

## Biodiversity and ecosystems

Course title - Intitulé du cours	Biodiversity and ecosystems
Level / Semester - Niveau /semestre	M2 / S1
School - Composante	Ecole d'Economie de Toulouse
Teacher - Enseignant responsable	DE MAZANCOURT CLAIRE - ROY MELANIE
Other teacher(s) - Autre(s) enseignant(s)	Jérôme Chave
Other teacher(s) - Autre(s) enseignant(s)	Julien Cucherousset
Other teacher(s) - Autre(s) enseignant(s)	Bart Haegeman
Other teacher(s) - Autre(s) enseignant(s)	Michel Loreau
Other teacher(s) - Autre(s) enseignant(s)	
Lecture Hours - Volume Horaire CM	30
TA Hours - Volume horaire TD	
TP Hours - Volume horaire TP	
Course Language - Langue du cours	Anglais
TA and/or TP Language - Langue des TD et/ou TP	Anglais

### **Teaching staff contacts - Coordonnées de l'équipe pédagogique :**

Preferred means of interaction: email

Claire de Mazancourt (SETE) [claire.demazancourt@sete.cnrs.fr](mailto:claire.demazancourt@sete.cnrs.fr)

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### **Course's Objectives - Objectifs du cours :**

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.

### **Prerequisites - Pré requis :**

being accepted in M2 Economics & Ecology track

### **Practical information about the sessions - Modalités pratiques de gestion du cours :**

Due to the pluri-disciplinary nature of this master, attendance at lectures will be required.

### **Grading system - Modalités d'évaluation :**

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 pluridisciplinary 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 or written essays.

**Session planning - Planification des séances :**

LECTURE OUTLINE

Moulis part:

Course 1 Biodiversity measures, species area relationships Claire de Mazancourt 1h CM, 1h TD

- Richness, evenness, Hill's diversity measures (2 h lecture & practical)

Course 2 Modelling approaches in ecology Claire de Mazancourt & Bart Haegeman 3h CM 3h TD

- Modelling population dynamics (Bart, 2h lecture & practical)
- Competition model (Claire, 2h lecture & practical)
- Ecosystem model (Claire, 2h lecture & practical)

Course 3 Biodiversity – ecosystem functioning Michel Loreau, Bart Haegeman, Claire de Mazancourt 1h30 CM, 6h30 TD, 1h conference, work in autonomy alone and in group

Introduction: groups of students receive one basic paper / book chapter on a selection of the following topics; they prepare a report that is rated & corrected, students then prepare a 1h lecture for all other students on their topic. List of possible topics :

- Causes and rates of biodiversity loss,
- Predictive models of biodiversity: species distribution models
- Biodiversity – ecosystem functioning
- Biodiversity – stability
- Alternative Stable States
- Metacommunities
- Gaia
- Planet boundaries

All students read a selection of papers for a debate

- Ecosystem services (Michel, 1h30 paper discussion, debate, role play)

Conference:

- Human-Nature dynamics (1h conference)

Toulouse Part:

Course 4 History of ecological concepts Jérôme Chave 1 h CM, 2h TD

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

Course 5 Niche theory Jérôme Chave 1 h CM, 2h TD

- 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 1 h CM, 2h TD

- 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 1 h CM, 2h TD

- 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 1 h CM, 2h TD

- 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 1 h CM, 2h TD

- Niche construction theory, Intraspecific specialisation, Eco-evo feedbacks
- Intraspecific variability in ecosystem ecology (1h article discussion)

Course 10 Biosphere Jérôme Chave 1 h CM, 2h TD

- Biosphere and global change, modelling fluxes, history of the biosphere

Courses 1-3 would have taken place in Moulis in other years ; due to Covid19, they will take place online or in Toulouse. Courses 4-10 will take place in Toulouse

**Distance learning – Enseignement à distance :**

Due to Covid19, some classes will take place online