



Using wood-anatomical traits to clarify *Araucaria araucana* decline in Northern Patagonia

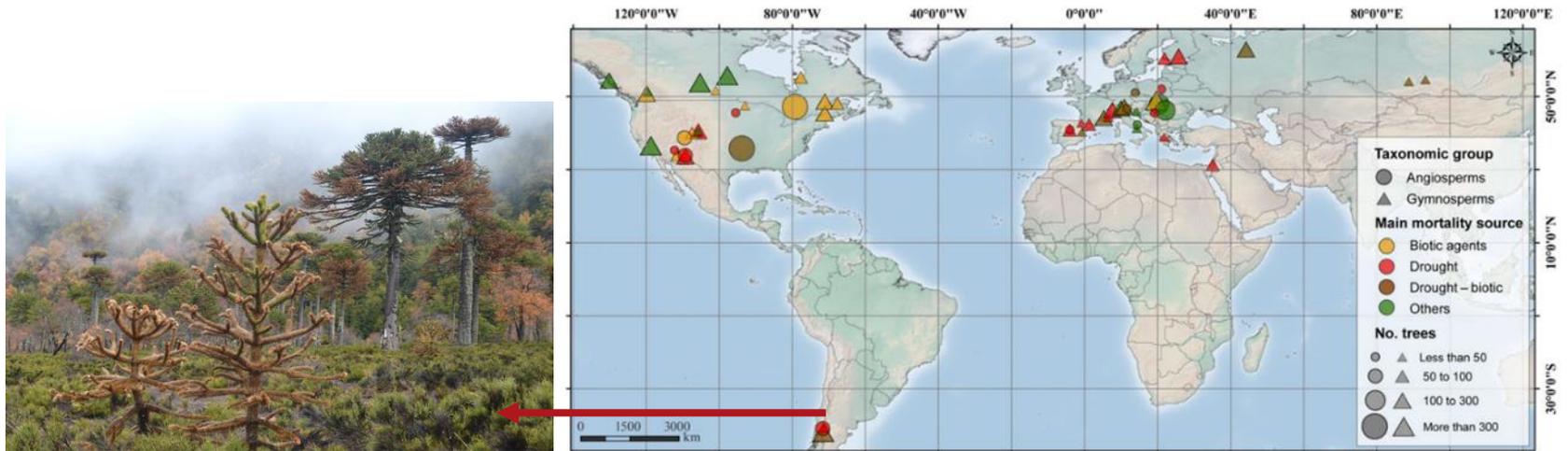
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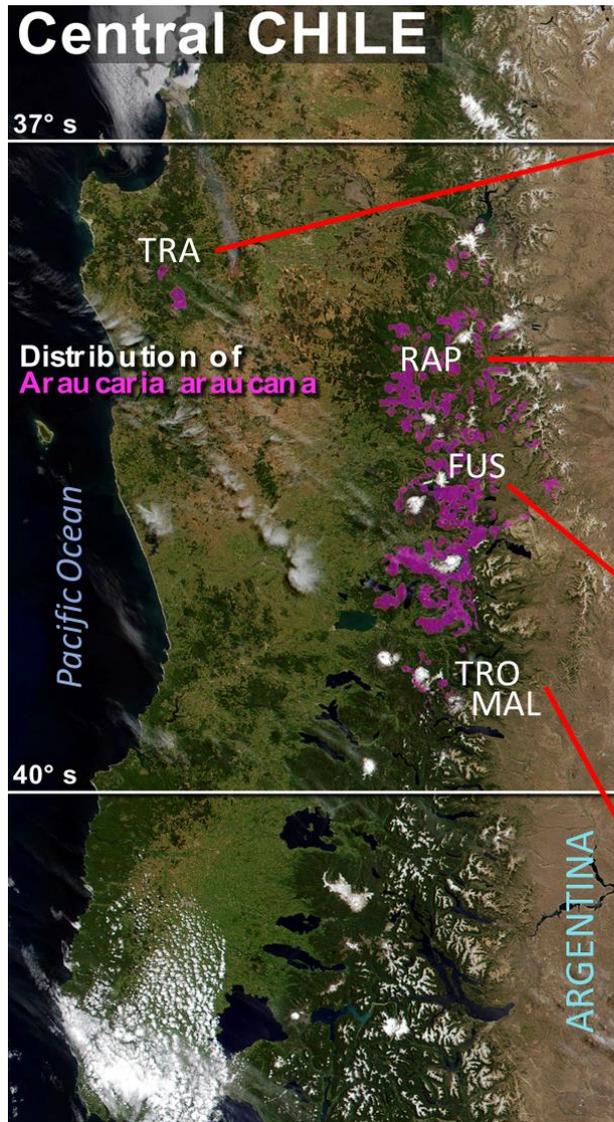
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Executive Summary

Araucaria araucana is an endemic species of the temperate rainforest in Chile and Argentina, declared a natural monument in 1990 and classified as Endangered by the IUCN in 2013. In recent years mega-drought and warming have been inducing decline and mortality phenomena in many stands. These enduring extreme conditions are challenging the potential of these ecosystems to recover. The aim of this research is to determine the effective drivers of tree decline by applying cutting edge techniques and analyzing wood-anatomical traits (tracheid size and cell wall thickness) in *A. araucana* trees across its natural distribution range.



