



SYLLABUS

1. Course description

Degree:	Environmental Sciences
Subject:	WATER AND SOIL MANAGEMENT, CONSERVATION AND EXPLOITATION
Department:	Physical, Chemical and Natural Systems
Year:	2015-16
Term:	Fall
ECTS credits:	4,5
Course:	3rd year
Type:	Basic
Language:	English

Course Model:	B1	
a. Basic learning (EB):		60 %
b. Practical learning (EPD):		40 %

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2. Teachers

2.1. Principal Teacher: Professor MIGUEL RODRÍGUEZ RODRÍGUEZ

2.2. Teachers

Name:	MIGUEL RODRÍGUEZ RODRÍGUEZ
School:	Experimental Sciences
Department:	Physical, Chemical and Natural Systems
Area:	External Geodynamics
Category:	Senior Lecturer
Office hours	Monday and Tuesday (9 to 13 h) <i>*previous email appointment</i>
Office	22.02.06
E-mail:	mrodrod@upo.es
Phone:	954349524

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3. Objectives and previous requirements

3.1. Main objectives

- To learn to know-how of the main techniques of surface and ground water resources exploitation and withdrawal
- To transmit the basic knowledge and skills in the field of management and conservation of water resources and its application to environmental studies
- To highlight the importance of water planning and the main features of water management and environmental regulations related to national, european and international level
- To recognize the characteristics of soil resources and acquire the main techniques for quantifying physical degradation, chemical and biological
- To highlight the importance of water and soil as natural resources and preservation
- To understand and characterize the ecological role of these natural resources

3.2. Contributions to the degree in Environmental Sciences

This course is included in the Module “*Environmental Management, Conservation and Planning – Land-use planning*”. This subject, along with the courses: “*Management, conservation and animal resource development*” (3rd), “*Management, maintenance and operation of plant resources*” (3rd), and “*Environmental pollution*” (3rd), will help the student to reach the goal of being able to quantify and assess the pollution in the different environmental areas and guide rational management. The main background to this course is the subject of the second year, “*Hydrology and Soil Science*”, which addresses the basic knowledge about the nature and dynamics of the first two elements of importance present in the earth's surface: the inland waters and the soil.

Water and soil are two primary natural resources and play a key role, both for the development of life on Earth and for economic activities, and resources that are indispensable. Its proper use is essential for a proper environmental planning and management.

Finally, this course is related to other subject that the students should follow throughout the degree of Environmental Sciences: “*Geology*” (1st), “*Geographical Information Systems*” (2nd), “*Natural Hazards*” (3rd), “*Land-use planning*” (3rd), “*Field Geology*” (4th), “*Geomorphology*” (4th) and “*Urban environment management*” (4th), among others.

3.3. Recommendations or previous requirements

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Previous knowledge about hydrology and soil sciences (2nd course) is needed. Even more, basic math, physics and geology skills (acquired through 1st and 2nd years) are strongly recommended.

4. Skills

4.1 Degree Skills developed during this course

- To demonstrate ability to analyse and synthesize
- To understand the contents of environment sciences (texts, papers...) at a scientific and technical level.
- Be able to prepare and defend arguments and correctly express them both spoken and written
- To learn independently

4.2. Subject skills developed during this course

- To be able to identify, address and propose realistic and effective solutions for the problems arising from the actions of management, conservation and exploitation of water resources, soil, plants and animals.
- To identify the main threats to water resources, soils, vegetation, Iberian flora and fauna, the causes that have led to the current situation and the keys to its recovery and conservation.
- To know the basics needed to understand, plan and develop activities related to the management and conservation of water resources, soil, plants and animals.
- To develop a critical attitude needed to solve actual problems arising from the management and conservation of water resources, soil, plants and animals.
- To understand the procedures related to the withdrawal of water resources, soil, forestry, hunting and fishing.
- To learn the basics of managing natural resources in protected areas.

4.3. Specific skills

- To understand the importance of preserving water and soil to stop environmental degradation at different scales
- To define and quantify the processes of physical and chemical degradation of soil resources
- To understand the main methods of studying soil erosion and the main techniques of contaminated soil remediation

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- To analyse the major issues related to international water planning.
- To understand the traditional aspects of water policy in Spain and current trends in water resources management according to the Water Framework Directive (WFD).
- To learn the main techniques of exploitation of groundwater pollution and its causes.
- To assess the importance of the main techniques for water resources management such as artificial recharge techniques, provision of environmental flows, hydrological modelling, etc.

5. Topics

1. SOIL MANAGEMENT.

This subject introduces students to the problems of using the Earth's resources and contextualizes the problem of the use of soil resources in particular. It analyzes the current state of this resource degradation globally and soil degradation in Spain in particular.

