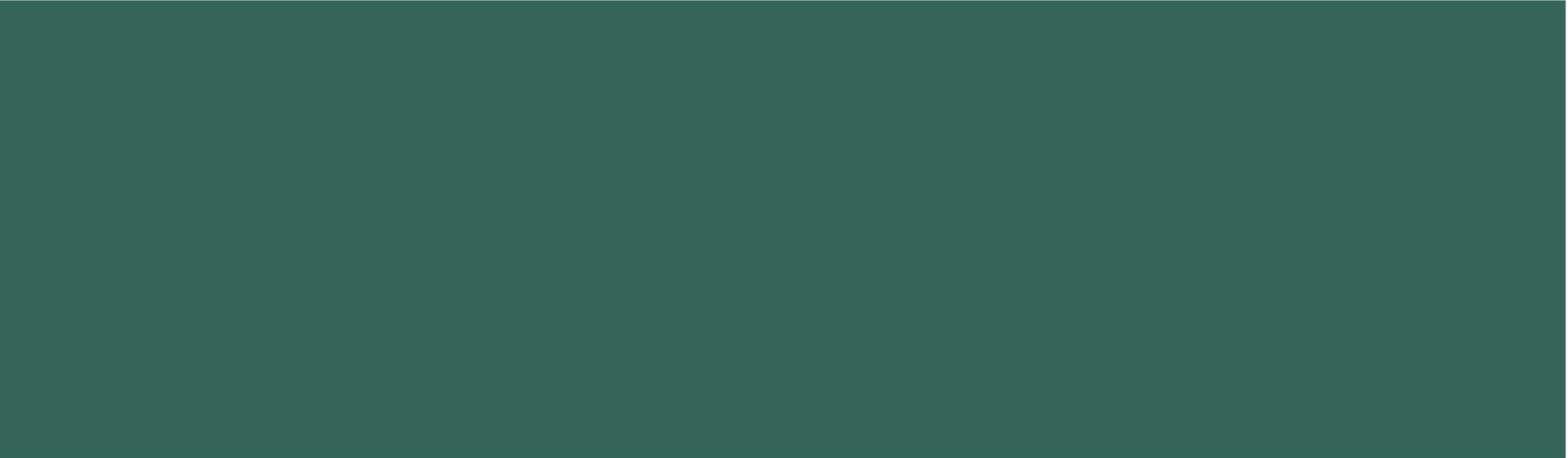


URBAN FORESTRY & LAMINATED ROOT ROT

M.S. PATTERSON, MPA, MSES

KAREN DYSON, PHC, MMA



WELCOME & INTRODUCTIONS



- Introducing Karen Dyson and Matthew Patterson, PhD candidates at the Urban Ecology Research Laboratory at the University of Washington.

PRESENTATION OVERVIEW



- Introduction to Laminated Root Rot (LRR)...very exciting!
- Opportunities for research and collaboration to inform development of the Urban Forestry Master Plan (UFMP):
 - Policy Review
 - Canopy Assessment
 - Pine Lake Park Research Study
- Feedback and next steps.



INTRODUCTION TO LAMINATED ROOT ROT



WHAT IS LAMINATED ROOT ROT?

- LRR is a disease of coniferous trees.
- In the PNW two closely-related infectious fungi are important:
 - *Phellinus sulphurascens* which infects Douglas-fir, hemlock, and other firs
 - *Phellinus weirii* which primarily infects western red cedar and yellow-cedar.
- All hardwoods are immune.

