COURSE DATA

DATA SUBJECT

Code: 47089
Name: Cambio climático, biodiversidad y ciclos biogeoquímicos
Cycle: Master's Degree
ECTS Credits: 3
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Facultat de Ciències Biològiques	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología	Cambio climático y contaminación ambiental	COMPULSORY

COORDINATION

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SUMMARY

The Intergovernmental Panel on Climate Change (IPCC, UN) recognises that atmospheric CO_2 concentrations exceed the natural range of the last 650,000 years. Human activities that pollute the atmosphere with greenhouse gases have recently been identified as the main cause of climate change at both the global and regional levels (IPCC 2001, 2007). It is therefore necessary to understand the components of climate and their susceptibility to change due to natural or human causes.

The effect of climate change on biota has been difficult to demonstrate, but since the beginning of the 21st century, there has been conclusive evidence of the impact of climate change during the 20th century on species. Biodiversity, as the sum of species, ecosystems and genetic diversity in the world, has been continuously transformed by changes in climate. Now, changes in this diversity (e.g., losses) are accelerating as the effect of humans on the climate is added to its natural variability. For all these reasons, it is important to study and relate: a) the components of climate and its variability due to increasing pollution from gases such as CO_2; b) the dynamics of biodiversity at all levels, including c) the variability in the processes or functional diversity of ecosystems. Furthermore, climate is a complex system of interacting external and internal forces: the climate system. This includes the atmosphere, oceans, ice, soil (including its biota), snow cover, hydrology, water bodies (including their biota), etc. Thus, it is understood that climate change affecting ecological systems produces synergistic effects when altered natural systems in turn favour climate change. This synergy will also be addressed in this course as the alteration of the gas emitter/sink ratio presented by

ecosystems related to their diversity and climate change.

Finally, the differences in the effect of climate change on very different ecosystems (soil, sea and continental waters) will be analysed. The knowledge available on these topics for application to the Iberian Peninsula will be detailed.

Recognition of climate change: What is climate change? The history of climate variability and recent trends.

Climate change in Spain.

Biodiversity dynamics: changes in populations and communities.

Biodiversity and ecosystem functioning.

Biotic responses to climate change: evolutionary impact, life cycles, distribution and abundance of populations.

Response models of ecosystems, biomes or the planet to climate change.

Effects of climate change on terrestrial, marine and continental water systems.

Modification of basic ecosystem processes: greenhouse gas sinks or emitters, vulnerability to climate change.

Conservation efforts and strategies in the face of climate change.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

There are no specified enrollment restrictions with other subjects of the curriculum.

COMPETENCES / LEARNING OUTCOMES

2285 - Máster Universitario en Contaminación Ambiental y Ecotoxicología

Acquire the capacity for autonomous and organised learning and for adapting to new situations.

Act autonomously in learning, make informed decisions in different contexts, issue judgements based on experimentation and analysis and transfer knowledge to new situations.

Contribute to the design, development and implementation of solutions that respond to social demands,

considering the Sustainable Development Goals as a reference.

Develop the ability to work in multidisciplinary teams and to cooperate effectively.

Develop the capacity for analysis, synthesis and critical thinking in applying the scientific method.

Evaluate and assess the impact of human activities on pollution in the atmosphere, inland waters, marine waters and soils.

Evaluate the behaviour of pollutants and their interactions in different environmental compartments.

Evaluate the effects of climate change.

Learn how to write scientific articles in the fields of environmental pollution and ecotoxicology.

Propose creative and innovative solutions to complex situations or problems within the field of knowledge to respond to diverse professional and social needs.

Understand and interpret the processes of atmospheric, aquatic and soil pollution and their effects.

Understand indicators and effects of climate change on ecosystems and the carbon cycle, as well as the mitigation potential of terrestrial ecosystems.

Understand the natural world as a product of evolution and its vulnerability to human influence.

Understand the structure, dynamics and flows of ecosystems.

Use different bibliographic sources and biological databases.

DESCRIPTION OF CONTENTS

1. Climate components and teleconnection. Identification of climate change. Effects on the hydrological cycle, atmospheric circulation and teleconnections.

2. Paleoperspective on climate variability and change. Gradual and rapid changes. Natural changes and human impact. Recent climate trends. Projections and models. Climate change in Spain.

3. What is biodiversity? Measures of biodiversity. Biodiversity and space-time scales. Patterns of diversity.

4. Models of diversity equilibrium. Phylogenetic gains and losses: from population to large groups. Gains and losses in the community: from population to global diversity.

5. Biodiversity, composition and ecosystem processes. Diversity, complexity, productivity and stability. Effects of biodiversity on ecosystem functioning.

6. Evolutionary impact. Life cycles. Distribution of population abundance.

7. Distribution of biodiversity. Modification of basic ecosystem processes. World system models and synergistic effects.

8. Effect of climate change on soil. Changes in fundamental soil properties. Emissions and gas flow in soil. Effect on soil organisms. Influence on crops.

9. Soil adaptation and mitigation mechanisms in the face of climate change. Soil organic matter. Carbon capture and storage in soil. Soil management and stewardship for climate change mitigation and adaptation.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Total hours	**30,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	1,00
Individual or group project	8,00
Independent study and work	5,00
Preparation of lessons	4,00
Preparation for assessment activities	25,00
Resolution of case studies	2,00
Total hours	**45,00**

TEACHING METHODOLOGY

Theoretical classes, in which the teaching staff will present the fundamental concepts of each of the topics. Prior to the class, the audiovisual material will be made available to students via the university's teaching support platform.

Theoretical-practical classes, in which students will carry out exercises or solve problems related to some of the topics covered.

Seminars, which are held individually or in pairs. The teacher will propose a number of topics from which students can choose. Students will research the bibliography and develop a project that they will present orally to the rest of the students and the teacher, followed by a discussion at the end. The presentations will take place during the teaching period.

There will be a group tutorial to answer questions raised by students. In addition, there will be one hour of online tutorial to exchange information with students and answer any specific questions that may arise.

EVALUATION

Exam. This will take place at the end of the course and a minimum mark of 5 out of 10 is required to pass the course. It will preferably be a written test, although it may also be oral if the teaching staff considers this more appropriate. It accounts for 60% of the total mark for the course.

Continuous assessment, non-classroom activities and activities related to cross-curricular skills. Seminars, critical reviews, classroom participation, case studies, presentations, assignments. This accounts for 40% of the total mark for the course.

REFERENCES

Intergovernmental Panel on Climate Change Fourth Assessment Report. Consueltar el Informe más reciente y los anteriores como evolución de la materia.

Kinzing, A.P. et al. 2001. The functional consequences of biodiversity. Princeton UniversityPress.Narasimha Vara Prasad, M., Pietrzykowski, M. 2020. Climate change and soil interactions. Elsevier. Amsterdam, Netherlands.

Loreau, M. et al. 2002. Biodiversity and ecosystem functioning. Oxford Univ. Press.

Lovejoy, T.E. y Hannah, L. 2005. Climate change and Biodiversity. Yale University Press.

McKinney, M.L. y Drake, J.A. 1998. Biodiversity dynamics. Columbia Press.

Moreno, J.M. (ed.) 2006. Evaluación preliminar de los impactos en España por efecto del cambio climático Ministerio de Medio Ambiente y Universidad de Castilla-La Mancha.

Muñoz, M.A., Zornoza, R. 2018. Soil management and climate change : effects on organic carbon, nitrogen dynamics, and greenhouse gas emissions. Elsevier/Academic Press.

Pal Singh, B., Cowie, A. L., Yin Chan, K. 2011. Soil health and climate change. Heidelberg : Springer.