

# Predicting rank abundance distributions in woody plant communities under current and future climates

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At present, most biodiversity projections are based on simple species occurrence data. However, almost all communities contain many rare and few common species, resulting in the ubiquitous skewed species abundance distributions observed across most ecological communities on Earth. Ignoring species' abundances in predictive models can inflate the influence of rare species and affect estimates of important ecosystem processes and functions. Here we aim to predict the diversity and abundances of woody plant communities across south-eastern Queensland (SEQ), Australia, at a fine resolution. We modelled the joint distribution of the three components of rank abundance distributions (RADs)—abundance, richness and evenness—from existing survey sites and a suite of environmental covariates. We then predicted RADs at a one-hectare resolution under future climatic conditions. Our continuous projections of RADs across SEQ closely match observed patterns with high abundances in rainforest and shrubby-heath and lower abundances in eucalypt-dominated forests, particularly in areas burned repeatedly in recent decades. Richness is currently highest and evenness is lowest in subtropical rainforest. Under future climates we predict that RADs in some rainforest areas will become even more extreme, with increases in abundance and richness and corresponding decreases in evenness. Our results provide new insights about the drivers of current diversity and abundance patterns, and likely changes into the future. These RAD predictions will form the basis for future work linking changes in compositional diversity with changes in ecosystem structure and function.