

Early arboreal colonization, postglacial resilience of deciduous *Nothofagus* forests, and the Southern Westerly Wind influence in central-east Andean Patagonia

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The history and dynamics of deciduous *Nothofagus* forests along the eastern slopes of the central Patagonian Andes (44°-49°S) remain insufficiently studied and understood, particularly at timescales ranging from centuries to millennia. Available fossil pollen records point to time-transgressive responses of the arboreal vegetation to climatic changes during the Last Glacial Termination (T1) and early Holocene, and spatial heterogeneity since then along north-south, east-west, and elevation transects. The degree to which these results represent biogeographic and climatic trends, varying environmental gradients, or site-specific phenomena has not been assessed in detail. Here we present a fossil pollen and macroscopic charcoal record from Lago Churrasco (45°41'S, 71°49'W), a small closed-basin lake located in the deciduous *Nothofagus* forest zone of the central-east Andes of Chilean Patagonia. Our results suggest that *Nothofagus* trees colonized newly deglaciated terrains at ~16,000 cal yr BP and formed scrublands/woodlands several millennia earlier than reported by previous studies east of the Andes. This suggests expansion and local densification of tree populations sourced from the eastern margin of the Patagonian Ice Sheet during the Last Glacial Maximum, with the additional implication that temperature and precipitation conditions favorable for tree survival and reproduction developed early during T1. We posit that the amount of moisture delivered by the Southern Westerly Winds was not a limiting factor for arboreal expansion during T1 in this sector of the central Patagonian Andes. Closed-canopy *Nothofagus* forests established at ~10,000 cal yr BP and have remained essentially invariant despite climate change and natural disturbance regimes. This resilience was challenged and exceeded by human

disturbance during the 20th century through the use of fire, leading to deforestation and spread of invasive exotic species in an extraordinarily rapid event. Our record suggests a permanent influence of the Southern Westerly Winds over the last 10,000 years, with relatively modest variations at centennial and millennial timescales.