



Reply to Lima-Ribeiro et al.: Human arrival scenarios have little influence on interpretations of late Quaternary extinctions

In a recent study (1), we analyzed the pattern of late Quaternary megafaunal extinctions in relation to changes in global climate and the timing of human arrival on different landmasses. Lima-Ribeiro et al. (2) write that some of the human arrival scenarios we considered are more plausible than others and that this affects the interpretation of our analysis. We incorporated a wide range of human arrival scenarios to allow precisely this sort of analysis, and we therefore welcome this contribution.

To clarify, we considered 32 human arrival scenarios not to imply that they are all equally plausible, but rather to cover the full range of dates suggested in the literature (tables 1 and S5 of ref. 1). Our intention was not to weigh in on the debates about the timing of human arrival in different landmasses, but rather to see how far uncertainty about human arrival dates would impact the conclusions of our analysis.

Lima-Ribeiro et al. (2) found that, for North and South America, human-only models had a slightly higher mean R^2 than climate-only models if humans are assumed to have arrived 20 to 10 kya in both landmasses, and that the opposite was true if humans are taken to have arrived 30 to 20 kya in North America and 10 to 0 kya in South America. Although significant, the effect size is small (and in Eurasia and Australia, our different arrival scenarios have no such effects): for every scenario listed in their figure 1 (2), the proportion of R^2 explained by human-only and climate-only models (squares and circles,

respectively) is approximately the same. Although they claim that these differences lead to “strikingly different conclusions about the role of each in the late Quaternary extinctions,” their figure 1 (2) shows that human- and climate-only models have approximately the same explanatory power across all human arrival scenarios.

The paucity of data available for some taxa and regions meant that we had to sacrifice some temporal and spatial resolution to achieve near-global coverage. As better data become available, it should be possible to eliminate some of the uncertainty surrounding human arrival and megafaunal extinction dates and improve the spatial and temporal resolution of these analyses. We agree with the authors that the details of the results will differ among human arrival scenarios, but we disagree with their assessment of the strength of the effect: from their analyses, it seems that the same broad patterns (with climate and humans both affecting the pattern of extinctions) are seen across all human arrival scenarios.

Graham W. Prescott^{a,1,2}, David R. Williams^{a,1,2}, Andrew Balmford^a, Rhys E. Green^{a,b} and Andrea Manica^a

^aDepartment of Zoology, University of Cambridge, Cambridge CB2 3EJ, United Kingdom; and ^bRoyal Society for the Protection of Birds, Sandy SG19 2DL, United Kingdom

1. Prescott GW, Williams DR, Balmford A, Green RE, Manica A (2012) Quantitative global analysis of the role of climate and people in explaining late Quaternary megafaunal extinctions. *Proc Natl Acad Sci USA* 109:4527–4531.
2. Lima-Ribeiro MdS, et al. (2012) Human arrival scenarios have a strong influence on interpretations of the late Quaternary extinctions. *Proc Natl Acad Sci USA* 109: E2409–E2410.

Author contributions: G.W.P., D.R.W., A.B., R.E.G., and A.M. wrote the paper.

The authors declare no conflict of interest.

¹G.W.P. and D.R.W. contributed equally to this work.

²To whom correspondence may be addressed. E-mail: davidrwilliams87@gmail.com or grahamprescott@gmail.com.