1.1. Introduction

1.2. The environmental impact of the exploitation and use of the resources of the Earth: planetary boundaries.

1.3. Land uses.

1.4. National Action Programme to Combat Desertification.

2. DEGRADATION AND SOIL CONSERVATION

This topic discusses the physical process of soil degradation and presents the main methods of quantifying water erosion. It introduces the aspect of chemical contamination of soil and major regeneration techniques these soils.

2.1. Types of degradation and its consequences. Current Status: GLASOD report.

2.2. Water erosion: concepts and importance. Causes, forms and factors.

2.3. Assessment of water erosion: the USLE.

2.4. Others types of erosion and control techniques.

2.5. Contamination of soil. Detection techniques and reclamation of contaminated soil.

3. WATER MANAGEMENT.

Water is a strategic resource in any region of the world. Countries have to base their development plans based on their resources, but taking into account the water needs of the associated ecosystems. They must also respond to the needs of neighboring countries, if sharing the resource, according to the relevant international treaties. Poor management can lead to economic disaster or even lead to an armed conflict with a neighboring country.

3.1. Introduction

3.2. Water Uses

3.3. Reserves - Resources – Demands



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- 3.4. Water pollution
- 3.4. Water and war

4. WATER PLANNING

In developed countries there is a growing awareness about planning and sustainable use of water resources. Because these resources are under increasing pressure from the continuous growth in demand, the need for action to protect both water quality and quantity and ensure their sustainability.

- 4.1. Introduction
- 4.2. Traditional water policy in Spain
- 4.3. Water Framework Directive and the New Water Culture
- 4.4. Water planning in the Guadalquivir River Authority

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6. Methodology and resources

METHODOLOGY

1. Basic Learning sessions (20 h) in which, with the support of PowerPoint presentations, the professor will explain the fundamentals of the subject, with particular emphasis on processes related to the management of soil and water resources.
2. Lab and Field work Sessions (15 h): Application of basic concepts to solve practical problems both in the laboratory and in the field: application of the Universal Soil Loss Equation (USLE) in soils of Andalusia; interpretation of hydro-chemical data to assess the degree of conservation of surface water and groundwater, the use of computer programs to solve water balances in watersheds and field work in Las Cruces Copper (CLC) mine (Seville).
3. Student work with teacher support (68 h): individual work will focus on the resolution of questionnaires posed by teachers for each subject, directing such work to (1) a deeper understanding of the most important aspects, (2) augmentation of the subject and (3) the relationship between different parts. To do this, students must use the material provided by teachers, their classroom session notes and bibliography. It is essential that this activity entail monitoring by teachers, for which students must make use of tutorials.

RESOURCES

- Classrooms
- Teaching and Research Laboratory of External Geodynamics
- Collection of hydrogeological, soil, topographic and geological maps
- Documentation mapping from MDT (aerial photo, shadow models, etc..)
- Field water samplers, water level probes, pH-meters and Electric Conductivity-meters.
- Soil Augers to build shallow piezometers by hand
- Buses (to rent at the time of the activity)

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7. Course grading

The course will be evaluated through a series of activities. Evaluation activities include:

- **Continuous assessment** (3 points out of 10):

Lab and field questionnaires. An evaluation of the attitude (attendance and interest) and comprehension of the students will be made during practical classes. Rating: 3 out of 10 point.

- **Teamwork** (2 points out of 10):

Presentation of a scientific work based on the literature. 2 authors. Rating: 2 out of 10.

- **Final exam** (5 out of 10):

Written exam related to the basic topics, lab and field work. Rating: 5 out of 10. For a positive evaluation (pass) on the subject will be essential to obtain a score equal to or above 40% on the final exam.

* Second call in JULY: As for the **second call**, the same criteria explained above will be held, unless the student specifically requests a final exam (Rating 10 out of 10 of the course grading).

8. Textbooks

- Baird, C. (1995). *Environmental Chemistry*. Ed. Freeman. New York.
- Cech, T.V. (2003). *Principles of water resources*. Ed. John Wiley & Sons.
- Chow, V.T., Maidement, D.R., Mays, L.W. (1988). *Applied Hydrology*. Ed. McGraw-Hill. Singapore.
- Fetter, C.W. (2001). *Applied Hydrogeology*. Ed. Pearson Education. New Jersey.
- Ribeiro, L., Chambel, A. y Condesso, M.T. (2007). *Groundwater and Ecosystems*. Abstract Book of the XXXV IAH Congress. Ed. Arlindo Silva Artes Gráficas. Lisboa.
- Rockström, J. (2009). A safe operating space for humanity. *Nature* **461**, 472-475
- Ward, A.D. (2004). *Environmental Hydrology*. Lewis Publishers.
- Wilby, R.L. (1997). *Contemporary Hydrology*. Ed. John Wiley & Sons.