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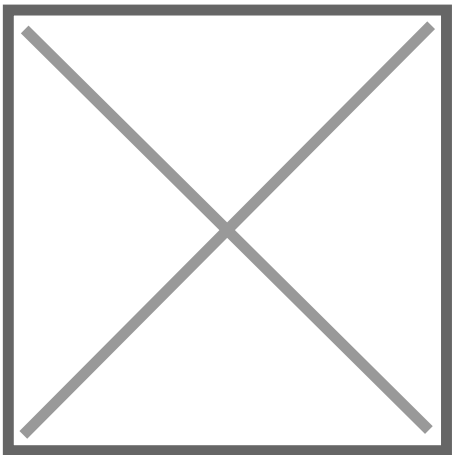
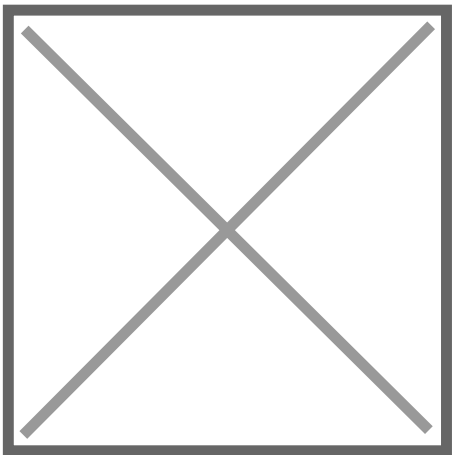
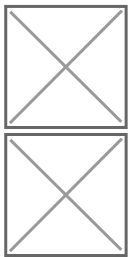
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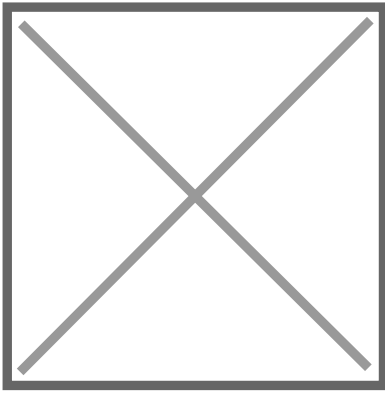
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Add to Compare

M2 Climate, Land Use and Ecosystem Services





Master's degree

Specialisation Agrosciences, Environment, Territory, Landscape, Forest

Enrolment type

Full-time academic programmes Life-long learning

Language(s) of instruction

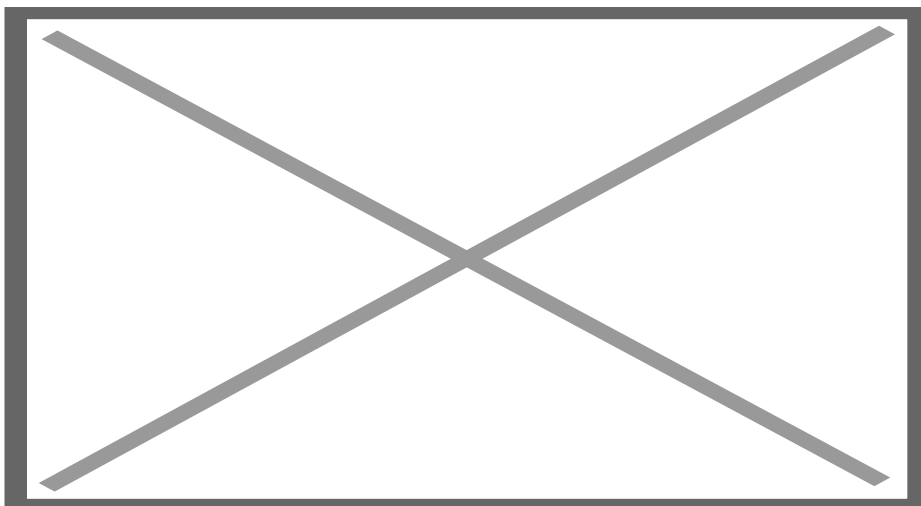
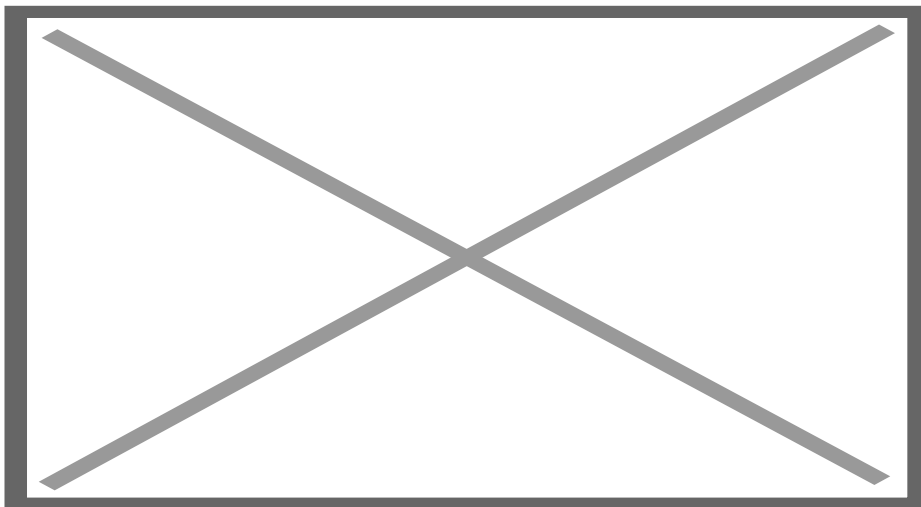
English

