



## WP1

# **Analysis of soil erosion state and torrential floods in Western Balkan Countries**

Lead Organisations of WP1: **UNSCM; UB**

**Participating Organisation:** UNS; UNI; UBL; UNSA; INSZASUM; BOKU; UNIRC; FRI-BAS

Deliverable 1.4

Title: Report of analysis and elaboration of bachelor and master curricula in field of soil and torrent control in EU countries

**Participating Organisation:** BOKU, UNIRC



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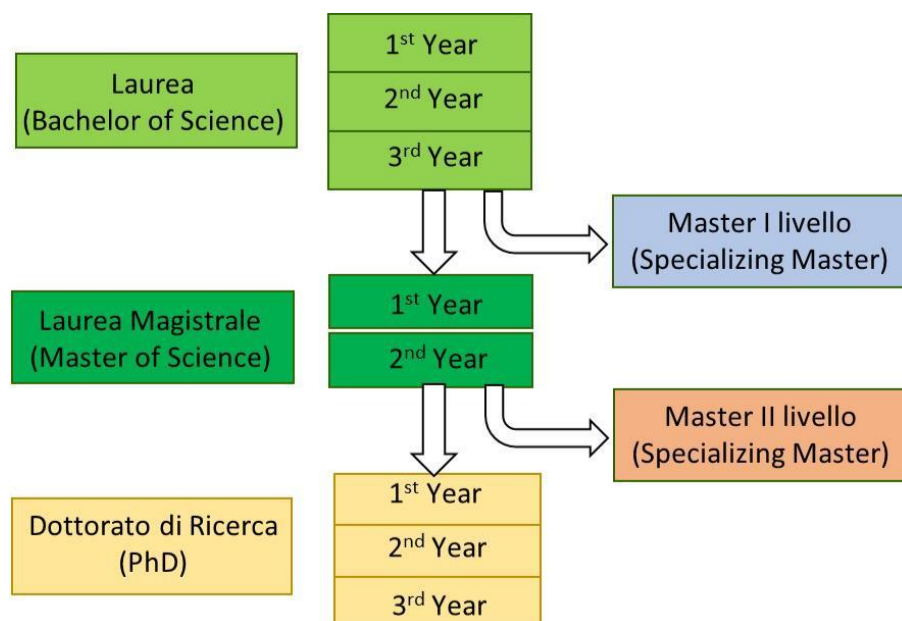
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## 1. Introduction - The Italian University system in brief

The Italian University System was re-designed based on the Ministerial Decree no. 509/1999. This decree has introduced some important innovations in the organization of the academic degrees, implementing the decisions taken by EU Ministers in Bologna in 1998. Further changes have been introduced by the Ministerial Decree n.270/2004 that made Italian graduates equal to other European graduates, both for course duration and for the qualifications awarded. In other words, the 3+2 system was adopted and the knowledge of a further European language, excluding Italian, was also required. Also, this reform has introduced a system based on the university credits (ECTS) for the first time in Italy. Each credit corresponds to 25 hours of student workload, including independent study. Nowadays, based on the above decrees, degree courses are structured in the following cycles (see Fig. 1):

- The first cycle (Laurea) has a 3-year duration for a total of 180 ECTS. It leads to a Bachelor of Science equivalent degree (UK);
- The second cycle (Laurea Magistrale) has a 2-year duration for a total of 120 ECTS. It leads to a Master of Science equivalent degree (UK);
- The third cycle (Dottorato di ricerca - Ph.D.) has a 3-year duration for a total of 180 ECTS. It leads to a Ph.D. equivalent.



**Fig. 1** – The Italian University System

Each Degree programme provides a curriculum in which the courses are grouped into three categories:

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- compulsory;
  - non-compulsory within a group indicated by the Faculty;
  - chosen by the student.

Additional qualifications within this basic 3-cycle system are also possible (see **Fig. 1**). For example, after the first cycle, the Italian system provides a 1-year course (minimum of 60 ECTS) leading to a 1st level Specializing Master; After the second cycle, the Italian system provides a 1-year course (minimum of 60 ECTS) leading to a 2nd level Specializing Master. Additional qualifications are not provided by all the Universities in Italy.

## **2. Bachelor and master degrees with disciplines in soil erosion and torrent control in Italy**

The Italian University system does not provide specific curricula in soil erosion and torrent control. However, disciplines and courses related to these scientific fields are available in different bachelor and master degrees. The three main groups of degrees where these (or similar) topics are provided are as follows:

- Forest Sciences
- Civil Engineering
- Geological Sciences

The general degree in Forest Sciences is probably the more complete considering that it provides specific knowledge in Hydraulics, Surface hydrology, Torrent control (check-dams design and construction), Soil erosion, Sediment transport, Naturalistic engineering.

