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This document presents some ideas for student research projects in, or related to, Seward's old-growth forest. We welcome fresh ideas and research help during the coming summer.

Background

Seward Park's 100 acre "Magnificent Forest" is a rare remnant old-growth forest - all the more rare for its urban location. Our best guess is that the current forest seeded in about 550 years ago after a stand-replacement fire. Many douglas firs, 4-7 feet in diameter, date from this forest stage. Another fire, not quite so severe, appears to have swept the peninsula about 250 years ago. About 100 large doug firs with their thick bark, and a dozen cedars, survived that fire, recognized today by their size and burn scars.

Since 2014 we have observed and tried to understand the decline and mortality of two core species of the forest community: sword ferns, and Western Hemlock. We have mapped, experimented, observed disease progression, and come up with some hypotheses about cause. But we are still in the dark. Both species declines are now seen throughout the PNW, but are especially dramatic at Seward. Thus Seward's decline, though tragic, provides opportunities for study and research. We mention a few possibilities here, then provide links to previous work, blog posts, and publications.

Research Ideas (in no particular order)

1. With the loss of fern and hemlock, the forest community is reduced; the successor forest is unknown. We hope that the doug firs, being somewhat adapted to summer drought and heat, will survive to anchor the next

forest. This summer, with funding for interns from [CHOOSE 180](#), an organization which supports young people who are disproportionately impacted by the criminal justice system in King County, we will survey doug fir health, focusing on the big trees, using aerial photography (if we can get it) and ground-based observations.

2. The sword fern die-off, first observed in 2014, continues to spread. Fine mapping of this spread, and of differential survival - not all ferns die - may further illuminate the problem.
3. Our experiments suggest that a water-borne pathogen may be involved. High-resolution microscopy has not been attempted, and may be fruitful.
4. Polystichum genus expert, University of Vermont's David Barrington, confirmed our hunch that individual sword fern plants (*Polystichum munitum*) live very long lives. "A thousand years is not out of the questions" he said. To a first approximation, sword ferns establish (like doug firs) on bare soil before a forest canopy develops, rarely reproduces once the canopy forms, rarely die, living very long lives. Careful study of healthy sword fern communities elsewhere in the Puget Lowland could provide evidence for this hypothesis.
5. Several nearby mature forest parks offer a contrast to Seward. Healthier than Seward, they raise questions about what circumstances lead to our higher mortalities. One hypothesis concerns hydrology: with the lowering of Lake Washington by 11 feet 110 years ago, and with no year-round streams, Seward's forest may have tipped from a "dry but healthy" state to one of "slow steady decline", leading to the mortality we now belatedly see. In addition, the peninsula forest has for 70 years been surrounded by a paved road, possibly interrupting mycorrhizal water transport into the interior - which is rumored to sometimes occur. Perhaps comparative hydrology and/or mycorrhizal studies could be done using other local parks: Schmitz Preserve, St. Edwards State Park, Mercer Island's Pioneer Park, Dead Horse Canyon.
6. Red cedars are also declining across the region, with drought and heat conjectured to be primary cause. We now see this at Seward, but it is irregularly distributed. The pattern of affected and unaffected

cedars, if carefully mapped and examined, might illuminate the problem. We will probably add this task into the CHOOSE 180 doug fir project this summer.

7. We hope to soon have permission to install two "chronolog stations" which invite those visiting the woods to contribute to time series photographic monitoring of a selected site. One station will be where the sword fern die-off is rapidly progressing, the other at the "Hemlock graveyard" (see photo below) to capture forest succession as the forest recovers here. Other opportunities for close observation may be possible. The 2011/2017 fern die-off before/after photo included below has been very useful for conveying the magnitude and scope of this problem. A chronolog station photo is also included below.
8. Student researchers may have innovative ideas of their own about Seward's decline, its causes, and possible remedies. We welcome these.

Some background reading, references, figures

Seattle Times Magazine, March 2019: [The Case of the Vanishing Ferns: Citizen sleuths can't figure out what's killing Seattle's sword ferns](#)

Some research progress, December 2019: [Citizen-scientists are still trying to figure out why Sattle's sword ferns are disappearing](#)

Doug Fir project final [report](#)

Hemlock Video microscopy:

[Nine healthy branch tips](#)

[Ten affected branch tips](#)

The continental context: [Over half of western United States' most abundant tree species in decline.](#)

Stanke, H., Finley, A.O., Domke, G.M., Weed, A.S. and MacFarlane, D.W., 2021. Nature Communications, 12(1), pp.1-11.

What we have lost - as seen from the Hatchery Trail at Seward.

June 2011



May 2017



Last summer's Hemlock project, with regional context and possible future work: <https://pshannon.net/nextSteps/narrative.html>

Sword Fern die-off blog:
<http://sewardparkswordferndieoff.blogspot.com/>

80 doug firs 4-7' DBH



Last summer's crew in action:



CHOOSE 180 interns spent six weeks in Seward Park's old-growth forest documenting the dramatic decline and death of Western Hemlock.



The cluster of black dots at the top (north) of the map look like this on the ground:



A Chronolog Station welcoming citizen contributions to time-series monitoring.

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