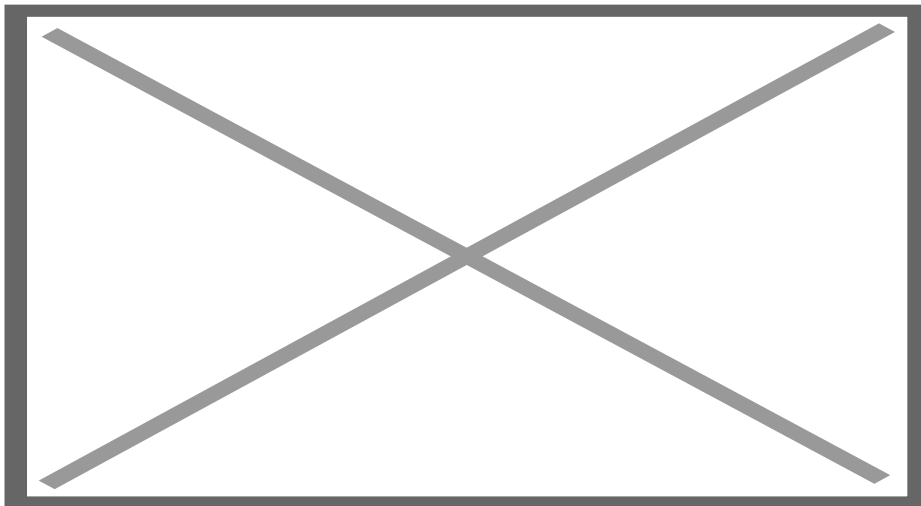
Climate, Land Use and Ecosystem Services (CLUES)

The master's program is organised into a first semester that provides skills, knowledge, and expertise, followed by a second semester of practical experience in an internship, culminating in the writing of a thesis and a defence.

[Télécharger la fiche détaillée](#)

[Apply Now](#)





Information

- [Overview](#)
- [Application requirements](#)
- [Schedule](#)

Présentation

Skills

Courses will promote integrated approaches through a **multi-disciplinary curriculum** combining natural sciences, social and economic sciences, and advanced courses in **data management, analysis and modelling to promote sustainable development in rural and semi-urban areas.**

Objectives

Terrestrial ecosystems are a core component of the climate system and a key provider of services to human societies via their production of biomass for food and fuels or their regulation of environmental resources. As the demand for these services is rapidly growing, these ecosystems have been manipulated and managed to an unprecedented extent, via changes in land occupation and use worldwide, in particular for agricultural and forestry purposes. Facing up to the current ecological challenges thus requires a careful understanding of ecosystem processes and services to design and implement management strategies that enhance ecosystem services in a changing global environment. The economic sectors targeted include agriculture and forestry but also the agri-food sector, energy and the bio-economy in general, while the programme will also be relevant to policy-making in the area of environmental regulation and natural resources management, from local to global scales. The overarching objective of this MSc programme is to provide students with the scientific knowledge, know-how and skills necessary to understand the functioning of terrestrial ecosystems in response to major drivers such as climate change, land-use change patterns and ecosystem management technologies. Graduates from this programme will possess in-depth knowledge of biosphere-climate interactions, acquire methods to assess ecosystem services, and be fully aware of the panel of technological options available in terms of land-use planning management to promote the sustainable development in rural and semi-urban areas.

