

Training course: Use of Agrobiodiversity information in GBIF and other databases

Lisbon, 28 - 30 June 2017

Exercise 4:

GBIF data applied to biodiversity indicators

How to use this exercise and report template?

1. Please download this file from the link <https://goo.gl/G6M27T> as a Word docx file.
2. Suggestion: rename it as "Exercise_4_group#.docx" (replace # by the number/name of your group)
3. Fill in the responses in the Task sections of the file.

How to deliver the results report

1. Create (if you haven't done so) a folder for your group at the link <https://goo.gl/DXQ3gi>.
2. Upload all the report files and attachments to the newly created folder. Name attachment files consistently as "Exercise_4_attachment#"
3. Upload result report of all your exercises to the same folder

Introduction

Drivers of biodiversity change and loss, such as land use change, climate change, invasive species, pollution, and overexploitation are causing changes in the composition of biotic communities, including species replacement and changes in species relative abundances, but also loss of genetic and species diversity from local to global scales (Pereira et al. 2012). Biodiversity indicators provide information on the state and change trends of biodiversity. This information is relevant to inform ecosystem management and policy. Biodiversity indicators are diverse and cover different facets of biodiversity, from ecosystems, to species to genetic diversity.

The aim of this exercise is to use GBIF data to compare species communities using biodiversity indicators, namely community richness, evenness and proportion of rare species. Communities could occur in separate locations (spatial comparison) or time intervals (temporal comparison), or both.

Task 1

a) Define your research question. Identify the communities (two or more) to be compared (target taxa), study area (spatial extent, ecosystem type), time interval, and motivation. List the criteria used for data extraction in GBIF.

b) Open the GBIF datasets in excel. For each community create a pivot table to count the number of occurrences per species (see Figure 1 in the Annex, and example in BiodivInd_GBIF_exercise.xls <https://goo.gl/QnpAV9>). Copy the content of the pivot table to a new excel sheet (suggestion: paste values), sort species counts from largest to smallest.

c) Estimate the total number of species in each community using the calculator in

<https://www.mbr-pwrc.usgs.gov/software/specrich.html>

(value to extract: INTERPOLATED N)

Use the number of occurrences (counts) in GBIF as a proxy for species abundance in the study area.

Note: occurrence data may be affected by various biases (Yesson et al. 2007), and should only be used as a proxy for abundance when they are the best data available. Also, while abundance data is still not available in GBIF, the GBIF's Integrated Publishing Toolkit (<http://www.gbif.org/ipt>) is currently being adapted to support the recording of species abundance (Wieczorek et al. 2014).

d) Calculate sampling completeness = (observed species richness/estimated species richness)*100. If completeness < 75%, reassess the criteria used for data extraction (repeat steps from a to d), if completeness ≥ 75%, proceed to Task 2.

If applicable, discuss the limitations of available data to reach the minimum sampling completeness of 75%, namely taxonomic limitations, spatial distribution of data, or temporal distribution data.

Note: due to time limitations, do not repeat steps a) to d) more than twice; proceed to Task 2 and finish the exercise (but keep in mind that results may be affected by the level of sampling completeness).

Task 2

Use the tables with the counts of occurrences to calculate the following biodiversity indicators for each of the communities being compared. See the examples in BiodivInd_GBIF_exercise.xls <https://goo.gl/QnpAV9>. Discuss the results.

a) Calculate the Simpson Diversity Index $= 1 - D = 1 - \sum p_i^2$; where p_i is the relative abundance of species i (use GBIF occurrences as a proxy for abundance).

b) Calculate the Simpson Evenness Index $= 1 - D / 1 - D_{max} = (1 - D) / (1 - (1/S))$, where S is the total number of species observed

c) Produce a rank abundance curve, to visually assess and compare richness and evenness.

d) Assess the proportion of rare species

e) Calculate the Jaccard similarity index $S_j = a / (a + b + c)$, where a are the shared species, and b and c the species unique to each community. Note: the calculation of this index is optional and only relevant if you compare 3 or more communities.

Use the biodiversity indicators to answer the research question described in Task 1.

References

Pereira, H.M., Navarro, L.M., Martins, I.S., 2012. Global biodiversity change: the bad, the good, and the unknown. *Annu. Rev. Environ. Resour.* 37, 25–50.

Yesson, C., Brewer, P.W., Sutton, T., Caithness, N., Pahwa, J.S., Burgess, M., Gray, W.A., White, R.J., Jones, A.C., Bisby, F.A., Culham, A., 2007. How global is the global biodiversity information facility? *PLoS One* 2, e1124.

Wieczorek, J., Bánki, O., Blum, S., et al., 2014. Meeting report: GBIF hackathon-workshop on Darwin Core and sample data (22–24May 2013). *Stand. Genomic Sci.* 9, 585–598.

Annex

Row Labels	Count of species
Acridotheres cristatellus	656
Acridotheres tristis	9
Acrocephalus agricola	17
Acrocephalus arundinaceus	382
Acrocephalus melanopogon	1
Acrocephalus schoenobaenus	79
Acrocephalus scirpaceus	848
Aegithalos caudatus	1099
Alauda arvensis	1371
Amandava amandava	40
Anthus campestris	189
Anthus cervinus	6
Anthus godlewskii	4
Anthus hodgsoni	14
Anthus petrosus	38
Anthus pratensis	3367
Anthus richardi	80
Anthus spinoletta	384
Anthus trivialis	230
Calandrella brachydactyla	362
Calandrella rufescens	2
Calcarius lapponicus	4
Carduelis carduelis	7009
Carpodacus erythrinus	2
Cecropis daurica	1939
Certhia brachydactyla	2497
Cettia cetti	3290
Chloris chloris	5165
Cinclus cinclus	8
Cisticola juncidis	6005
Coccothraustes coccothraustes	379
Coloeus monedula	309
Corvus corax	696
Corvus corone	5094
Corvus frugilegus	1

PivotTable Fields

Choose fields to add to report: ⚙️

Search

- ID
- order
- family
- genus
- species**
- decimallatitude
- decimallongitude
- day
- month
- year

More Tables...

Drag fields between areas below:

Filters	Columns
<p>Rows</p> <p>species</p>	<p>Values</p> <p>Count of spec...</p>

Defer Layout Update Update

Fig.1 – Example of pivot table with counts of species occurrences.