Montpellier Training offer for international incoming students

Academic year 2017/2018

(21 ECTS)

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| **Period 1 :****29 January -23 February 2018** **7 ECTS** | **Period 2 :****5 – 30 March 2018****7 ECTS** | **Period 3:****3 – 13 April and 23 April – 4 May 2018****7 ECTS** |
| Discover Agroecology  | Agroecology Principal Concepts  | The Agroecological Transition  |
| Designing New Crops for the Future  | Training in AGROPOLIS Research Community  | Evolutionary applications in agriculture : Evolutionary Concepts for the Management of Agro-Ecosystems  |
| Collecting Environmental Data  | Environmental Data Processing and Analysis  | Mobile and Web Management of Environmental Data  |

What is agroecology?

## SPRING 2018 29 January -23 February 2018

Reference of the course: AGROECOLOGY UE1 - 300

## Persons in charge

Aurélie Javelle, Magali Jouven, **Stéphane de Tourdonnet**. Assistant: Mylène Letellier

Department of Soil, Water, Crops and Livestock Systems

Department of Biology and Ecology

Department of Economics, Management and Social Sciences

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits

## Teaching language

English (B1 level)

## Objectives

The general objective of the course is to apprehend agroecology through an interdisciplinary approach combining agronomy, ecology, social and economical sciences. The aim of this specific course is to present the players and the different dimensions of agroecology (scientific disciplines / social and political movements / sets of practices), and analyze the reference framework on which they are based.

The objective of the course will not be to give a single definition of the polysemous concept of agroecology but to help students to understand the multiple facets of this concept.

## Course content

The teaching is organized around two main themes:

(i) an historical and scientific approach to understand how agroecology has emerged, has shifted the lines within various disciplines and at their interfaces, and has generated controversy

(ii) an analysis of the diversity of actors and of experiences of the agroecology, rooted in the real world.

A large place will be given to reflexive analysis, comparative analysis and discussion to allow students to understand the diversity of the agroecology approaches, identify conceptual and ethical positioning and analyze the modalities for the practical implementation of agroecology.

The course will combine lectures-seminars, tutorials, analyses of real-world case studies, interviews and on-site visits. Students are required to: (1) attend all classes, tutorials and discussion, (2) develop self-learning, (3) work on interviews and (4) take a final examination.

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

The course is open to Junior or Senior Students in agronomy. No specific prerequisites.

## Grades

The final mark will be a weighted average between an individual exam and a group project.

## Partnership

Research Units: Innovation, Cefe, Eco&Sols, System, Selmet, Agap, HortSys et Aida

Associations: Terre & humanisme, semeurs de jardins Civam etc.

Fundamentals of agroecology

## SPRING 2018 5 – 30 March 2018

Reference of the course: Agroecology UE2 - 400

## Persons in charge

Elena Kazakou, Aurélie Metay, Muriel Tavaud and **Stéphane de Tourdonnet****;** Assistant: Martine Paradis.

Department of Soil, Water, Crops and Livestock Systems

Department of Biology and Ecology

Department of Economics, Management and Social Sciences

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits

## Teaching language

English (B1 level)

## Objectives

The general objective of the course is to present the processes underpinning agroecology to mobilize ecological functionality in agro-ecosystems. Students are expected to analyze, evaluate and integrate these processes through a systemic approach conducted at different levels: plot, ecosystem, production system, socio-ecosystem. Teaching is focused on a functional analysis of the agro-ecosystem to highlight the key processes of agroecology as well as the concepts and methods to study and evaluate the provided ecosystem services.

## Course content

The teaching will address the following topics: Ecological, Biological, Technical and Social Processes in agroecology, biodiversity and diversity of practices in agro-ecosystems, construction of agroecology knowledge and learning. Students will develop an integrated analysis on case studies and a field camp.

The course will make extensive use of a digital learning resources developed by the teaching team (MOOC agroecology). During the Mooc session, the students will be placed in the position of tutor of the participants forums, community manager, animator of the live events of the Mooc. A dedicated training will enable them to work the necessary skills.

The course will combine lectures-seminars, tutorials, and on-site visits. Students are required to: (1) attend all classes, tutorials, e-learning activities and discussion, (2) develop self-learning, (3) work on a project during the field camp, and (4) take a final examination.