Débouchés

Career prospects

After a Master's + PhD: researcher or lecturer

After a Master's degree: Research analyst

Agricultural services, environment or sustainable development, local authority planning or government services

Agricultural development or nature protection/conservation organisations and associations

Engineering firms specialising in environmental impact assessments

Private-sector companies, including agricultural production

Calendar

Start of programme (indicative date)

01/09/2026

End of programme (indicative date)

01/10/2027

Admission

Capacity

Available Places

22

Target Audience and Entry Requirements

Knowledge of biosphere-climate interactions from a biological and physical perspective.

Période(s) de candidature

Inception Platform

From 02/02/2026 to 15/06/2026

Supporting documents

Compulsory supporting documents

Rank of previous year and size of the promotion.

Motivation letter.

In English

List of other masters requested (excluding Saclay).

Professional project.

in English

All transcripts of the years / semesters validated since the high school diploma at the date of application.

Certificate of English level.

Any documents that certify a "B2 or upper" level or equivalent in English (CEFR)

Curriculum Vitae.

In English

Additional supporting documents

Referring contact information (compulsory for non-international applicants).

Letter of recommendation from a trainee.

Certificate of French (compulsory for non-French speakers).

In principle we ask for a B1 certificate for French, but it is not mandatory either. We trust that you will pick up enough French during the programme to get by in Paris.

Detailed description and hourly volume of courses taken since the beginning of the university program.

VAP file (obligatory for all persons requesting a valuation of the assets to enter the diploma).

Document indicating the list of local M2 choices available here : <https://urlz.fr/i3Lo>.

Supporting documents :

- Residence permit stating the country of residence of the first country
- Or receipt of request stating the country of first asylum
- Or document from the UNHCR granting refugee status
- Or receipt of refugee status request delivered in France
- Or residence permit stating the refugee status delivered in France
- Or document stating subsidiary protection in France or abroad
- Or document stating temporary protection in France or abroad.

Programme

UE à choix

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	practical class	directed study/practical class	d
Nature-based solutions to substitute fossil resources and address global change	3	Semestre 2	12	6	6				

Nature-based solutions to substitute fossil resources and address global change

ECTS : 3

Semester: Semestre 2

Detail

Lecture: 12

Practical study : 6

Directed study: 6

Project : 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

None

Programme/contents

1. Introduction to course content and assignment (individual work on topics related to the subjects taught in the course). Overview of energy, economic, environmental and policy issues related to nature-based solutions. Environmental benefits and drawbacks, as well as current bottlenecks to their deployment. NBS examples around the world (3h lecture – B. Gabrielle).
2. Basics of agricultural biomass feedstock production and supply
 - Photosynthesis : principles and regulations ; pedo-climatic drivers and constraints for biomass productivity ;(3h practical on photosynthesis measurements on various crops in Grignon – S. Saint-Jean).
 - Designing cropping systems to produce biomass (input rates, growing cycles, technical constraints, multi-criteria assessment) ; Biomass quality constraints and management for various conversion routes (3 h lecture – C. Loyce + field tour of lignocellulosic crops in Grignon).
3. Green chemistry – biorefineries to produce fuels, chemicals and biomaterials in lieu of petrochemical alternatives (S. Baumberger ; 3h lecture)

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Urban vegetation for sustainable cities	3	Semestre 2	12	12					

Urban vegetation for sustainable cities

ECTS : 3

Semester: Semestre 2

Detail

Lecture: 12

Directed study: 12

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

1. Trends of urbanisation worldwide
2. Impacts of urbanisation on urban microclimate and air quality
3. Mitigation of these impacts by urban greening strategies

Learning objectives

Nowadays, more than half of the world's population resides in cities, a proportion that can reach over 80% in developed countries. However, cities and urbanisation, due to the artificialization of land surfaces, cause numerous changes (e.g., urban heat islands, water runoff, and flooding).

In order to make cities more sustainable and livable for their populations, particularly in the context of climate change (rising temperatures, more intense rainfall events), the greening of urban spaces is developing for many reasons, including improving the thermal insulation of buildings, reducing or delaying the flow of rainwater collected on roofs, and helping to mitigate the urban heat island effect as well as assessing the urban air quality.

The objectives of this course are to provide knowledge on how urban greening strategies can mitigate the deleterious effects of urbanisation and assess the comfort and health of citizens.

Type of assessment

Evaluation Continue non Intégrale

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Understanding and managing soil organic matter for ecosystem services delivery	2	Semestre 1	17.5	8.5					

Understanding and managing soil organic matter for ecosystem services delivery

ECTS : 2

Semester: Semestre 1

Detail

Lecture: 17.5

Directed study: 8.5

Project : 3

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Basics in soil science (including biogeochemistry), agronomy, environmental sciences.

