Measuring Biodiversity:
How to get data, assess its quality and measure different aspects of diversity

Lecturers: Joaquín Hortal, Museo Nacional de Ciencias Naturales – CSIC; Ana Margarida C. Santos, Universidad Autónoma de Madrid

Note: This course will be given remotely

Calendar: June 28th-July 2nd 2021

Duration: 36 hours

Schedule: 9h-13h and 14h-17h30, every day

Objectives: This course offers an overview of the different ways to measure biodiversity, and provides tips for the stratification of primary biodiversity data and the construction of variables that describe its various facets. It also includes an in-depth review of the different types of data used to measure biodiversity and their problems and limitations.

Overview: Biodiversity is a complex phenomenon that includes many different facets and functions, covering a wide array of ecological and evolutionary characteristics. In spite of this most studies on biodiversity focus on species richness and, to a lesser extent, on the variation in species composition or the diversity of evolutionary processes. Because of this, many facets of biodiversity are poorly known. In addition, knowledge about the geographical distribution of the biota is incomplete and spatially and taxonomically uneven. The problems of biodiversity data hamper studying the determinants of diversity gradients, and limit their usefulness in conservation planning.

During the course we will describe the facets of biodiversity that are commonly studied, with an emphasis on ecological and species diversity. This includes richness, composition, replacement (beta diversity), rarity, endemism, phylogenetic diversity and functional diversity. We will also review the different ecological functions that have been assigned to some of these facets, their possible role in ecosystem functioning, and the relationship between biodiversity and some ecosystem services that are essential to the functioning of the biosphere.

Throughout the course we will focus on how to measure biodiversity, with special reference –but not limited– to its geographical and temporal variations. I will review the various sources of information about biodiversity, as well as its accessibility and/or potential utility. We will discuss how to use this information to measure different facets of biodiversity. After that, we will review current shortfalls in biodiversity data. We will describe various sources of bias and/or lack of knowledge associated with these data and measures, their origin, and the effects they have on the knowledge of biodiversity.

Finally, we will discuss the different ways to correct or mitigate the limitations imposed by these shortfalls, namely additional sampling, diversity estimators (of richness and composition), and predictive models of the geographic distribution of both species and different measures of diversity. We will overview the methods available for these strategies, as well as their logical order of application and its usefulness in terms of specific objective of the study and the type of data available. We will use several practical examples – including the students' own work – to discuss about (1) how to decide the most appropriate sampling plan, (2) assessing survey quality, (3) using estimates, (4) how to stratify data, and (5) developing and validating predictive models of geographic distribution. Finally, we discuss the usefulness of the data and methods currently available for the study of diversity gradients, community ecology and conservation planning.

Plan:

1. Course Introduction - Biodiversity, concept and types: genetic diversity, ecological and specific - Facets of Biodiversity.
2. Measures of species diversity: richness, composition, substitution (beta diversity), rarity, endemism.
3. Phylogenetic and functional diversity.
4. Species traits and functional groups.
5. Stratification of biodiversity data.
6. Main shortfalls in biodiversity data.
7. Databases, data quality and bias.
8. Sampling effort evaluation.
9. Species richness estimators.
10. Survey design.
11. Species distribution models: theory, utility and limitations.
12. Measuring and communicating uncertainty associated to data quality. Maps of biogeographical ignorance.

This course can have a recognition of 6 ECTs for FCUL PhD students enrolling in it as part of their first doctoral year. For students only requiring 5 ECTs recognized in their specific PhD programmes the last 6 hours of the course are not mandatory and the certificate will be on 'Topics in Measuring Biodiversity'.

Location: Departamento de Biologia Animal (FCUL)

Nº (min, max) students: 10 – 20

Minimal formation of students: "Licenciatura" (bachelor) in Biology, Environmental Sciences, Geography or related areas.

Directed to: PhD or MSc students in Ecology, Biodiversity, Geography or related areas, and postdocs and other professionals working in related topics.

Fee: free for 1st year PhD students in Doctoral programmes at FCUL (e.g. Biologia), Biodiversity, Genetics and Evolution (BIODIV UL; UP) and Biology and Ecology of Global Changes (BEAG UL, UA) when the course counts credits for their formation, in which case the delivery of a final report done after the course is mandatory; the course is also free for more advanced PhD students of the BIODIV programme (ULisboa or UPorto); 30 € for other PhD students from cE3c, 60 € for PhD students from institutions of the PEERS network (CFE-Coimbra); 105 € for FCUL Master students and unemployed; 160 € for BTI, BI and other PhD students; 230 € for Professional and postdocs.

When the maximum number of students is reached 10 vacancies will be available for non-paying 1st year PhD students mentioned above, being, by order of preference: 1) cE3c students; 2) BIODIV students (not from cE3c); 3) FCUL students (not from cE3c); 4) BEAG students (not from FCUL).

Deadline for applications: May 14th 2021

Candidates should send a short CV and motivation letter to Joaquín Hortal (jhortal@mncn.csic.es) explaining why they are interested in the course, including a brief description of their research projects. The CV and letter should be named as *1st-lastNAME-CV.pdf and 1st-lastNAME-ML.pdf* (that is personalize the name of each file with your first and last name).

In the email please add the following information:

Full Name:

E-mail:

Phone:

Professional activity: Professional/Postdoc, BTI, BI (or other non-post-doc research grant), PhD student (with/ without scholarship), Lic. (Bachelor)/Master student

PhD student of the 1st year of a Doctoral programme at FCUL, BIODIV (FCUL/FCUP), or BEAG (FCUL or UA)?

If yes to the above question, PhD student doing the Course to count credits for 1st year?:

PhD student of cE3c or CEF (Centro de Ecologia Funcional)?:

Name of the PhD programme: