UAB
Universitat Autònoma de Barcelona

Biosphere Sciences

2026/2027

Code: 100820
Credits: 6

Degree programme	Type	Course
Environmental Biology	OB	2

Contact lecturer

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Group languages

You can consult this information at the end of the document.

Prerequisites

Those of the degree.

Objectives

The aim of this course is to understand and analyse the processes that govern the functioning of the biosphere at the global scale, with particular emphasis on the interactions between biota and the geophysical components of the Earth system, and on the alterations that human activities are causing to these processes. The course also examines the environmental history of the Earth as a means of understanding the processes that currently govern the functioning of the planet.

The course studies the Earth as a system composed of interconnected components within the atmosphere, oceans, and continents. These interactions give rise to the major processes that determine the functioning of the Earth system, including the energy balance and energy fluxes, the climate system, atmospheric and ocean circulation, primary production, the distribution and functioning of biomes, biogeochemical cycles, and global change.

Learning outcomes

- CM13 (Propose viable projects and actions in the field of ecology that enhance social, economic and environmental benefits.) Propose viable projects and actions in the field of ecology that enhance social, economic and environmental benefits.

- KM19 (Identify specific bibliographic sources on ecology and global change to substantiate the state of the art of the main current biological-environmental challenges.) Identify specific bibliographic sources on ecology and global change to substantiate the state of the art of the main current biological-environmental challenges.
- SM18 (Conduct ecology studies that include the description and classification of all types of populations, communities and ecosystems so they can be managed, conserved and restored.) Conduct ecology studies that include the description and classification of all types of populations, communities and ecosystems so they can be managed, conserved and restored.

Contents

Part 1

1- Introduction to Biosphere Sciences. Why Biosphere Sciences? Development of Biosphere Sciences. Tools and approaches in Biosphere Sciences.

2- Earth as a System. Systems theory. Positive and negative feedbacks. Regulation of matter fluxes. Alternative stable states and tipping points.

3- Energy balance. Electromagnetic radiation. Radiative fluxes and net radiation. Greenhouse effect and atmospheric composition. Global energy balance. Climate feedbacks.

4- Atmospheric dynamics. Atmospheric pressure and air movement. General atmospheric circulation. Global climate patterns. Water in the atmosphere. Regional and local circulation patterns. Climate feedbacks.

5- Ocean circulation. Winds and surface currents. Convergence, divergence, and upwelling. El Niño and its impacts. Teleconnections. Salinity and thermohaline circulation. Deep ocean circulation. Effects of ocean circulation on climate.

6- Cryosphere. Components of the cryosphere. Snow cover. Ice on land (continental ice sheets, ice shelves, and mountain glaciers). Permafrost. Sea ice. Interactions between the atmosphere and the cryosphere.

7- Lithosphere. Structure of the Earth. Plate tectonics. Volcanism and earthquakes. Continental drift. Rocks: types and formation. Climate feedbacks.

Part 2

8- Environmental history of the Earth. Techniques for reconstructing past environments. History of climate, atmospheric composition, and continents. Evolution of biological groups and the history of the Earth System.

9- Short-term carbon balance. Terrestrial and marine primary production. Decomposition of organic matter. Measurement methods. Biogeographical patterns. Limiting factors and recent trends.

10- Long-term carbon balance. Global carbon cycle: organic and inorganic carbon. Carbon sources and sinks. Anthropogenic alteration of the carbon cycle: CO_2 and CH_4.

11- Interactions of biota within the Earth System. Regulation of atmospheric composition. Vegetation-atmosphere interactions. Extreme events: droughts and wildfires.

12- Biogeochemical cycles. Nitrogen cycle in terrestrial and marine ecosystems. Anthropogenic alteration of the nitrogen cycle. Global phosphorus cycle: sedimentation and long-term return. Global sulfur cycle: atmospheric fluxes. Anthropogenic alterations of the phosphorus and sulfur cycles.

13- Global change. History and causes of global changes. The Anthropocene. Changes in atmospheric

chemistry: the ozone layer-origin, effects, and anthropogenic alteration. Biological effects of climate change. Climate modelling and projections. Adaptation and mitigation strategies. Geoengineering.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Study	55	2.2	CM13, KM19, SM18
Classroom activities - problem-solving classes	3	0.12	SM18
External visit	4	0.16	CM13, SM18
Classroom activities - seminars	8	0.32	CM13, KM19, SM18
Tutorial	5	0.2	CM13, KM19, SM18
Computer lab assignment	10	0.4	KM19, SM18
Seminars assignment and presentation	20	0.8	CM13, KM19
Theory classes	32	1.28	CM13, KM19, SM18
Computer lab practicals	3	0.12	CM13

Lectures: The fundamental contents of the course will be presented, with particular emphasis on topics that are more difficult for students to understand. Students will be provided with the core material from the instructors' presentations. These lectures complement students' independent learning through the reading and study of the recommended textbooks. Lectures may include assessable activities based on questions, discussions, or numerical exercises.

