



University of Minho  
THIRD TERM  
PANGEA TRACK/PROFILE: 3B - GEOCONSERVATION

**TITLE OF UNIT: Computer Resources and GIS Applied to Geosciences**

**NUMBER of ECTS: 6**

**OPTIONAL or COMPULSORY (if applicable): Compulsory**

**PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course): None**

**MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): Theoretical and practical classes**

**Number of hours dedicated to lectures, practices, field-excursions, etc: 60**

**Personal workload (hours expected to be dedicated to, including supervised projects): 168**

**Description of the course**

**General aims**

- To understand the principles of digital photography in the areas of hardware, software and photographic composition;
- To develop the basic knowledge to use tools of digital image processing;
- To learn basic techniques of photogrammetry;
- To develop database solutions;
- To understand the use of precise positioning systems (GPS).
- To understand the basic structure and functioning of Geographic Information Systems;
- To produce georeferenced spatial information enriched with data attributes.
- To produce thematic cartography using dedicated software.

**Expected outcomes (knowledge)**

It is expected that students acquire a solid base on photography, 3D modelling, computer resources and GIS tools for geosciences, allowing the production of geospatial information and helping to solve everyday problems in geosciences.

**Expected outcomes (skills)**

This Unit aims to develop several skills related with geoconservation supporting topics, namely:

- research and analysis of relevant literature;



- critical thinking;
- analytic ability;
- aptitude to produce geospatial information;
- capacity to use computer resources and GIS tools.

### Content summary

- Digital Photography: Hardware, software and techniques of photographic composition;
- Software Postprocessing digital image;
- HDRi Photography and panoramic photography, photogrammetry in order to create three-dimensional models using free software;
- Creation of databases on environment FilemakerPro;
- GPS use and coordinate systems; Cartographic representation Techniques;
- Basic structure and functionality of a GIS package;
- Production of georeferenced spatial information based on the use of an open source GIS application;
- Production of thematic cartography.

### Person in charge of the unit (first and last name, e-mail)

Renato Henriques, [rhenriques@dct.uminho.pt](mailto:rhenriques@dct.uminho.pt)

EVALUATION MODE (final exam, oral defence, report...)	Ratio of the final grade
Individual report 1	50%
Individual report 2	50%



## TITLE OF UNIT: Characterisation and Assessment of the Environmental Impact

NUMBER of ECTS: 6

OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course): **None**

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **Lectures, theoretical-practical lessons and tutorials**

Number of hours dedicated to lectures, practices, field-excursions, etc: **60**

Personal workload (hours expected to be dedicated to, including supervised projects): **168**

### Description of the course

#### General aims

- To understand the basics of EIA in Portugal and in Europe;
- To identify the main types of projects that generate environmental impact;
- To apply indicators of environmental impact;
- To discuss the relevance of geological information for the analysis of impacts and mitigation of negative impacts;
- To know the steps and procedural aspects of AIA;
- To meet the technical standards for preparation of environmental impact studies, monitoring plans and monitoring reports;
- To implement models of assessment and prediction of impacts by types of projects;
- To know criteria for technical appreciation in different types of projects, with emphasis in mining industry and energy sector;
- To understand the framework for strategic environmental assessment, using case studies.

#### Expected outcomes (knowledge)

It is expected that students master environmental impact assessment procedures, providing adequate tools, namely of geological nature, to perform characterization of the environmental impact in some relevant sectors of the economy such as mining and energy production (quality criteria, monitoring and estimation tools).

#### Expected outcomes (skills)

This Unit aims to develop several skills related with geoconservation supporting topics, namely:



- research and analysis of relevant literature;
- critical thinking;
- analytic ability;
- aptitude to develop fieldwork;
- capacity to use technological tools in environmental impact assessment.