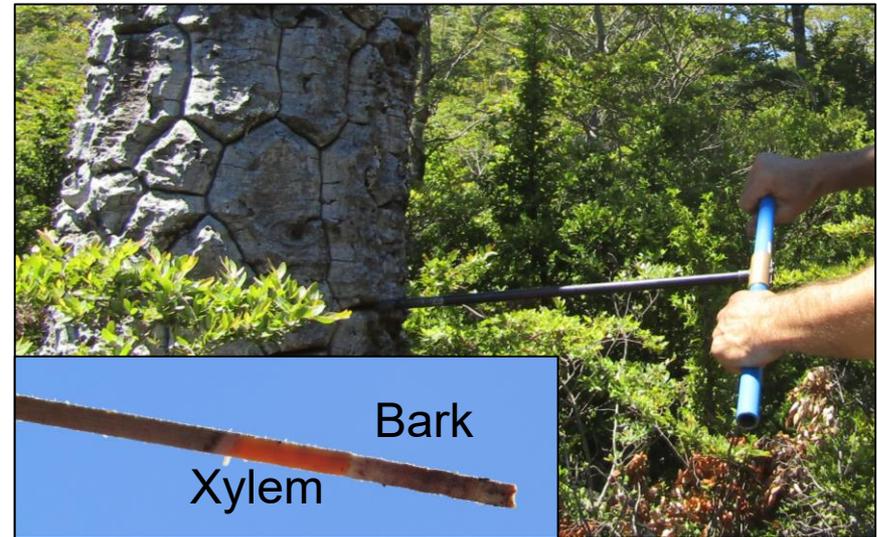
Location of *Araucaria Araucana* study sites in northern Patagonia.



Field sampling was performed in January of 2019 in five sites of *Araucaria araucana* stands with declining conditions, such as: branch dieback, discoloration of leaves, necrotic leaf symptoms, discoloration; at the tree-line in the Coastal and Andes Mountain range in Chile and Argentina. The five sites run along all the distribution of *Araucaria* in Chile and Argentina, which in the last decades have been affected by extreme drought conditions.

Data collection

- ❖ 20 cores per site
(10 non decline & 10 decline trees)
- ❖ 5 mm and 12 mm diameter.



Healthy



Decline

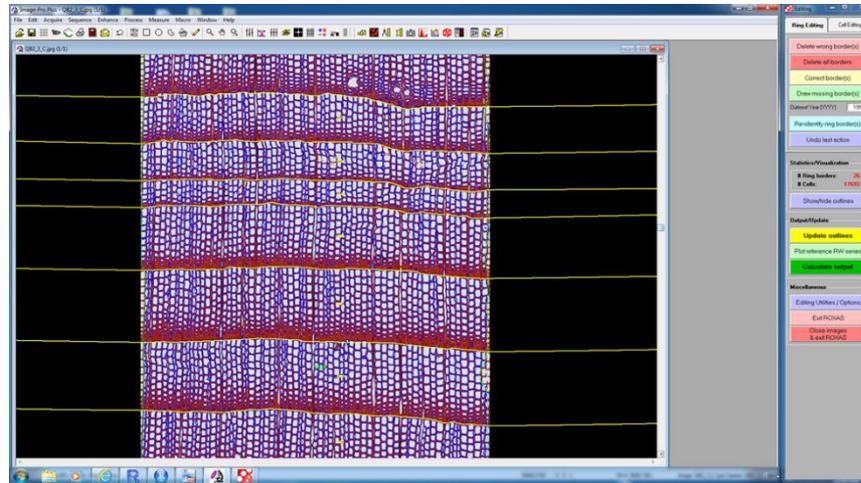
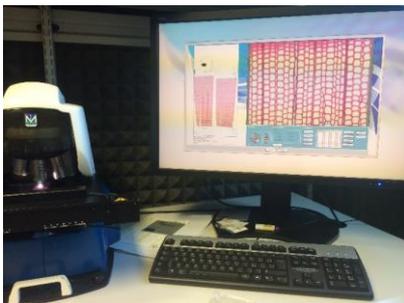
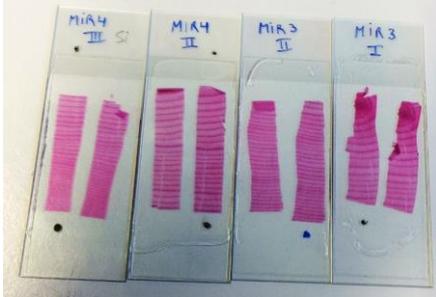