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

The course is open to Junior or Senior Students in agronomy. Prerequisites: sequence 1 of the Mooc Agroecology.

## Grades

The final mark will be a weighted average between an individual exam and a group project.

## Partnership

Research Units: Innovation, Cefe, Eco&Sols, System, Selmet, Agap, HortSys et Aida

Associations: Terre & humanisme, semeurs de jardins Civam etc.

Agroecological transition

## SPRING 2018 3 – 13 April and 23 April – 4 May 2018

Reference of the course: Agroecology UE3 - 400

## Persons in charge

Ronan Le Velly, Claire Marsden, Sophie Thoyer and **Stéphane de Tourdonnet****;** Assistant: Isabelle Bastié.

Department of Soil, Water, Crops and Livestock Systems

Department of Biology and Ecology

Department of Economics, Management and Social Sciences

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits

## Teaching language

English (B1 level)

## Objectives

The general objective of the course is to analyze the evolution of practices and systems, as well as the innovation and transition processes toward agroecology. The course will present the levers (Public and Research Policies, devices to co-design technical systems, support systems and socio-technical networks ...) to guide these evolutions, aiming at addressing issues such as adaptation to the climate change, reduction of inputs, development of sustainable agriculture and food systems, through the implementation of the principles of agroecology.

Teaching is focused on the presentation of concepts, approaches and instruments of the agroecological transition to strengthen students' ability to drive change and to assess the corresponding impacts at the economic, social, agricultural and ecological levels.

## Course content

The teaching will address the following topics: Innovation and agro-ecological transition, Greening of public policy, Technical, organizational and economic levers of agroecology, Evaluation methods and (co) design of agro-ecological systems, Ecological Engineering.

Small groups of students will have to work on projects in relationship with outside partners (community, association, cooperative etc.) to conceive and ex-ante evaluate the agroecological transition of a small territory.

The course will combine lectures-seminars, tutorials, and project-based learning through the analysis of a real-world case study. Students are required to: (1) attend all classes, tutorials and discussion, (2) develop self-learning, (3) work on a project, and (4) take a final examination.

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

The course is open to Junior or Senior Students in agronomy. Prerequisites: sequences 1 to 4 of the Mooc Agroecology.

## Grades

The final mark will be a weighted average between an individual exam and a group project.

## Partnership

Research Units: Innovation, Cefe, Eco&Sols, System, Selmet, Agap, HortSys et Aida

Communauté d’agglomérations de Montpellier, Ville de Montpellier (zoo)

Designing new crops for the future

## SPRING 2018 29 January -23 February 2018

Reference of the course: Plant Science UE1 - 300

## Persons in charge

Dr. Dominique THIS , office phone: (+33) 467 615 829

Department of Biology and Ecology

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits

## Teaching language

English (B1 level)

## General theme of the course

Changes affecting agriculture at the world level (environmental and societal changes) bring questions about paradigm shift in crop breeding and health. This course aims at guessing and designing the upcoming crop varieties and plant protection strategies to be developed in future production chains.

This course will bring scientific bases and methods to reflect on evolutions of plant breeding and plant protection at the global level. It will aim at learning how to design new plant ideotypes and plant protection systems in line with natural resources preservation, and integrate them into either innovative or traditional farming systems. Finally, this course aims at making students acquire additional operational skills and discover careers in plant breeding and crop protection sectors.

## Course content

The course will combine lectures-seminars, laboratory, field and/or Company on-site visits and project-based learning.

1. **First week theme:** To analyze and predict the impacts of climate and societal changes on cropping systems

Keywords: Climate change, societal expectations, crop pests, food security, diversification of agricultural production

1. **Second week theme:** To define suitable crop ideotypes well adapted to environmental constraints and new-coming agricultural systems

Keywords: ideotype, biocontrol, tolerance to biotic and abiotic constraints, genotype/environment interaction

1. **Third week theme:** Available methods to be developed to go towards the engineering of the desired crop ideotypes

Keywords: genetic innovation, interaction between plants, pests and their natural enemies, link between genotype and phenotype, multi trait combination, control of genetic recombination

1. **Fourth week theme:** Technical, societal and legal challenges

Keywords: perception towards innovation, public acceptability, production processes, GMOs, participatory plant breeding, legal issues

Students are required to: (1) attend all classes, discussion and on-site visit sections, (2) informally and formally participate in class and all exercises, (3) prepare an essay on a synthesis case study, and (4) take a final oral examination.