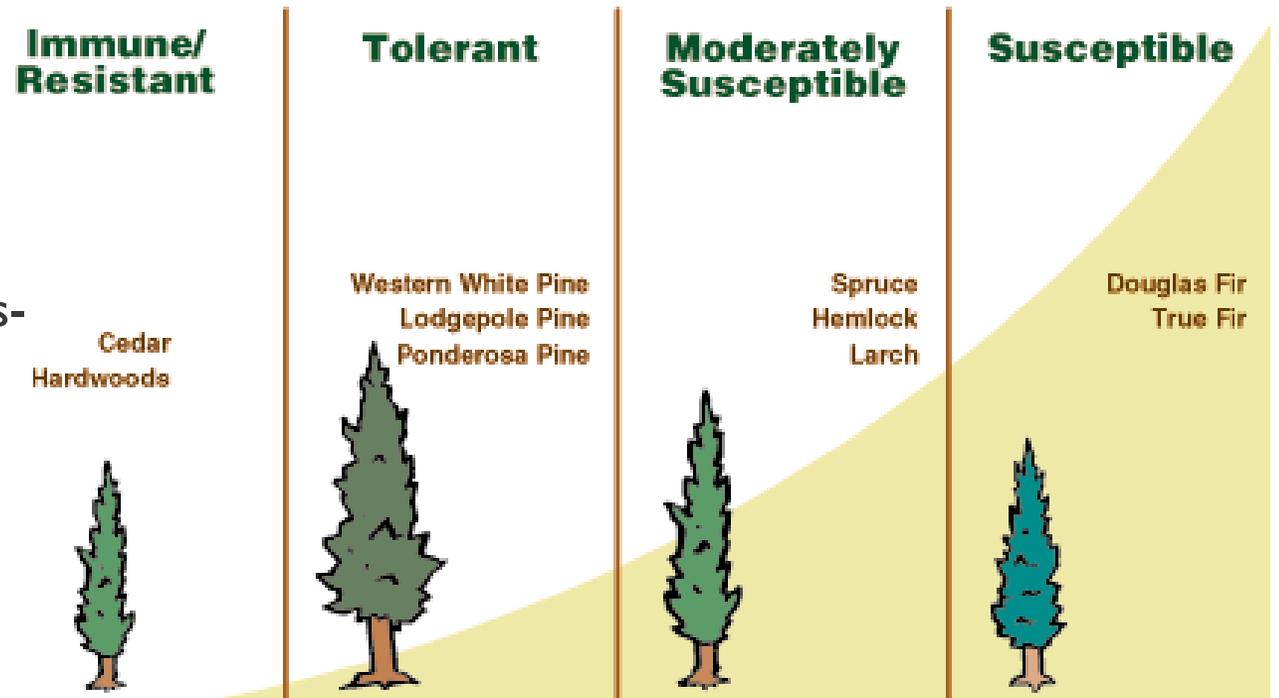
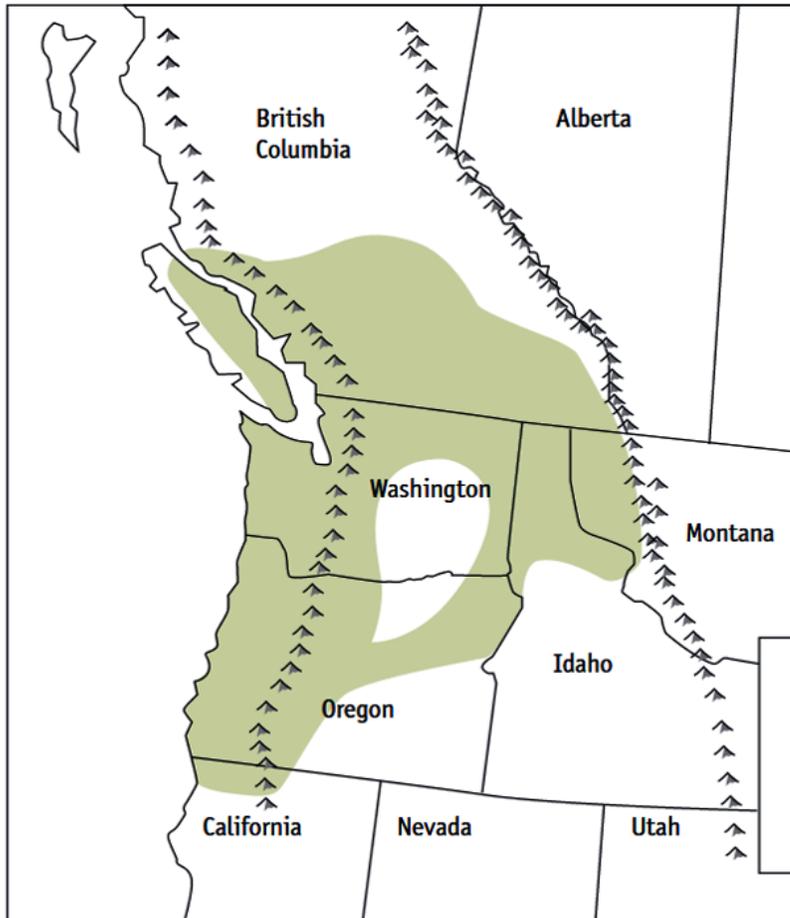


