Universitat Autònoma de Barcelona

2018/2019

Biosphere Sciences

Code: 100769
ECTS Credits: 6

Degree	Type	Year	Semester
2500250 Biology	OB	3	2

Contact

Name: Francisco Lloret Maya
Email: Francisco.Lloret@uab.cat

Use of languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: No

Teachers

Carlos Hernández Castellano
Víctor Flo Sierra
Àngela Ribas Artola

Prerequisites

There are no prerequisites, but it is recommended to have passed Ecology, Mathematics and Physics.

Objectives and Contextualisation

The objective is to know and analyze the processes that determine the functioning of the biosphere on a global scale, with a particular emphasis on the mutual interaction between biota and geophysical components, and on the alterations that human activity is introducing. It will also be considered 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 components interconnected in the atmospheric, oceanic and continental environments. This connection results on processes as balance and flow of energy, climate system, atmospheric and ocean circulation, primary production, distribution and functionalism of biomes, nutrient fluxes.

Content

PART 1

1. Introduction. Why about biosphere sciences? The Earth system and its components. Global change. The Gaia hypothesis.

2. Introduction to systems theory. Positive and negative feedback. Equilibriums. Qualitative behavior of dynamic systems.

3. The global balance of energy. Electromagnetic energy. Albedo. Equilibrium temperature of a planet. Composition of the atmosphere and the greenhouse effect. Effect of clouds on the energy balance. Main climatic feedbacks.

4. Atmospheric circulation system. Vertical and horizontal movement of the air. Atmospheric circulation at different latitudes. The effect of Coriolis and the distribution of surface winds. Global distribution of temperature and precipitation. The global hydrological cycle.

5. Ocean circulation. Winds and superficial currents. Convergence, divergence and upwelling. El Niño. Teleconnexions. Salinity and thermohaline circulation. Deep circulation of the oceans. Effect of ocean circulation on climate.

6. Cryosphere. Components of the cryosphere. Snow cover. Permafrost. Glaciers, Greenland and Antarctica. Marine ice. Interactions between the atmosphere and the cryosphere.

7. Lithosphere. Inner Earth structure. Plate tectonics and continental drift. The recycling of the lithosphere: vulcanism, orogeny, weathering, sedimentation.

PART 2

8- Environmenta history of the Earth system. Techniques of environmental reconstruction of the past. History of climate, atmospheric composition and continents. Evolution of the biological groups along the Earth history.

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

10- 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.

11- Effect of biota on the atmosphere and the climate. Climate-vegetation feed-backs at global and regional scales: albedo, evapotranspiration, chemical composition of the atmosphere. Control of the concentration of atmospheric gases: oxygen, N_2O, CO_2, methane, DMS.

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

13- 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.

14- 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. Landuse changes. Strategies for mitigation and adaptation. Geoengineering.