Universitat Autònoma de Barcelona

2018/2019

Soil Protection

Code: 100816
ECTS Credits: 6

Degree	Type	Year	Semester
2500251 Environmental Biology	OT	4	0

Contact

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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

Andrea Vidal Durà

Prerequisites

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

The skills acquired and concepts explained in the subjects Physical Environment, Ecology, Natural Environment Survey and Valuation of Ecosystems and Species, among others, will be useful in this course.

Objectives and Contextualisation

Soil Protection is an optional course in the fourth year Degree in Environmental Biology which introduces students to applied soil science issues, especially with regard to environmental issues, trying to bring it closer to a professional profile and activities. The concepts explained in the second-year course in Soil Science will be the starting point to introduce the soil as a natural resource and, then to explain the principles of sustainable use and management. Also, the course addresses the regulatory framework for soil protection. It also describes the main degradation processes that affect this natural resource, such as erosion, loss of organic matter, salinization, pollution, sealing, etc. and explains the conservation or rehabilitation measures most appropriate in each case. The contribution to environmental and social services provided by soils, as well as their role in aggravation or mitigation the effects of the global change will be discussed. Information about the current state of soils and about our responsibility in their management will be also tackled.

The aim of this course is to train the students in assigning the correct or more sustainable use of soils, evaluate their conservation state, detecting the main problems of soil degradation, and to enable them 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 provided to the society. People as soil users and managers. Regulations promoting soil protection, such as the Thematic Strategy for Soil Protection.

Degradation processes and soil conservation practices

2- Soil 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. Soil physical degradation processes. 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. Study of erosion models: 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 forest and agricultural soils. 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. The basis for spatial land-use planning.

Ecological restoration of degraded areas

11- A 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 restoration assessment.

12- Restoration of mining activities: Evolution of rehabilitation works in a quarry and comparison of alternatives. Evaluation of restoration (one-day field practical, at Dos Maries quarry Dos, 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 amended with an organic waste or a pollutant (2h)

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

Environmental assessment of soils from an area and proposals for corrective measures. The students will look at land use and degradation problems, they will assess the state of soil and will suggest a set of corrective measures (supervised work evaluable). There will be a plenary session (1h) to explain what the work consists of. Students will be organised in teams (3-5 students per group) and they will work autonomously (25h) with a follow-up session (1h). The work will be presented as a scientific poster (in digital format) with an oral presentation for the audience.

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 different learning strategies so that students lead their training.

1) Lectures (26 h). Sessions will be accompanied by handouts 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 allows students to apply the knowledge acquired in lectures. These activities will consist on explanation and discussion of soil erosion and pollution problems.

3) Field practice. A one-day trip to visit the restoration of a quarry and the results of various tests applied in the past. Also, students will work in small teams to evaluate the effects of two quarry restoration techniques on revegetation (8 h).

4) Laboratory practices (14 h). These sessions are planned to assess the effects of an organic waste or a pollutant amendment on the soil. The laboratory practices comprise a first session to prepare the experiment (2h), and three sessions of four hours (12h) in which students, working in small teams, will analyse the effects of the soil amendment on some physical, chemical, and biological soil parameters. They will need autonomous work for the interpretation of the results (6h). Students will share their data and submit (per group) a summary of the results and discussion of the overall experiment. To attend these practicals, students must have passed a biosafety and security test, that can be found on the Virtual Campus, and must be aware of and accept the laboratory operation rules of the Faculty of Biosciences.

5) Practical work. It consists of an environmental assessment of soils of a selected zone, their current uses, and the conservation status, and to propose corrective measures. This practical work will be performed in teams of 3-5 students and they will do a presentation of their work in a scientific poster format. An informative session will be held in which the practical work will be explained (1h). Evaluable activity (25 h of team-work). There will be follow-up sessions (assistance will be voluntary) in which the professors will guide the progression of the work. At the end of the semester, all the teams will perform an oral presentation of their poster.

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 the test realization. It does not eliminate materials/topics being evaluated in 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 soil degradation and management.

3. Interpretation of results of laboratory practicals. It consists of the submission of a report of the results and discussion of the analyses carried out in the laboratory. Students must report and discuss the results of the overall experiment, which means that they will use not only the data of their own group but the other group's results. Correct interpretation and critical evaluations will be assessed.

4. Scientific poster. It consists of the submission (only in digital format, A1 equivalent, 594 x 840 mm) and oral presentation of a scientific poster. It will be carried out in groups and aim to address the environmental assessment of soils in a particular area, their uses, and their conservation status. The students will suggest a set of potential corrective measures. The poster must include, at least, the following parts:

-Location and description of the study area

-Distribution of soil uses

-Soil degradation problems detected, their causes, size (estimation of the affected area) and intensity

-Potential corrective measures

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

A public session for the oral presentation of the posters will be held at the end of the semester and each group will have 10 minutes to present their work.

All assessment items are mandatory. To pass the course, it is necessary to obtain a global average mark of 4,9. However, the students that do not reach such score and have been assessed of 2/3 of the overall assessment items, will be able to take an exam resit. According to the current UAB assessment regulations, having an average score equal to or greater than 3,5 will be a sine qua non (i.e. 3,5 is the minimum required mark) to be eligible for the exam resit.

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	15%	0	0	2, 5, 6
Practical work (poster) and public session	30%	2	0.08	1, 4, 5, 3

Bibliography

Further electronic resources and materials will be posted by the professors on the Campus Virtual during the developing of the course.

Basic 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/