Complex causes of Australian megafauna extinctions during the Late Pleistocene

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The causes and mechanisms of megafauna extinctions during the Late Pleistocene are hotly debated because robust data are rare, and inferences are often biased owing to differential preservation of older evidence. Many mechanisms have been proposed to explain the causes of megafauna extinctions: (i) changes in climate conditions increasingly restricting habitats suitable for species; (ii) humans as a 'new and efficient big predator' dramatically impacting megafauna naïve to human hunting; (iii) a possible combination of human hunting pressure on populations already compromised by climate-driven environmental changes (or vice versa). Most contributions rely on chronological analyses, where the timing of both megafauna extinctions and the initial arrival of humans (associated with the age of the last and first fossil records and archaeological evidence, respectively) are compared to the reconstruction of climate variation at these times. Recent continental-scale modelling discarded climate variability and aridity as the main drivers of megafauna extinctions. However, such approaches have been criticised because they disregard spatial variation in extinction patterns, human colonisation trajectories, and palaeoclimate change. We combined a new statistical approach to infer the regional timing of megafauna extirpation and first human colonisation compared with palaeoclimate change simulated across south-eastern Australia over the last 120,000 years. We show that > 80% of regional megafauna extirpations were likely driven by a combination of human pressure and increasing aridity. These results provide new insights into how synergies between human pressure and past climate conditions profoundly affected the ecosystems of south-eastern Australia during the Late Pleistocene.