



## Measuring Biodiversity: Obtaining data, assessing its quality and generating measures of different aspects of diversity

**Lecturer:** Joaquín Hortal (Museo Nacional de Ciencias Naturales – CSIC & Universidade Federal de Goiás)

**Calendar:** February 10-14 2014

**Duration:** 30 hours

**Schedule:** 9h-12h and 14h-17h, everyday

**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.

In the first part of the course I 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. I 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.

The second part of the course will focus on how to measure biodiversity, with special reference to its geographical – and temporal – variations. I will first review the various sources of information about biodiversity, as well as its accessibility and/or potential utility. Then I will show how to use this information to measure different facets of biodiversity. After that, I will describe the various sources of bias 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 this bias, 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.

**General Plan:**

1. Course Introduction - Biodiversity, concept and types: genetic diversity, ecological and specific - Facets of Biodiversity.
2. Biodiversity and ecosystem functioning.
3. Measures of species diversity: richness, composition, substitution (beta diversity), rarity, endemism.
4. Biodiversity data, databases, quality and bias.
5. Sampling effort evaluation.
6. Species richness estimators.
7. Survey design.
8. Phylogenetic and functional diversity. Species traits and functional groups. Stratification of biodiversity data.
9. Species distribution models: theory, utility and limitations. Maps of uncertainty.
10. Discussion, synthesis and future challenges: good practices in the use of biodiversity data.

**Location:** Departamento de Biología Animal (FCUL)

**Nº (min, max) students:** 10 – 20

**Directed to:** PhD or MSc students in Ecology, Geography or related areas, and postdocs working in related topics

**Fee:** free for 1st year PhD students in the Doctoral programme in Biology (FCUL), Biodiversity, Genetics and Evolution (UL; UP) and Biology and Ecology of Global Changes (UL, UA); 20 € for PhD students from institutions of the PEERS network (CBA, CFE, ABG); 100 € for FCUL Master students and unemployed; 150 € for BTI, BI and other PhD students; 200 € for Professional and postdocs.

**Deadline for applications:** January 27<sup>th</sup>, 2014

Candidates should send a short CV and motivation letter explaining why they are interested in the course, including a brief description of their research projects. Send all information and requests to Joaquín Hortal ([jhortal@mncn.csic.es](mailto:jhortal@mncn.csic.es)).