Photo British Columbia Ministry of Forestry

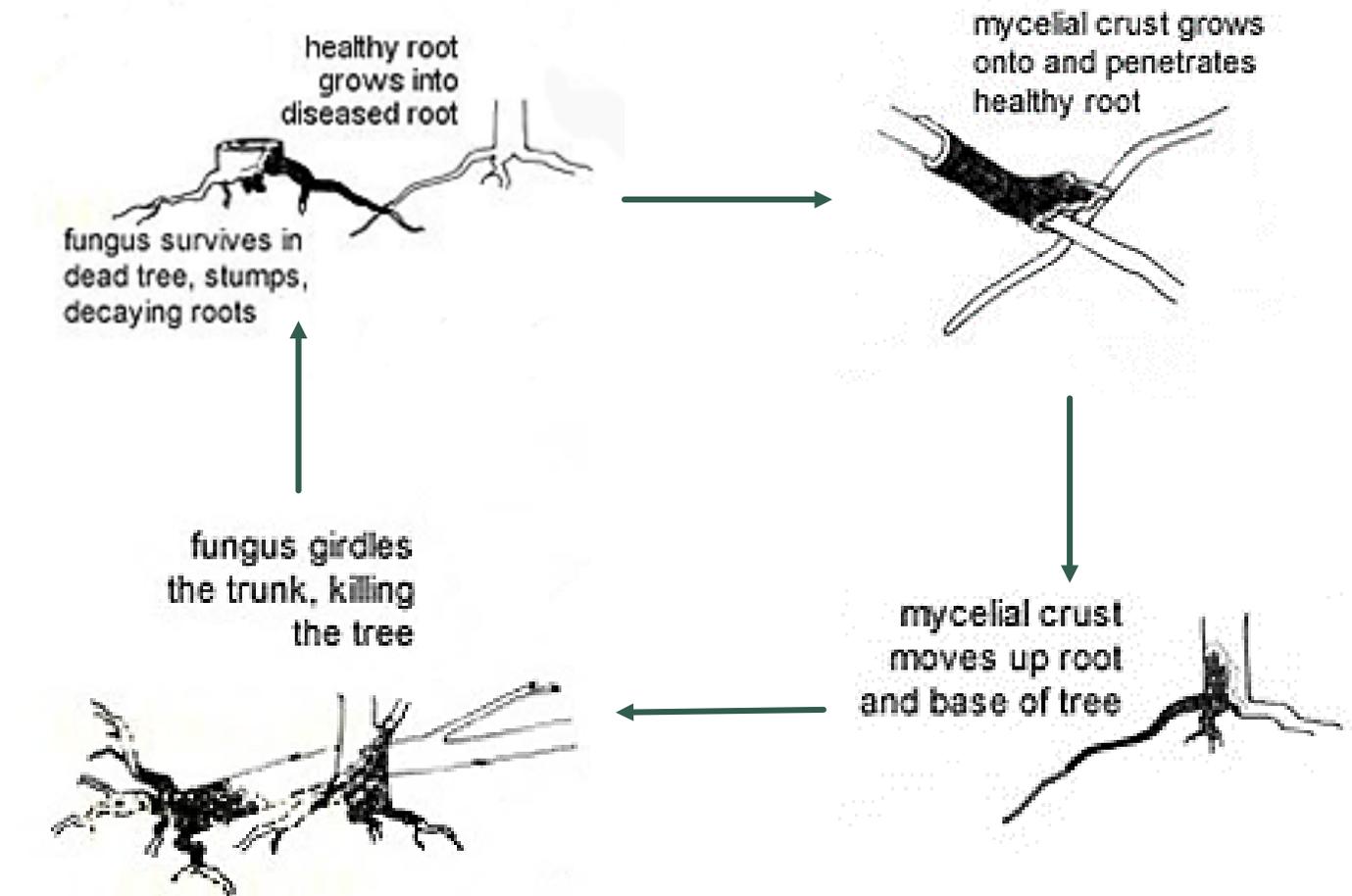
IS LAMINATED ROOT ROT NATIVE?



- Yes, LRR is a native pathogen.
- Historically, it had a patchy distribution.
- Logging in the early 1900s likely spread the disease across the landscape.
- The current range and infection rate is likely a legacy of logging.

HOW DOES LAMINATED ROOT ROT SPREAD?

- LRR spreads when the woody roots of a healthy tree make physical contact with the woody roots or stump of an infected tree.



Life cycle of *Phellinus sulphurascens* and *P. weirii*, which infect Douglas fir and western red cedar via root contact with infected material. Modified from Brooks 2002.

HOW DOES LAMINATED ROOT ROT KILL TREES?

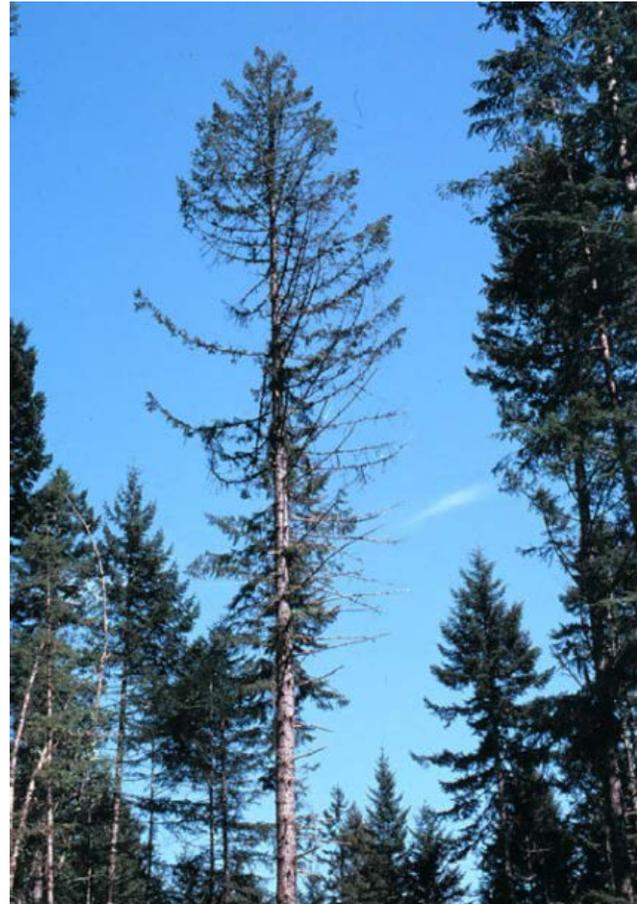
- LRR damages and weakens the woody roots and the base of the trunk.
- Infected trees may die standing, but are frequently windthrown.
- There is a history of tree loss during windstorms in the Sammamish area, many of these Douglas fir trees may be infected. Analysis of the root ball confirms the disease.



Photo: K. Dyson

HOW AND WHEN IS LAMINATED ROOT ROT DETECTED?

- Arborists diagnose by visually inspecting trees.
- Symptoms can take a decade to become obvious, most damage is invisible.
- Symptoms may differ between trees.
- Visual diagnosis can be unreliable.



