Living on the edge: the effects of long-term climate change and fire activity on the remnant cool temperate rainforests of Tasmania (Australia)

Michela Mariani*†[1,2], Michael-Shawn Fletcher[2], Simon Haberle[3], Jay Chin[3], Geraldine Jacobsen[4], and Atun Zawadzki[4]

[1]University of Nottingham, UK (UON) – University of NottinghamUniversity ParkNottinghamNG7 2RD, United Kingdom

[2]University of Melbourne – Parkville VIC 3010, Australia

[3]Australian National University (ANU) – The Australian National University Canberra ACT 0200 Australia, Australia

[4]Australian Nuclear Science and Technology Organisation [Australie] (ANSTO) – New Illawarra Rd, NSW, Australia

Abstract

In a world where ecosystems are threatened by climate change, environmental disasters, and human disturbances, acquiring information about past environmental change and species responses is crucial to develop meaningful conservation plans. Wildfires are one of the major ecosystem disturbances worldwide and are projected to increase under the future climate change scenarios, especially in temperate regions. In this context, wildfires threaten the remnant patches of Gondwana-linked temperate forests of the island of Tasmania, Australia. A case in point are Tasmanian montane rainforests, which form at high elevation (ca. 700-1000 m a.s.l.) and are dominated by endemic tree species, such as the UNESCO heritage-listed trees *Athrotaxis cupressoides*, *A. selaginoides* and *Nothofagus gunnii*. These tree species display several life history attributes that suggest they are poorly adapted to disturbance by fire, including poor seed dispersal, slow growth to maturation and high stand mortality. Montane rainforest communities have suffered major fire-driven landscape-scale losses over the last 200 years and today cover less than 5% of the Tasmanian landscape. To date, these populations have not shown post-fire recovery and it is still unclear whether this loss of resilience is the result of 1) an insufficiently long fire return intervals or 2) climate change is now precluding the recovery of these species to fire disturbance. Here, we use species distribution modelling and palaeoecology to assess and test the influence of long-term climate change on the resilience to fire of the endangered temperate montane rainforests of Tasmania. Thanks to our long-term approach, we managed to distinguish high resilience locations, where montane rainforest was able to withstand past fire disturbance through a phase of dry climatic conditions. Our study indicates that climatic change between 3000 and 4000 cal yr BP drove a disequilibrium between montane rainforest and climate across much of the range of this vegetation type. Current and future climate change are likely to shift the climatic envelope of this plant community further, suggesting that current high resilience locations may face a reduction in resilience.

*Speaker

†Corresponding author: michela.mariani@unimelb.edu.au

Keywords: resilience, montane rainforest, Tasmania, Australia, climate change