Biosphere Sciences

Code: 100820
ECTS Credits: 6

2024/2025

Degree	Type	Year
2500251 Environmental Biology	OB	3

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Teaching groups languages

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

Prerequisites

Those of the degree.

Objectives and Contextualisation

The main objective is to know and analyze the processes that determine the functioning at a global scale of the biosphere, with a particular emphasis on the mutual interaction between the biota and the geophysical components, and on the alterations that human activity is producing in this functioning. It will also deal with the environmental history of the Earth as a tool to understand the processes that currently govern the functioning of the planet.

This implies a conception of the Earth as a system with different interconnected compartments (atmosphere, oceans and continental environments) through the energy balance and flow, the climate system, the atmospheric and ocean circulation, the primary production, the distribution and functionalism of the biomes, and the fluxes of the main chemical elements and compounds.

Competences

- Describe, analyse and assess the natural environment.
- Design models of biological processes.
- Develop analysis and synthesis skills.
- Develop strategies of analysis, synthesis and communication in order to teach biology and environmental studies.
- Focus on quality.
- Know a foreign language (English).
- Reason critically.
- Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
- Take sex- or gender-based inequalities into consideration when operating within one's own area of knowledge.
- Understand the bases of regulation of vital functions of organisms through internal and external factors, and identify environmental adaptation mechanisms.
- Work in an international context.

Learning Outcomes

1. Actuar en l'àmbit de coneixement propi avaluant les desigualtats per raó de sexe/gènere.
2. Develop analysis and synthesis skills.
3. Focus on quality.
4. Identify the principal effects of climate change on different planetary systems, especially on the biota.
5. Interpret the principal models for predicting climate change.
6. Know a foreign language (English).
7. Reason critically.
8. Recognise the different factors that determine the distribution of biological diversity on the scale of the whole biosphere.
9. Recognise the processes that determine energy and matter balances on a planetary scale.
10. Take account of social, economic and environmental impacts when operating within one's own area of knowledge.
11. Work in an international context.

Content

Part I

1- Introduction.

Why Biosphere Sciences? The Earth System and its components. Global change.

2. Introduction to a systems theory

Positive and negative feed-backs. Dynamic equilibrium and tipping points. Qualitative behaviour of dynamic systems.

3- Global balance of energy

Planetary energy balance. Albedo. Atmospheric composition and greenhouse effect. Climatic feed-backs.

4- Atmospheric circulation

Cells of atmospheric circulation. Wind regime. Coriolis. Regional circulation. Global distribution of temperatures and precipitation: climatic regions.

5- Hydrosphere

Ocean surface circulation. Light gradients, temperature and salinity in oceans. Upwelling. El Niño, La Niña and ENSO. Climate teleconnections. Ocean thermohialine deep circulation.

6- Criosphere

Components of the criosphere. Snow cover. Permafrost. Glaciers and ice platforms: Greenland and Antartida. Sea ice. Interactions between atmosphere and criosphere.

7- Lithosphere

Internal Earth structure of. Plate tectonics and continental drift. Orogeny. Weathering and sedimentation. Volcano activity.

Part II

8- Environmental history of the Earth.

Techniques of environmental reconstruction of the past. History of climate, atmospheric composition and continents. Evolution of the biological diversity along the Earth history.

7- Distribution of primary production

Measurement of primary production. Limiting factors in terrestrial and aquatic ecosystems. Changes induced by human activity.

8- Terrestrial biomes functioning

Tropical rainforest, tropical deciduous forests, savannahs, warm deserts, Mediterranean forests and shrublands, cold deserts, deciduous forests, temperate rainforests, prairies, boreal forests, tundra.

9- Effect of biota on the atmosphere and climate

Climate-vegetation feed-backs at global and regional scales: albedo, evapotranspiration, chemical composition of the atmosphere. Control of the concentration of atmospheric gases: O2, N2O, CO2, CH4, DMS.

10- Carbon balance

The cycles of organic and inorganic carbon in the short and long term. Sources and sinks. Anthropogenic modifications of the carbon cycle.

11- Global nutrient cycles

Global cycle of N in terrestrial and marine ecosystems: atmospheric flows, recycling and anthropogenic modifications. Global cycle of P: sedimentation and long-term return. S global cycle: atmospheric fluxes and anthropogenic modifications.

