



## Study Plan

**School:** School of Sciences and Technology

**Degree:** Master

**Course:** Landscape Ecology (cód. 464)

### 1st Year - 1st Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PAO10613	Landscape Ecology	Landscape and Planning Sciences	6	Semester	156
PAO10614	Ecosystem Ecology	Environment and Ecology Sciences	6	Semester	156
GEO10615	Physical Structure of the Landscape	Geography	6	Semester	156
PAO10616	Modelling and Landscape Metrics	Landscape and Planning Sciences	6	Semester	156

### Group of Options

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PAO10621	Human Ecology and Sustainability	Environment and Ecology Sciences	6	Semester	156
PAO10622	Geobotanics	Environment and Ecology Sciences	6	Semester	156
PAO10212	Ecological Modelling - Advanced	Environment and Ecology Sciences	6	Semester	156
PAO10623	Landscape Remediation	Environment and Ecology Sciences	6	Semester	156
PAO10191	Advanced Spatial Analysis	Landscape and Planning Sciences	6	Semester	156
BIO10182	Biodiversity and Conservation	Biological Sciences	6	Semester	156
ECN10624	Natural Resource Economics	Economy	6	Semester	156
GEO10625	People, Activities and Landscape	Geography	6	Semester	156

Group of Free Options

### 1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PAO10617	Landscape in Land Use Planning and Policies	Landscape and Planning Sciences	6	Semester	156
PAO10618	Planning and Management of Ecological Systems	Environment and Ecology Sciences	6	Semester	156
PAO10619	Patterns, Processes and Landscape Changes	Landscape and Planning Sciences	6	Semester	156
PAO10620	Seminar	Landscape and Planning Sciences	3	Semester	78



### 1st Year - 2nd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
<b>Group of Options</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PAO10621	Human Ecology and Sustainability	Environment and Ecology Sciences	6	Semester	156
PAO10622	Geobotanics	Environment and Ecology Sciences	6	Semester	156
PAO10212	Ecological Modelling - Advanced	Environment and Ecology Sciences	6	Semester	156
PAO10623	Landscape Remediation	Environment and Ecology Sciences	6	Semester	156
PAO10191	Advanced Spatial Analysis	Landscape and Planning Sciences	6	Semester	156
BIO10182	Biodiversity and Conservation	Biological Sciences	6	Semester	156
ECN10624	Natural Resource Economics	Economy	6	Semester	156
GEO10625	People, Activities and Landscape	Geography	6	Semester	156
*** TRANSLATE ME:Optativa livre ***					
<b>Group of Options</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
PAO10626	Environmental Assessment	Environment and Ecology Sciences	3	Semester	78
PAO10627	Bioengineering Systems	Landscape and Planning Sciences	3	Semester	78
*** TRANSLATE ME:Optativa livre ***					

### 2nd Year - 3rd Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
<b>Mandatory alternatives</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Dissertation				
	Project Work				

### 2nd Year - 4th Semester

Component code	Name	Scientific Area Field	ECTS	Duration	Hours
<b>Mandatory alternatives</b>					
Component code	Name	Scientific Area Field	ECTS	Duration	Hours
	Dissertation				
	Project Work				



## Conditions for obtaining the Degree:

\*\*\* TRANSLATE ME: Para aprovação na componente curricular nesta área de especialização deste mestrado é necessário a aprovação (através de avaliação ou creditação) das seguintes unidades curricula-

res: { \ } newline

{ \ } newline

1º Semestre: { \ } newline

- 4 UC Obrigatórias num total de 24 ECTS

- 1 UC Optativa do Grupo I ou optativa Livre (aprovada pela Comissão de Curso) num total de 6 ECTS

{ \ } newline

2º Semestre: { \ } newline

- 4 UC Obrigatórias num total de 21 ECTS

- 1 UC Optativa do Grupo I ou optativa Livre (aprovada pela Comissão de Curso) num total de 6 ECTS

- 1 UC Optativa do Grupo II ou optativa Livre (aprovada pela Comissão de Curso) num total de 3 ECTS { \ } newline

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Para obtenção do grau, é necessário também a aprovação em Dissertação ou Trabalho de Projecto, com o total de 60 ECTS, no 3.º e 4.º Semestre. \*\*\*

