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#### PROPOSAL TO ACCESS THE ARNOLD ARBORETUM LIVING COLLECTIONS FOR SCHOLARLY PURPOSES

The collections and natural areas of the Arnold Arboretum support scholarship in a wide array of disciplines; scholarship includes all forms of research projects, teaching activities, and artistic endeavors. These may involve the formal, accessioned plants in the collection, the unaccessioned or spontaneous vegetation in natural areas, as well as the environments within the 281-acre urban ecosystem. Prior to beginning, however, all activities must be approved, and upon completion must be documented.

Applicants must complete and submit this proposal for review *at least* five business days before the initial access date. Submitting proposals well in advance of the five-day deadline is appreciated, particularly for complex projects or those which involve many accessions. E-mail proposals, **as a Microsoft Word file**, to the appropriate contacts listed below.

All attempts will be made to support projects as they are initially proposed, however modifications may be required. All applicants will be made aware of their proposal status within five business days of receipt of a completed proposal. Successful applicants will be provided with a collections-access letter as well as a signed research/collecting permit, if appropriate. Scholars are not allowed to collect from the collections or conduct their study until approval is provided.

Please submit proposals to both Michael Dosmann and Kathryn Richardson:

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Michael Dosmann  
Keeper of the Living Collections  
[michael.dosmann@harvard.edu](mailto:michael.dosmann@harvard.edu)

Kathryn Richardson  
Curatorial Assistant  
[kathryn.richardson@harvard.edu](mailto:kathryn.richardson@harvard.edu)

#### **Contact Information:**

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1. **Primary Contact Name:** Elizabeth Wolkovich
2. **Primary Contact Email Address:** [e.wolkovich@ubc.ca](mailto:e.wolkovich@ubc.ca)
3. **Name of Principle Investigator (if different from above):** NA
4. **Names and affiliation of other researchers working on project:** Christophe Rouleau-Desrochers (MSc student at UBC with Wolkovich lab) [christophe.rouleaudesrochers@ubc.ca](mailto:christophe.rouleaudesrochers@ubc.ca)

**5. Institutional Address and phone number:** If this request pertains to the shipment of materials, include a building shipping address, and not a PO Box number.

We do not need any items shipped, but here is information:

Forest and Conservation Sciences  
University of British Columbia  
3041 - 2424 Main Mall  
Vancouver, BC V6T 1Z4  
Office: 604-827-5246

**6. Are Arboretum staff members formally collaborating with this project?** If so, please list names and describe in what capacity:

Not currently, though we would be happy to collaborate if staff are interested. Additionally, this project leverages long-term data from the Tree Spotters, a community science group that is part of the National Phenology Network and has been collecting phenological data at the Arboretum for over 8 years now. Additionally, Wolkovich is a Visiting member of OEB at Harvard.

### ***Project Details:***

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**7. Project title:** Do longer seasons lead to increased tree growth? A case study across species at the Arnold Arboretum

**8. Initial access date:** Some flexibility, but ideally April 2025.

**9. Full date range if for extended periods, with intended frequency of visits/shipments:** One visit of 5-7 days if only one person works and 3-4 days for two people to core trees, with a return short visit by Wolkovich once the cores have dried and can be imported to Canada for tree ring analysis. The cores will be further scanned using a tree-ring imaging machine that was built in our lab at UBC. You can find more about the device here: <https://github.com/temporalecologylab/TreeRings> (and a blog post showing the device operation here: <https://www.tumblr.com/temporalecology/765354938781040641/tree-ring-analysis-is-ongoing?source=share>)

**10. Briefly describe the project (1 paragraph is sufficient):**

Numerous studies have shown that climate change extends the phenological growing season in many temperate ecosystems, with plants shifting leafout earlier by several weeks and often delaying end-of-season events. While the assumption that a longer growing season leads to increased growth is an intuitive and common one, recent evidence shows that this may not be the case (citations available upon request). Using unique phenological data from the Arnold Arboretum, we aim to couple ground phenological observations (leafout, flowering, fruiting, leaf coloring) with tree ring data to test how phenological season length relates to growth. This is a major question in fundamental biology, but also critical to forecasts of climate change itself, since most carbon models assume that plants experiencing longer seasons will sequester more carbon, but recent studies have called this assumption into question. We would like to take two cores per tree to combine with existing phenological data from the Tree

Spotters program. We plan to use standard dendrochronological protocols that minimize damage, following methods of Dr. Ailene Ettinger who cored trees at the Arboretum 8-9 years ago.

**11. Briefly describe the necessity/importance of using the Arboretum collections for the project:** From 2015 to 2020, the Tree Spotters program trained hundreds of community scientists to collect phenological data from 57 trees representing 11 native species and today has a unique 9-year data of phenological growing season length (some of these data previously used here: [https://harvardforest1.fas.harvard.edu/publications/pdfs/Chamberlain\\_CCE\\_2023.pdf](https://harvardforest1.fas.harvard.edu/publications/pdfs/Chamberlain_CCE_2023.pdf)). To our knowledge, no one has coupled ground observations and growth data. Hence, coring Tree Spotters individuals at the Arnold Arboretum would allow a unique and important test of how phenology and growth are related.