The courses in Civil Engineering (with specific curricula in hydraulics) aim to focus on Hydraulics and Hydrology, with special attention to Hydraulic constructions (dams, check-dams, levees, bridges, etc.). In general, no attention is given to soil erosion and conservation that, on the contrary, are the main goals of the courses in Forest Sciences.

The courses in Geological Sciences aim at focusing on problems more or less related to Geomorphology, Hydrogeology, and Sedimentology but at large spatial scales. Even if these topics interact with the general problem of land degradation, generally, no specific courses are devoted to providing basic knowledge on torrent control or soil erosion.

Considering the importance given to the problem of soil conservation in the courses in Forest Sciences, from now on, only the general structure of these courses will be considered in the attempt to recall a valuable example on how a specific Master in soil erosion and torrent control can be designed.

## **3. Courses in Forest Sciences in Italy – An overview and a specific example at the University Mediterranea of Reggio Calabria**

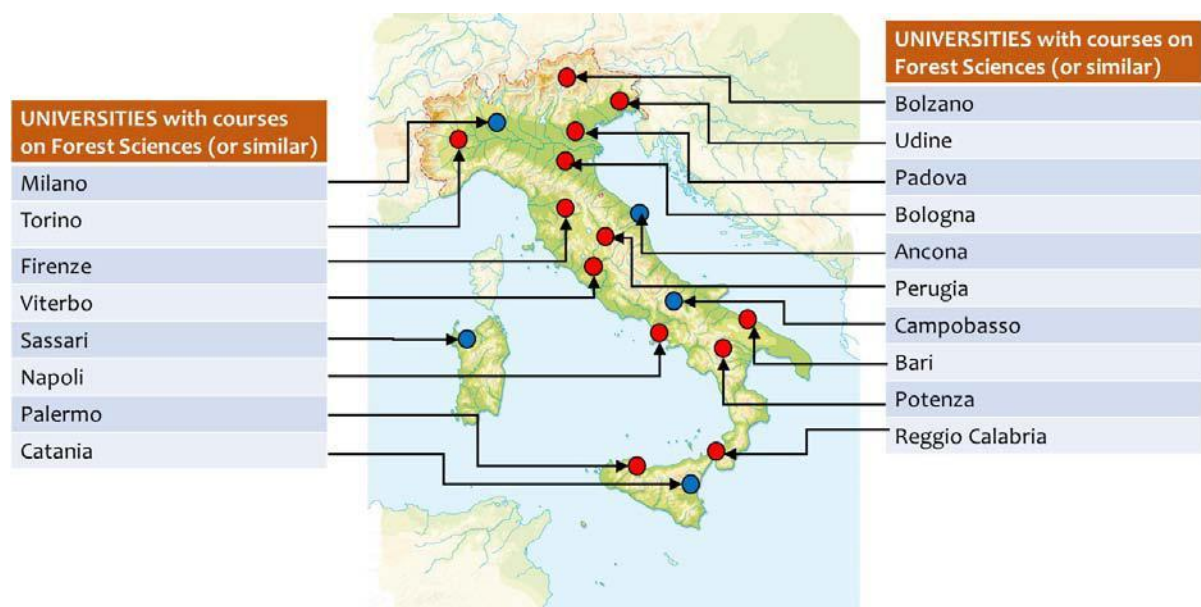
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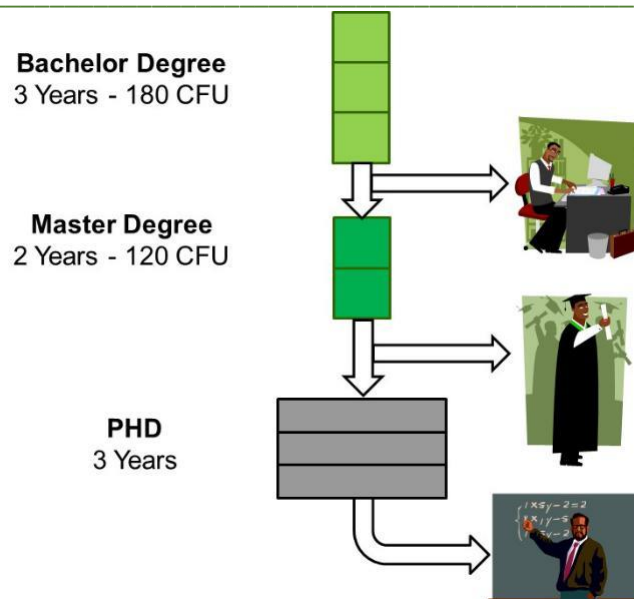


