Impact of Holocene land use and climate change upon Brazil's Atlantic Forest biodiversity hotspot

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Brazil's tropical Atlantic Forest (AF) is exceptionally biodiverse and critically endangered due to centuries of deforestation, with less than 20% of its original forest cover remaining. Although less famous than its Amazon cousin, its designation as a global 'Biodiversity Hotspot' highlights its global importance and conservation priority. A key challenge for conservationists is how best to maintain AF ecosystem functioning and biodiversity in the future, in the face of increasing fire, drought, and deforestation (Wilson *et al.* 2019, 2021).

This project can help address this challenge by providing insights into long-term resilience, tipping points, and environmental sustainability via palaeoecology coupled with modelling. It focuses on the southern portion of the AF, spanning coastal tropical rainforest and upland forest dominated by 'Parana pine'. This iconic pine is a 'living fossil' which has been a key food source – both for dinosaurs during the Jurassic as well as humans over recent millennia.

The overarching **aim of this PhD project** is to determine how ancient human societies and climate change have shaped the biodiversity, land cover, and fire regime of the southern AF through the Holocene – the last 12,000 years. To achieve this aim, a **novel inter-disciplinary approach** will be undertaken: 1. Lab-based analysis of fossil pollen and charcoal from bog sediments to reconstruct Holocene vegetation and fire history; 2. Agent-based modelling (ABM) to quantify pre-Columbian land-use impacts; 3. Correlation with existing palaeoclimate and archaeological data to determine Holocene human-climate-environment relationships.

Training opportunities:
Mayle and Singarayer will provide training in palaeoecology and ABM, respectively, while Iriarte will provide training on integration with archaeological data. Further training on ABM, radiocarbon dating, and Itrax XRF core scanning will be provided via short courses at Oxford, Southampton, and Italy. Sediment cores have already been collected, so fieldwork is not essential, but there will be opportunities to visit the study area.

Student profile: At least a 2.1 BSc degree is required in either biology, geography, environmental science, or related subject. A strong background in numerical/statistical techniques is essential. Knowledge of ecology, biogeography, palaeoecology, pollen microscopy and modelling would be advantageous.

References: Wilson, O. J., Mayle, F. E. , Walters, R. J., et al. (2021) Floristic change in Brazil's southern Atlantic Forest biodiversity hotspot: from the Last Glacial Maximum to the late 21st Century. *Quaternary Science Reviews*, **264**, 107005. Wilson, O. J., Walters, R. J., Mayle, F. E., et al. (2019) Cold spot microrefugia hold the key to survival for Brazil's critically endangered Araucaria tree. *Global Change Biology*, **25 (12)**, 4339-4251.

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