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

The course is open to Junior or Senior Students in Biology.

## Grades

Grades are based on (i) evaluation of individual participation to classes and to the different exercises; (ii) evaluation of a written report (10 pages max) and (iii) final oral examination (15 minutes)

## Civility in the classroom

It is a requirement of this class that you not engage in non-class e-activities during lecture and section. If you should engage in non-class e-activities will be asked to leave the classroom for the remainder of the day. In the unlikely event that this becomes an ongoing problem, your final grade will be affected.

## Final note

We reserve the right to make modifications [additions, deletions, etc.] to the syllabus, assignments, requirements and expectations for this course; any such modifications will be clearly communicated and communicated in a timely way.

Training in Agropolis research community

## SPRING 2018 5 – 30 March 2018

Reference of the course: Plant Science UE2 - 400

## Persons in charge

Jean-Jacques Kelner, Anna Medici, Véronique Marie-Jeanne.and Dr. Dominique THIS

Department of Biology and Ecology

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits

## Teaching language

English (B1 level)

## General theme of the course

The attractiveness of the Montpellier Research Campus in the field of plant science is mainly due to the excellence of the scientific research and higher education network of Agropolis ([www.agropolis.fr](http://www.agropolis.fr)). However, this community is not well known by students. Also, some of the research units do not know the potential of the students coming to Montpellier SupAgro as future trainees or staff. This course aims at filling this gap by introducing the students to the richness of the Montpellier scientific network in plant sciences, ecology and crop protection. Students will participate to a scientific project conducted within an Agropolis research unit and supervised by our research partners. They thus will learn the different steps of the scientific approach: to carry out a state-of-the-art, to formulate scientific hypotheses, to implement an experimental process and to discuss the results. This will contribute to develop scientific rigor, scientific communication, ability to work in a team, and more generally the adaptation to a professional environment.

## Course content

The course will be based on project-based learning as well as practical exercises. The students will work in small groups. Students will also attend scientific seminars and develop self-learning.

1. **First week:** Presentation of the scientific environment and analysis of the state-of-the-art relative to the research project (bibliography)
2. **Second week:** Establishment of the methodology and start of the experiments
3. **Third week:** Development of the experiments and collection of results
4. **Fourth week:** Analysis of the results and presentation of the work

*The week-to-week progress of the work will depend on the subject the student will work on.*

Students are required to: (1) attend all classes, discussion and practical exercises, (2) report on their work on a weekly basis, and (3) make a final oral presentation of their work. The course requires a full time investment in the projects

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

The course is open to Junior or Senior Students in biology

## Grades

Grades are based on (i) evaluation of individual participation to classes and to the different exercises; (ii) evaluation of a written report (10 pages max) and (iii) final oral examination (15 minutes)

## Final note

We reserve the right to make modifications [additions, deletions, etc.] to the syllabus, assignments, requirements and expectations for this course; any such modifications will be clearly communicated and communicated in a timely way.

Evolutionary applications in agriculture: evolutionary concepts for the Management of Agro-Ecosystems

## SPRING 2018 3 – 13 April and 23 April – 4 May 2018

Reference of the course: Plant Science UE3 - 400

## Persons in charge

Pr. Vincent RANWEZ and Dr. Jean-François MARTIN

Department of Biology and Ecology

## Organization and credits

The course is a full time 4-week-long course. There is one week of vacation in the middle of the course. Successful completion of this course brings 7 ECTS credits.

## Teaching language

English (B1 level)

## General theme of the course

Modern agro-ecosystem management must resolve the potentially conflicting objectives of short-term, intensive production and long-term sustainability whilst simultaneously reducing negative environmental impacts. This course aims at providing students with the key theoretical background elements needed to comprehend and assess the agro-ecosystem within an evolutionary framework.