Forests in Italy are estimated to cover 8759 km<sup>2</sup>, corresponding to ca. 29% of the national territory INFC (2005). The large area devoted to woodland and the economical importance related to timber exploitation required special professional figures capable to understand the complex mechanisms of forest ecosystems and to manage the related activities including silviculture, soil protection, hydro-geological control. The courses in Forest Sciences provide such a professional figure and have a long history in the national territory. In **Fig. 2** the geographic location of the Universities (Faculties or Departments) that offer courses in Forest Sciences (or similar) is reported.



**Fig. 2** – Location of the Italian Universities with courses in Forest Sciences or similar

The locations marked by red circles in **Fig. 2** indicate the Universities with an older tradition in the area of Forest Sciences and that offer specific courses in soil erosion and/or torrent control. The blue circles, on the contrary, indicate places of younger establishment or Universities that do not offer similar courses. The University of Firenze is the place with the oldest tradition (since 1924) in this field but its course in *Environmental and Forest Sciences* follows the same structure of the other locations. Below, a general organization of bachelor and master degree in Forest Sciences is reported with specific reference to the University Mediterranea of Reggio Calabria.



**Fig. 3** – The basic structure of a degree in Forest Sciences (3 + 2 system) at the University Mediterranea of Reggio Calabria (1 CFU = 1 ECTS)

The programme follows the 3 + 2 scheme of the national University System and allows participation to a Ph.D. Course (3 more years) in different research themes. In **Fig. 4** a detailed list of the Courses for the Bachelor Degree is reported.

The Teaching Modules that offer a specific programme in Torrent Control are given during the third year and are indicated by an arrow in **Fig. 4**. These modules (Hydraulics, Hydrology and Torrent Control) cover a total of 12 ECTS and aim at providing students with the acquisition of knowledge on:

- basic tools as well as theoretical and practical methods for the analysis of hydrological processes and design of river control works;
- solution of the most relevant problems concerning control and mitigation of hydrogeological risks in agro-forestry areas.

The two modules require also basic knowledge of Mathematics (6 ECTS) and Physics (6 ECTS), both mandatory, given during the first year (see marked boxes in **Fig. 4**).

- Specific information on Soil Erosion is given during the first year of the Master Degree (see the general structure in **Fig. 5**).

In this case, two Teaching Modules (Watersheds Planning and Management - 3 ECTS - and Soil Protection and Conservation and Hydraulic Rehabilitation - 6 ECTS) are provided that cover a total of 9 ECTS (see the marked box in **Fig. 5**).



### First year

COURSE	ECTS	SSD	SEMESTER
ELEMENTS OF MATHEMATICS	6	MAT/05	First semester
CHEMISTRY	8	CHIM/03	First semester
ENGLISH			First semester
- ENGLISH	3		First semester
- ENGLISH	3		First semester
GENETICA	6	AGR/07	Second semester
PLANT BIOLOGY	8	BIO/03	Second semester
ELEMENTI DI FISICA	6	FIS/01	Second semester
Forest Botany	6	BIO/03	Second semester

### Second year

COURSE	ECTS	SSD	SEMESTER
FOREST ENTOMOLOGY	6	AGR/11	First semester
Mountain Agronomy and Zootechnics			First semester
- MOUNTAIN AGRONOMY	6	AGR/02	First semester
- PRINCIPI DI NUTRIZIONE ED ALIMENTAZIONE ANIMALE IN AMBIENTE MONTANO	6	AGR/18	First semester
FORESTAL ECONOMICS AND POLICY			First semester
- ELEMENTS OF FORESTAL ECONOMICS	6	AGR/01	First semester
Forest Chemistry			Second semester
- PLANT MOLECULAR PHYSIOLOGY	6	AGR/13	Second semester
- Chemistry of the Forest Floor	6	AGR/13	Second semester
Forest Plant Pathology	6	AGR/12	Second semester
FORESTAL ECONOMICS AND POLICY			Second semester
- FORESTAL ECONOMICS AND POLICY	6	AGR/01	Second semester
- FORESTAL AND ENVIRONMENTAL LAW	6	IUS/03	Second semester

