

Fire and land cover change during the Maori colonization of New Zealand: Hypothesis testing with model simulations and charcoal data

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The arrival of the Maori in New Zealand around 1280 CE was followed by widespread, rapid changes in flora and fauna, including deforestation and extinction of many endemic species. The emerging consensus is that a small number of Maori, through their extensive application of fire, were able to permanently change land cover over large regions quickly. There is no direct proof of this human impact, however. While the sedimentary charcoal record provides evidence of the timing and magnitude of fire in New Zealand, the record is spatially patchy. To overcome the limitations of point-based observations and test hypotheses on the number of people, climate, and vegetation that could have led to the transformation of New Zealand's land cover, I apply a numerical model of human-environment interactions that simulates wildfire, including human and natural ignitions and impacts on vegetation. My simulations show that small numbers of highly mobile hunter gatherers, using fire to improve their mobility and hunting and foraging opportunities, could have had a large impact on the vegetation. Following an initial peak in fire for deforestation, a small increase in background fire frequency could have prevented forest vegetation from regenerating because of changes in the structure of the vegetation; mainly an increase in herbaceous fuels. My simulations also show that both the rate of deforestation and lack of recovery are sensitive to climate, and suggest that it may have taken a "perfect storm" of both human agency and the Medieval Climate Anomaly to lead to the rapid and permanent deforestation of New Zealand.