## Program Contents

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### Landscape Ecology (PAO10613)

The roots of a new science, between Ecology and Geography. Integration of disciplines for progresses in a problem solving, applied scientific approach. The concept of landscape and its evolution within Landscape Ecology (LE) and associated disciplines. The novelty of spatial landscape analysis. Progresses in LE since the middle of the 20th century. The role of the International Association for LE. Particularities of the European approach and the enlargement of the LE community. The emergence of the European Association for LE and its background. The fundamentals of the LE analysis. The classical literature and authors. Developments. The spatial approach and the local landscape as the specific context of work. Integration of natural and human sciences, and integration of quantitative and qualitative methods. Examples. Research and analysis, planning and design, decision support, the integration of the human and social perspectives. Novel developments in research and design.

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### Ecosystem Ecology (PAO10614)

General Principles:

Living systems and emergence: from organisms to ecosystems

Ecological systems metabolism and its laws

Aquatic vs. Terrestrial Ecosystems:

Similarities and singularities

Key factors, strategies and producers types

Time scales, renewal rates and autotrophic biomass/ heterotrophic biomass

Interaction terrestrial-aquatic systems

Terrestrial Ecosystems:

Structure and function

Ecological succession, complexity, production, stability

Climatic and edaphic factors. Distribution and characteristics of the main ecosystem types.

Effects of human actions at functional and structural levels.

Aquatic Ecosystems:

Lentic , Lotic and Transition systems - time scales and axes

Types of systems , key factors and structural and functional characteristics

Ecological succession, eutrophication, dysfunctions

Effects of human actions.



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### **Physical Structure of the Landscape (GEO10615)**

- Tectonic Setting and Landscape Development (lithology, faults and seismic phenomena).
- Identification criteria of physical landscape units (geomorphologic, hydrographic, climatic, vegetation associations, soils, land use... others).
- Weathering processes and soil formation. Soil morphology and soil maps.
- Reconnaissance of morphoclimate heritages in the present landscapes.
- The water balance, hydrologic regime, sediment supply, causes and consequences.
- Climate change, uncertainty, foreseen scenarios, consequences in physical structure of the Mediterranean landscape.
- The heritage value of landscape physical elements.
- Climate change, uncertainty, foreseen scenarios, consequences in physical structure of the Mediterranean landscape.

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### **Modelling and Landscape Metrics (PAO10616)**

Landscape cartographical representation. Different landscape representation metaphors. Types of landscape metrics. Different taxonomies or classifications of landscape metrics. The importance and effects of scale and context in the definition of spatial landscape metrics through the implementation on GIS environment.

The multi-attribute landscape metrics evaluation. Analysis of the importance of multi-attribute approach on the definition of spatial landscape metrics.

Time and landscape dynamics. Evaluation of different temporal approach and conceptualization of metrics of landscape dynamics. Relation of landscape metrics and other spatial based phenomena. Evaluation of the relations of landscape metrics with other spatial based phenomena, namely biodiversity measures and indexes, water quality, ecological performance, etc.

Creation of new landscape metrics. Presentation of methods and examples for the creation of landscape metrics based in the development of GIS analytical tools.

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### **Human Ecology and Sustainability (PAO10621)**

Sustainability, a difficult concept. Historical markers: from the Club of Rome to the recent earth summits. The states, the enterprises, the citizens and the sustainability issues. The crises and the sustainability dimensions: environment, resources, social, economical, political.

The ecological footprint and the bio-regenerative capacity of the planet. Consumption, consumerism and its psychological and social dimensions. The linkage consumption-economic growth. From the consumption society to the "green" consumption society. The "sustainable" capitalism. The decarbonation: the carbon business and consequences

The human population growth and resources. Population prospects. Food and the agriculture development limits. Causes and consequences of populations explosions and implosions.

Crises and future. The big challenges. Cassandra vs Cornucopia. The lessons of history. Conciliating the inconciliable? Quality of life without economic growth? The Transition movement and visions of the future.