### Third year

COURSE	ECTS	SSD	SEMESTER
General Microbiology	6	AGR/16	First semester
Dendrometry and Principles of Forest Arrangement	6	AGR/05	First semester
FOREST ECOLOGY, SILVICULTURE AND MANAGEMENT OF PROTECTED AREAS			First semester
- FOREST ECOLOGY AND GENERAL SILVICULTURE	6	AGR/05	First semester
- MANAGEMENT OF PROTECTED AREAS	3	AGR/05	First semester
Forest Appraisal	6	AGR/01	First semester
Logging Mechanization	6	AGR/09	First semester
CAD LABORATORY	3		First semester
MATERIE A SCELTA	12		First semester
APPRENTICESHIP TRAINING AND GUIDANCE	2		First semester
STAGE AND ESTERNAL TRAINING	2		First semester
FINAL TEST	4		First semester
FOREST BUILDINGS AND LANDSCAPE			Second semester
- COSTRUZIONI FORESTALI E PAESAGGIO	6	AGR/10	Second semester
- LAND SURVEYING AND REPRESENTATION	6	AGR/10	Second semester
IDRAULICA, IDROLOGIA E SISTEMAZIONI IDRAULICO FORESTALI			Second semester
- IDRAULICA E IDROLOGIA FORESTALE	6	AGR/08	Second semester
- SISTEMAZIONI IDRAULICO FORESTALI	6	AGR/08	Second semester

**Fig. 4 – The Courses of the Bachelor Degree in Forest Sciences (3 years – 180 ECTS)**

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First year				Second year			
COURSE	ECTS	SSD	SEMESTER	COURSE	ECTS	SSD	SEMESTER
Environmental Chemistry of Urban and Forest Ecosystems	6	AGR/13	First semester	Forest Fire Protection	6	AGR/05	First semester
Soil Protection and Conservation and Watersheds Planning			First semester	ECONOMICS AND ENVIRONMENT APPRAISAL	6	AGR/01	First semester
- Watersheds Planning and Management	3	AGR/08	First semester	Ethology and wildlife management	6	AGR/19	First semester
- Soil Protection and Conservation and Hydraulic Rehabilitation	6	AGR/08	First semester	Landscape planning and infrastructures in agro-forestry areas	6	AGR/10	First semester
Plant diseases and phytosanitary protection			First semester	MATERIE A SCELTA	12		First semester
- MALATTIE DEL VERDE E DELLE PIANTE ORNAMENTALI	6	AGR/12	First semester	APPRENTICESHIP TRAINING AND GUIDANCE	3		Second semester
FOREST GEOBOTANY	6	BIO/03	First semester	STAGE AND ESTERNAL TRAINING	9		Second semester
Laboratory of GIS	5		First semester	Final project	13		Second semester
Plant diseases and phytosanitary protection			Second semester				
- Integrate Protection of the Forest Systems	3	AGR/11	Second semester				
SOIL ECOLOGY	6	AGR/13	Second semester				
Natural and Cultivated Mountain Systems	6	AGR/02	Second semester				
Management of Forest Systems and Safety in Forestry Operations			Second semester				
- Silviculture and arboriculture for timber production	9	AGR/05	Second semester				
- Wood Harvesting and Safety in Forestry Operations	3	AGR/09	Second semester				

**Fig. 5** – The Courses of the Master Degree in Forest Sciences (2 years – 120 ECTS)

Both the modules aim at providing students with:

- basic methodologies and technologies to individuate the main agents and atmospheric phenomena causing water erosion;
- basic methodologies aimed at planning and managing watersheds using an integrated approach;
- basic knowledge to analyze the different management planning practices within a watershed area;
- basic knowledge on the effects of the anthropogenic activities on water resources;
- basic knowledge on the possible measures to be applied in the semi-arid Mediterranean context, in view of the law framework, in order to achieve effective river basin planning, including possible effects of hydraulic systems on the ecosystem.

Further information on Soil Erosion and Torrent Control is provided within the Modules of Stage and External Training as well as Apprenticeship Training and Guidance. Both these Modules are offered during the Bachelor and the Master Degrees (see **Fig. 4** and **Fig. 5**) and cover a number of ECTS ranging from 4 (Bachelor) to 12 (Master). This is an important issue that needs to be considered if the aim is to develop a Master Curriculum in Soil Erosion and Torrent Control. The aim of these modules is to provide students with internships and placements in companies, public or private bodies, and/or professional associations, and further training activities in the field. Among the spectrum of activities developed during the attendance of these modules, the participation to field classes is an important strategy adopted by several universities with courses in Forest Sciences in Italy. The first Italian University that provided such opportunity is the University of Firenze (see **Fig. 2**) that allows students to spend 10-15 days in the field to acquire knowledge on different themes related to the degree programme (see the link below)

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<https://www.youtube.com/watch?v=huSL6BB3cg0&feature=youtu.be>

In that case, the field classes are organized at the site of Vallombrosa, a forest that was owned by the State, and that, in 1977, became Biogenetic Nature Reserve. Every year the Vallombrosa forest is visited by thousands of tourists, and by students of the Faculty of Forest Sciences of Florence University, who in Vallombrosa hold their study camp. Similar examples are in other Faculties/Departments in Italy. The Degrees in Forest Sciences of the University Mediterranea of Reggio Calabria (see **Fig. 6**) organize every year field classes (10-15 days) in different areas of Aspromonte, Sila and Pollino.



