W13-1 Ordination analysis

This worksheet puts the regression analysis to a next level by non-linearly changing the data value space in order to retrieve some insights into potentially explaining relationships between biotic variables and environmental parameters. After completing this worksheet you should know how to compute a ordination analysis.

Things you need for this worksheet

- R — the interpreter can be installed on any operation system. For Linux, you should use the r-cran packages supplied for your Linux distribution. If you use Ubuntu, this is one of many starting points. If you use windows, you could install R from the official CRAN web page.
- R Studio — we recommend to use R Studio for (interactive) programming with R. You can download R Studio from the official web page.
- Field survey 2014 subset 01 as shape data set - a subset of the 2014 field survey data set as ESRI shape data set can be downloaded from here.
- Fogo DEM and NDVI - a digital elevation model derived from SRTM observations and a Landsat based NDVI from 2013 can be downloaded from here.
- Field survey 2014 species - a subset of the 2014 field survey data providing natural and agricultural species occurrences can be downloaded from here.

What's the plan?

What we want to do in this worksheet is to have a look into potential relationships between the distribution of plant and animal species and environmental parameters at the plots of the field survey 2014. Regarding the species data set we will test the distribution of all plant species, natural plant species, agricultural species and animal species one after another. For the environmental parameters we will always consider the elevation, the plant coverage and the NDVI. All variables will be extracted from the field survey data subset except for the NDVI.

To check potential relationships, a ordination analysis will be computed.

Learning log assignments

Please open a new script and name it “W13-1.R”.

For this worksheet we will need the packages “raster” and “vegan”. Please load them (peek at W04-1 if you forgot how to load libraries or install packages).

Please load the ESRI shape file version of the field survey subset along with the NDVI GeoTiff and two additional CSV data sets which hold information on animal and plant species into memory.

Since the plant species data set encompasses both natural and agricultural species, we have to create two additional data sets which only hold the information on one of the categories. This might be the most demanding individual task of the course, so please take your time!

Please create two subsets of your plant species data: one should include all natural plants (i.e. the ones with “NAT” in the column header name) and one should include all the agricultural plants (i.e. the ones with “AGR” in the column header name). The functions substr(), nchar() and names() will be very helpful.

Finally, we must extract the NDVI values at the locations of the field survey plots. This is nothing new and you now already how it is done.

Please extract the NDVI values for the field survey plot locations. Once you have done it, store the attribute data of your spatial data frame which holds the shape file information in a normal data frame. You can use the extract() function for that. Add the previously extracted NDVI values to a new column of this data frame.

OK, now we are ready to compute the ordination:

Please compute individual ordination analysis using the cca() function for the following data sets always using elevation, vegetation coverage and NDVI as the constraining variables:

- all plant species
- natural plant species
- agricultural plant species
- all animal species

Please visualize one ordination after another and interpret the relationships. To get some statistical indices, you can compute an analysis of variance for each of the ordinations using the annova() function (e.g. `anova(<variable name you stored the ordination>, by=“terms”, permu=999))`