ZMT LEIBNIZ CENTRE for Tropical Marine Research

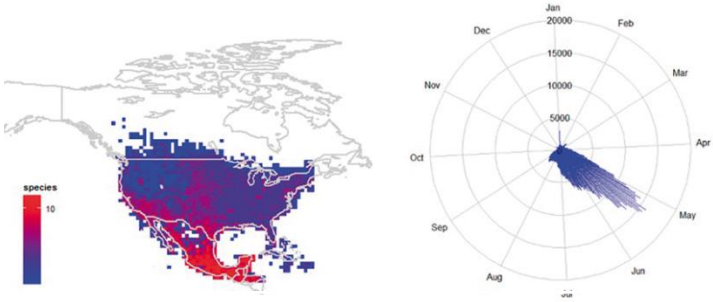
Biodiversity data visualization tools

A whole other point of view

Before deepening inside biodiversity visualization, let's be clear: data visualization tools have not been developed to satisfy ecologists demands. Although biologists have a bit more offer on the table, coming from the bioinformatics and genetics, the best tools to plot data are most of the times developed for the business management and advertising ecosystems. However, in recent years some applications have been launched for the scientific community, and the purpose of this document is to present them in general terms.

There is a major division of the tools used to plot and analyse biodiversity data: programming languages and specific visualization software.

Programming languages have the main advantage that allow a very wide management of data. Their uses can go from map analysis, to population dynamics, evolution or taxonomy.
Among biologists and ecologists, two programming languages are nowadays the most used tools to analyse and graph scientific data: **Python** and **R**.



„bdvis" package: R package that allows for spatial (e.g. maps), temporal (e.g. chronograms, heatmaps of time records)and taxonomic (eg. trees) visualization of biodiversity data.

1. R is a language for statistical computing and graphics that was developed in 2004 as an open source resource for data analysts of many scientific disciplines. Since ecology is traditionally strong in statistics, the use of this programming language in the field is broadly used nowadays. Among the 12.000 packages developed in R, some of them are especially adequate for ecological data plotting:

2. Python is a more generalist programming language also designed to work with data that manages big data more efficiently than R. Most of the data science can be done with few libraries (Panda, Numpy, Scipy).

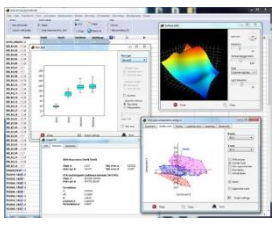
The main counterpoint of programming languages is that they require a considerable time and effort investment in order to master them, while more user-designed software provides a steeper learning curve. However, more user-friendly software is normally more specific in its uses and possibilities.

3. Past 4: This is the latest version of Past software, a free tool for ecological data analysis, manipulation and plotting. This is a good alternative to programming languages if the user aims for relatively simple analysis.

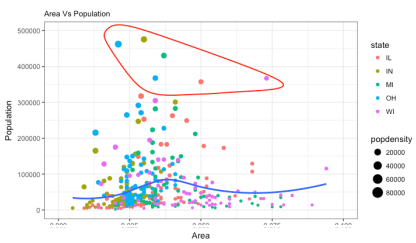
4. QGIS: This is a professional Geographic Information System (GIS) tool proud of being Free Open Source Software. It is extensively used in ecology to plot and produce species distribution models, to work with species ranges, environmental variable rasters and everything related to cartography and GIS.

5. Gephi: Open-source manipulation tool for visualizing and analyzing network graphs. It is relatively widely used in ecology to plot and analyze Food Webs and Ecological Networks.

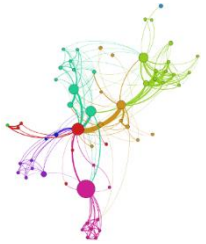
6. BioVis Explorer is a project to collect visualization all the molecular biological, genetics and taxonomy data visualization techniques in an interactive and intuitive link map. Freely available online https://biovis.lnu.se/



Past. Three fidderent ways of visualizing the data.



„ggplot2" package**:** This package was deliberately designed to plot datasets of variable complexity. Available for python and R.



Gephi network .