

# Analysing the flora richness in Caucaia-CE

Cristiana Aparecida Nogueira Couto

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## Introduction

Collecting information of the existence of species in specific locations is critical for determining its diversity and richness. Which species are found in a specific location? Which species are on risk of extinction? Why are there more species in this or that type of vegetation? All of these and other questions are present in the day-to-day work of ecologist and botanist researchers, and it is critical to have this information documented and available in order to answer them; this is where herbariums come into play. A herbarium is a collection of pressed, dried, and organized plant specimens based on taxonomic classification. The herbarium contains flora diversity registers and can be used as a foundation for many scientific studies. Having these digital collections is important for making them more accessible not only to scientists but also to the general public, as well as for protecting these collections.

The database used in this work contains the different species found in the city of Caucaia located in the Brazilian state of Ceará. The city has a coastal extension of 44 kilometers, where part of it is in a area of environmental protection. The vegetation formations of the city includes Coastal Zone Vegetation Complex, Shrubby Caatinga and Cerrado (IPECE 2017). In this short project for the discipline of Computational Methods in the Serrapilheira/ICTP-SAIFR Training Program in Quantitative Biology and Ecology, I plan to do a initial data analysis, following some steps to clean the database and organize it. Subsequently, I would like to calculate the genus richness of the city.

## Material e Methods

### Database

The dataset includes all plants register in a herbarium database collected in the municipality of Caucaia in Ceará. Data used for this project was compilation of the datasets collected using the Specieslink, GBif and re flora database. The dataset contains 28 columns, which some of them are the following: *colectao*: the herbarium where the dried plant was deposited, *n<sup>o</sup>.tombo*: identifier number of herbarium specimen, taxonomic classification, where we have *filo*: phylum, *classificacao*: class, *familia*: family, *genero*: genus, *especie*: species and *sub.especie*: sub-species; *nome.popular*: common name, *status.de.conservacao*: the conservation status, *pais*: country, *estado*: state, *município*: municipality, *tipo.de.vegetacao*: the type of vegetation and *tipo.de.substrato*: substrate where the species is found. We also have *latitude.decimal*, *longitude.decimal*: the geographic coordinates of the collection site.

### Implementation

All the implementations I did for this project used the programming language R. You can find the codes in the GitHub repository here, along with the dataset.

## Results and Discussion

### Data cleaning

For the initial data analysis, I started cleaning the data removing duplicates and empty lines. I also changed the column names to avoid naming columns using spaces and accents. Subsequently, I focused on solving

the problems with different writing formats of the names on the rows. Some of the lines with the identifier number (*nº.de.tombo*) had the official herbarium acronym, since this number is a unique number register, the herbarium code is unnecessary in this column.

Some of the other errors identified were regarding the names of the collection. The same herbarium institutional name appears with different writings throughout the dataset, so I changed it to only one name. The names were checked in the official websites of the institutions. Another issue spotted was information placed in the wrong column, the popular name of a plant was on the column that refers to the conservation status.

## Richness

Now I can start exploring the dataset to calculate the genus richness in the city of Caucaia. The most common genus were *Cyperus*, *Croton*, *Eleocharis*, *Borreria*, *Sida*, *Fimbristylis* and *Ipomoea*.

