

No evidence that the orchid bee *Eulaema nigrata* is more abundant in more heterogeneous landscapes

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Introduction

Euglossine bees are important pollinators in the neotropics (Dressler 1982). Due to their diverse resource needs, including pollen, nectar, fragrances (males) and nesting resources (females), these bees have been proposed to have large home ranges incorporating multiple habitat types (Janzen 1982). This hypothesis yields the testable prediction that euglossine bees should be more frequently encountered in heterogeneous landscapes comprising variable habitat types. To test this prediction, we analyse data from baiting surveys of male *Eulaema nigrata* from the Brazilian Atlantic forest, a highly fragmented region. Specifically, we ask whether *El. nigrata* is more frequent in more heterogeneous landscapes after accounting for climatic factors.

Methods

The data comprise bee abundances and sampling effort for 178 baiting surveys conducted at 72 sampling sites. We also obtained climatic and land-use data from each sampling site. To test the hypothesis that *El. nigrata* are more frequent in more heterogeneous landscapes, we fitted a generalized linear model with negative binomial errors (accounting for overdispersion). To account for variation in sampling effort, we included sampling effort as a covariate. To account for climatic drivers unrelated to local land-use, we included annual precipitation and annual temperature as additional covariates. Thus, in R syntax, the model took the following form:

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y ~ land-use heterogeneity + sampling effort + climatic variables
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Results

The model linking bee abundance to land-use heterogeneity, sampling effort and climatic covariates (annual temperature, annual precipitation) explained 29.9% of the variance in bee abundances across the landscape (pseudo $r^2 = 0.299$, Table 1). Bee abundance did not depend detectably on local land-use heterogeneity (slope = 0.012 ± 0.26 log bees/S, Table 1, Figure 1) or annual temperature (slope = 0.005 ± 0.39 log bees/°C) but increased in drier parts of the study region (slope = -0.002 ± 0.0002 log bees/mm, Table 1, Figure 1). For example, the expected number of bees at a site with no land-use heterogeneity and an average annual precipitation of 1457 mm (SD = 409 mm) is 59 and would drop to 32 at a site with one standard deviation greater annual precipitation ($1457 + 409 = 1866$ mm).

Table 1. Parameter estimates from a generalized linear model with negative binomial errors. Land-use heterogeneity (S) is the Shannon diversity of land-use proportions surrounding each sampling site. Model is supported over a null model with only effort as a fixed effect ($\Delta\text{AIC} = 30.97$). Pseudo $r^2 = 29.9\%$.

Parameter	Estimate \pm SE
Intercept (log bees)	4.08 ± 0.24
Land-use heterogeneity (S)	0.012 ± 0.26
Effort (log hours)	0.38 ± 0.06
Mean annual temperature ($^{\circ}\text{C}$)	0.005 ± 0.039
Mean annual precipitation (mm)	-0.002 ± 0.0002

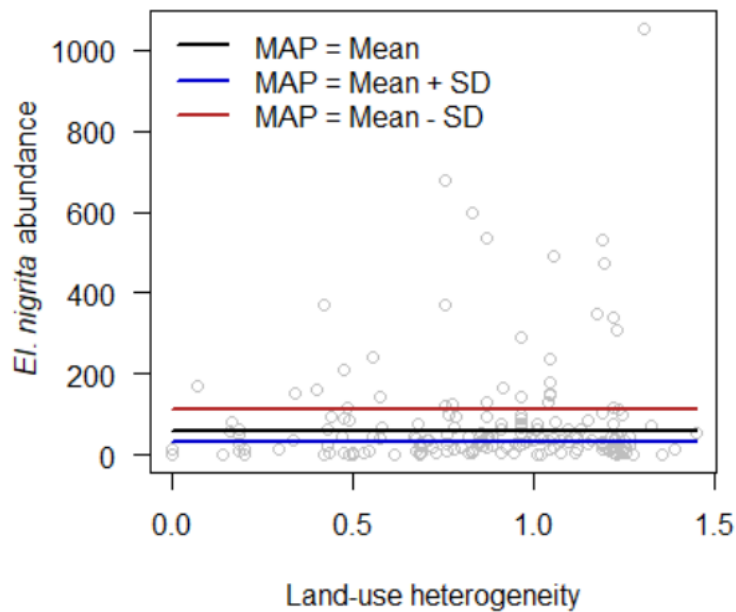


Figure 1. Joint effects of land-use heterogeneity (Shannon diversity of land-use classes) and mean annual precipitation on the number of *Eulaema nigrita* attracted to fragrance baits in the Brazilian Atlantic Forest.

Conclusions

Our analysis of data from baiting inventories yielded no support for the hypothesis that euglossine bees are more abundant in more heterogeneous landscapes. Instead, our focal species *Eulaema nigrita* was more common in drier parts of the study region. The lack of a detectable land-use effect may relate to the specifics of the study species' biology, because *Eulaema nigrita* is a rather generalist species associated with diverse habitats.

References

- Dressler, R.L. (1982) Biology of the orchid bees (Euglossini). *Annu. Rev. Ecol. Syst.* 13, 373–394.
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