

**COURSE DATA****Data Subject**

<b>Code</b>	33094
<b>Name</b>	Environmental rehabilitation and restoration
<b>Cycle</b>	Grade
<b>ECTS Credits</b>	4.5
<b>Academic year</b>	2023 - 2024

**Study (s)**

<b>Degree</b>	<b>Center</b>	<b>Acad. year</b>	<b>Period</b>
1104 - Degree in Environmental Sciences	Faculty of Biological Sciences	3	Second term

**Subject-matter**

<b>Degree</b>	<b>Subject-matter</b>	<b>Character</b>
1104 - Degree in Environmental Sciences	147 - Environmental rehabilitation and restoration	Obligatory

**Coordination**

<b>Name</b>	<b>Department</b>
PONS MARTI, VICENTE	25 - Plant Biology
SORIA GARCIA, JUAN MIGUEL	275 - Microbiology and Ecology

**SUMMARY**

The subject "Rehabilitation and environmental restoration" is a compulsory subject in the Degree in Environmental Sciences conducted by the University of Valencia, with 4,5 credits (ECTS) and is integrated in the module "Environmental Technology", 25.5 ECTS credits, taught in the second semester of 3rd year grade.

In a very anthropized world, in which the management of natural resources has often been disrespectful to good ecological health of ecosystems, restoration of degraded areas is a necessity that helps to restore the ecological functions of these systems, and the recovery of the services they provide to human society. This subject is intended to provide the minimum contents that a graduate in Environmental Science should know about the restoration of degraded sites, both on the ecological basis of restoration and the causes and effects of degradation, as well as the main techniques for restoring these areas, encouraging students to acquire criteria that underpin the best decisions regarding the technical feasibility of recovering degraded areas.



## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

To have completed or be enrolled in all subjects of the modules " General Scientific Basis"and " Scientific bases of the natural environment "and the subject "Environmental Law and public administration ".

## OUTCOMES

### 1104 - Degree in Environmental Sciences

- Dominio de los principios y técnicas de restauración y rehabilitación del medio natural.
- Conocer las técnicas de biorremediación aplicadas a la recuperación del medio natural.

## LEARNING OUTCOMES

With the completion of the course students should acquire:

- Mastery of ecological principles that underpin the restoration of degraded ecosystems and other areas.
- Analytical ability on the causes of degradation of natural areas and the effects of the various degradation processes on the ecological health of ecosystems.
- Knowledge of the main techniques for restoring and rehabilitating the natural environment and acquisition criteria for practical application to solve environmental problems.
- Ability to integrate concepts and techniques, and holistic view on the functioning of ecological systems and the potential effects of active restoration.

## DESCRIPTION OF CONTENTS

### 1. BLOCK I. Scientific basis of restoration and environmental rehabilitation

Topic, title and content.

1. Ecological basis of ecosystem restoration. Key Concepts in restoration ecology.
2. The value of ecosystems. Intrinsic value. Instrumental value. Ecosystem Services.
3. Restoration. Intervention types, active and passive measures. Ecological trajectory. Scales. Reference ecosystems. Attributes of restored ecosystems. Considerations on the species.
4. Design of a restoration plan. Evaluation and monitoring of restoration.
4. Law applicable to the restoration: a brief synopsis.



## **2. BLOCK II. Degradation and disturbance of natural areas**

Topic, title and content

6. Natural and anthropogenic disturbances , characteristics and effect on the ecological integrity (structural and functional).
7. Concept and types of degraded areas. Incidence of various types of impacts on the structural and functional integrity of the aquatic ecosystem: impacts, degradation and destruction. Degradation of aquatic ecosystems. Physical, chemical and biological degradation.
8. Concept and types of degraded areas. Incidence of various types of impacts on the structural and functional integrity of terrestrial ecosystems: impacts, degradation and destruction. Land degradation. Agrícolas marginales abandonados, sobrepastoreo, desmontes, otros espacios degradados.
9. The degradation at different scales. Degradación física, química y biológica.
10. Methodologies for the degradation assessment at different levels: global (GLASOD), Mediterranean(DISMED), national (PAND) and regional levels (WOCAT).

## **3. BLOCK III. Techniques for restoration and rehabilitation of degraded areas**

Topic, title and content

11. Recovery of Aquatic Ecosystems: Main techniques for the restoration of lakes, wetlands and reservoirs
12. Recovery of Aquatic Ecosystems: Main techniques for restoring coastal aquatic ecosystems: wetlands, marine coastal areas, reefs.
13. Recovery of Aquatic Ecosystems: Main techniques for the restoration of rivers and riverbanks.
14. Restoration: comprehensive view of landscape and watershed.
15. Recovery of degraded land: Main techniques for restoring and rehabilitating, exploited areas (abandoned marginal farming, overgrazing, deforested).
16. Recovery of degraded land: Main techniques for restoration and rehabilitation of contaminated soils and exhausted areas (exploited miners, clogging landfills)
17. Recovery of degraded land: Main reasons that justify the recovery. Project presentation of restoration.