An infected Douglas fir showing characteristic symptoms of LRR.

Note the difference when compared with healthy Douglas fir in background.

HOW CAN LAMINATED ROOT ROT BE MANAGED?

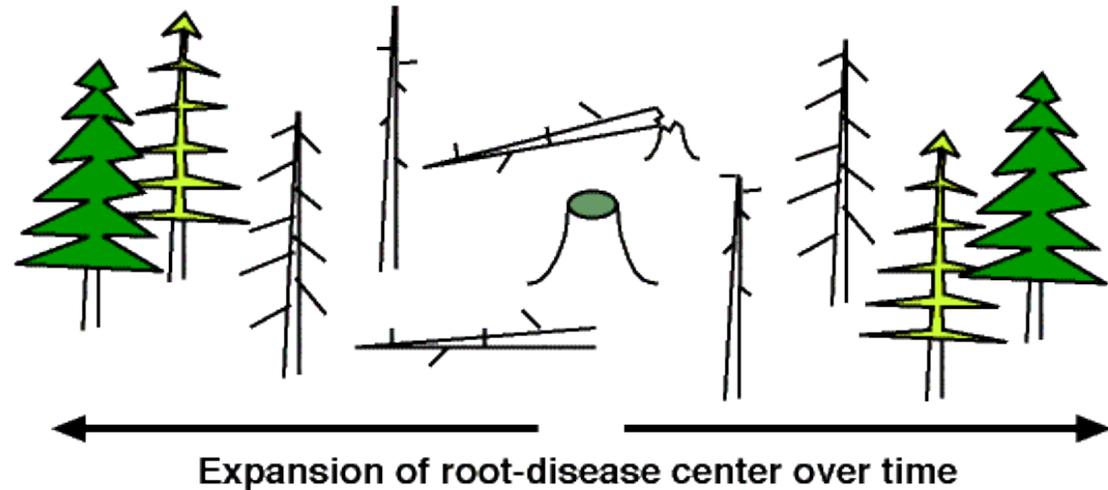
- There is no known treatment for LRR.
- Disease has high mortality.
- Currently, best management practices include:
 - Early identification of infected areas
 - Tree, stump and root removal
 - Replanting with resistant species
 - Monitoring



Photo © Washington State Academy of Sciences

WHAT ARE THE LONG-TERM IMPLICATIONS FOR SAMMAMISH?

- With limited management, LRR will expand, producing patches without Douglas fir.
- In forest stands, these may regenerate as early successional hardwood stands.
- Development and climate change may increase vulnerability of trees to windthrow and secondary infections, etc.



Top: K. Dyson

Bottom: <http://www.forestpathology.org/root.html>

WHERE DO WE START?

- Continue to pursue comprehensive study of the urban forest.
- Map the current forest cover, which will provide an important benchmark to monitor long-term changes in the forest condition and inform future management practices.
- Ensure current and future policies do not conflict with management of LRR.
- Work on methods to improve early detection of the disease:
 - New DNA-based methods can be used to enhance or replace existing methods (visual diagnostics).