### Content summary

- Anthropogenic activities that generate environmental impact and main project types;
- Concepts and principles of environmental impact assessment (EIA);
- Methods of characterizing the environmental impact - environmental indicators and technical standards;
- Geological constraints in the procedures of environmental impact assessment;
- National and European guidelines for EIA;
- EIA procedure and main stages;
- Methods of assessment and previewing impacts;
- Elaboration of environmental impact studies;
- Implementation of monitoring plans for economic key sectors (mining, energy, water resources);
- Strategic environmental impact assessment and land management;
- Case studies with emphasis on the following sectors: mining industry, energy, water resources and roads.

### Person in charge of the unit (first and last name, e-mail)

Teresa Valente, [teresav@dct.uminho.pt](mailto:teresav@dct.uminho.pt)

EVALUATION MODE (final exam, oral defence, report...)	Ratio of the final grade
Individual reports	50%
Group reports	50%



## TITLE OF UNIT: Mapping

NUMBER of ECTS: 6

OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course): **None**

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **Lectures, theoretical-practical and field classes**

Number of hours dedicated to lectures, practicals, field-excursions, etc: **60**

Personal workload (hours expected to be dedicated to, including supervised projects): **168**

## Description of the course

### General aims

- To interpret the information of geological maps and diagrams;
- To know and interpret the geometry and kinematic of geological structures;
- To know and control de technics and methods of the geological and land management mapping;
- To characterize the parameters and constraints of a land management plan;
- To integrate cartographic data from different sources;
- To know the phases of geological and land management projects.

### Expected outcomes (knowledge)

It is expected that students will be able to perform field surveys (eg, descriptive and interpretative schemes and definition of network sampling) for the production of maps of different themes and scales, with emphasis on geological mapping.

### Expected outcomes (skills)

This Unit aims to develop several skills related with geoconservation supporting topics, namely:

- research and analysis of relevant literature;
- critical thinking;
- analytic ability;
- aptitude to develop fieldwork;
- capacity to read and prepare maps.

### Content summary

**Land management mapping:**

- areas of intervention, conditions and stages of development,
- Natural hazards: floods and landslides,
- Geological resources. Planning instruments.

**Geological mapping (litho-structural and mineral occurrences):**

- geological structures
- ii) Methods and techniques of data acquisition and processing;
- iii) Integration of data from different sources.

**Person in charge of the unit (first and last name, e-mail)**

Jorge Pamplona, [jopamp@dct.uminho.pt](mailto:jopamp@dct.uminho.pt)

EVALUATION MODE (final exam, oral defense, report,...)	Ratio of the final grade
Individual report	50%
Group report	50%



## TITLE OF UNIT: Relief and Landscape Evolution

NUMBER of ECTS: 6

OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course): **None**

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **Lectures, practical classes and field work**

Number of hours dedicated to lectures, practicals, field-excursions, etc: **60**

Personal workload (hours expected to be dedicated to, including supervised projects): **168**

## Description of the course

### General aims

- To identify key processes of formation and evolution of topography and describe how they operate and the intensity, spatial scale and temporal scale;
- To identify key processes of soils evolution, and understand their relationship with the physical and geological processes and climate;
- To know the main landforms, and explain their origin and evolution;
- To identify and understand the relationship between landforms evolution and the timescale;
- To identify and understand the causes of the evolution of topography and soils;
- To identify the main stages of the relief evolution of mainland Portugal and foresee the future evolution.

### Expected outcomes (knowledge)

It is expected that, with this unit, the students acquire knowledge on the processes of formation and evolution of relief and soils. With examples from various regions of the globe, students must identify distinctive landforms and understand the natural landscape dynamics at different temporal and spatial scales, and the importance of atmosphere elements and weathering in landscape evolution.

### Expected outcomes (skills)

This Unit aims to develop several skills related with geoconservation supporting topics, namely:

- research and analysis of relevant literature;
- critical thinking;
- analytic ability;



- aptitude to develop fieldwork;
- capacity to use computer resources.