12- Global change and climate change

History and causes of global change. Recent climate change. Global circulation patterns and scenarios of global change. Changes in atmospheric chemistry: ozone layer - origin, effects and anthropogenic alteration. Impacts of global change in biota and human systems. Land use changes. Strategies for mitigation and adaptation. Geoengineering.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes

Type: Directed			
Classroom seminars	7	0.28	1, 6, 8, 10, 11
External visit	4	0.16	2, 4, 5
Problems in computer room	3	0.12	5, 7, 9
Problems seminars	4	0.16	3, 5, 7, 9
Theory classes	32	1.28	1, 2, 4, 5, 7, 8, 9, 10
Type: Supervised			
Practical exercises	10	0.4	2, 3, 4, 5, 7, 8, 9
Tutorial	5	0.2	2, 3, 4, 5, 6, 7, 8, 9, 11
Type: Autonomous			
Reports	24	0.96	1, 2, 3, 4, 5, 7, 8, 9, 10, 11
Study	40	1.6	2, 3, 4, 5, 6, 7, 8, 9, 11
Text reading	15	0.6	2, 3, 4, 5, 6, 7, 8, 9, 11

Theory class: The fundamental contents of the subject will be explained, emphasizing those of more difficult comprehension for the student. The basic material of the presentations made by the teacher will be provided. These classes are complementary to the student's activity based on reading and studying textbooks. They can incorporate evaluable activities.

Classroom practicum: they will be based on students presentations on subjects proposed by the teachers. They will be prepared in working teams. The contents, and the rigorous communication capabilities in public will be valued. The attendance at the seminars presented by other students will also be valued, carrying out questionnaires on the classroom presentations.

Problems practicum in classroom: Numerical resolution of problems related to the contents of some topics. They may involve the complete resolution of problems in the classroom or the correction of problems previously proposed to students.

Problems practicum in computer room: numerical resolution of problems related to the contents of some subjects.

Practical exercises: a series of exercises will be proposed, which can be numerical, reasoning, graphic repensation, etc., to be solved individually or in a group. The student will be provided with the basic instructions and information necessary for their resolution, stimulating and valuing the student's creativity and ability to research at the same time. The exercises must be delivered promptly within the established deadlines and must be edited properly.

External visit: exit to an installation with educational resources (museum) following the guidelines set by the teachers, which will indicate the activities to be carried out, as well as the works that must be presented.

Tutorials: The tutorials will be carried out at scheduled hours in the teacher' office. If the development of the subject, and particularly the exercises, requires it, a part of the tutorials can be done in the classroom in hours and location to be specified.

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

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Exams	60%	6	0.24	2, 3, 4, 5, 7, 8, 9
Reports	40%	0	0	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11

The evaluation will be based on different activities: exams, oral presentations in public by the student, problems, activities and resolution of questionnaires in class or autonomously. The program is structured in two parts that comprise approximately half of the content each one.

There will be two exams corresponding to the two parts of the program. To pass the program, a minimum score of 4.5 must be obtained in both exams. Students with a score of less than 5 in any of the exams may do another recovery examination at the end of the course. The student can only do these additional exams from the non-approved previous exams of each part (with a score of less than 5); additional recovery exams do not serve to raise the score of the approved exams.

The final grade will be obtained by weighting the scores of the different activities in the following proportion:

- First part of the theory program: 30%, including exams and classroom activities (if any)

- Second part of the theory program: 30%, including exams and classroom activities (if any)

- Work related to the external visit: 5%

- Problems and computer work (first part of the program): 15%.

- Practical work of the second part of the program (oral presentation and questionnaires): 20%.

The recovery system contemplates a written additional exam corresponding to the examinations of the first and the second part, as well as a set of sequential written tests on the practices of the second part.

The students will obtain a "Non-Valuable" qualification when the evaluation activities carried out have a weighting of less than 67% in the final grade.

The single evaluation consists of an exam in which the contents of the entire theory program will be assessed. The exam will consist of short questions on topics to be developed and the grade obtained in this exam will account for 60% of the final grade. The evaluation of computer practice activities and seminars will followthe same process as the continuous evaluation and the grade obtained will represent 40% of the final grade of the subject. The delivery of evidence from the computer practices and seminars will follow the same procedure as the continuous evaluation. Students who take the single evaluation can hand in all the evidence together on the same day as the one set for the theory exam.

Bibliography

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Software

Excel. Simulation programs from the book *Ecología con Números.* Available a http://ddd.uab.cat/record/225887

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	231	Catalan/Spanish	second semester	morning-mixed
(PAUL) Classroom practices	232	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	231	Catalan	second semester	afternoon
(PLAB) Practical laboratories	232	Catalan	second semester	afternoon
(PLAB) Practical laboratories	233	Catalan	second semester	afternoon
(TE) Theory	23	Catalan	second semester	morning-mixed