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How much does a tropical forest elevational gradient contribute to biodiversity? Insights from the ant communities of Mt. Wilhelm.

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Mountains increase the diversity and endemism of most taxa. Consequently, turnover of species is expected to be higher along elevational gradients compared to more uniform lowland areas of tropical forests. Arboreality hypothesis states that poikilothermous animals decline with elevation less steeply in higher (arboreal) strata than on the ground level of tropical forest. However, if this is valid for ants is not clear, as previous studies of tropical mountains focused on one stratum.

Mt. Wilhelm, the highest peak of Papua New Guinea of 4509 m above sea level (asl.), represents one of the last complete elevational forest transects with high-levels of biodiversity and pristine forests at all elevations. We studied species diversity and distribution of Mt. Wilhelm ant communities from 200 m a.s.l. up to the tree line at 3700 m asl., using a wide range of sampling techniques. The ants were sampled across different forest strata and at equally spaced elevational bands (500 m als. between sites) along the complete gradient (262 species in total).

We contrasted the species diversity patterns between all ants, ground-dwelling and vegetation-dwelling communities. The ants occurred up to 2700 m asl., with a general decline in their species richness and occurrence with elevation, and maximum diversity at 700 m asl. This pattern of low elevation plateau with mid peak was found for both ground and vegetation. Most species occurred in only one or two elevational sites and there was no difference in the mean elevational range between ground-nesting and arboreal-nesting species. Consequently, species turnover with elevation was high in both strata. A model based on species accumulation curves showed that Mt. Wilhelm gradient nearly doubles ant species richness, when compared to the same number of species occurrences sampled from the lowlands.

Our study demonstrates that the pristine rainforests of Mt. Wilhelm considerably boost species diversity, and as such they should be of high conservation priority. Furthermore, the results suggest that ground-dwelling and vegetation-dwelling ant communities change in rather similar way with increasing elevation despite their different species composition.