Aliwen

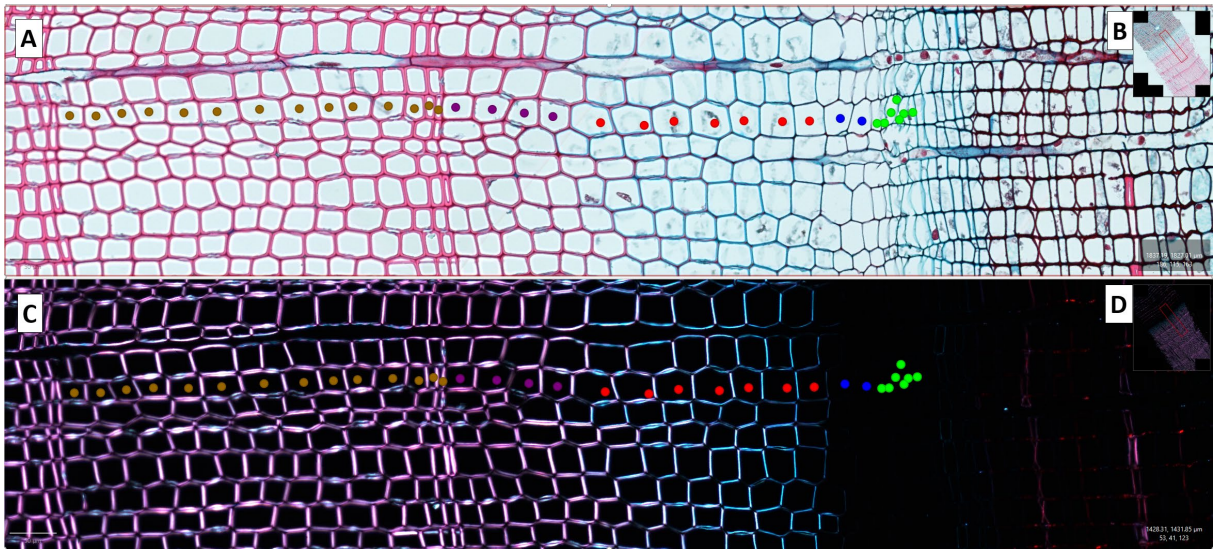

Figure 1. *Compound images of an anatomical section of a growth ring in formation (Cordillera Cypress, San-Carlos de Bariloche, 17/01/2019) observed under light microscopy (objective x20) and showing all the stages of cell differentiation. A. Composite image made in white light and providing a detailed 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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Thematic action concerned: WP2

Context —
The Cordilleran cypress (*Austrocedrus chilensis*) is a species of conifer native to Patagonia that grows over a wide geographical range. However, Patagonia is being affected by both strong global warming (accentuated by the effect of the ozone hole on the regional climate) and a significant reduction in the amount of annual rainfall. These disruptions are affecting the cypress forests of the Cordillera, with dieback and high mortality rates throughout their range.

Objectives — In the Aliwen project, we are monitoring the xylogenesis of Cordilleran cypress in order to better assess its sensitivity to climate and detect the first signs of decline. In particular, we are looking at the influence of environmental conditions (mesic vs. xeric sites), climatic variations (dry vs. wet growing years) and individual development (male vs. female trees) on the dynamics of wood formation, ring structure and wood functions.

The aim of the project is to understand how wood formation adapts to water stress in a continental environment. These results will contribute to a better understanding of drought-induced mortality mechanisms.

Approaches —
For four southern growing seasons, from 2018 to 2022, we took weekly microcores from dominant, healthy trees in a closed, mixed and irregular Cordillera cypress forest growing on a hill near San Carlos de Bariloche (Patagonia, Argentina). Each year, we selected around twenty cypress trees, divided between males and females and between mesic and xeric plots. In addition, climatic conditions during the 2021-2022 growing season were particularly hot and dry compared with previous years. A total of 1,724 microcores were collected over the four growing seasons, all of which were processed in the laboratory to make anatomical sections and used to produce digital images on which to analyse wood formation (Figure 1). Only the first year was analysed in this project, in line with the initial ambitions.

Key results —
Processing the microcores posed no particular problems, and the anatomical sections were very good. Analyses of the first year of monitoring showed that:

- Males produce twice as many wood cells as females;
- They have a 40% longer growth period;
- And they have a faster rate of cell production.

Main conclusions including key points of discussion —
The difference in growth dynamics between males and females helps to explain the greater sensitivity of females to climate change, as their shorter growth period, centred on the austral summer, is more likely to be affected by drought. This difference between males and females could be explained by their preferential allocation of resources to reproduction rather than wood growth.

Perspectives —
The continuation of this work and the analysis of the next three years of monitoring are necessary to clarify the influence of climatic and environmental conditions on the xylogenesis of the species and to answer our other scientific questions:

- Do trees in the xeric station have different wood formation dynamics to trees in the mesic station?
- How do the dynamics of wood formation in dry years differ from those in wet years?

Valorization —
The project is still being developed, but here are the highlights so far:

- A long M1 internship (April to August 2023);
- A presentation by Anne-Sophie Sergent at 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 wood formation of several Mediterranean species in Chile and who have come to process their samples in the laboratory in May 2023. In addition, the Aliwen project is contributing to the influence of the LIA FORESTIA (INRAE, INTA, UNAH, COLPOS), under which Annabel Porté (INRAE Bordeaux) is putting together an ANR project that should enable us to continue the research initiated in the Aliwen project. In the short term, we are pleased to be able to count on the support of the ARTEMIS program, which will fund the continuation of this work through the Lahuan project (which will fund an M2 to continue the observations and analyses).