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	32,00	100
Computer classroom practice	6,00	100
Laboratory practices	5,00	100
Tutorials	2,00	100
Development of group work	12,50	0
Study and independent work	10,00	0
Readings supplementary material	2,00	0
Preparation of evaluation activities	16,00	0
Preparing lectures	12,00	0
Preparation of practical classes and problem	5,00	0
Resolution of case studies	10,00	0
<b>TOTAL</b>	<b>112,50</b>	

**TEACHING METHODOLOGY**

- Lectures given by the teacher to provide basic knowledge and methodological tools.
- Use, individual or in groups, of materials prepared or referenced by the teacher, to prepare papers and seminars by students.
- Case study and discussion of these, guided by the teacher, among students. Introduction of case studies: Introduction to restoration projects near Valencia specific areas (eg swamps, dunes, spring sources, Quarries, Landfills, fire-affected areas, riparian areas, etc. ..). 1-2 hours (classroom or problems) at least one week before the field trip.
- Preparation in groups of a management or restoration plan of a natural area, and defend it.
- Field trips to observe and work on case studies: Visits to several cases of environmental restoration (both terrestrial and aquatic habitats), near Valencia, as well as some areas that could be a candidate for restoration. 5 hour field trip (to optimize the visit share resources with EIA, which would have another 5 hours on the same visit, which would have a total duration of 10 hours). For the organization of teaching there would be groups of 16 and be attended by several teachers, but could be grouped to 3 groups in the same visit (up to 48 students), since that is the capacity of the bus ( a bus every 48 students is needed).
- Critical evaluation, in the classroom and laboratory, of the cases visited restoration: restoration objectives achieved in regard to those planned, and schematic design of a recovery plan for any of the degraded areas visited. 2 sessions of 3 hours in computer lab (UD Ecology, one taught by UD Soil Science), the later to be performed at least 15 days after the field trip.



- Tutorials individualized or in groups with the teacher to outline and review the work done by students.

*Use the virtual classroom as a communication tool.*

## EVALUATION

The module is evaluated through:

- Objective evidence, consisting of one or more tests that consist of both theoretical and practical questions.
- Assessment of practical activities from the preparation of papers / reports and / or oral presentations, and / or defenses of case studies.

The student must complete the compulsory activities before to apply for the advancement of the exam.

- Continuous evaluation of each student, based on regular attendance at classes and classroom activities, participation and degree of involvement in the process of teaching and learning and skills and attitudes displayed during the development of activities and by resolution of individual questionnaires.

TYPE OF EVALUATION	% OF THE FINAL MARK
Knowledge and ability to apply the same assessed through examinations.	60
Development of activities in practices and / or defense of a case study.	30
Attendance and participation in scheduled activities (classes, seminars, field trips, etc..)	10

## REFERENCES

### Basic

- Clewell A. F. & J. Aronson. (2013). Ecological Restoration: Principles, Values, and Structure of an Emerging Profession. Island Press. Washington, D.C.





- Perrow, M. R. & A. J. Davy, (2002). Handbook of ecological restoration. Cambridge University Press, Cambridge.
- Mitsch W. J & S. E. Jorgensen. (2004). Ecological engineering and ecosystem restoration. Wiley, Hoboken, NJ
- Society for Ecological Restoration International Science & Policy Working Group. (2004). The SER Primer on Ecological Restoration. Society for Ecological Restoration International, Tucson, AZ
- Lal R. & B.A. Stewart (eds.) (1990). Soil Degradation. Advances in Soil Science, vol. 11.
- Oldeman L.R.; R.T.A Hakkeling,. & W.G. Sombroek, (1991). World map of the status of human-induced soil degradation. An explanatory note. Second revised edition. ISRIC/UNEP, Wageningen.
- UNCCD (2007). Informe abreviado del taller Internacional sobre el clima y la degradación de las tierras. Documento ICCD/COP(8)/CST/8.
- Faz Cano A.; A.R. Mermut, , J.M Arocena.& R. Ortiz Silla. (2009): Land Degradation and Rehabilitation. Advances in Geoecology 40. Catena Verlag, Germany.
- WMO (2005). Climate and Land Degradation. Nº 989. World Meteorological Organization. Rome.
- Gomez Orea, D. (2004). Recuperación de espacios degradados. Editorial Mundi-Prensa. 582pp. Madrid
- Pardue G. H. & T. K. Olvera (eds.). 2009. Ecological restoration. Nova Science Publishers, New York.
- Van Andel, J. & J. Aronson (2012). Restoration ecology. Blackwell, Oxford.

#### **Additional**

- Colomer, J.C. & J. Sánchez, (2001). Agricultura y procesos de degradación. En: Agricultura y Desertificación. Ed. Mundi Prensa, pp. 109-132.
- Cooke G. D., E. B. Welch, S. A. Peterson & S. A. Nichols. (2005). Restoration and Management of Lakes and Reservoirs. Taylor & Francis Group - CRC Press. Boca Raton, FL
- Darby S. & D. Sear. (2008). River Restoration: Managing the Uncertainty in Restoring Physical Habitat. Wiley, Chichester, UK
- di Castri F. & H.A. Mooney (eds.) (1973): Mediterranean Types Ecosystems: Origen and Structure.. Chapman and Hall. London,
- Fingerman, M. & R. Nagabhushanan (2005). Bioremediation of aquatic and terrestrial ecosystems. SP Science Publishers, Enfield (NH) USA, Plymouth, UK
- González del Tánago, M. et al (2008). Guía Metodológica para la elaboración de proyectos de restauración de ríos. Ministerio de Medio Ambiente, Madrid
- Ibañez, J.J.; B.L. Valero Garcés & C. Machado (eds.) (1997): El paisaje mediterráneo a través del espacio y del tiempo. Implicaciones en la desertificación. Geoforma Ediciones, Logroño, España.
- Livingston, R. J. (2006). Restoration of aquatic systems. Taylor & Francis Group - CRC Press. Boca Raton, FL



- Montanarella, L. (2007). Trends in Land Degradation in Europe. Climate and Land Degradation Environmental Science Engineering. Springer-Verlag. Heidelberg.
- NAP (2000). National Action Plan for Salinity and Water Quality. [www.napswq.gov.au](http://www.napswq.gov.au)
- O'Sullivan P. E. & C. S. Reynolds (ed.).(2005). The Lakes Handbook Vol 2: Lake restoration and rehabilitation. Blackwell.