Biodiversity dynamics after human arrival on islands: are islands at an ecological crossroad?

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Abstract

Human activities are increasingly dominating ecological systems and are often considered the main drivers for ecosystems change. The need to quantity the speed of human impacts in ecosystem dynamics have caused a controversial debate on natural baselines and the start of the Anthropocene. However, it is now increasingly evident that hardly any "natural" baselines are available for timescales with sufficient available data (e.g. thousands of years). Oceanic islands are rare exceptions, many of which have been sheltered from human impacts due to their isolation from the continent. Oceanic islands thus provide repeated, complex systems with an excellent opportunity to quantify the direct effect of human impacts after their arrival on the islands (pre-human baseline) on the local vegetation. Here, we tackle this challenge using palaeoecological datasets of fossil pollen time-series covering the past 5000 years. We gathered these datasets from Neotoma database and other published sources. We selected oceanic islands that together covered large gradients of: latitude, elevation, size, distance from continent, and human arrival times. We calculated a "system state metric"

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using the pollen time series and a combination of Bray Curtis similarity analysis and ordination analysis (NMDS). We also applied a breaking point analysis to calculate whether the vegetation composition changed abruptly or otherwise followed a constant transformation over time. Preliminary results, showed that in many islands there is a vegetational compositional change that seems to start around human arrivals. However, we found that in other islands major vegetation changes may happen without human presence on the island. These independent records on multiple island ecosystems will inform a novel model framework to simultaneously quantify ecosystem dynamics and structure prior to human arrival (and its associated impacts), and also those that occurred after human arrival; this will allow identifying the main changes that humans have caused in island ecosystem processes.

Keywords: Holocene, Oceanic Islands, Palaeoecology, pollen records