A Recommendation of Lora Keyte for Graduate Study in Plant Pathology

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In summer of 2021, advised by WSU's Marianne Elliot and UW's Tim Billo, we - the Friends of Seward Park, led by me, bioinformatics software engineer from the Institute for Systems Biology and Seattle Parks forest steward - documented very high mortality and the broad decline of Western Hemlock in the 120 acre urban old-growth forest at Seward Park. Juxtaposed to a decade's observation of, and experiments to elucidate the high sword fern mortality in the forest, we feared that the overall community health prospects for this forest were grim.

So in the summer of 2022 we turned to assessing the health of the many 300-500 year old Douglas-Firs in the forest. It is here that I met and worked many days a week for six weeks with UW Biology student Lora Keyte.

I went looking for Douglas Fir health assays practical, within our competence and small budget. I consulted with University of Washington ecologist Timothy Billo, UW emeritus professor & forest pathologist Bob Edmonds, and two staff pathologists from Weyerhaeuser Corporation, Neither of the standard methods of canopy inspection nor comprehensive root rot assays were within our capabilities.

Thus we began our six-week project with an open-ended methodological question: how can we assess mortality rates of these trees over the last century? Lora Keyte's field savvy, observation skills, her questioning mind, and her scientific inventiveness were crucial to devising and implementing the field assay method that we settled on.

We ended the summer with enough preliminary data (about which more below) to construct a linear model of doug fir mortality across 100 years, reaching the optimistic preliminary conclusion that mortality is holding approximately steady. These data, and our model, are not of publication quality. But they do set the stage for more rigorous future study. I worked with Lora Keyte, benefiting from her skill and judgement as we improvised a variety field assays, and explored the complementary relationships among theory, observation, and modeling which,

with iteration and refinement, can - and in our case, arguably did - lead to useful results and scientific insight. I learned that Lora has the makings of a very fine scientist.

Our data begin with in-person reports of doug-fir tree fall dates from long-term visitors to the park. We were able to associate these unambiguously with specific dramatic PNW wind storms which have occurred since 1993. A half-dozen other fallen trees were deductively dated, with high confidence, to 1962 and 1935.

Blinding ourselves to these dates, and examining a further two dozen undated fallen trees in the study area, we assessed each tree for epiphyte cover, epiphyte variety, bark loss, terminal decay, wood structure and log collapse. We debated semi-quantitative measures of each of these features until we reached consensus. The heterogeneity of the forest and, especially, the patchiness of each of the features in each tree obscured any correlation of any feature, or combination of features, to trees with known fall dates.

Every feature, that is, except one: log collapse. Our visual assessment of this feature, expressed as a number 1-10, turned out to be a reliable predictor of known fall dates, and became the basis of our linear model, and the basis upon which we tentatively concluded that doug fir mortality is approximately constant between 1935 and 2022.

In any early stage research into biological questions I have found that preliminary data obtained from exploratory methods and analysis often contribute to rigorous subsequent reproducible research. Lora Keyte's exemplary scientific sensibility, her hard work, her collegiality, along with her imaginative approach - married to her judicious skepticism - were instrumental to the success of our project.

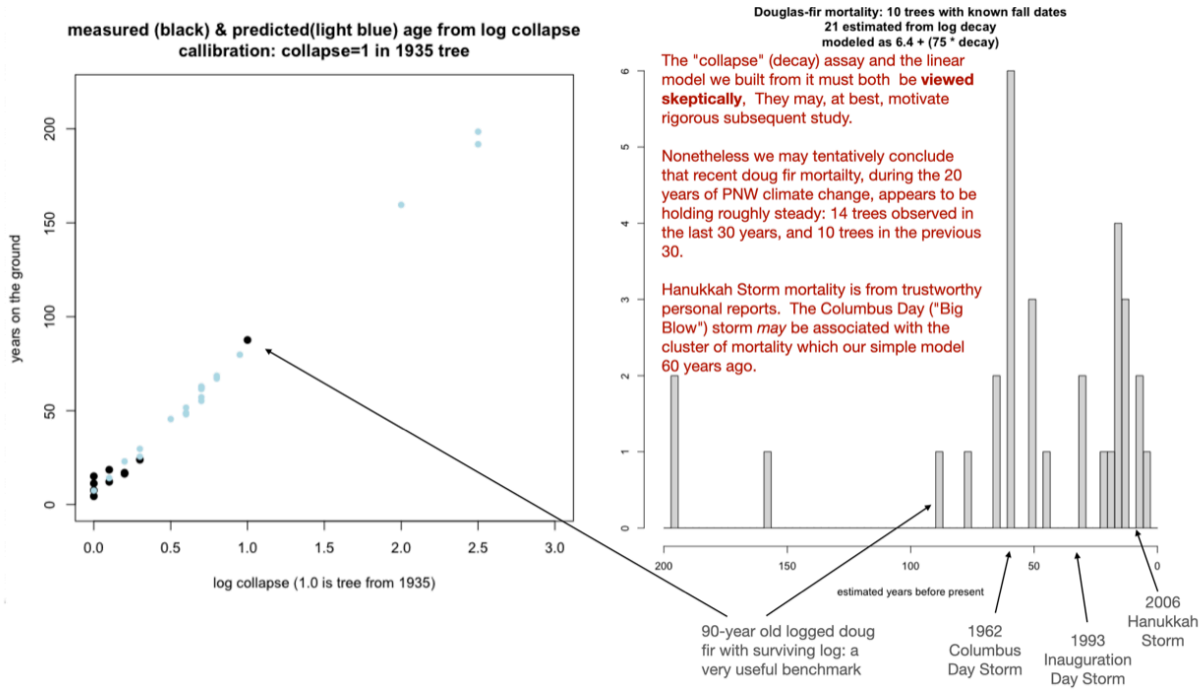
For decades I have worked with PI's, postdocs and interns studying gene regulation at the Institute for Systems Biology. I recognize in Lora the same attributes I see in the successful scientists, young and old, with whom I have worked.

I recommend Lora unequivocally for graduate study in plant pathology.

Three figures from our final report

Legend

Orange circles: trees with known fall dates
Blue circles: trees with estimated fall dates
Circle size: estimated years since fall



The "collapse" (decay) assay and the linear model we built from it must both be **viewed skeptically**, They may, at best, motivate rigorous subsequent study.

Nonetheless we may tentatively conclude that recent doug fir mortailty, during the 20 years of PNW climate change, appears to be holding roughly steady: 14 trees observed in the last 30 years, and 10 trees in the previous 30.

Hanukkah Storm mortality is from trustworthy personal reports. The Columbus Day ("Big Blow") storm *may* be associated with the cluster of mortality which our simple model 60 years ago.