Photo K. Dyson



OPPORTUNITIES FOR RESEARCH AND COLLABORATION

URBAN FOREST POLICY REVIEW, CANOPY COVER ASSESSMENT, LRR FIELD STUDY



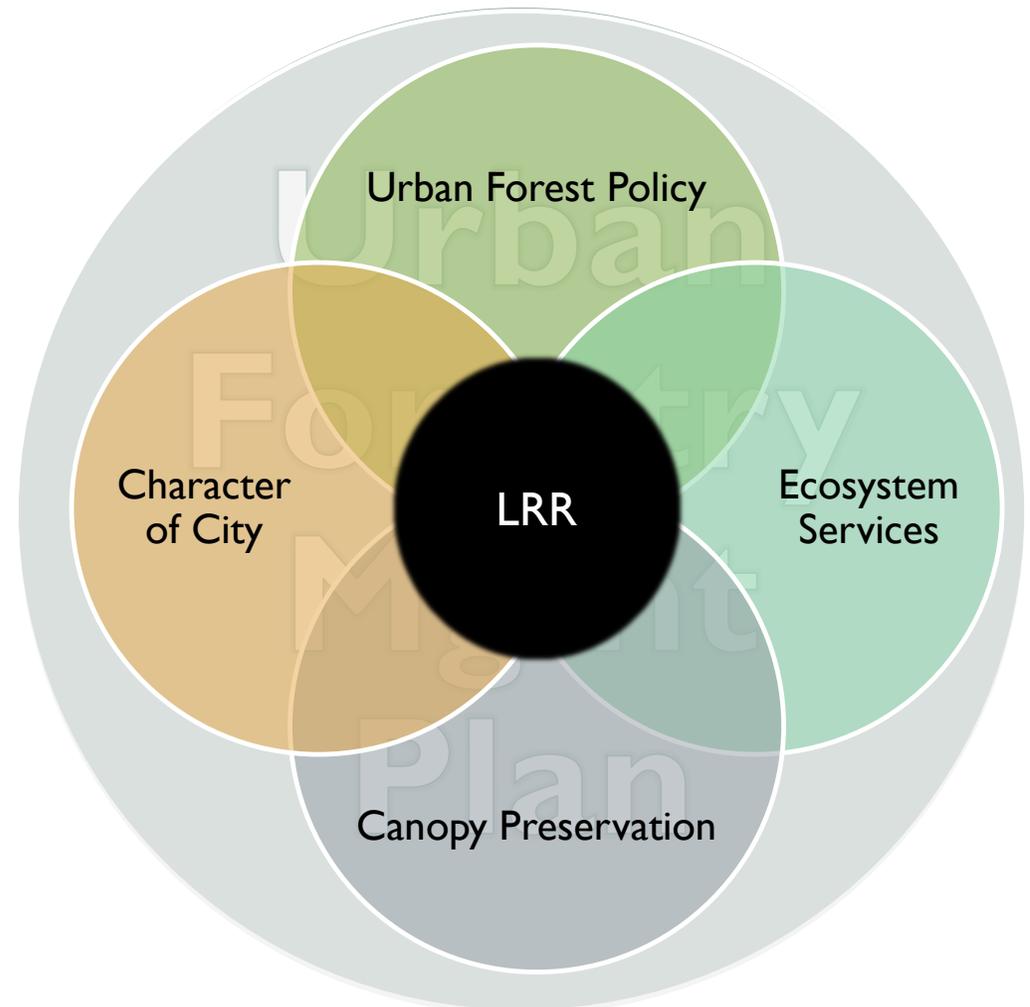
FURTHER STUDY OPPORTUNITIES RELATED TO LRR

- I. Enhanced policy analysis, looking through the lens of LRR and long-term implications for the forest. \approx \$20k
(Partially included in the UFMP scope)
- II. Canopy Cover Assessment \approx \$40k
(Included in UFMP scope)
- III. Local study of LRR in Pine Lake Park to better understand the disease, how it spreads etc. \approx \$200k
(Not included in the UFMP scope)



I. EXISTING URBAN FOREST POLICY REVIEW: INTEGRATING BEST AVAILABLE SCIENCE

- LRR alters the composition and function of the forest over time, and thus impacts every aspect of urban forest management in Sammamish.
- If the city wishes to account for LRR, this should be reflected in City policies and management practices.



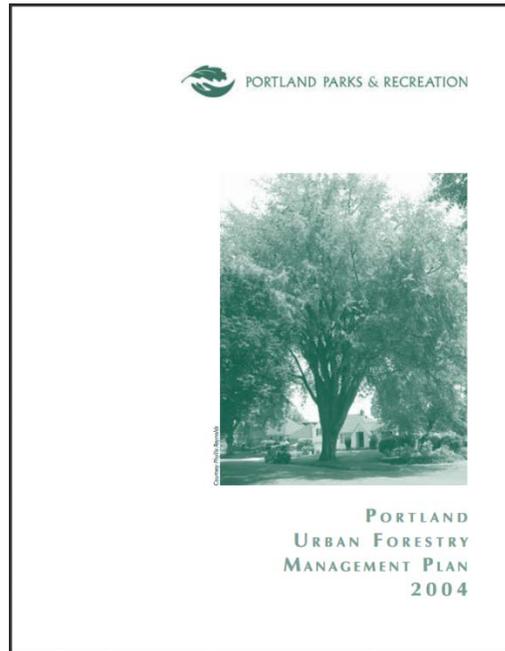
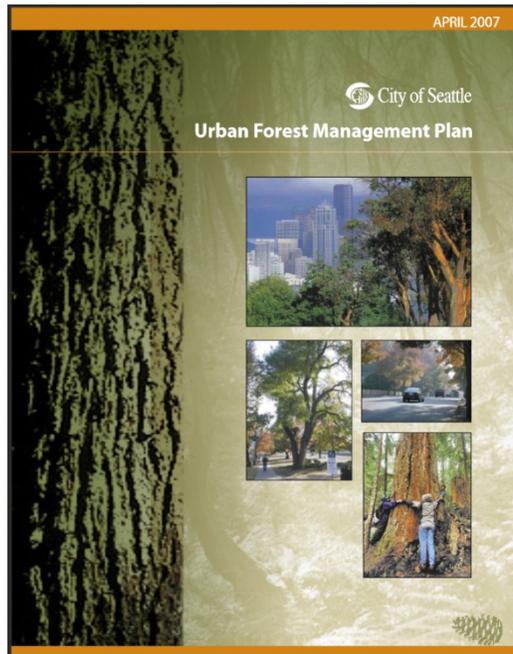
I. EXISTING URBAN FOREST POLICY REVIEW: WHAT DO WE GET?

- It is recommended that all current and future policies be reviewed using best available science and recommendations integrated into the UFMP, future code revisions, etc.
- Some examples of potential policy outcomes:
 - Susceptible conifers should not be planted in or near infection centers.
 - Tree preservation decisions must take into account infection status of trees.
 - When infected trees are removed, the stump and roots should be cleared as well.
 - And more...



