Thermoregulatory traits combine with range shifts to alter the future of montane ant assemblages

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Predicting and understanding the biological response to future climate change is a pressing challenge for humanity. In the 21st century, many species will move into higher latitudes and higher elevations as the climate warms. In addition, the relative abundances of species within local assemblages are likely to change. Both effects have implications for how ecosystems function. Few biodiversity forecasts, however, take account of both shifting ranges and changing abundances. We provide a novel analysis predicting the potential changes to assemblage-level relative abundances in the 21st century. We use an established relationship linking ant abundance and their colour and size traits to temperature and UV-B to predict future abundance changes. We also predict future temperature driven range shifts and use these to alter the available species pool for our trait-mediated abundance predictions. We do this across three continents under a low greenhouse gas emissions scenario (RCP2.6) and a business-as-usual scenario (RCP8.5). Under RCP2.6, predicted changes to ant assemblages by 2100 are moderate. On average, species richness will increase by 26%, while species composition and relative abundance structure will be 26% and 30% different, respectively, compared with modern assemblages. Under RCP8.5, however, highland assemblages face almost a tripling of species richness and compositional and relative abundance changes of 66% and 77%. Critically, we predict that future assemblages could be reorganized in terms of which species are common and which are rare: future highland assemblages will not simply comprise upslope shifts of modern lowland assemblages. These forecasts reveal the potential for radical change to montane ant assemblages by the end of the 21st century if temperature increases continue. Our results highlight the importance of incorporating trait-environment relationships into future biodiversity predictions. Looking forward, the major challenge is to understand how ecosystem processes will respond to compositional and relative abundance changes.Âl' 2019 John Wiley & Sons Ltd.
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