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### **Geobotanics (PAO10622)**

Ecological factors that influence the adaptation and distribution of plants and phytocoenosis

Bioclimatology and Biogeography

Methods to study vegetation (phytosociological methodology) and analysis of plant communities

Landscape (Phytosociology Integrated): Series and Geoseries

Conservation and Management of the Vegetation Heritage

Applied phytosociology

Recovery of degraded areas: particular case-studies



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### **Ecological Modelling - Advanced (PAO10212)**

Topics:

What is ecological modeling? Mathematical tools for modeling. The components of the ecological models. Steps in ecological modeling. Conceptual models and their languages. Population dynamics models. Plant growth models. Algal growth models. Wetland models. Biogeochemistry models. Individual growth models.

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### **Landscape Remediation (PAO10623)**

#### 1. Degraded landscapes

- 1.1 Concepts, historic evolution, dynamic of the processes and the limiting factors;
- 1.2 Temporal and spatial scale;

#### 2. Human Intervention on the Landscape

- 2.1 Functional and non-functional Landscape;
- 2.2 Measures of functionality

#### 3. Landscape Remediation

- 3.1 Strategy and methods;
- 3.2 Management and conservation;
- 3.2 Improvement and cultural valorization;

#### 4. Strategies to prevent Landscape Degradation

#### 5. Legislation

#### 6. Cases-Study

- 6.1 Human Intervention on the Landscape in terms of the exploration of natural resources and its remediation (Abandoned Mines, etc.);
- 6.2 Human Intervention on the Landscape in terms of the agriculture exploration and its remediation

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### **Advanced Spatial Analysis (PAO10191)**

Geographic representation: Evaluation of the different representation metaphors and an introduction to a systemic approach to representation metaphors.

Spatial data models: Detailed analysis of vectorial model, raster model and other data models.

Unique layer spatial operations: Neighbourhood analysis, buffering, masks and filtering.

Multiple layer spatial operations: Overlay analysis and geoprocessing operations.

Dimensionality of geographic data: 3-dimensional models and an introduction to time modelling.

Conceptual design of data models and geographic modelling: Geographic modelling concepts and flowcharts design including map algebra operations.

Network analysis: Shortest path analysis, service area, cost distance functions

Methods for spatial knowledge acquisition and formalization.

Methods for the definition of advanced research perspectives in spatial analysis

Future perspectives: New spatial data models, new models for spatial relations and new spatial analysis processes.



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### **Biodiversity and Conservation (BIO10182)**

- 1. Introduction
  - 1.1. Environmental problems and human population growth
  - 1.2. Guiding principles of Conservation Biology
  - 1.3. Conservation values
  - 1.4. Ethics of Conservation
- 2 Biodiversity
  - 2.1. Losses and threats
  - 2.2. Patterns and processes
- 3 Conservation
  - 3.1. Statutes of Conservation
  - 3.2. Legislation
  - 3.3. Management towards conservation
  - 3.4. Protected areas
  - 3.5. Sustainable development
  - 3.6. Ecology, Sociology, Politics and Economics
  - 3.7. Conservation biologists: learning to be practical and efficient
- 4 Population Viability Analysis
  - 4.1. Extinction and minimum viable populations
  - 4.2. Spatially structured populations and metapopulations
  - 4.3. Questions to answer
- 5 Global changes
  - 5.1. Scenarios and impacts
  - 5.2. Main measures
- 6 Landscape Ecology and Conservation
  - 6.1. Factors that affect the spatial occurrence and movement
  - 6.2. Habitat fragmentation
  - 6.3. Ecology of linear infrastructure
- 7 Agriculture and Conservation

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### **Natural Resource Economics (ECN10624)**

- One. Economic Exploitation of Natural Resources
- 2nd. Management of Natural Resources
- 3rd. Economic Management Fisheries
- 4th. Economic Management of Forests
- 5th. Economic Management and Distribution of Water Resources
- 6th. Management of non-renewable natural resources
- 6th. Economy and Environment



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### **People, Activities and Landscape (GEO10625)**

Evolution of man-nature relationship: inheritance, naturalist and determinism possibilism;

Relevance of the concepts of Natural Environment, Geographical Environment, and Environment and its connection to the socio-economic contexts;

The existence, or not, of "natural landscapes";

The new emphasis given to the study of landscapes resulting from the current relationship between individual and environment;

The issues arising from globalization: the homogenization of societies and the pursuit of identity and diversity on various scales;

Dichotomy between intense and disorderly exploitation of natural resources and the growth of urban spaces and industrial (factors of danger and threat: natural hazards and human danger and vulnerability) and aesthetic appreciation and "arbitrary" landscape;

The enhancement of the landscape for its multiple dimensions: living, heritage, identity, diagnosis feature, value (for planning policies).