Photo K. Dyson

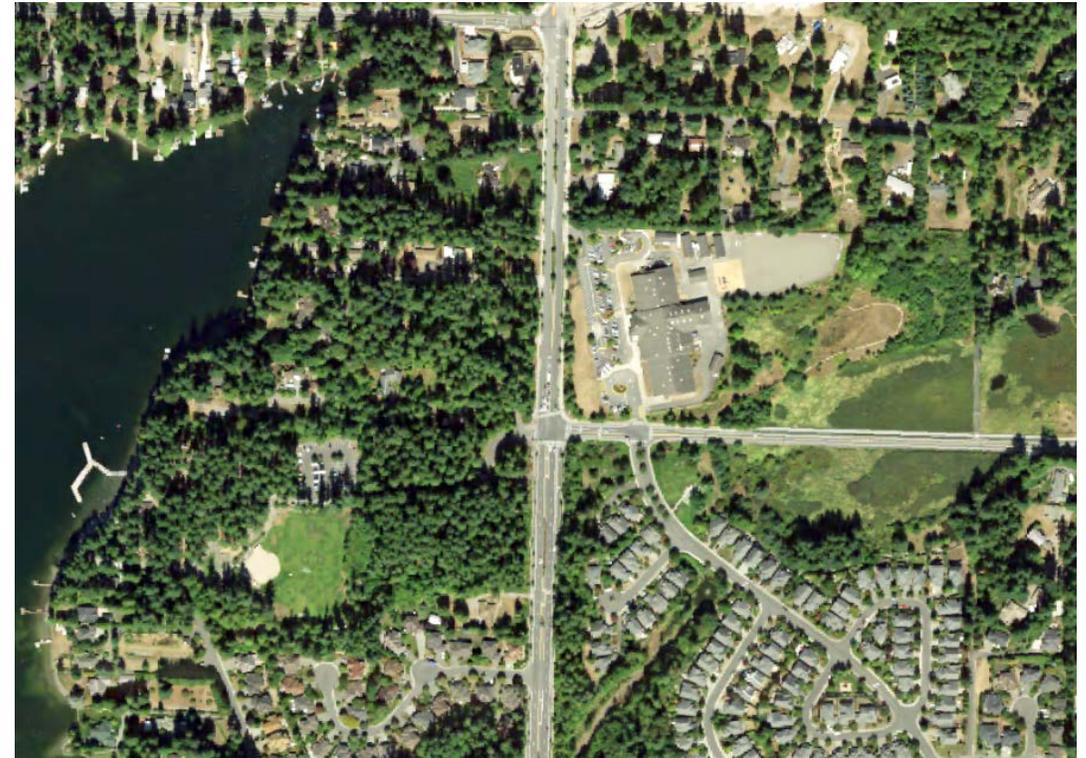
I. EXISTING URBAN FOREST POLICY REVIEW: HOW TO USE IT?



- Policies developed using best available science will:
 - Support long-term management of the urban forests in Sammamish, including minimizing the spread of LRR.
 - Support provision of ecosystem services (e.g. stormwater management).
 - Guide land acquisition decisions.
 - Inform development guidelines and regulations.

II. CANOPY COVER ASSESSMENT: WHY PERFORM ONE?

- A canopy cover assessment is a type of *land cover analysis*.
- Uses multi-band, high-resolution satellite (or other aerial) imagery.
- Delineates areas of canopy cover, impervious surface, and other land cover types.
- Capable of providing an accurate, comprehensive measurement of canopy extent.



A real color, one meter resolution image of Sammamish, as would be used in the production of a canopy cover analysis. (NAIP, 2015)

II. CANOPY COVER ASSESSMENT: WHAT DO WE GET?

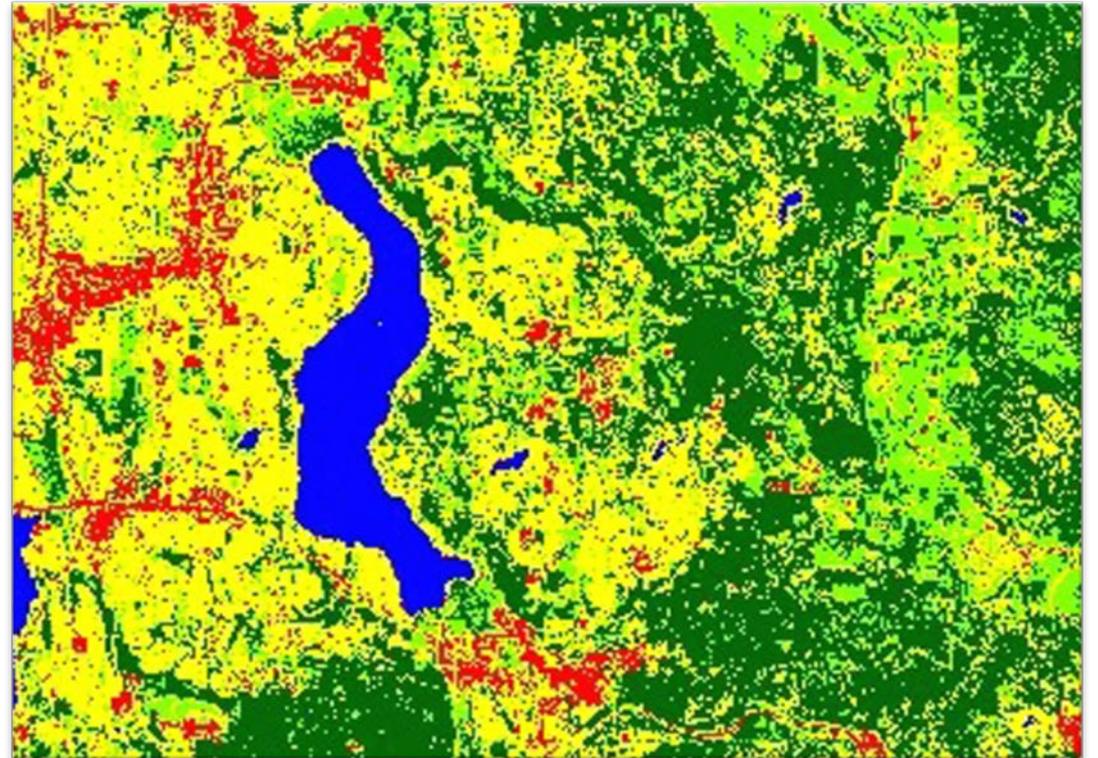
- An accurate, complete, high resolution land cover dataset to incorporate into the City's GIS.
- Will be developed using open, reproducible, fully documented methods to enable future comparison.
- Both public and private lands will be included in the assessment.