Relevant evolutionary concepts will be used to shed light on processes such as: domestication and its impact on cultivated plants; adaptive potential to biotic or abiotic stresses; identification of candidate genes for adaptation; community dynamics influencing host/pathogen, plant/microbiome or arthropod-related interactions; the spread of invasive species. To achieve this goal, students will be introduced to the essential theoretical background from population genetics, molecular evolution and phylogeny, as well as community dynamics and interactions.

Key concepts to be mobilized are molecular diversity, evolutionary and selection footprint, co-evolution, barcoding, microbiome.

## Course content

The course will combine lectures-seminars, tutorials, analyses of real-world case studies and project based learning. Students are required to: (1) attend all classes, tutorials and discussion, (2) develop self-learning, (3) work on a project, and (4) take a final examination.

Tutorials will aim at mastering F-statistics, sequence alignments, advance queries on EnsEMBL and NCBI databases, molecular phylogeny, taxonomic identification as well as understanding the fundaments of tests used to detect selection/adaptation or to characterize microbiomes.

Students are expected to develop their ability to read scientific article and question methodological choices, to apprehend agronomic question in a broader evolutionary framework, to propose biological interpretation based on molecular data analysis and to suggest further analysis to validate those hypotheses, to work with others: being able to emit/accept constructive criticism, being open-minded and inquisitive, being respectful of other point of view, being diligent and punctual.

Details on class participation, the proposed projects, and the final oral presentation will be discussed in class or in discussion section.

1. **First week:** Genetic resources in agriculture and conservation biology (molecular diversity): Characterizing genetic/genomic diversity via high-throughput molecular methods, Understanding evolutionary processes shaping allelic distribution, Quantifying molecular diversity, Conducting taxon identification and phylogenetics analyses for diagnostics and classification
2. **Second week:** Molecular breeding, dynamics of adaptation, candidate gene identification (footprints of selection): Establishing a null hypothesis to detect selection for adaptation to biotic and abiotic conditions, Detecting selection at the genome level for adaptation to biotic and abiotic conditions
3. **Third week:** Domestication history, epidemiology, emergence of resistances and geographical expansion (spreading): Understanding how molecular diversity is shaped by organism reproductive traits, Deciphering the history of populations at different time and space scales, Retracing phylogeography and geographical expansion to understand the past and predict the future
4. **Fourth week:** Community evolutionary dynamics (interactions): Understanding co-evolution and how it can be tested, Knowing the importance of soil microbiome and how metagenomics allows to characterize it, Understanding that the plant level is not the sole relevant level

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

The course is open to Junior or Senior Students in biology

## Grades

The final mark will be a weighted average between an individual exam and a group project.

## Final note

We reserve the right to make modifications [additions, deletions, etc.] to the syllabus, assignments, requirements and expectations for this course; any such modifications will be clearly communicated and communicated in a timely way.

Collecting Environmental data

## SPRING 2018 29 January -23 February 2018

Reference of the course: Data Manager for environmental projects UE1 - 300

## Persons in charge

Hazaël JONES (hazael.jones@supagro.fr) and Arnaud DUCANCHEZ (arnaud.ducanchez@supagro.fr)

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits.

## Teaching language

English (B1 level)

## Objectives

Measurement is one of the major components of environmental monitoring, whether for water quality, atmospheric conditions. It forms the basis on which hazard management strategies or policies related to the protection and management of the natural environment can be implemented. The objective of this teaching unit is to provide with students the physical and organizational principles for collecting information to describe the natural environment. This module will introduce the first steps of geo-referenced data project management with the application of sensors and their connection to a communication network. The sampling, data validation and representation of information issues will also be considered

## Course content

The course will combine lectures-seminars, tutorials, interviews and on-site visits and project-based learning.