Application of concepts and knowledge gained in specific cases.

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### **Landscape in Land Use Planning and Policies (PAO10617)**

1. Landscape and Spatial planning process: Basic concepts and main characteristics;

2. Environmental Policy, Nature Conservation and Landscape and Spatial Planning Strategies in European Union. Territorial Cohesion. LANDSCAPE EUROPEAN CONVENTION. Their integration in Portuguese policies: The National Policy Program for Spatial Planning; the National Strategy for Nature Conservation and Biodiversity. The National Strategy for Sustainable Development;

3. Sustainable Development as an objective of Landscape Planning and Management;

4. National legal framework: Environmental Law, Landscape Planning and Urban Law; NATURA network; Environmental Impact Assessment and Strategic Environmental Assessment;

5. Landscape in the National Legal Framework;

6. Potentialities and constraints for the future of landscape and spatial planning in Portugal.

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### **Planning and Management of Ecological Systems (PAO10618)**

1. Ecological systems

2. Basic concepts in ecological based management

3. Ecological Management

4. Processes of planning and management of ecological systems

5. Ecosystem services and green infrastructure

6. Target systems and habitats - Basic guiding concepts for conservation policies. Target systems (coastlands, hydrological ecosystems, grasslands, bush formations,, etc.)

7. Environmental and forestry management plans - Evaluation criteria in protected areas (concepts, rarity, diversity fragility, stability, cultural criteria, planning and management criteria). Puffer areas, management trough fire and grazing. biological activation structures (ecological corridors); definition of conservation areas, recover, restoration and use. Floristic and phytogeocenotic values, Regeneration ability, equilibrium gradients, instability risks, fire and invasion by exotic species.

8. Management concepts in areas with ecological interest - National System of Protected Areas, Natura 2000 Network



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### **Patterns, Processes and Landscape Changes (PAO10619)**

Possible ways in which a landscape analysis, exploiting multiple patterns descriptors, metrics and indices, can be used within an interdisciplinary approach to the study of processes which have a spatial expression, in different types of landscapes. Differences between composition and configuration, processes and integration of disciplines, will be particularly addressed. Several dimensions of the landscape analysis will be presented and discussed: different landscape types in Europe and the challenge of an operative landscape representation; landscape character; stable and dynamic components, the role of land use systems in the construction and maintenance of the landscape; land use and land cover; landscape elements and pattern; fuzziness; dynamics and changes in the landscape; drivers of change and impacts of this change; multifunctionality, landscape functions and ecosystems services; multiple demands of the landscape; multiple scale indicators of the landscape. Practical applications.

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### **Seminar (PAO10620)**

How to organize a thesis. Defining the problem, formulating the research question, selecting concepts and methods. Real object and research object. The challenge of interdisciplinary studies. Literature review. Presenting a poster, an oral communication. Preparing a paper.

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### **Environmental Assessment (PAO10626)**

1. The concepts of environmental assessment - environmental concept, evaluation concept - the cycle of project, planning and management
2. The environmental assessment concept in the frame of the sustainability concept - environmental assessment as a process of internalisation of environmental costs
3. EIA legal framework: national and EU legislation. Other national models, Relations with the planning and permit processes..
4. EIA phases: screening, scoping, reference situation, impact evaluation and mitigation, Environmental Impact Declaration, post evaluation (monitoring and auditing) Public participation
5. Impact evaluation and prediction methodologies, Universes of impact, Impact aggregation. EIA methodologies and mitigation methodologies.
6. Certification and auditing
7. Risk analysis. Outrage
8. Main types of environmental impacts.
9. Impacts on flora, fauna, vegetation and habitats.

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### **Bioengineering Systems (PAO10627)**

1. Introduction to the Bioengineering - concepts, domains and limits of application
2. Building systems typologies - coerture, stabilization, drainage, combined
3. Water bioengineering  
Consolidation, restoration, recovery and renaturalization
4. Soil bioengineering  
Erosion control, stabilization, hydrological management, post fire recovery
5. Building procedures and maintenance
6. Safety, and building site management