An Explorative Study of the Methods used in Dendrochronology and its Applications

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Introduction

- Dendrochronology is the science of dating tree rings and characterizing their patterns of growth.
- However, not all tree species have rings suitable for analysis, so preliminary research is required to determine suitable tree species.

Objectives:

- Determine the potential for local tree species to be used for dendrochronological analysis.
- Use software programs to measure ring width growth and correlate growth rates.
- Create a standardized chronology to analyze growth rates of tree species and allow for future climate correlations.

Methods

- *Acer saccharum* (15) and *Picea abies* (12) were cored at Fanshawe Conservation Area in London, Ontario (Figure 1).
- Two 5 mm increment cores were taken at approximately 1.3 m on opposing sides of the tree.
- Cores were glued to wood mounts and sanded using 100, 220, and 600 grit sandpaper.
- Rings of each core were counted under a microscope and the innermost tree ring was dated (Figure 2).

Figure 1. Increment borer used to collect a core from a *Picea abies* tree

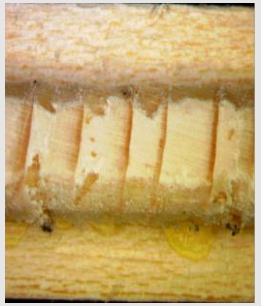

Figure 2. *Picea abies* rings under the microscope.

- Ring widths of each core were measured using WinDENDRO™ after scanning with an Epson V800 scanner (Figures 3 & 4).
- The software COFECHA was used to determine the correlation between tree cores.
- Four of the most strongly correlated *Acer saccharum* and *Picea abies* were selected to create standardized and detrended chronologies using ARSTAN software.
- The raw ring widths and growth index data were then graphed in Excel.

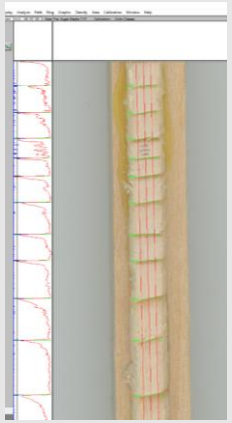

Figure 3. *Picea abies* ring widths measured in WinDendro.

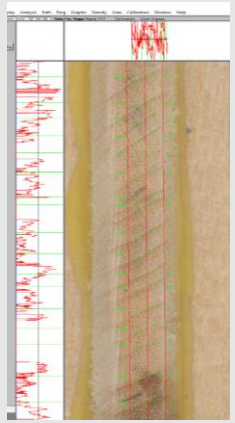

Figure 4. *Acer saccharum* ring widths measured in WinDendro.

Results & Discussion

- The top graphs display the annual average ring widths of all cores for both species (Figures 5a & 6a).
- The bottom graphs illustrate a standardized growth index where values>1 are above average growth and values <1 are below average growth (Figures 5b & 6b).
- The growth rates of *Picea abies* appear to be more variable and overall higher than *Acer saccharum* (Figures 5 & 6).
- Future analysis can be conducted to determine if the more variable growth rates of *Picea abies* are caused by greater climate sensitivity.

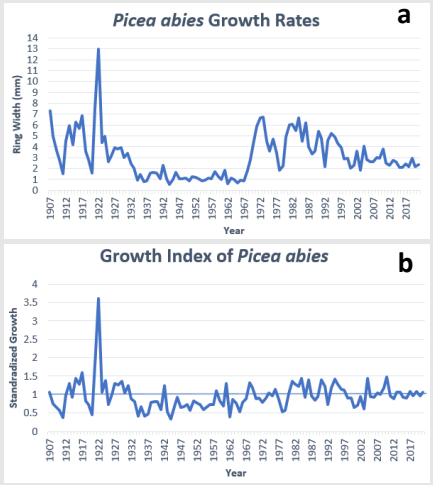

Figure 5. *Picea abies* average growth rates (a) and growth index (b).

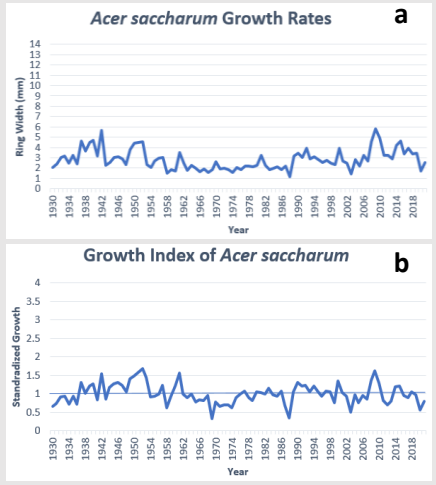

Figure 6. *Acer saccharum* average growth rates (a) and growth index (b).

Conclusion

- The next steps of this project are to continue the dendrochronological analysis of the existing cores, as well as of new cores and additional species.
- The goal is to first add *Quercus rubra* to this project.
- Following the addition of a third tree species, the project will continue by conducting climate correlations in an attempt to learn if/how climate determines growth rates.
- Additionally, given climate change and the urban heat island, the project might expand to coring trees growing in London's urban core to compare their growth rates and patterns to trees growing in rural areas.

Acknowledgements

- This work was made possible through the financial support of the USRI program at Western University.
- This work was also made possible by the support of the Department of Geography and Environment (particularly Erika Hill) and the Upper Thames River Conservation Authority.
- Special thanks to Brandon Williamson at the Upper Thames Conservation Authority for allowing the collection of tree cores on the property.