Aliwen

Figure 1. Compound images of an anatomical section of a growth ring in formation (Cordillera Cypress, San-Carlos de Bariloche, 17/01/2019) observed under light microscopy (objective x20) and showing all the stages of cell differentiation. A. Composite image made in white light and providing a detailed view of the observed radial file. B. Composite image providing an overview of the section in white light. C. Compound image providing a detailed view of the observed radial file in polarised light. D. Composite image providing an overview of the slice in polarised light. A & C. Tracheids were classified according to their stage of differentiation, green dots mark cambium cells, blue dots mark enlarging cells, red dots mark thickening cells, purple dots mark mature cells and brown dots mark ring cells formed the previous year.

Impact of environmental and developmental conditions on wood formation dynamics of cordilleran cypress, an endemic tree species of Patagonia threatened by global change

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LabEx partners: SilvaTech

Collaborations:

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Action thématique concernée : WP2

***Context** —*
The Cordilleran cypress is a conifer species native to Patagonia that grows over a wide geographical range. However, Patagonia is affected by both strong climate warming (mainly caused by the effect of the ozone hole on the regional climate) and by a significant reduction in the amount of annual precipitation. These disturbances affect the Cordillera cypress forests, which show high mortality and dieback throughout their range.

Objectives —
In the Aliwen project, we are monitoring the xylogenesis of Cordilleran cypress in order to better assess its sensitivity and to detect the first signs of decline. In particular, we address the influence of environmental conditions (mesic vs xeric sites), climatic variations (dry vs wet growing years) and individual development (male vs female trees) on wood formation dynamics as well as on tree-ring structure and wood functions. The project aims to understand the adaptation of wood formation to water stress in a cold environment. These results will contribute to a better understanding of the mechanisms of drought-induced mortality.

Approaches —
During four growing seasons, from 2018 to 2022, we collected microcores weekly from dominant and healthy trees in a closed, mixed and irregular Cordilleran cypress forest growing on a hill near San Carlos de Bariloche (Patagonia, Argentina). Each year, we selected about 20 cypress trees, divided between males and females and between mesic and xeric plots. In addition, the climatic conditions of the 2021-2022 growing season were particularly hot and dry compared to previous years. A total of 1,724 microcores were collected during the four growing seasons; 1,115 have already been processed in the laboratory to make anatomical sections and the remaining 609 are currently being processed. The 324 anatomical sections from the first growing season have been used to produce digital images on which we are analysing wood formation (Figure 1).

Key results —
Our preliminary investigations have demonstrated the feasibility of the project. The processing of the microcores has not posed any particular problem and the anatomical sections are very good. This will allow us to acquire data of excellent quality. Data analysis has not yet started, but the sampling plan should allow us to use our data to answer three main questions:
- Do male trees have different wood formation dynamics than female trees?
- Do trees at the xeric site have different wood formation dynamics than trees at the mesic site?
- How are the dynamics of wood formation in dry years different from those in wet years?

Main conclusions including key points of discussion —
A synthesis of the previous questions should allow us to evaluate the sensitivity of the growth of the Cordilleran cypress to drought and to better understand the current dieback.

Perspectives —
The quality of the anatomical sections could allow us to follow the dynamics of phloem formation, in addition to the dynamics of xylem formation, which was not initially planned in the project but is very interesting.

Valorization —
- A long M1 internship (April to August 2023);
- A presentation by Anne-Sophie sergent in an international scientific conference;
- A scientific article in preparation.

Leveraging effect of the project —
Thanks to our work on the Aliwen project and its integration into the NetForSur network, we are in contact with Chilean colleagues (Universidad Mayor y Universidad Católica de Valparaiso) who are starting a study on the formation of wood of several Mediterranean species in Chile and who will come to process their samples in the laboratory in May 2023. Moreover, the Aliwen project contributes to the influence of the LIA FORESTIA (INRAE, INTA, UNAH) in the framework of which Annabel Porté (INRAE Bordeaux) is setting up an ANR project (letter of intent accepted, final proposal under development) which should enable us to continue the research initiated in the Aliwen project.