Programme/contents

Soil organic matter has a pivotal role in soils and terrestrial ecosystem, it is a major component of soil fertility, soil structure and water holding capacity, it is the energy resource of soil organisms and thus sustains biodiversity, buffers contaminants and it is a major reservoir of carbon. It is thus at the crossroads of societal challenges: maintaining food security, mitigating greenhouse gas emissions and climate change, adapting to climate changes, recycling organic wastes and protecting biodiversity. This course aims to provide knowledge concerning soil organic matter, its functions and contributions to ecosystem services, its dynamics at different time scales and variations under management practices. It aims to provide tools to survey and manage soil organic matter and to increase C storage in soils.

Learning objectives

The aim of this course is to provide students with basic knowledge of the dynamics of organic matter in soils, to understand how to study and characterise it, and to make proposals for its management. Emphasis will be placed on the biogeochemical processes involved in the formation of organic matter and the methods available for studying its characteristics (e.g. different degrees of residence time).

Climate

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
Climatic system- Introduction to atmospheric dynamics and energetics	3	Semestre 1	20	8				

Climatic system- Introduction to atmospheric dynamics and energetics

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 20

Directed study: 8

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

Know and understand the fundamental exchanges that take place at the **land-atmosphere interface**. Know and understand the **global cycles of water, carbon, nitrogen, and phosphorus** at the global scale, as well as the variables that influence these cycles. Know and understand why the terrestrial biosphere can influence the composition and circulation of the overlying air masses.

The course will be divided into three major parts :
Fundamentals in the biogeochemical cycles and surface-atmosphere exchanges at the global scale (15h)

Directed work concerning the analyses and discussions of results coming from simulations of the global change model.

A more research-driven part that will make the best use of the science in progress to illustrate what we know, what the unknowns are, what and where the uncertainties are, and what remains to be done concerning **the biogeochemical cycles and the two-way interactions between biosphere and atmosphere** at the global scale (9h). This part will be handled by experts through conferences.

Learning objectives

Fundamental skills in biosphere atmosphere interactions at the global scale

Overall organisation

1. An overview of radiative processes affecting the global climate. Links with past climates.
2. From radiative to radiative-convective equilibrium: the role of stratification in

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
Biosphere- Atmosphere interactions at local scale	3	Semestre 1	12	6	12			

Biosphere-Atmosphere interactions at local scale

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 12

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Basic knowledge in bioclimatology and data processing

Programme/contents

This course aims to further students' understanding of the **interactions between the biosphere and the atmosphere** at a fine scale (plants, leaves, canopies), as well as their modelling and measurement. Those interactions are key to understanding the functioning of the biosphere and (agro) ecosystems, as well as assessing the impact of climate change on agriculture.

Learning objectives

- Understanding, modelling, and measuring the interactions between the biosphere and atmosphere at fine scales (plants, leaves, ...).
- Plant-Ecosystem-Atmosphere Interactions
- Mass and Energy transfer between plants, soil and atmosphere within the atmospheric boundary layer (energy budget, water transfer, evaporation, CO₂ exchange, pollution and GES emission (a)biotic particles transfer)

Overall organisation

Courses, Directed work and field trip

Special teaching arrangements

Evaluation/assignment Report concerning directed work about Data analysis of plant-Atmosphere Interactions/fluxes - Bibliographic summary -

Attendance and participation to the course will also

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class
Biogeochemical cycles and surface-atmosphere exchanges and interactions : global scale	4	Semestre 1	30	15				

Biogeochemical cycles and surface-atmosphere exchanges and interactions : global scale

ECTS : 4

Semester: Semestre 1

Detail

Lecture: 30

Directed study: 15

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Atmospheric circulation, plant functioning (ecophysiology).

Programme/contents

The course will be divided into three major parts :

Fundamentals in the biogeochemical cycles and surface-atmosphere exchanges at the global scale (15h)

Directed work concerning the analyses and discussions of results coming from simulations of the global change model.

a more research-driven part that will make the best use of the science in progress to illustrate what we know, what the unknowns are, what and where the uncertainties are, and what remains to be done concerning the biogeochemical cycles and the two-way interactions between biosphere and atmosphere [at global scale] (9h). This part will be handled by experts through conferences.