Phenological data from the Arboretum is especially unique in providing observations of reproductive events, which are often obscured in natural forests. We previously have used such data to show how critical reproductive events appear to plant growing seasons (this study was also conducted at the Arboretum: <https://bsapubs.onlinelibrary.wiley.com/doi/full/10.1002/ajb2.1174>). This very unique reproductive phenological data will also allow us to investigate potential connections between growth and reproduction. For example, we will be able to test if length of reproductive period (within individual plants across years) affects growth.

**12. Is this project currently supported through external funding (e.g., grants)? If so, please list:** It is related to Wolkovich's current NSERC Discover grant: How shifts in biological time and extended seasons alter plant growth across species with climate change

### ***Collections Use and Request Details:***

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**13. List the Arboretum resources to be monitored or collected.** Consult the Arboretum's online inventory of living collections (<https://arboretum.harvard.edu/plant-search/>), or Arboretum Explorer (<http://arboretum.harvard.edu/explorer/>) for information about the Arnold Arboretum's accessioned holdings, Herbarium of Cultivated Plants, and to use the download function to create your lists and maps. **Please select all access types that apply to your project.**

☒ Plants within the Living Collections

Please provide a list of taxa and/or specific accession numbers and send as a separate .csv file.

*Acer saccharum, Aesculus flava, Betula alleghaniensis, Betula nigra, Carya glabra, Carya ovata, Fagus grandifolia, Populus deltoides, Quercus alba, Quercus rubra, Tilia americana* (see also attached csv)

**\*Please note that Keeper of the Living Collections, Michael Dosmann, has provided an approved list of plants for your project. [KMR]**

☐ Environmental Access

Select all that apply:

☐ spontaneous flora (non-accessioned plants); please describe:

☐ other (describe):

☐ Herbarium of Cultivated Plants

Select all that apply:

- ☐ in-person visit to the herbarium
- ☐ destructive sampling (attach file with barcode numbers located on your download list via Plant Search to this proposal), please describe:
- ☐ request for scanning services (attach file with barcode numbers located on your download list via Plant Search to this proposal)
- ☐ other (describe):

**14. Does this project require the removal of tissue, propagules, or other plant material from the Arboretum?** Describe, as necessary. Please specify the intended use for the material you receive (molecular, propagation, herbarium, other (please describe)).

☒ Yes, check all that apply:

- ☒ fresh material; please describe: tree cores using an increment borer of 12" x 5.1mm.
- ☐ silica dried; please describe:
- ☐ vouchers of your plant collections; please describe:
- ☐ propagule type; please describe:
- ☐ other (describe):

**\*Please note the following coring requirements:**

- You may core each of the approved specimens twice, ca. 180 degrees from each other to capture variability.
- > Cores are to be taken as close to standard height (e.g., 1.35 m/4.5') as possible.
- > Try to keep core depth to 15 cm/6" or less; hopefully this allows capture of recent growth events and facilitate cross-dating.

**\*A collection form (SECTION C) will be provided in advance of your work. We ask that you fill out this form and return it electronically once you have collected all of your samples. Please note the following:**

- Height if it deviates from standard height Cardinal points for the two cores (we have hand-held compasses you can borrow)
- Notations/observations related to structural integrity-- sometimes the full or even partial core cannot be completed because the trunk is punky/hollow

**15. Does this project require arboretum staff to collect and ship tissue for molecular analyses or require you to voucher your plant collections?**

☐ Yes

**When shipping, the Arboretum prefers to use FedEx, UPS, and USPS as couriers whenever possible. \*Please note that all international shipments are sent via USPS.** Please confirm that the shipping address and contact telephone number are correct in question 5 above.

**Do you have an account number?**

- ☐ Yes, please provide:
- ☒ No, but we will ask to leave cores to air-dry, then pick them up to image at our lab at UBC.

**\*If making a request for shipments, please list any import requirements below.** It is the responsibility of all scholars requesting material to first investigate their own specific import requirements and supply the Arboretum with instructions and documents as needed well in advance of the request date.

**16.. Will you conduct environmental sampling or monitoring?**

☐ Yes, please describe:

Please attach a full schematic of device(s), if any, which you would like to deploy in the landscape to this proposal:

**17. Will you require landscape areas/plants to be managed in a particular way?** Please know that horticultural and landscape needs and requirements determine whether a request is fulfilled.

☐ Yes, please describe:

**18. Will you require specialized assistance from Arboretum staff or access to equipment?**

☐ Yes, please describe:

**19. Can any products of this proposed project result in commercialization? Are there any intentions to do so? Please describe.**

No.