Non-declining trees were considered with <50% of defoliation damage and trees with >50% will considered as declining

Sample preparation



Measure and cross-date tree rings
Cut cores in small pieces (3-5 cm)
Boiled → microtome cuts (10 μm)
→ stain (safranin, astrablue) → slide fixed (permanent slide)
Scan



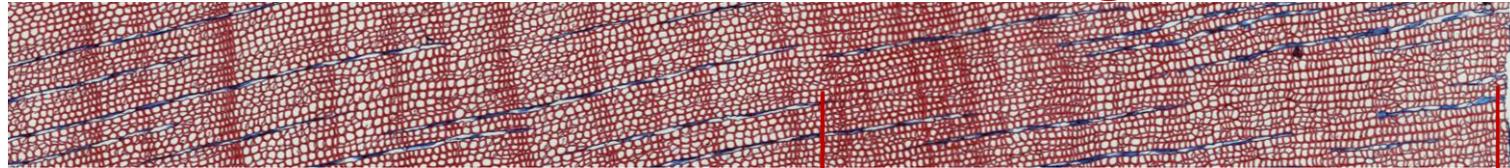
ROXAS (processing data)

Measure: TRW, CN, LA, CWT, Parenchyma ray, and cell relative position in the ring



PRELIMINARY RESULTS

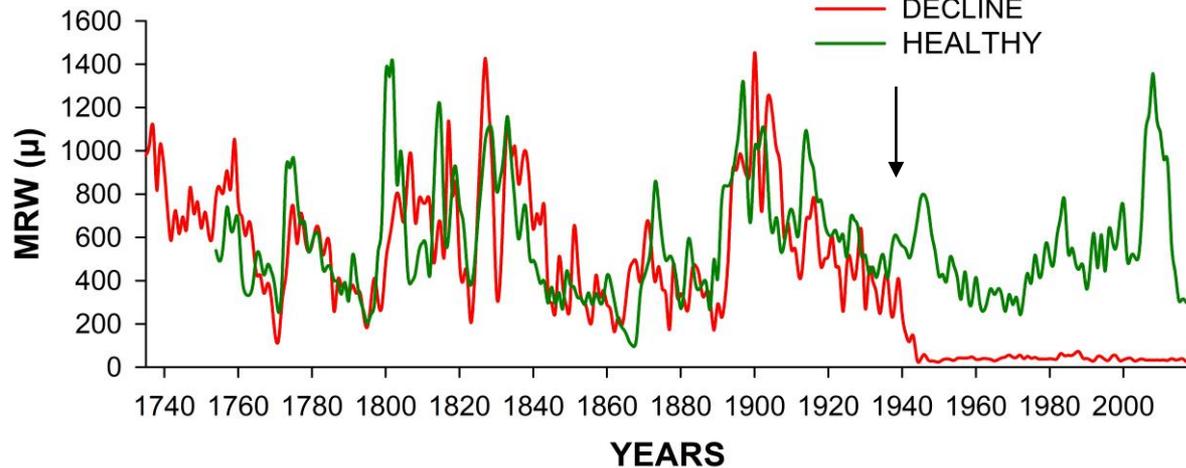
Araucaria araucana tree rings comparison between decline and healthy in the last 280 years in Trongol Alto at the Chilean Coastal Range



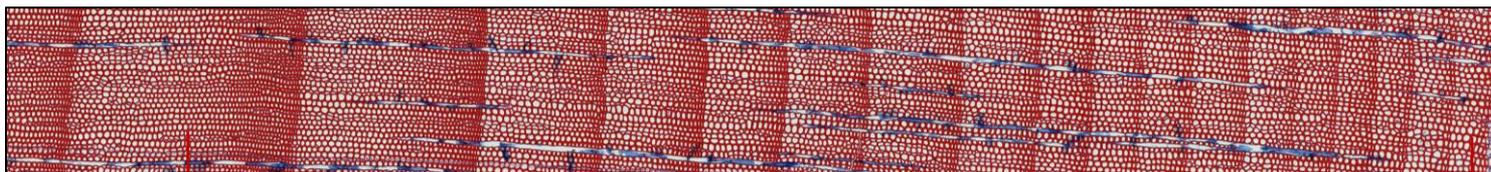
Decline

1940

2017



Araucaria araucana declining tree showed a drastic decreased on its growth since 1940 (red line). Instead, healthy tree (green line) showed a stable growth pattern until 2017 (last ring measured). This indicate that the declining tree started to produce narrower rings 77 years ago.

