Universitat Autònoma de Barcelona

2017/2018

Soil Protection

Code: 100816
ECTS Credits: 6

Degree	Type	Year	Semester
2500251 Environmental Biology	OT	4	0

Contact

Name: Josep Maria Alcañíz Baldellou
Email: JoseMaria.Alcaniz@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

Maria Rosa Cañizares Gonzalez

Prerequisites

Although there is no official prerequisites to take this course the student should have knowledge about soils at the level equivalent to a general course on soil science.

Also is useful skills and concepts explained in the subjects Physical Environment, Ecology, Natural Environment Survey and Valuation of Ecosystems and species, among others.

Objectives and Contextualisation

The Soil Protection is an optional course in the fourth year Degree on Environmental Biology which introduces students to applied soil science issues, especially with regard to environmental issues, trying to bring it closer to professional activities. Based on the concepts explained in the course of soil science, it considers the soil as a natural resource and explains the principles of sustainable use and management. Also, the course shows the regulatory framework that protects the soil. It also describes the main degradation processes that affect this natural resource, such as erosion, loss of organic matter, salinization, pollution, sealing, etc. and explain the conservation or rehabilitation measures most appropriate in each case. It discusses the contribution to environmental and social services furnished by soil, as well as its role in aggravation or mitigation the effects of global change. Information about the current state of soils and about our responsibility in its management are reported.

The aim of this course is to achieve training to assign proper use of soils, evaluate its conservation degree, detect the main problems of degradation, and to propose rehabilitation measures for degraded soils.

Skills

- Develop creativity.
- Diagnose and solve environmental problems regarding the biological environment.
- Manage, conserve and restore populations and ecosystems.
- Participate in environmental impact assessments regarding the biological medium.

- Solve problems.

Learning outcomes

1. Develop creativity.
2. Draw up plans for the fertilisation or management of soils.
3. Evaluate soils' capacity for use.
4. Identify impacts on soil.
5. Identify soil degradation problems and propose solutions to these.
6. Solve problems.

Content

1- The soil as a natural resource and its protection. Major environmental functions and services furnished to the society. Man as a manager and user of the soil. Regulations promoting soil protection, as Thematic Strategy for Soil Protection.

Degradation processes and soil conservation practices

2- Degradation processes. Main soil degradation processes. Evaluation of the soil quality and soil degradation. Soil quality indicators. Acceptable rates of degradation and sustainable management of soil.

3. Physical degradation processes of the soil. Degradation of the structure: causes and consequences on the environment. Structure stability. Soil compaction and crusting. Preventive methods for structure conservation. Soil sealing and urban use.

4- Erosion as a land degradation problem. Water erosion: rainfall erosivity and soil erodibility. The models for the study of erosion: the (R)USLE. Prevention techniques and erosion control, benches and terraces. Conservation agriculture.

5- Management of water and salinity in the soil. Conservation of water in the soil and control techniques. Irrigation and drainage. Soil salinization associated with irrigation. Management and improvement of saline and sodic soils.

6- Contaminated soils. Causes and characteristics of soil pollution. Current legal framework and its application. Generic reference levels, setting and interpretation. Environmental management of sites with contaminated soils. Remediation of polluted soils: extraction, degradation, immobilization, bioremediation. Case study: the pollutants associated with sewage sludge applied to soil.

7- Management of soil organic matter and carbon sequestration. The soil as a reservoir of carbon and nitrogen in the context of global change. Loss of soil organic matter as a result of the use and management. Composting. Recycling organic wastes, regulations and standards applicable to the soil. Biochar.

8- Soil fertility management and protection of forests and agricultural environment. Fertilization and biogeochemical cycles. Nutrient availability, conservation and efficient use of nutrients. Good practices in relation to nitrogen fertilization. Soil fertility problems (poor soils, acid soils, overfertilization) and corrective measures.

Soil diversity, mapping and evaluation

9- Soil mapping. Soil maps and their interpretation. Environmental information on current soil maps. Available maps. Applications.

10- Soil and land evaluation for different uses. General and specific systems. Applications. Basis for spatial land-use planning.

Ecological restoration of degraded areas

11- Conceptual framework for ecological restoration of degraded areas. Objectives of the restoration. Specification of the final use of the area to be restored. Main methodological items for soil rehabilitation. Restoration projects. Quality indicators of the restoration and its evaluation.

12- Restoration of mining activities: Evolution of rehabilitation works in a quarry and comparison of alternatives. Evaluation of restoration (one-day field practice, quarry Dos Maries, Alcover)

13- Restoration of wildfire affected areas. Effects of fire on soils. Techniques for the regeneration of burned areas.

14- Bioengineering techniques for the restoration of road slopes and other denuded areas.

Effects of pollutants or an organic waste applied to soil (Laboratory, 14h)

1. Preparing incubations of a soil with and organic waste or pollutant (2h)

2. Determinations of the effects on soil at the laboratory (3 sessions per group,12h)

Environmental assessment of soils from an area and proposals for corrective measures: land use, degradation problems, evaluation and corrective measures (supervised work evaluable). A plenary session (1h), independent work in groups of five students (25h) and follow-up session (1h). Presentation of a poster in digital format.

Methodology

The teaching methodology aims to achieve the objectives of the course and enable students to continue learning once it is completed. It will combine various learning strategies so that students are the protagonists of their training.

1) Lectures (26 h). Sessions will be accompanied by notes and various educational materials that may be delivered to students through virtual campus. Learning content and concepts explained in the lectures require student's personal study to assimilate them. As guidance, it is estimated that every hour of lectures requires two hours of personal study.