Learning objectives

- Know and understand the fundamental exchanges that take place at the land-atmosphere interface.
- Know and understand the global cycle for water, carbon, nitrogen, phosphorus at the global scale, and the variables that influence their cycles.
- Know and understand why the terrestrial biosphere can influence the composition and circulation of the overlying air masses.

Type of assessment

Evaluation Continue non Intégrale

Land-use

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Agronomy for global issues	3	Semestre 1	14	6					

Agronomy for global issues

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 14

Directed study: 6

Independant learning: 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Basic knowledge in agronomy and statistics

Programme/contents

During this class, students will get: (i) an overview of relevant methodologies for research in agronomy for global issues with a focus on meta-analysis and yield gap analysis; (ii) some insights into the past trends of some major drivers of the global food system (global crop production, harvested area and yields of major food crops); (iii) knowledge on major production systems worldwide, (iv) knowledge about the relationship between agriculture and biodiversity at the global scale, (v) knowledge about nutrients flows linked to agricultural activities at the global scale, with a focus on organic farming upscaling, and (vi) knowledge about relationships between agricultural systems and pests and diseases at large scale. Major open global data sources will be presented, and two of them (FAOSTATS and the Global Yield Gap and Water Productivity Atlas) will be used during tutorial classes to perform some calculations and simple statistics analyses (with R or Excel software).

Learning objectives

Agronomists play a crucial role in addressing global challenges within the context of a rapidly growing global population, changing diets, and the need to reduce the environmental footprint of agriculture. The objectives of this class are (i) to acquire knowledge about agricultural systems at the global scale in terms of production and its relationships with the environment and food security, and (ii) to present the methods used by agronomists to address these global issues.

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Public policy for climate and environmental regulation	1	Semestre 1	18						
■									

Public policy for climate and environmental regulation

ECTS : 1

Semester: Semestre 1

Detail

Lecture: 18

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Basics in biosphere-atmosphere exchanges
(environmental physics, plant ecophysiology)

Type of assessment

Evaluation Continue non Intégrale

[Land-use engineering](#)

for the provision of climate and environmental services	3	Semestre 1	12	3	9
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Land-use engineering for the provision of climate and environmental services

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 12

Practical study : 9

Directed study: 3

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Basics in land-use / climate interactions and agronomy

Programme/contents

Land-use and ecosystem management are key components of the environmental footprint of local communities, whether urban or rural. It encompasses impacts within and outside the geographical boundaries of these communities, because demand for ecosystem services may have consequences on distant countries through product imports or indirect market-related effects. Thus, designing and assessing strategies that minimise this footprint at product, citizen, or community levels requires a thorough understanding of the human, ecosystem, and environmental responses involved in the underlying scenarios, from local to global scales. These responses can be analysed using biophysical models of ecosystem functioning and the Earth/climate system, as well as economic models that describe the market mechanisms by which local demand may translate into global consequences for the use and management of land worldwide. The objectives of this course are to raise students' awareness of the biophysical and economic processes involved in the response of land-use and climate to economic drivers, and to equip them with state-of-the-art knowledge on modelling these processes across a range of scales. Case studies involving the models will illustrate how they can be used to design and assess low-carbon strategies. The course will

Ecosystem Services

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Ecology under climate change	3	Semestre 1	18	12					



Ecology under climate change

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 18

Directed study: 12

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

1. Fundamentals of ecology under climate change
2. Soil microbial ecology, soil C and N cycling under climate change
3. Impact of global change on terrestrial ecosystems
4. Current issues on ecology and climate change

Learning objectives

The objectives of this course are to raise students' awareness of the effects of climate change on biodiversity and the functioning of ecosystems, as well as the ecosystem services they deliver, and to gain insight into the relationships between biodiversity and ecosystem functioning under climate change. On completion of this course, students will:

1. Master the basics of functional ecology,
2. Be aware of the relationships between climate change drivers and the evolution of biodiversity and ecosystems, as well as the nature-based solutions that can mitigate climate change.
3. Develop their literature research and teaching skills in the field of ecology.

Overall organisation

Lectures and tutorials led by working groups on specific topics in ecology under climate change complement those covered during lectures.

Type of assessment

Evaluation Continue non Intégrale

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Integrated assessment of ecosystem services and sustainability	4	Semestre 1	12	6					

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
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Integrated assessment of ecosystem services and sustainability

ECTS : 4

Semester: Semestre 1

Detail

Lecture: 12

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Basic knowledge (at Bachelor's level) in ecology, biogeochemistry and agronomy.

