

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

|                      |                                                                     |
|----------------------|---------------------------------------------------------------------|
| <b>Code</b>          | 41055                                                               |
| <b>Name</b>          | Restoration of the environment and analysis of climatic alterations |
| <b>Cycle</b>         | Master's degree                                                     |
| <b>ECTS Credits</b>  | 10.0                                                                |
| <b>Academic year</b> | 2023 - 2024                                                         |

**Study (s)**

| <b>Degree</b>                                                      | <b>Center</b>                    | <b>Acad. year</b> | <b>Period</b> |
|--------------------------------------------------------------------|----------------------------------|-------------------|---------------|
| 2001 - M.D. in Environmental and Territorial Management Techniques | Faculty of Geography and History | 1                 | Second term   |

**Subject-matter**

| <b>Degree</b>                                                      | <b>Subject-matter</b>                                                   | <b>Character</b> |
|--------------------------------------------------------------------|-------------------------------------------------------------------------|------------------|
| 2001 - M.D. in Environmental and Territorial Management Techniques | 3 - Methods and techniques for the analysis of the physical environment | Optional         |

**Coordination**

| <b>Name</b>                 | <b>Department</b> |
|-----------------------------|-------------------|
| ESTRELA NAVARRO, MARIA JOSE | 195 - Geography   |

**SUMMARY**

Traditionally, especially in recent decades of great technological arrogance, the management of natural systems has been dominated by an economic vision, which has prioritised the conception of nature as a resource, using it above all as a source of energy and matter (springs, rivers) or valorising it as a public space (beaches, rivers). It is precisely this abusive use of natural systems that has led to the alteration of practically the entire territory, leaving few virgin spaces. To this must be added forest fires and the great vulnerability of plant communities in this Mediterranean area, especially in the current context of climate change. Increasingly serious environmental problems are leading to greater environmental awareness. This is why the administration is promoting restoration actions, often on an experimental basis, of various natural systems.

Cartographic representation is the precise basis on which to verify analyses and evaluations in environmental and territorial management. The great technological development experienced by cartography in recent decades, together with the scientific and technological progress of environmental issues, makes it necessary to have an adequate knowledge of the various thematic cartographies produced and used in environmental management. Environmental information is complex and diverse, it comes



from very different sources and has very different thematic, spatial and temporal components. For this reason, knowledge and handling of Geographic Information Systems is essential as a fundamental tool for storing, integrating and managing the large amount of environmental information currently available.

The course is structured in 8 parts, each of which is taught by specialist lecturers in the subject.

The first two parts are devoted to introducing basic concepts related, on the one hand, to environmental cartography and its elaboration and, on the other, to risk mapping, with special emphasis on flood risk. The third part is devoted to field work.

In the fourth theme, the forms and processes in watercourses, the intense anthropic action and, finally, river restoration are analysed. The fifth theme deals with the interaction between erosion and vegetation as a basis for the restoration of slopes and vegetation cover. The sixth theme is devoted entirely to forest fires, introducing general concepts (impact and recurrence of fire), before moving on to natural regeneration and management of burned areas.

The last two topics are dedicated to working on the techniques used in the analysis of climate extremes, from both hydrological (floods) and meteorological (torrential rainfall) perspectives, without forgetting the part of global model sources for climate change projections with a focus on local-scale processes.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

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

### Other requirements

None

## OUTCOMES

### 2001 - M.D. in Environmental and Territorial Management Techniques

- Capacidad de organización, planificación y gestión de la información ambiental y territorial
- Técnicas de análisis cuantitativo
- Manejo de Sistemas de Información Geográfica aplicados a los problemas medioambientales y territoriales
- Técnicas de Teledetección espacial
- Análisis del medio físico de una manera integrada, interrelacionando sus componentes a partir del trabajo de campo y manejo de elementos cartográficos y toma de datos.



- Capacidad de analizar y caracterizar los procesos naturales y de degradación y evaluar las posibilidades de restauración medioambiental.
- Capacidad de analizar y caracterizar riesgos medioambientales, su prevención, predicción y gestión.
- Students should apply acquired knowledge to solve problems in unfamiliar contexts within their field of study, including multidisciplinary scenarios.
- Students should be able to integrate knowledge and address the complexity of making informed judgments based on incomplete or limited information, including reflections on the social and ethical responsibilities associated with the application of their knowledge and judgments.
- Students should communicate conclusions and underlying knowledge clearly and unambiguously to both specialized and non-specialized audiences.
- Students should demonstrate self-directed learning skills for continued academic growth.
- Students should possess and understand foundational knowledge that enables original thinking and research in the field.

