Universitat Autònoma de Barcelona

2021/2022

Soil Protection

Code: 100816
ECTS Credits: 6

Degree	Type	Year	Semester
2500251 Environmental Biology	OT	4	0

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities.

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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

Other comments on languages

Some lessons will be taught in spanish (25%) and the most of them in catalan

Teachers

Sara Marañon Jimenez

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.

Competences

- 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 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 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 the 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, management and climate change.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 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. Geotechnical stability, erosion control, revegetation and landscape integration.

Practical case studies

15- Obtaining and interpreting soil descriptions and analysis. Soil quality indicators.

16- Studies of fertilization plans and effects of residues or pollutants in soil. Soil fertility problems and analysis (unfertile soils, acid soils, overfertilization) and corrective measures.

16- Estudi de plans d'adobatge i d'efectes de contaminants o de residus aplicats a sòls. Anàlisis i problemes de fertilitat de sòls (sòls pobres, sòls àcids, sobrefertilització) i les mesures de correcció.

17- Environmental assessment of soils from an area and proposals for corrective measures. The students will look at land use and degradation problems, estimation of soil losses by erosion, agrological capability, identification of activities with pollution risc, and they will assess the state of soil and will suggest a set of corrective measures.

*Unless the requirements enforced by the health authorities demand a prioritization or reduction of these contents.

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 of 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). In the event that the field trip cannot be carried out, examples of restoration work on extractive activities will be shown electronically.

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 thesepracticals, students must have passed a biosafety and security test, that can be found on the Virtual Campus, and must be aware of and accept thelaboratory operation rules of the Faculty of Biosciences. In the event that laboratory activities cannot be carried out, they will be replaced by case studies and / or problems that will be discussed and presented by each group of practices.

5) Practical (collaborative) group work: It consists on the production of a video-documentary about a process of soil degradation or about the processes of soil degradation that affect a specific area. The video will include an explanation of the soil degradation process (s), the mechanisms involved, their relevance and implications, as well as the corrective measures that could be carried out and their potential viability. The video may include interviews, visits to the field or affected areas, visits to centers (eg: waste treatment, treatment plants, etc). As an assessable previous activity, a script will be delivered with the contents of the video, the target audience and communication objectives (eg: educational and training, informative, informative, awareness, etc). The maximum length of the video will be 45 min. The video will be made in groups of 3-5 people. 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.

The proposed teaching methodology may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

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.

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 or alternative activities	8	0.32	1, 4, 5
Lab work or alternative activities	14	0.56	2, 4, 6
Lectures	26	1.04	4, 5, 3
Type: Autonomous			
Interpretation of practicals results or problems	6	0.24	1, 2, 5, 6
Personal learning	51	2.04	1, 2, 4, 5, 6, 3
Practical work (video)	25	1	1, 4, 5, 3
Resolution of cases and problems	8	0.32	2, 5, 6

Assessment

The assessment of this course 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 or multiple choice test on the main concepts that must be known at the time of the test realization. It does not eliminate materials/topics being assessed in the second test.

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

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 laboratoryor the resolution of problems, with a justification or interpretation of the same. The correct interpretation and critical evaluations will be assessed.

4. Video-documentary on soil degradation processes. A first evaluation consists of the presentation of a video script, made in a group, about a process or processes of degradation of an area, the mechanisms involved, their relevance and implications, as well as the corrective measures that could be carried out and their potential viability. Thirty days before the delivery of the video, it will be delivered a video script, which will represent the 33% of the final qualification mark of the video. After this delivery, the students will have feedback from the responsible teacher and will have to make the pertinent modifications. The final video will have 66% of the weight final qualification mark of the video. The projection of the video will take place in a joint session at the end of the course.

Qualification of the course and resit

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 beenassessed 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.

*Student's assessment may experience some modifications depending on the restrictions to face-to-face activities enforced by health authorities.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First test	25%	1.5	0.06	1, 2, 4, 5, 3
Interpretation of practical work or problems	15%	1	0.04	2, 5, 6
Practical work (video)	30%	2	0.08	1, 4, 5, 3
Second test	30%	1.5	0.06	1, 2, 4, 5, 6, 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):

-Brady N. C. & R. R. Weil. 2017. The nature and properties of soils (15th ed.). Prentice Hall Upper Saddle River, New Jersey. 975 p.
https://cataleg.uab.cat/iii/encore/record/C__Rb2007847__SBrady__Orightresult__U__X4;jsessionid=233CFE7E45

-Gómez Orea, D. (2004) Recuperación de espacios degradados. Mundi Prensa, Madrid, 583 p.
https://cataleg.uab.cat/iii/encore/record/C__Rb1688473__SG%C3%B3mez%20Orea__Orightresult__U__X4?lang

-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.
https://cataleg.uab.cat/iii/encore/record/C__Rb1481201__SLal%2C%20R__Orightresult__U__X3?lang=cat&suite=

-Magdoff, F. & H. van Es. 2009. Building Soils for Better Crops. Sustainable Agriculture Network (SAN) - USDA
https://cataleg.uab.cat/iii/encore/record/C__Rb1874950__SMagdoff__Orightresult__U__X4;jsessionid=73123C4B

-Porta, J., M. López-Acevedo & R. M. Poch. 2014. Edafología: uso y protección de suelos, 3ª ed, Mundi-Prensa.
https://cataleg.uab.cat/iii/encore/record/C__Rb1795204__SL%C3%B3pez-Acevedo__Orightresult__U__X4?lang=

-Tan, K. H. 2009. Environmental soil science. Marcel Dekker. New York.
https://cataleg.uab.cat/iii/encore/record/C__Rb1874950__SMagdoff__Orightresult__U__X4;jsessionid=73123C4B

-TRAGSA (1998). Restauración hidrológico forestal de cuencas y control de la erosión. Ed. Mundi Prensa.
https://cataleg.uab.cat/iii/encore/record/C__Rb1450709__SRestauraci%C3%B3n%20hidrol%C3%B3gico%20fore

Web links:

-USDA - Natural Resources Conservation Service: https://www.nrcs.usda.gov/wps/portal/nrcs/site/soils/home/

- FAO Soils Portal: http://www.fao.org/soils-portal/en/

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

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

- Institut Cartogràfic i Geològic de Catalunya: https://www.icgc.cat/

- Sociedad Española de Ciencias del suelo: https://www.secs.com.es

- The nature Education Knowledge Project, Soil, Agriculture and Agricultural Biotechnology:
https://www.nature.com/scitable/knowledge/soil-agriculture-and-agricultural-biotechnology-84826767/

- 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

- European Society for Soil Conservation http://www.soilconservation.eu/

Software

Comun software of Microsoft Office.

Other common software of video edition.

Internet browsers.