2) Case studies and practical problems (5 attendance hours + 8 h hours of personal study). The case-based learning is a tool particularly useful because it enables students to apply the knowledge acquired in lectures. These activities will consist on explanation and discussion of soil erosion and pollution problems.

3) Field practices. It consists of a one-day trip to see the restoration of a quarry and the results of various tests. Also, a work in small groups to evaluate the effects on revegetation of two ways to restore the quarry will be performed (8 h).

4) Laboratory practices (14 h). These sessions are planned to assess the effects of an organic waste or pollutant amendment on soil. They comprise a session to prepare the experiment (2h) and three sessions of four hours (12h) in which students, working in small groups, analyse the effects on some physical, chemical and biological parameters of amended soil, and interpret results (6h). It will submit a one-page summary of results per group. To attend these practices, students must have passed a biosafety and security test, found in the Virtual Campus, and to be aware and accept the laboratories operation rules of the Faculty of Biosciences.

5) Practical work. It consists of anenvironmental assessment of soils of a selected zone, its uses and the conservation status, and to propose corrective measures. Work will be performed in groups of about five students and presented as a poster. Work will also present a brief (two pages) which will explain the most serious problem affecting the soils of the study area and propose solutions. A session will be held to explain what the work will consist of (1h). Evaluable activity (25 h). There will be a follow-up in which the teachers will guide and evaluate the progression of the work (1h).

Activities

Title	Hours	ECTS	Learning outcomes
Type: Directed			
Case studies and practical problems	5	0.2	2, 5, 6
Explanation of practical work	1	0.04	1, 4, 5, 3
Field work	8	0.32	1, 4, 5
Lab work	14	0.56	2, 4, 6
Lectures	26	1.04	4, 5, 3
Type: Autonomous			
Interpretation of field and lab results	6	0.24	1, 2, 5, 6
Personal learning	51	2.04	1, 2, 4, 5, 6, 3
Practical work (poster)	25	1	1, 4, 5, 3
Resolution of cases and problems	8	0.32	2, 5, 6

Evaluation

The evaluation is done throughout the year and has a formative character. It is based on the following elements:

1. First test. It consists of 4-6 questions and / or short answer exercises on the main concepts that must be known at the time of its realization. It does not eliminate matter for the final test.

2. Final test. It consists of 4-6 questions and / or exercises that will be formulated in relation to the knowledge explained about problems of degradation and soil management.

3. Interpretation of results of laboratory practices. It consists of the presentation of the results of the analyses carried out in the laboratory, in a single sheet for each group of practices, with a justification of the results obtained. Correct interpretation and critical evaluations will be assessed.

4. Poster and summary of practical work

It consists in presenting a digital poster A1equivalent (594 x 840 mm), carried out in groups, about the environmental assessment of soils in a particular area, its uses and the conservation status, as well as the proposed corrective measures. It must include, at least, the following parts:

-Location and description of the study area

-Distribution of soil uses and potentially contaminated sites

-Soil degradation problems detected, its causes, size and intensity

-Possible corrective measures

-Overall evaluation of conservation status of the soils in the studied area

That problem considered more serious or of greater relevance for the soils of the studied area, and the solutions proposed, will be explained in a concluding summary of maximum two pages.

All assessment tests are obligatory. To pass the course, it is necessary that in the individual evaluations a score of not less than 3 points has been obtained.

Evaluation activities

Title	Weighting	Hours	ECTS	Learning outcomes
Final test	30%	2	0.08	1, 2, 4, 5, 6, 3
First test	25%	2	0.08	1, 2, 4, 5, 3
Interpretation of practical work	10%	0	0	2, 5, 6
Practical work (poster) and summary of soil problems	35%	2	0.08	1, 4, 5, 3

Bibliography

Textbooks:

-Agassi, M. (1996) Soil erosion, conservation and rehabilitation. Marcel Dekker, New York, 402 p.

-Brady N. C. & R. R. Weil. 2008. The nature and properties of soils (14th ed.). Prentice Hall Upper Saddle River, New Jersey. 975 p. http://wps.prenhall.com/chet_brady_natureandp_13

-Gómez Orea, D. (2004) Recuperación de espacios degradados. Mundi Prensa, Madrid, 583 p.

-Lal, R.; W.H.Blum, C. Valentine, B.A. Stewart (1998) Methods for assessement of Soil Degradation, Advances in Soil Science, CRC press, New York, 558 p.

-Magdoff, F. & H. van Es. 2000. Building Soils for Better Crops. Sustainable Agriculture Network (SAN) - USDA

-Porta, J., M. López-Acevedo & R. M. Poch. 2014. Edafología: uso y protección de suelos, 3ª ed, Mundi-Prensa.

-Tan, K. H. 1994. Environmental soil science. Marcel Dekker. New York.

-TRAGSA (1994). Restauración hidrológico forestal de cuencas y control de la erosión. Ed. Mundi Prensa.

Web links:

-USDA - Natural Resources Conservation Service. Technical References: http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/

-USDA - Natural Resources Conservation Service. Soil Education.

http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/edu/

-Universidad de Granada. Departamento de Edafología y Química Agrícola. http://edafologia.ugr.es/index.htm

-National Aeronautics and Space Administration (NASA). Soil Science Education Homepage. http://soil.gsfc.nasa.gov/

-Soil-net. Welcome to Soil-net.com. http://www.soil-net.com/

-International Union of Soil Sciences. Soil science education. http://www.iuss.org/popup/education.htm

-Institut d'Estudis Catalans. Protecció de sòls, mapa de sòls de Catalunya. http://www.iec.cat/mapasols/