**Assignment questions**

The temperature seasonality is calculated as a standard deviation as in an environment that is very seasonal, we can have a variation in the temperature that has different strengths. In this case, we focus on the standard deviation instead of the mean as this statistical measure informs us of variation. A greater standard deviation would mean that we have a stronger seasonality effect. We use the coefficient of variation in the case of precipitation seasonality instead of SD because we are also interested in the mean precipitation as both variation and value can affect species distributions. In this case, then we have a relative variation that also depends on the mean so when the mean is larger, we will have a smaller coefficient of variation. This comes as the SD can only inform in variation but can have similar values for different means.

**Scientific question**

We aim to understand the effect that a forest cover, combined with measures of precipitation such as the mean annual precipitation and the precipitation seasonality can have on the population distribution abundance of bee *Eulaema nigrita.*

**Methods**

To analyse the effect that forest cover, mean annual precipitation and precipitation seasonality have on the abundance of *Eulaema nigrita* we fitted our data to a GLM with the abundance of *Eulaema nigrita* as the response variable and forest cover, mean annual precipitation and precipitation seasonality as predictors. We fit our GLM with negative binomial errors given the strong overdispersion present in our data (Fig. 1) with the resulting model, as formulated in R:

**Results**

We analysed the data of 178 counting samples of *E. nigrita* in the Brazilian Atlantic forest where for each observation we had forest cover ranging from values between 0 to 1 as the proportion of the land covered by forest in the sampling sites. Mean annual precipitation ranged from 623 to 3073 (i.e. 4.93 times more mean annual precipitation in the site with more precipitation as compared to the one with the lowest precipitation) with a mean of 1457mm per year and precipitation seasonality varied between 10 and 92% with a mean of 50.42% revealing a strong variation in precipitation between our sampling sites. To start our analysis we confirm the overdispersion of the abundance data of *E. nigrita* across our samplings by the estimate of our fitted GLM, which fitted a low to provide more possible variation between the mean and variance of our model. (. An increase in forest cover appears to have a negative effect on the population abundance of *E. nigrita* with a decrease of 1.090 log population abundance percent of *E. nigrita* per one percent of forest cover increase (, Table 1, Fig. 2a). In the case of precipitation, we have a contrast of results where increasing mean annual precipitation (MAP) has a negative effect on population abundance of *E. nigrita* with a decrease of -0.001 log abundance percent per one percent of mean annual precipitation increase (, Table 1, Fig. 2b). On the other side, precipitation seasonality has a positive effect on *E. nigrita* population size with an increase of 0.02 log population abundance percent of *E. nigrita* per one percent of precipitation seasonality increase (, Table 1, Fig. 2c). We confirm the predictability of our model as our (, ).

**Figures**

A graph of a number of numbers

Description automatically generated with medium confidence

Figure 1: E. nigrita abundance in our dataset

*A group of graphs showing different seasons

Description automatically generated with medium confidence*

c)

a)

b)

Figure 2: Response of E. nigrita abundance to a) variation of forest cover, b) mean annual precipitation and c) precipitation seasonality. The dots represent the data points of our sampled data. The lines correspond to the fitted model and estimates and the shaded area represents the fitted model with the standard error included.

***Tables***

Table 1: Summary table of our negative binomial GLM

|  |  |  |  |
| --- | --- | --- | --- |
|  | Estimate | Std. error | z value |
| (Intercept) | 5.348 | 0.421996 | 12.672 |
| Larval host | -0.001 | 0.000214 | -5.966 |
| Maternal:Larval host | -1.090 | 0.317824 | -3.433 |
| Residuals | 0.02 | 0.004186 | 4.766 |