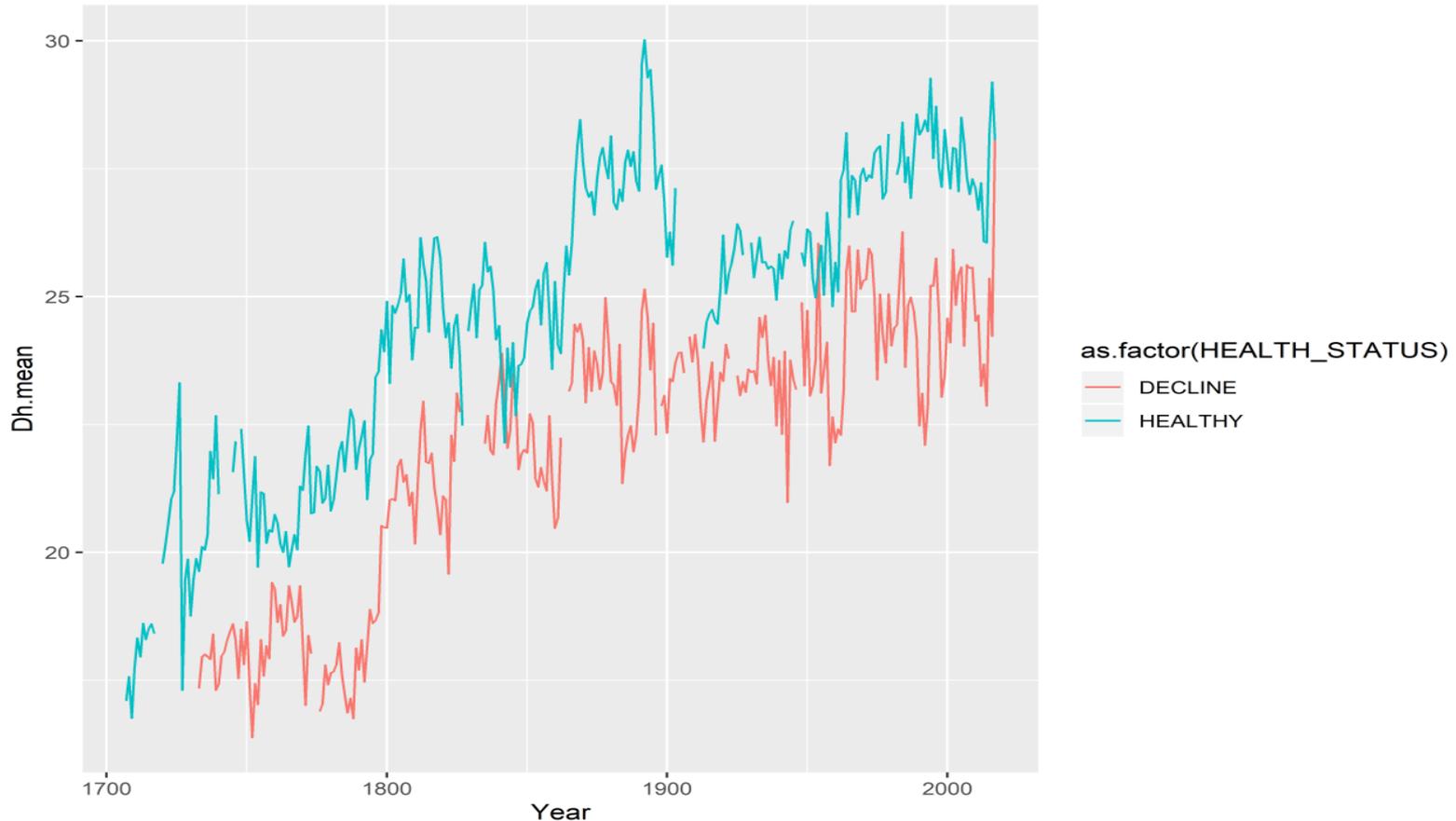


Healthy

2000

2017

***Araucaria araucana* hydraulic diameter (water transport) comparison between decline and healthy trees at the Chilean**



Declining trees showed smaller hydraulic diameter (Dh) i.e. water transport capacity in the 280 years analyzed, in comparison with healthy trees. The smaller hydraulic diameter in the decline trees could indicate they are more susceptible to a hydraulic failure, i.e. to xylem embolism due to extreme drought conditions or prolonged droughts.