A false color, one meter resolution image of Sammamish, as would be used in the production of a canopy cover analysis.

II. CANOPY COVER ASSESSMENT: HOW DO WE USE IT?

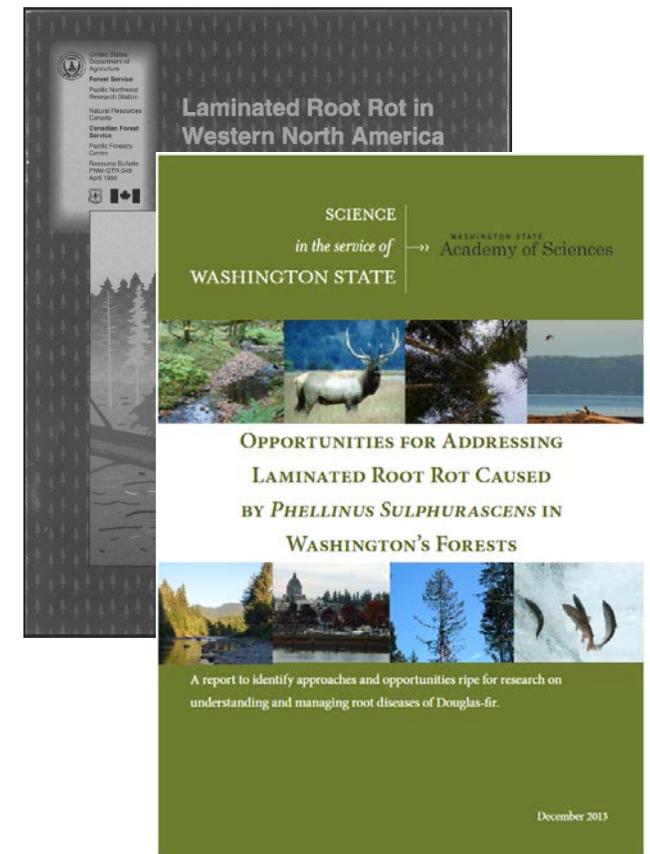
- Used to inventory and map the City's forest.
- Ability to calculate canopy coverage for specific areas.
- Provides a baseline for monitoring changes (gain or loss) in forest cover.
- Important info for UFMP and long-term management practices.
- With good enough data, it *may* be possible to identify patches of stressed trees.



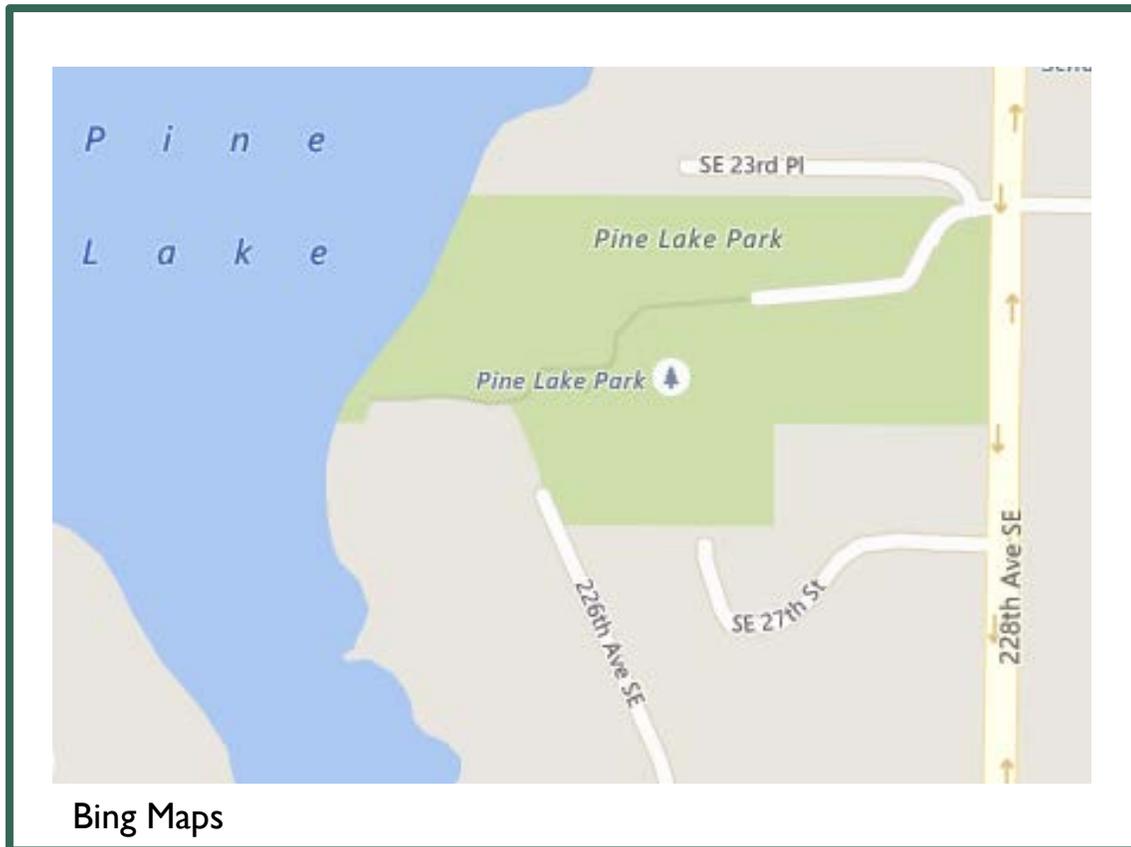
A coarse, 30 m resolution example of a land cover and canopy map. Dark green represents forest cover.

