

# **Environmental controls and patterns of cumulative radial increment of evergreen tree species in montane, temperate rainforests of Chiloé Island, southern Chile**

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## **Abstract**

We investigated the local environmental controls on daily fluctuations of cumulative radial increment and cambial hydration of three dominant, evergreen tree species from montane, Coastal rainforests of Chiloé Island, Chile ( $42^{\circ} 22' S$ ). During 2 years (1997–1998 and 1998–1999) we recorded hourly cumulative radial increments using electronic band dendrometers in the long-lived conifer *Fitzroya cupressoides* (Cupressaceae), the evergreen broad-leaved *Nothofagus nitida* (Nothofagaceae), and the narrow-leaved conifer *Podocarpus nubigena* (Podocarpaceae). We also measured soil and cambial tissue hydration using capacitance sensors, together with air and soil temperature and rainfall during the period of the study. In addition, we collected cores of these tree species to evaluate how dendrometer measurements reflect annual tree ring width. One-year long daily time series of cumulative radial increments suggests that radial growth of *Fitzroya cupressoides* was initiated slowly in early spring, with a maximum in early summer. Multiple regressions showed positive relations between daily precipitation and radial index (i.e. the difference in cumulative radial increment of two consecutive days) in the three species. According to path analysis there was a significant direct effect of changes in tree hydration on radial index of the three focal species. In emergent, pioneer species such as *Nothofagus* and *Fitzroya*, radial index was negatively affected by changes in maximum air temperature and photosynthetically active radiation, probably because of high evapotranspiration demand on warm sunny days. The shade-tolerant species *Podocarpus nubigena* was positively affected by photosynthetically active radiation. Our diel scale findings support the use of tree ring widths for reconstructing past climate in these southern temperate forests and provide evidence that rainforest trees may be highly sensitive to future declines in rainfall and temperature increases during summer.

**Keywords:** Band dendrometer, environmental variables, *Fitzroya cupressoides*, *Nothofagus nitida*, *Podocarpus nubigena*, radial increment, tree hydration.