25218 - Soil degradation and pollution

Información del Plan Docente

Academic Year	2018/19
Subject	25218 - Soil degradation and pollution
Faculty / School	201 - Escuela Politécnica Superior
Degree	277 - Degree in Environmental Sciences 571 - Degree in Environmental Sciences
ECTS	6.0
Year	2
Semester	Second Four-month period
Subject Type	Compulsory
Module	---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

This subject is offered in the English Friendly form

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, seminars, laboratory sessions, fieldwork and autonomous work and study.

The preferred methodology in the lectures and practice sessions will combine an expositive and a demonstrative method. The expositive method, which is characterized by the communication of concepts, will be used when students do not have

prior knowledge that allow participatory debate, or in the case of concepts or relationships requiring a formal precision. The demonstrative method is marked by demonstrating a task or a procedure, and will be used in practice tasks.

For the students, the interrogative method is recommended for their learning, by asking the teacher or trying to find answers to his questions, and the active method, becoming the agent of his own formation through personal research, direct contact with reality and experience in the working group in which he is incorporated.

4.2.Learning tasks

This course is organized as follows:

- **Lectures**. Expositive and participatory lectures that will be followed by exercises and discussion topics.
- **Seminars** and **laboratory sessions**. Demonstrative and interrogative activities essentially aimed to dominate laboratory and field procedures.
- **Fieldwork**. Field work carried out during the second half of the course, and focused to the consolidation and expansion of concepts.
- **Autonomous work and study**. Study and application of the topics covered, preparation of practices' reports, elaboration of a group work, preparation of exams...

4.3.Syllabus

This course will address the following topics:

Lectures

Section 1. Introduction

- Topic 1. Types of soil degradation (physical, chemical and biological) and its effects on ecosystemic services. Diagnostic properties of soil vulnerability and auto-depuration. Legal regulation on soil protection, pollution and remediation.

Section 2. **Soil degradation processes**

- Topic 2. Water erosion. Rainfall erosivity and soil erodibility. Methods of study of water erosion. Available techniques of erosion prevention and control.
- Topic 3. Degradation of the soil structure by compaction and surface crusting. Prevention methods. Correction technologies. Prime farmlands and soil sealing.
- Topic 4. Management of organic matter and carbon sequestration. Recycling of organic waste through agricultural soils and Tecnosols. Carbon stock and transfer. Technical options for carbon sequestration in soil.
- Topic 5. Contamination by over-fertilization and agrochemicals. Dynamics of nutrients in the soil. Good practices in relation to nitrogen and phosphate fertilization. Characteristics of agrochemicals: persistence and evolution in the soil. Factors and mechanisms of degradation.
- Topic 6. Contamination by heavy metals. Definition, origin, dynamics in soil, especiation, factors controlling presence and bioavailability. Generic reference values and their interpretation. Legal regulation of heavy metals in soils. Phytoremediation.
- Topic 7. Organic pollutants. Characteristics and properties. Evolution in soils, processes, types and origin.
- Topic 8. Rehabilitation or sanitation of contaminated soils. Planning and treatments: 1) physical, chemical and biological; 2) "in situ", "on site" and "off site" treatments. Monitoring of rehabilitation: Ecotoxicology, key concentrations (PNEC and PEC).

Section 3. **Soil restoration. Case studies in Aragon**

- Topic 9. Restoration, rehabilitation and reclamation. Fundamentals and main goals. Basic methodological aspects.

Spatial and temporal planning. Soil quality indicators.
- Topic 10. Erosion of badlands in marls. Properties and management of soils developed on marls. Bioengineering applied to the control of erosion.
- Topic 11. Soils affected by wildland fires. Effects of fire on soil properties. Evolution of plant cover after fire. Soil erosion control and plant recovery techniques.
- Topic 12. Soils affected by opencast mining. Technosols. Impacts, factors limiting reclamation. Restoration programme.
- Topic 13. Saline soils. Effects of salts and sodium on plants and soils. Management of saline and sodic soils. Restoration of agricultural saline soils.
- Topic 14. Conservation agriculture: characteristics, advantages and problems regarding traditional agriculture, evolution and current status. Conservation agriculture vs. traditional agriculture in Spain. Cultivation of olive and vineyard with plant covers.
- Topic 15. Soils affected by pesticides. The case of lindane. Origin, redistribution and accumulation. Treatment and remediation.