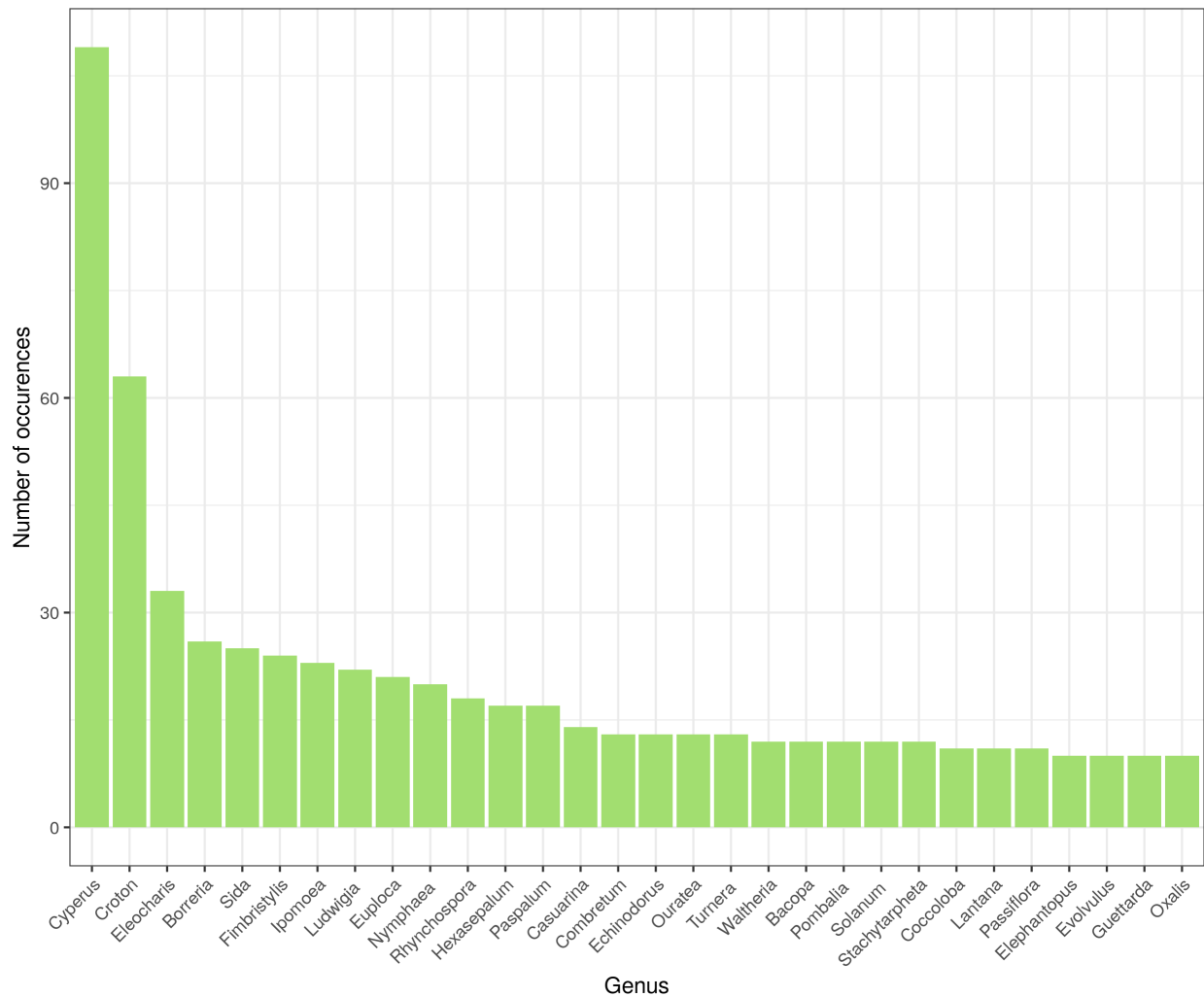


Figure 1: Genus richness: the 30 most common genus in the city of Caucaia-CE.

## Conclusion

This short project was helpful to put in practice the topics discussed in the class, especially around the good practices that should be used when creating R projects. While working with a biodiversity database,

it was possible to see the common problems with these databases regarding errors on collection names, manual typos and more. It was also possible to see the importance of working closely with a botanist and ecologist. The preparation of the database took most of the time while working on the project. This step of the data analysis is extremely important to pay close attention, since any erroneous cleaning decisions can result in inaccurate conclusions. Finally, for future work I would like to calculate richness considering the different vegetation and substrates and look at how the richness of species differ depending on substrates and vegetation type.

## **Acknowledgements**

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## **References**

IPECE. 2017. “Perfil Municipal 2017.” *Instituto de Pesquisa e Estratégia Econômica Do Ceará*. <https://www.ipece.ce.gov.br/perfil-municipal-2017/>.