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Woody-plant encroachment leads to widespread occupancy declines in southern Africa's birds

Woody-plant encroachment can act as an ecological filter for animal populations, through changes in habitat structure and landscape heterogeneity. These changes may impact biodiversity, species distributions and community assemblages. Wide-scale citizen science sampling efforts, such as the South African Bird Atlas Project (SABAP) improve our ability to look for widespread changes in population dynamics beyond the site or community scale. Here we aimed to identify 1) the responses of passerine birds to woody cover change, and 2) the importance of ecological strategies in driving these responses.

We used hierarchical multi-season occupancy models to analyse changes in bird occupancy over a ten-year period (2007-2016) in response to woody-plant encroachment. We fitted these occupancy models for each of 266 bird species across South Africa, Lesotho and eSwatini's grassland and savanna biomes, using SABAP2 observation data and remotely sensed woody cover change products. This led us to identify species that were either winners, losers or neutral in response to increased woody cover. We then tested for relationships between birds' occupancy response to increased woody cover and their ecological strategies.

We show that most birds (82%) in our analysis have a decreasing occupancy trend, with few showing increasing or stable population dynamics. 81 of 266 species (30%) showed a negative response to increased woody cover. Overall, 24% of the birds were classified as losers, where they have both a decreasing occupancy trend and a negative response to increased woody cover, with only 12 birds (5%) classified as winners. Importantly, both winners and losers showed large spatial variability in occupancy trends, with both increasing and decreasing occupancy across their distribution ranges. We found little evidence for ecological strategies driving the patterns in occupancy responses to increased woody cover, with only two ecological strategies, habitat breadth and clutch size, explaining a small amount of variability across the different bird species.

Our findings provide additional evidence for shifting animal distributions and occupancy changes due to woody-plant encroachment. With current woody cover change trends, we predict further occupancy declines across species with a preference for low woody cover and more specialized habitat requirements.