

25218 - Soil degradation and pollution

Syllabus Information

Academic Year: 2020/21

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...

In relation to the Sustainable Development Goals, the students are invited to develop a group task about soil degradation processes assessment and solving. Each group receives a set of real study cases, and the students must (1) assess which are the most feasible degradation processes and suggest a set of analytical approaches to reach a definitive assessment, (2) analyze the severity of the processes, in terms of affected area and process intensities, and (3) propose the most feasible actions, both in terms of soil use and management and restoration actions, which could counteract the adverse effects of the identified degradation processes.

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 Technosols. 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.

Type of activity / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
<i>Onsite activity</i>																
Theory	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2
Problem-solving activities															2	2
Laboratory practice		2	2		2	2	2			2	2		2	2	2	
Group working																
Field trip														5		
Face-to-face tutorial			2				2					2				
Assessment																
<i>Off-site activities</i>																
Individual working	5	3	2	4	4	2	2	8	4	4	4	2	4			4
Group working		1		2		2			2			2			2	
TOTAL	7	8	8	8	8	8	8	8	8	8	8	8	8	9	8	8

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
- BB** Brady, Nyle C.. The Nature and properties of soils / Nyle C. Brady, Ray R. Weil . Rev. 14th ed. Upper Saddle River, N.J. : Pearson/Prentice Hall, cop. 2008
- BB** Introducción a la contaminación de suelos / editor científico R. Jiménez Ballesta . Madrid : Mundi-Prensa, D.L. 2017

- 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
- BB** Porta Casanellas, Jaime. Introducción a la edafología : uso y protección del suelo / Jaime Porta Casanellas, Marta López-Acevedo Reguerín, Rosa M. Poch Claret. Madrid, [etc.] : Mundi-Prensa, 2008
- 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 ; traducido 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
- BC** Duchaufour, Philippe. Edafología. Vol.1, Edafogénesis y clasificación / por Philippe Duchaufour; versión española de los doctores Mª Tarsy Carballas Fernández y Modesto Carballas Fernández . Barcelona : Masson, 1984
- 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
- BC** Ferreras Chasco, Casildo. Biogeografía y edafogeografía / C. Ferreras Chasco, C. Fidalgo Hijano . [3ª reimp.] Madrid : Síntesis, D.L. 1991 (reimp. 2009)
- BC** FitzPatrick, E. A.. Suelos : su formación, clasificación y distribución / E.A. FitzPatrick ; [traducido por Antonio Marino Ambrosio] . [1a. ed., 3a. reimp.] México : Compañía Editorial Continental, 1987
- BC** Gómez Orea, Domingo. Recuperación de espacios degradados / Domingo Gómez Orea . Madrid : Ediciones Mundi-prensa, 2004
- BC** Honorato, R. (2000). Manual de edafología. Mexico: Alfaomega
- BC** Kohnke , H., Franzmeier, D.P. (1995). Soil science simplified. Waveland Press
- BC** Kubiëna, Walter L.. Claves sistemáticas de suelos : diagnóstico y sistemática ilustrados de los suelos más importantes de Europa con sus sinónimos más usuales / por W. L. Kubiëna ; traducido al español por Ángel Hoyos de Castro . Madrid : Consejo Superior de Investigaciones Científicas, 1952
- BC** Lacoste, Alain. Biogeografía / Alain Lacoste y Robert Salanon ; versión y adaptación al castellano de J. M. Camarasa . 3ª ed. Vilassar de Mar, Barcelona : Oikos-Tau, D.L. 1981
- BC** Lal, R., Blum, W.E.H. (1998). Methods for Assessment of Soil Degradation (Advances in Soil Science). New York: CRC Press
- BC** López Ritas, Julio. El diagnóstico de suelos y plantas : (métodos de campo y laboratorio) / por Julio López Ritas y Julio López Melida. 4ª ed., rev. y amp. Madrid : Mundi-Prensa, 1990
- BC** Palmer, Robert G.. Introductory soil science : laboratory manual / Robert G. Palmer, Frederick R. Troeh . - 3rd ed. New York [etc.] : Oxford University Press, 1995
- BC** Parisi, Vittorio. Biología y ecología del suelo / Vittorio Parisi . 1a. ed. Barcelona : Blume, 1979
- BC** Pedraza Gilsanz, Javier de. Geomorfología : principios, métodos y aplicaciones / Javier de Pedraza Gilsanz ; colaboradores Rosa María Carrasco González...[et al.] . Alcorcón, Madrid : Rueda, D.L. 1996
- BC** Porta Casanellas, Jaime. Agenda de campo de suelos : información de suelos para la agricultura y el medio

ambiente / Jaime Porta Casanellas, Marta López-Acevedo Reguerín . Madrid : Mundi-Prensa, 2005

- BC** Restauración hidrológico forestal de cuencas y control de la erosión : ingeniería medioambiental / [dirección, Filiberto López Cadenas de Llano ; colaboradores, Gonzalo Fernández Tomás...(et al.)] . 2ª ed., rev. y amp. Madrid : TRAGSA : TRAGSATEC : Ministerio de Medio Ambiente : Mundi-Prensa, 1998
- BC** Robinson, Gilbert Wooding. Los suelos : su origen, constitución y clasificación, introducción a la edafología / Gilbert Wooding Robinson ; traducción de la tercera edición inglesa por José Luis Amorós . 2ª ed. Barcelona : Omega, 1967
- BC** Rosa, Diego de la. Evaluación agro-ecológica de suelos [recurso electrónico] para un desarrollo rural sostenible / Diego de la Rosa. [Libro electrónico]. Madrid : Mundi-Prensa, 2008
- 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

LISTADO DE URLs:

Assessing soil contamination. A reference manual
[<http://www.fao.org/docrep/003/x2570e/X2570E00.HTM>]

Clave para las Unidades de suelos de la FAO (1974)
[<http://www.fao.org/soils-portal/soil-survey/clasificacion-de-suelos/leyenda-de-la-fao/es/>]

Fotografías de perfiles de suelos
[<http://jorgemataix.carbonmade.com/projects/47854#1>]

International Union of Soil Sciences, IUSS
[<http://www.iuss.org/>]

Natural Resources Conservation Service Soils, USDA
[<http://soils.usda.gov/>]

Páginas de la Universidad de Granada con conceptos muy claros y sencillos y buenas fotos que los ejemplifican y aclaran
[<http://edafologia.ugr.es/index.htm>]

Sabroso, M.C., Pastor, A. (2004). Guía sobre suelos contaminados. Zaragoza: Gobierno de Aragón
[<http://usuaris.tinet.org/aduspyma/documentos/AUTONOMIAS/ARAGON/4.pdf>]

Se explican e ilustran suelos difíciles de encontrar en nuestro entorno
[<http://www.eweb.unex.es/eweb/edafo/>]

Sociedad Española de la Ciencia del Suelo
[<http://www.secs.com.es/>]

World Soil Information
[<http://www.isric.org/>]

The updated recommended bibliography can be consulted in: <http://psfunizar10.unizar.es/br13/egAsignaturas.php?id=10976>