## LEARNING OUTCOMES

- Production of environmental cartography with GIS.
- Handling of topographic information and extraction of useful data for land and environmental management.
- Carrying out studies of environmental risks, their prevention, prediction and management.
- Carrying out applied climate studies and risk mapping.
- Carrying out studies on the degradation of natural systems and restoration proposals.
- Management of restoration strategies in the management of areas burnt in forest fires.

## DESCRIPTION OF CONTENTS

### 1. Environmental Cartography

Introduction to Environmental Cartography. Fundamentals and principles. Methodologies and technical standards for its elaboration. Examples. Cartography of natural resources: basic, derived and synthesis maps. Analysis and interpretation. Case study.



## **2. Risk mapping and GIS. Floods**

Conceptual and methodological aspects. Concepts of hazard, vulnerability, exposure and risk. Resolution of a practical case of flood mapping in a wadi. Hazard maps. Studies of the main processes and forms in floods. Preparation of hydrogeomorphological flood hazard maps. Case study.

## **3. Field work**

Territorial reconnaissance (various burnt areas in the Valencian Community). Evaluation of impacts and forest restoration projects after fires. Review of environmental cartography in the field.

## **4. Alteration of fluvial systems (geomorphology/hydrology). Restoration**

Principles of fluvial dynamics. Geomorphology: forms and processes in watercourses. Anthropogenic changes in river systems (direct and indirect anthropic actions). River restoration. Ecological flow regime.

## **5. Restoration of slopes and vegetation cover**

Erosion-vegetation interactions and their application to the restoration of natural and artificial slopes. Impact of climate change on erosion-vegetation interactions and on the restoration of slopes and vegetation cover. Degradation and vegetation colonisation thresholds.

## **6. Regeneration and management of burnt areas**

Block I. Fire as a shaper of the Mediterranean landscape: impacts of fire. Fire recurrence and degradation. Thresholds and vulnerability of plant communities.

Block II. Natural regeneration. Resilience and regeneration of species and communities. Successional dynamics. Functional traits of vegetation: resprouting and germinating species. The case of the great fire of Ayora 1979.

Block III. Management of burnt areas. The traditional approach versus new alternatives. Restoration strategies - temporary approach: urgent, short and medium term measures. POSTFIRE tool.

## **7. Techniques for the analysis of extremes: I. Hydrology; II. Meteorology**

I. Hydrology. Selection, characterisation and analysis of rainfall events. Brief characterisation of extreme Mediterranean rainfall. Sources of information and the recording of rainfall. Criteria for the selection of rainfall events. Characterisation of episodes by means of statistical indicators.

II. Meteorology. Meteorological analysis of extreme events and their relationship with sea temperature. Genetic factors of heavy rainfall. Sea water temperature (SST) and its relationship with heavy precipitation.

**8. Climate change models and adaptations at local level**

It addresses the global model sources available for the projection of climate change to future scenarios and the technique to obtain a climate change projection correctly adapted to local processes and realities. This issue is particularly important in a context of increasing demand for local and regional plans for future adaptation to climate change by public administrations, as global model outputs cannot be used directly.

**WORKLOAD**

| ACTIVITY                                     | Hours         | % To be attended |
|----------------------------------------------|---------------|------------------|
| Classroom practices                          | 25,00         | 100              |
| Other activities                             | 19,00         | 100              |
| Theory classes                               | 10,00         | 100              |
| Seminars                                     | 6,00          | 100              |
| Tutorials                                    | 2,00          | 100              |
| Development of individual work               | 50,50         | 0                |
| Readings supplementary material              | 10,00         | 0                |
| Preparation of practical classes and problem | 92,50         | 0                |
| Resolution of case studies                   | 35,00         | 0                |
| <b>TOTAL</b>                                 | <b>250,00</b> |                  |

**TEACHING METHODOLOGY**

The course is based on the use of different learning activities including the following:

**Participative lectures:**

- Presentation of theoretical content in the classroom and discussion.
- Comparison with nearby experiences, critical analysis of the same.
- Proposals for environmental management strategies.
- Reasoned selection of different solution proposals.

