation to tree ring samples to estimate biomass and carbon allocation. As seen in Acosta-Hernández et al., 2020, this practice would allow researchers and forest managers to more concretely convey the relationship between climate change and carbon storage. She is expected to proactively engage in other activities relevant to the proposed project to better prepare her for a holistic knowledge set that will be challenged and tested during her dissertation defense and qualifying exams. Such activities include installing dendrometers, creating R scripts for data analysis, mastering version control software like Git, and mentoring new students in her joint lab. An important and sometimes overlooked aspect of science is the ability to share your work with the public. Over the last year, John has taken advantage of several opportunities to do so with her current project, and the proposed project will be no different. Future opportunities for John to share the proposed work include the Pacific Northwest Water Research Symposium, OSU Biology Graduate Student Symposium, Western Forestry Graduate Research Symposium, and the Ecological Society of America Annual Meeting.

***Timeline of student expectations and deliverables for the proposed project***

John is expected to complete and submit a publication from her current LTER8 work in the summer of 2025, allowing for a natural transition to focus on the proposed project the following fall. With the exception of the summer 2024 quarter, John has relied on Teaching Assistantships alongside LTER8 funding. Receiving this award will give John additional time to focus on her work and provide deliverables as she would not have the extra commitment of managing an undergraduate course. This is especially true because the fall is an ideal time frame to collect tree core samples as this is at the end of the water year and is less likely to be hindered by wildfire.

Thanks to the current LTER8 work, John and Still are closely involved with Andrews personnel and activities. For example, John is attending the Early Career Critical Zone Workshop at the Andrews this March, and she has already given a graduate student flash talk at an Andrews Forest LTER Monthly Meeting. In line with the expectations outlined in this proposal criteria, she is prepared to present the results of the proposed project at another monthly meeting whenever it is appropriate to do, likely during the winter or spring of 2026. Similarly, both John and Still have experience completing NSF annual reporting forms together and are expected to continue doing so upon completion of this GRA funding period. A minimum of one publication is expected from this project by the end of 2026. John will present her research before then via flash talks and poster presentations at conferences and symposia like those mentioned above.

***References***

Acosta-Hernández et al., 2020. *Forests* 11:1134. <https://doi.org/10.3390/f11111134>

Davis et al., 2023. *Fifth National Climate Assessment*. <https://doi.org/10.7930/NCA5.2023.CH32>

Duarte et al., 2016. *J. Plant Physiol.* 205:57–66. <https://doi.org/10.1016/j.jplph.2016.08.012>

Still et al., 2023. *Tree Physiology* 43(2), 203–209. <https://doi.org/10.1093/treephys/tpac143>

Teskey et al., 2014. Plant, Cell & Environment 38:1699–1712. <https://doi.org/10.1111/pce.12417>