## Content summary

- Tectonic evolution, morphotectonic, and the main reliefs of the Earth;
- Climate and landscape evolution;
- Climatic zones, weathering and erosion;
- Weathering of rocks, weathering products and soil formation;
- Earth dynamics, climate, biotic, and abiotic factors in the evolution of soils;
- Tectonic uplift versus erosion rate;
- Analysis methods and tectonic indices;
- Relief at regional scale;
- Characterization of coastal, river, desert and sub-desert, glacial and periglacial landscapes;
- Residual reliefs - time and landscape evolution;
- Causes and evidences of landscape evolution;
- Characterization and evolution of topography and soils of Portugal;
- The evolution of the relief of the Iberian Massif - mountains, river network, plain surfaces and residual reliefs;
- Relief evolution of Meso-Cenozoic areas in Portugal - evaporites; karst landforms; volcanic and sub-volcanic landforms;
- Evolution of coastal areas; beaches, cliffs, estuaries, coastal lagoons and barrier islands.

## Person in charge of the unit (first and last name, e-mail)

Diamantino Pereira, [insuad@dct.uminho.pt](mailto:insuad@dct.uminho.pt)

EVALUATION MODE (final exam, oral defence, report...)	Ratio of the final grade
Group report	45%
Oral presentation	45%
Class discussions	10%



## TITLE OF UNIT : Research Techniques in Geosciences

NUMBER of ECTS: 6

OPTIONAL or COMPULSORY (if applicable): **Compulsory**

PREREQUISITES (in term of either skills or knowledge or units to be validated before registration to this course): **None**

MODE OF TEACHING (distance education, webinar, workshops, seminars, lectures, supervised projects, etc): **Theoretical lessons and field and laboratory practical classes**

Number of hours dedicated to lectures, practicals, field-excursions, etc: **60**

Personal workload (hours expected to be dedicated to, including supervised projects): **168**

## Description of the course

### General aims

- To understand and be able to apply techniques for grinding and pulverizing rocks;
- To understand and be able to apply techniques for mineral separation;
- To understand and be able to apply techniques for particle size determination;
- To know the basic operation of a X-ray diffraction equipment and identify mineral phases based on the analysis of diffractograms;
- To learn the use of georadar equipment and to interpret the results;
- To understand the principles of operation of the electron microscope and electron microprobe in geological materials;
- To learn the principles of operation of chemical analysis techniques of rocks.

### Expected outcomes (knowledge)

It is expected that students know to use the equipment and master some field and laboratory techniques (identification of minerals, sieving, and particle size analysis of sediments, georadar) and understand the various steps involved in the process of acquisition of laboratory data, reading, processing and interpretation.

### Expected outcomes (skills)

This Unit aims to develop several skills related with geoconservation supporting topics, namely:

- research and analysis of relevant literature;
- critical thinking;
- analytic ability;
- aptitude to develop fieldwork;
- capacity to use laboratory and technology resources.



## Content summary

- Techniques of grinding and pulverizing of rocks for chemical analysis;
- Techniques for mineral separation: sieving, electromagnetic separation and heavy liquid separation;
- Methods and techniques for separation of clay;
- Techniques for determining particle size for sedimentary samples: sieving the coarse fraction and determining the fine fraction by attenuation of X-rays (SediGraph), obtaining granulometric curves;
- Identification of mineral phases by X-ray diffraction: principles of method, sample preparation, reading and interpreting diffraction patterns;
- Methods and techniques of chemical analysis of rocks: atomic absorption spectrometry, emission spectrometry with inductively coupled plasma (ICP-AES) and mass inductive coupled plasma (ICP-MS), X-ray fluorescence.
- Working principles of Scanning Electron Microscope and Microprobe Electronics, types of observations and data obtained for geological materials.
- Georadar: principle of operation and description of the equipment used in field work, gathering and processing of field data;
- Realization of practical work involving various laboratory techniques from samples collected in the field.

## Person in charge of the unit (first and last name, e-mail)

Pedro Pimenta, [pimenta@dct.uminho.pt](mailto:pimenta@dct.uminho.pt)

EVALUATION MODE (final exam, oral defence, report...)	Ratio of the final grade
Group report	50%
Theoretical and practical exam	50%