Classroom activities - Problem-solving sessions: Numerical problems related to the contents of selected topics will be solved. These sessions may involve either the complete resolution of problems during class or the discussion and correction of problems assigned to students in advance.

Classroom activities - Seminars: Students will work in teams to prepare and deliver presentations on topics assigned by the instructors. Assessment will consider both the quality of the content and students' ability to communicate rigorously and engage in public discussion. Attendance at seminars presented by other students will also be assessed through in-class quizzes based on the presentations.

Computer practicals: Numerical problem-solving using simulation software.

Tutorials: Tutorials will be held by appointment in the instructors' offices. If required by the development of the course, particularly for problem-solving activities, some tutorials may be conducted in the classroom at times and locations to be announced in due course.

Supervised field visit: Visit to a scientific facility with educational resources. The instructors will specify the activities to be carried out during the visit, as well as the assignments to be completed and submitted afterwards.

Annotation: within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Seminars assignment and presentation	20%	2	0.08	CM13, KM19
Exams	60%	4	0.16	CM13, KM19, SM18
Problem-solving exam	7.5%	1	0.04	SM18
External visit assignment	5%	1	0.04	CM13, KM19
Computer lab assignment	7.5%	2	0.08	SM18

Assessment will be based on different types of assessment activities, including examinations, student oral presentations, classroom activities, problem-solving exercises, and quizzes completed either in class or independently.

The course is divided into two parts, each covering approximately half of the syllabus. There will be two examinations, corresponding to the two parts of the course syllabus.

To pass the course, students must obtain a minimum mark of 4.5/10 in both examinations. Students obtaining a mark below 4.5/10 in either examination may take a resit examination at the end of the course.

Students will only be required to resit the part(s) in which they obtained a mark below 4.5/10; resit examinations are not intended to improve the marks of examinations that have already been passed.

The final grade will be calculated by weighting the marks obtained in the different assessment activities as follows:

- First part of the syllabus: 30%, including the examination and, where applicable, in-class activities.
- Second part of the syllabus: 30%, including the examination and, where applicable, in-class activities.
- Problem-solving exercises and computer practical assignments (first part of the course): 15%.
- Assignment related to the supervised field visit: 5%.
- Seminars (second part of the course), including a group oral presentation in class and individual in-class assessments: 20%.

To pass the course, the final grade must be 5.0/10 or higher.

In accordance with UAB regulations, students may only take the resit examination if they have previously completed assessment activities accounting for at least two-thirds of the final course grade. Students who have completed assessment activities

representing less than 67% of the final grade will receive a final grade of "Not Assessable".

Single Assessment

- Single assessment consists of a single comprehensive examination covering the entire theoretical syllabus of the course. The mark obtained in this examination will account for 60% of the final course

grade.
- Assessment of the computer practical assignments and seminars will follow the same procedure as in continuous assessment, and the marks obtained will account for the remaining 40% of the final course grade.
- To pass the course through the single assessment system, students must also obtain a minimum mark of 4.5/10 in the comprehensive examination.
- Submission of evidence for the computer practical assignments and seminars will follow the same procedure as in continuous assessment. Students opting for single assessment may submit all required evidence together on the same day as the comprehensive examination.

Use of Artificial Intelligence

- For this course, the use of Artificial Intelligence (AI) technologies is permitted exclusively for support tasks, such as literature or information searches, text editing, or translation.
- Students may be required to clearly identify which parts of an academic assignment have been generated using AI, specify the tools used, and include a critical reflection on how these tools have influenced both the process and the final outcome of the activity.
- Failure to disclose the use of AI in an assessed activity will be considered a breach of academic integrity and may result in a partial or total penalty in the mark for that activity, or more severe disciplinary sanctions in serious cases.
- Any irregularity committed during an assessment activity (including academic fraud, plagiarism, or the unauthorized use of AI, unless such use is explicitly authorized in the course syllabus) that may lead to a significant alteration of the assessment result will result in a mark of 0 for that assessment activity.
- If the course syllabus specifies that obtaining a minimum mark in that assessment activity is a requirement for passing the course, or if multiple irregularities are committed in assessment activities within the same course, the final grade for the course will be 0. In addition, disciplinary proceedings may be initiated against any student who commits any of these irregularities.

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https://www.divulgameteo.es/archivos/articulos/meteoroteca/Historia-Clima-Tierra.pdf

Software

- Simulation software, Ecología con números, https://ddd.uab.cat/record/225887/
- Spreadsheets: Microsoft Excel, LibreOffice Calc
- R (https://www.r-project.org/) and Rstudio (https://posit.co/download/rstudio-desktop/)

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	23	Catalan	second semester	morning-mixed

(PAUL) Classroom practices	231	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	231	Catalan	second semester	afternoon
(VEXT) Visites externes a entitats	231	Catalan	second semester	morning-mixed
(PAUL) Classroom practices	232	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	232	Catalan	second semester	afternoon
(VEXT) Visites externes a entitats	232	Catalan	second semester	morning-mixed
(PLAB) Practical laboratories	233	Catalan	second semester	afternoon
(VEXT) Visites externes a entitats	233	Catalan	second semester	morning-mixed