The goal for the students is to be able to perform an effective environmental data collection in order to carry out an agri-environmental project. To achieve this goal, the following program will be done:

* First week: Sensors and Arduino, Data Format: this week is about how to concretely manage sensors with basic knowledge of sensors and their characteristics for agro-environmental applications. Development of measuring system based on Arduino open-source platform within the framework of agro-environmental project is done. An introduction about data for agronomy and agriculture is also given.
* Second Week: Wireless Sensor Network (WSN) and Arduino, Computer networks, Metadata: this week will give theoretical knowledge about how computer networks work and how wireless sensor network are managed with Arduino. An introduction about what are metadata and why they are useful for environmental data projects is given.
* Third Week: Statistics and Sampling, In-field data acquisition: this week will give the basics on how to perform a good sampling for data acquisition; it will then be concretely achieved in the field on a concrete application.
* Fourth Week: Data processing, Geomatics and Geographic Information System (GIS) basics, Global navigation satellite system (GNSS). This week will be about the first steps of data processing once the data have been gathered. As many data are of spatial nature, geomatics, GIS and GNSS notions will be investigated.

Keywords: Sensors and Metrology, Wireless Sensors Networks (WSN), Arduino platform, Networks, Metadata and Data formats

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

Very basic skills in programming (any language) may be useful.

## Grades

Grades are based on evaluation of individual participation to classes and a group project.

## Partnership

Research Units: UMR MISTEA (SupAgro INRA) and UMR ITAP (SupAgro IRSTEA)

Environmental Data Processing and Analysis

## SPRING 2018 5 – 30 March 2018

Reference of the course: Data Manager for environmental projects UE2 400

## Persons in charge

Bénédicte FONTEZ (benedicte.fontez@supagro.fr) and Nicolas DEVAUX (nicolas.devaux@supagro.fr)

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits.

## Teaching language

English (B1 level)

## Objectives:

To propose a set of methods and tools to study complex data (georeferencing, temporal data and so on) in order to identify consistent sub-sets and to represent these results in the form of maps and charts.

## Course content

The course will combine lectures-seminars, tutorials, interviews and on-site visits and project-based learning.

Detailed contents:

* Distributed spatial data extraction and management
* Spatial autocorrelation - variogram - variance estimation
* Introduction to linear model
* Regression over spatially autocorrelated variables
* Variogram – Kriging
* Introduction to semantic networks, ontologies
* Introduction to big data management
* Geomatics

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

Basic knowledge in:

* Statistics (sampling, estimation, principle of statistical tests)
* Databases (tables and simple SQL queries)

## Grades

Grades are based on evaluation of individual participation to classes and a group project.

## Partnership

Research Units: UMR MISTEA (SupAgro INRA) and UMR ITAP (SupAgro IRSTEA)

Mobile and web management of environmental data

## SPRING 2018 3 – 13 April and 23 April – 4 May 2018

Reference of the course: Data Manager for environmental projects UE3 -400

## Persons in charge

Bruno TISSEYRE (bruno.tisseyre@supagro.fr) and Philippe VISMARA (philippe.vismara@supagro.fr)

## Organization and credits

The course is a full time 4-week-long course. Successful completion of this course brings 7 ECTS credits.

## Teaching language

English (B1 level)

## Objectives:

To provide decision support at different level (local, national, regional and international) environmental data and land use information must be available for many different activities and stakeholders. Sharing and dissemination of environmental data is therefore a challenging issue which largely relies on web and mobile technologies. The first goal of this teaching unit is to provide with the student an overview as well as a description of the main technologies available to tackle the issue of dissemination of environmental data. The second goal is to involve the student in a project management aiming at applying these technologies to real environmental project with collecting platforms (crowd-sourcing, sensor networks, and so on) and dissemination of information. Spatial data like maps and remote sensing image will be the core of the project.

## Course content

The course will combine lectures-seminars, tutorials, and project-based learning.

* First fortnight theme: Designing a mobile web application for on-site collecting data

Keywords: Interactive web pages with JavaScript, Web services

* Second fortnight theme: Project in precision agriculture

Students are required to: (1) attend all classes, tutorials and discussion, (2) develop self-learning, (3) work on a project and contribute to the restitution seminar.

## Books and other reading materials

No books have been ordered for this course. All required readings are available as downloads from the Montpellier SupAgro teaching platform. There is no formal reading packet for this course.

## Requirements

Very basic skills in:

* Web design (basic knowledge of HTML tags and CSS)
* Programming (any language)

## Grades

Grades are based on evaluation of individual participation to classes and a group project.

## Partnership

Research Units: UMR MISTEA (SupAgro INRA) and UMR ITAP (SupAgro IRSTEA)