# Biodiversity and Ecosystems

| Course name | BIODIVERSITY AND ECOSYSTEMS |
|---|---|
| Level / Semester | Master 2 Economics and Ecology / Semester 1 |
| Credits | 6 ECTS |
| Instructor(s) | Jérôme Chave (EDB)<br>Julien Cucherousset (EDB)<br>Claire de Mazancourt (SEEM)<br>Bart Haegeman (SEEM)<br>Michel Loreau (SEEM) |
| Number of lecture hours | 30 |

## OBJECTIVES

This course will cover a broad array of ecological theory in order to understand ecosystem structure and functioning, and address the big issues raised by biodiversity loss.

We shall review existing empirical evidence coming from multiple habitat and taxa types, in the light of expectations from theoretical models. Models to study biodiversity and ecosystem functioning will be build up from single species population dynamics to multi-species community dynamics to ecosystem models. Integration of social and economic factors in ecological models will be discussed.

## LECTURE OUTLINE

Course 1 **Biodiversity measures, species area relationships** *Bart Haegeman*　　**3h**

- ✓ Richness, evenness, Hill's diversity measures (1 h lecture)
- ✓ Data analysis (2h practical)

Course 2 **Modelling approaches in ecology** *Claire de Mazancourt*　　**5h**

- ✓ Consumer-resource model, Lotka-Volterra model (2 h lecture)
- ✓ Consumer-resource model (3h practical)

Course 3 **Biodiversity – ecosystem functioning** *Michel Loreau, Bart Haegeman, Claire de Mazancourt*　　**8h**

- ✓ Causes and rates of biodiversity loss, predictive models of biodiversity: species distribution models (Michel, 1h lecture)
- ✓ Biodiversity – ecosystem functioning (Michel, 2h lecture)
- ✓ Biodiversity – stability (Claire, Bart, 2h lecture + 2h pratical: stability in a consumer-resource model)
- ✓ Ecosystem services (Michel, 1h paper discussion, debate, role play)

Course 4 **History of ecological concepts** *Jérôme Chave*　　**2h**

- ✓ Nutrient depletion, ecological succession, management of hazards, global ecology, law and environmental challenges

Course 5 **Niche theory** *Jérôme Chave*　　**2 h**

✓     Simple models of interacting species,
the niche concept, fundamental versus realized niches, models of species distribution and applications

Course 6 **Food webs and stable isotope ecology** *Julien Cucherousset*        **2 h**
  ✓ Trophic niche, cross-ecosystem subsidies (1h lecture)
  ✓ Mixing models, contribution of allochthonous resources (1h practicals)

Course 7 **Biological invasions and their ecological impacts** *Julien Cucherousset*   **2 h**
  ✓ Profiling invaders, ecological impacts, debate on invasive species (1h lecture)
  ✓     Impacts across levels of biological organisations (1h article discussion)

Course 8 **Biodiversity theory** *Jérôme Chave*        **2 h**
  ✓ Why are there so many species ?
  ✓ Spatial processes, Janzen-Connell effect, neutral theory of biodiversity

Course 9 **From individuals to ecosystems and *vice-versa*** *Julien Cucherousset*    **2 h**
  ✓ Niche construction theory, Intraspecific specialisation, Eco-evo feedbacks
  ✓ Intraspecific variability in ecosystem ecology (1h article discussion)

Course 10 **Biosphere** *Jérôme Chave*        **2 h**
  ✓ Biosphere and global change, modelling fluxes, history of the biosphere

*Courses 1-3 will take place in Moulis, while courses 4-10 will take place in Toulouse*

## REQUIREMENTS AND GRADING POLICY

Due to the pluri-disciplinary nature of this master, attendance at lectures will be required. The course grade will be determined by the performance of the student on assignments (individual or team-based assignments, and/or presentations), and/or a final exam. Due again to the pluri-disciplinary nature of this master, assignments and exams may be different for economics and for ecology students.

**Grading policy for this module**: The module will use a combination of several evaluation methods, including a written examination and oral presentations.