**Practical classes:**

- Approach and resolution of applied cases.
- Use of GIS (IDRISI and ARC MAP) for the treatment of basic digital cartography (DTM, lithology, land use, etc.), as well as for the elaboration of risk cartography (hazard, exposure/vulnerability and flood risk maps, etc.).



### **Field work:**

- Field trips will take the form of itinerant visits to points of interest, with brief explanations by the teaching staff and/or group discussion.

### **Reading of scientific articles and manuals.**

### **Tutorials**

## **EVALUATION**

Assessment of learning will be carried out by taking into account one or more of the sections proposed by the module teachers:

- Continuous assessment taking into account attendance and participation in class.
- Attendance and participation in field trips (compulsory).
- Completion of work or reports proposed by the lecturer.
- Reading and summarising research articles.
- Completion of an objective test on the basic knowledge taught.

The evaluation model will be adjusted to the following percentages:

- Attendance at face-to-face classes (minimum requirement of 80% attendance).
- Exam: up to 40%.
- Directed work and practicals: 30%-50%.
- Complementary activities: 30%-50%.

## **REFERENCES**

### **Basic**

- AGÈNCIA CATALANA DEL AGUA UNIVERSIDAD POLITÈCNICA DE VALENCIA (2006). Validación biológica del régimen de caudales de mantenimiento definido en el Plan Sectorial de las Cuencas Internas de Cataluña en 10 tramos fluviales. Departament de Medi Ambient i Habitatge.
- AYALA-CARCEDO, F. J., y OLCINA, J. (coord.) (2002). Riesgos naturales. Ariel.
- BOCHET, E., GARCÍA-PALACIOS, P., PECO, B., TORMO, J., y GARCÍA-FAYOS, P. (2011). Procesos ecológicos y restauración de la cubierta vegetal. En F. Valladares, L. Balaguer, I. Mola, A. Escudero, y V. Alfada (eds.), Restauración ecológica de áreas afectadas por infraestructuras de transporte. Bases científicas para soluciones técnicas (pp. 102-141). Fundación Biodiversidad.



- BROOKES, A. (1989). Channelized rivers: perspectivas for environmental management. John Willey & Sons.
- CAMARASA, A. M. (1993). La estructura interna de las tormentas mediterráneas. Cuadernos de Geografía, (54), 169-188.
- CERDA, A., & DOERR, S. H. (2005). Influence of vegetation recovery on soil hydrology and erodibility following fire: an 11-year investigation. International Journal of Wildland Fire, 14(4), 423-437.
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- GARCÍA-FAYOS, P. (2004). Interacciones entre la vegetación y la erosión hídrica. En F. Valladares (ed.) (pp. 309-334). Ministerio de Medio Ambiente. Organismo Autónomo de Parques Naturales.
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- GONZÁLEZ DEL TÁNAGO, M. (2005). La restauración de los ríos y sus riberas. En E. Cruz, L. Babiano, y J. M. Alonso (eds.), La restauración de la Cuenca del Guadalquivir. Aportar ideas para construir realidades (pp. 15-29). Confederación Hidrográfica del Guadalquivir, Ministerio de Medio Ambiente.
- GRAY, D. H., y SORTIR, R.B. (1996). Biotechnical and Soil Bioengineering Slope Stabilization. A Practical Guide for Erosion Control. John Wiley & Sons, Inc
- GRIFFITH, D. A., and AMRHEIN, C. G. (1997). Multivariate statistical analysis for geographers. Prentice- Hall, Inc.
- HARRIS, J. A., PALMER, J., & BIRCH, P. (1996). Land Restoration and Reclamation: Principles and Practice. Prentice Hall.
- LEY VEGA, C., GALLEGU, J. B., y VIDAL, C. (2007). Manual de restauración costeras. Ministerio de Medio Ambiente, Dirección General de Costas.
- MINISTERIO DE MEDIO AMBIENTE (2008a). Directrices sobre actuaciones en playas, Secretaria general para el Territorio y la Biodiversidad, Dirección General de Costas.
- MINISTERIO DE MEDIO AMBIENTE (2008b). Directrices para el tratamiento del borde costero, Secretaria general para el Territorio y la Biodiversidad, Dirección General de Costas.
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- RRC (RIVER RESTORATION CENTRE) (1999). Manual of River Restoration Techniques. River Restoration Centre.
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#### **Additional**

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