Practice sessions

1. Scientific documentation (with the collaboration of the School library)
2. Effect of soil physical attributes on seed germination and growth.
3. Microbial reduction of soils.
4. Soil organic matter mineralization in aerobic conditions.
5. Soil pH regulation and management.
6. Structural stability of soil aggregates.
7. Soil erodibility (rainfall simulation).
8. Soil salinity.
9. Transport of fluid pollutants through soil.
10. Field trip. Soil conservation and degradation processes in Aragón.

4.4.Course planning and calendar

It is estimated that an average student should devote to this subject, 6 ECTS, a total of 150 hours. This time must include both classroom and non-attendance activities. The student must ensure that the dedication is distributed all over the semester.

The basic pattern for classroom and laboratory activities is composed by four weekly hours. Nevertheless, this pattern should be modified by non school days, field trips or by other academic activities. These changes will be announced in classroom and also through the Moodle e-learning campus.

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle.

4.5.Bibliography and recommended resources

BB	Brady, Nyle C.. Elements of the nature and properties of soils / Nyle C. Brady, Ray R. Weil . 3rd ed. Upper Saddle River, NJ : Prentice Hall, cop. 2010
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BB	Porta Casanellas, Jaime. Edafología para la agricultura y el medio ambiente / Jaime Porta Casanellas, Marta López-Acevedo Reguerín, Carlos Roquero de Laburu . 3ª ed., rev. y amp. Madrid [etc.] : Mundi-Prensa, 2003
BC	Agassi, M. (1996). Soil erosion, conservation and rehabilitation. New York: Marcel Dekker
BC	Aubert, Georges. La edafología : el suelo en el que vivimos / Georges Aubert, Jean Boulaine . Barcelona : Orbis, D.L.1986
BC	Breemen, Nico van.. Soil formation / by Nico van Breemen and Peter Buurman. . 2nd ed. Dordrecht ; London : Kluwer Academic, cop. 2002
BC	Buckman, Harry O.. Naturaleza y propiedades de los suelos : texto de edafología para enseñanza / Harry O. Buckman y Nyle c. Brady ; traduccido por R. Salord Barceló ; texto revisado por José Mª Vives de Quadras . Barcelona [etc.] : UTEHA, D.L. 1965
BC	Cobertera Laguna, Eugenio. Edafología aplicada : Suelos, producción agraria, planificación territorial e impactos ambientales / Eugenio Cobertera Laguna . Madrid : Cátedra, 1993
BC	Dingus, Del. Introductory soil science : laboratory manual / Del Dingus . Upper Saddle River : Prentice Hall, cop. 1999
BC	Duchaufour, Philippe. Atlas ecológico de los suelos del mundo / por Philippe Duchaufour ; con la colaboración de Pierre Faivre, Michel Gury ; versión castellana de Ma. Tarsy Carballas Fernández. Barcelona : Toray-Masson, 1977
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BC	Duchaufour, Philippe. Manual de edafología / por Philippe Duchaufour ; versión española de los doctores Ma. Tarsy Carballas Fernández y Modesto Carballas Fernández . Barcelona [etc.] : Masson, 1987
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	edafogeografía / C. Ferreras Chasco, C. Fidalgo Hijano . [3ª reimp.] Madrid : Sintesis, D.L. 1991 (reimp. 2009)
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BC	Soil genesis and classification / S.W. Buol ... [et al.] . 5th. ed. Ames, Iowa : Iowa State Press, 2003
BC	Tan, Kim H.. Environmental soil science / Kim H. Tan . 3th. ed. Boca Raton : CRC press, cop. 2009

The updated recommended bibliography can be consulted in:
http://psfunizar7.unizar.es/br13/egAsignaturas.php?id=10976