III. LAMINATED ROOT ROT STUDY: WHY DO WE NEED ONE?

- To effectively manage LRR, we must first be able to accurately and reliably ID and locate it on the landscape.
- Most research on LRR has been performed in timber lands, and it has never been studied in an urban context or with the goals of preserving trees for the long-term.
- An approach more suited to long-term preservation and maximization of ecosystem services and function is needed in Sammamish.



III. LAMINATED ROOT ROT STUDY: WHAT WILL WE DO?



- Study in northern section of Pine Lake Park.
- Sample trees that have been identified as being infected with LRR along with nearby soil.
- These samples will be used for metagenomic analyses, which will tell us about the organisms present, and their abundance.



III. LAMINATED ROOT ROT STUDY: WHAT WILL WE GET?

- Determine accuracy of current methods used to detect LRR.
- Identify a method for verifying infection with a high degree of reliability.
- Foundation for methods that can be used to accurately map infection centers, to implement effective management plans.
- Knowledge about the composition of the soil community associated with infected/healthy tree roots, which may point towards biological methods of control for LRR.

III. LAMINATED ROOT ROT STUDY: HOW DO WE USE IT?

- A method to reliably determine LRR presence will enable the city to effectively implement the UFMP and to collaborate with private citizens, developers, and other public entities to make informed decisions about the long term health and sustainability of urban forests.
- Verifying the healthy or infected status of trees makes tree preservation efforts much more effective.
- DNA methods can be combined with visual surveys to quickly identify and accurately map infection centers, allowing more careful management and control of the disease.

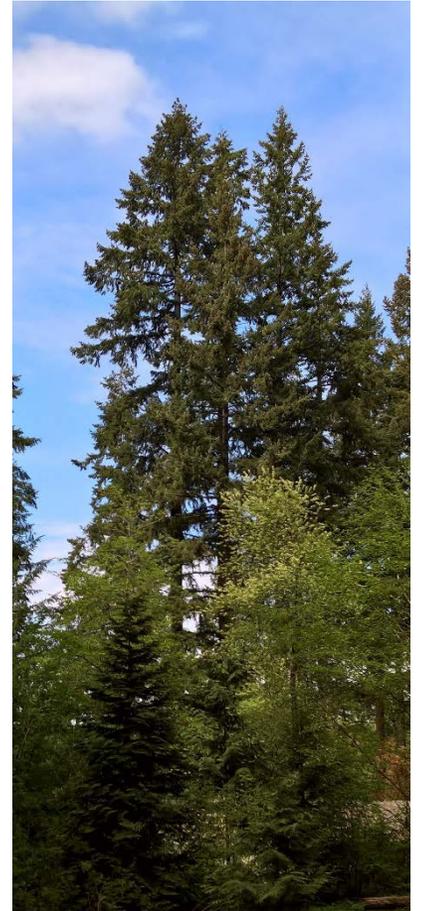


Photo K. Dyson

III. LAMINATED ROOT ROT STUDY: WHO MIGHT HELP?

- WA Department of Natural Resources has identified a need for research on LRR that makes use of modern biological techniques, including community ecology of Douglas-fir roots.
- Other cities in the region are also facing LRR problems.
- Foundations interested in funding research related to the urban microbiome or fungi may also be interested in supporting this work.



POLICY QUESTIONS?



- Should we consider enhancing the UFMP to include a more comprehensive look at LRR through a partnership with the Urban Ecology Research Lab at the University of Washington?
- Should we pursue a specialized study at Pine Lake Park to better understand LRR?
- If yes to the above, should we seek partnerships to help fund the study?
- Other considerations?

FURTHER STUDY OPPORTUNITIES RELATED TO LRR

- I. Enhanced policy analysis, looking through the lens of LRR and long-term implications for the forest. \approx \$20k
(Partially included in the UFMP scope)
- II. Canopy Cover Assessment \approx \$40k
(Included in UFMP scope)
- III. Local study of LRR in Pine Lake Park to better understand the disease, how it spreads etc. \approx \$200k
(Not included in the UFMP scope)





QUESTIONS?