Programme/contents

The course aims to raise students' awareness of environmental management, the ISO 14000 standards, and the principles of their implementation in various decision-making contexts, with the goal of improving the environmental performance of production systems or organisations. The course will equip students with the tools and methods currently used in the environmental assessment of products and services, as well as their eco-design. Life-cycle assessment, whose use is currently spreading across all economic sectors for purposes of eco-design, consumer information, or policy design, will occupy a central place in pedagogy.- Background on environmental management; organisation- and product-oriented approaches.- Operation of an environmental management system (EMS) at in organizations : key concepts and implementation principles- Applications in various industrial sectors: eco-design and environmental information- Conceptual framework of industrial ecology and impact assessment methods ; connections with the ecosystem services framework- Life-cycle assessment : ISO standards 14040 to 14044, steps of the method in theoretical and practical terms (system definition, inventory, impact characterization, normalization)- Application to food products, and practical work highlighting the connection of environmental management with the

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d
Everyone Eating Well within Environmental Limits	3	Semestre 1	21	6					
■									

Everyone Eating Well within Environmental Limits

ECTS : 3

Semester: Semestre 1

Detail

Lecture: 21

Directed study: 6

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Global agronomy course (Clues)

Land use and ecosystem services course (Clues)

Programme/contents

1. Introduction on global challenges to food security and the environment
2. How to use the planetary boundaries approach
3. Regeneration and restoration
4. Connection with human diets and food policies
5. The role of business

Learning objectives

Understanding and modelling the connections between agriculture, food security, poverty, planetary boundaries, and the role regenerative agriculture and industries can play

Special teaching arrangements

Sequence relocated to Montpellier or La Rochelle, lectures, tutorials and field trips to understand the relationship between agriculture and biodiversity.

Type of assessment

Evaluation Continue non Intégrale

Integrative project

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning
Integrative project	4	Semestre 2	6	12					
■									

Integrative project

ECTS : 4

Semester: Semestre 2

Detail

Lecture: 6

Directed study: 12

Tutored project 30

Language(s) of instruction

Anglais

Remote teaching

non

Type of assessment

Evaluation Continue non Intégrale

Internship

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning
CLUES Internship	23	Semestre 2							

CLUES Internship

ECTS : 23

Semester: Semestre 2

Language(s) of instruction

Anglais

Remote teaching

non

Prerequisites

Defence and Master's Thesis in English. An internship can be completed in any language.

Programme/contents

Internship can be conducted in the laboratories of the Master, such as EcoSys Joint Research Unit (INRA/AgroParisTech), Agronomy Joint Research Unit (INRA/AgroParisTech), Laboratoire des Sciences du Climat de l'Environnement (LSCE ; UVSQ/CNRS/CEA), CIRED (CIRAD/CNRS/AgroParisTech), Institut d'écologie et des sciences de l'environnement de Paris (IEES ; UPMC/CNRS/IRD), UR HBAN, Antony (IRSTEA).

Additionally, students will be encouraged to find their own internships in various domains, including agriculture, the agro-food industry, and audit and consultancy firms, with a focus on environmental and sustainable

development issues within the topics of the three main pillars of the master CLUES.

Public administrations (municipalities, regional authorities, national governments) are also a possible target, as are international organisations (FAO, the World Bank, or international research bodies such as the Agricultural Research Partnership CGIAR).

Learning objectives

Internships are designed to place students in professional settings. Objectives are to apply and strengthen scientific and technical skills in a professional environment and develop interpersonal skills. This internship and the Master's thesis enable students to identify and clarify a problem or issue by applying the theories and methods acquired through their undergraduate and graduate studies. The Thesis and his oral defence must follow the

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distance learning
Modelling concepts and applications	3	Semestre 2	3	10	3				

Modelling concepts and applications

ECTS : 3

Semester: Semestre 2

Detail

Lecture: 3

Practical study : 3

Directed study: 10

Tutored project 30

Language(s) of instruction

Anglais

Remote teaching

non

Programme/contents

Formalise a scientific problem, and draft of a code to solve a scientific problem, design and scheme of an algorithm

Learning objectives

- Formalise a scientific problem, design a system, and provide an algorithm to solve it while implementing it with a computer language
- Answer a scientific question by building a model

Skills

Algorithmic thinking

Problem-solving
(Coding)

Type of assessment

Evaluation Continue non Intégrale

Teaching Location(s)

PALAISEAU

Contact

- **CLUES M2**

Responsables de Formation CLUES

<http://www.universite-paris-saclay.fr/formation/master/agrosciences-environnement-territoires-paysage-foret/m2-climate-land-use-and-ecosystem-services>