**Fig. 6** – Field classes organized by the Degrees in Forest Sciences of the University Mediterranea of Reggio Calabria

During the field classes, specific technical aspects of soil erosion and torrent control are covered.

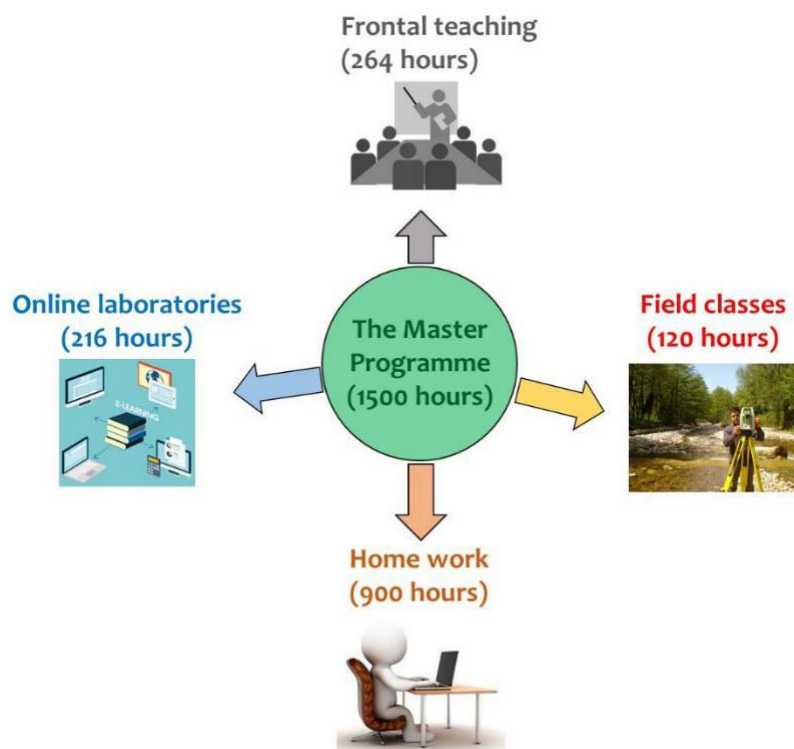


#### 4. Building a Master Curriculum on Soil Erosion and Torrent Control – What is needed?

The overview of the general structure of the courses in Forest Sciences in Italy, with a specific example adopted by the University Mediterranea, is useful to establish the basis of a Master to provide specific skills in Soil Erosion and Torrent Control. Based on the Italian experience, a minimum of 60 ECTS, that include both teaching classes and field classes, is necessary. Clearly, this proposal must be balanced with that of other countries involved in this project but, at least, number and types of courses that have to be included in the programme can be established.

Below, an example of how a Master Programme can be built is provided. It concerns a Master on 'Sustainable Management of Geo-hydrological Risk in Mountain Environments' organized by the University of Bolzano (see Fig. 2 for the location). This Master was built based on the attendance of 15-30 participants and it is open to post-grad students in agricultural and forest sciences, engineering, environmental sciences, geology. The duration is 1 year and covers a number of 60 ECTS. The Master is organized with the co-operation of Maccaferri Innovation Center (MIC) that has a large experience in the field of Torrent Control (see link <https://www.maccaferri.com/it/en/>).

The teaching programme is based on a total of 1500 hours that are distributed following the scheme in Fig. 7.



**Fig. 7 – The master programme**

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The frontal teaching (264 hours) provides the students with contents of the general topics; the online laboratories (216 hours) can be covered by e-learning activities; field classes (120 hours) can be covered by specific applications in the field (measurements) and/or participation to stages in public/private enterprises; the homework will be devoted to the final report/dissertation.

About the teaching programme, six integrated courses are considered as follows:

- Evaluation of geo-hydrologic risk;
- Evaluation of mitigation strategies;
- Designing of intervention for mitigation;
- Building and management of hydraulic structures;
- Non-structural intervention for mitigation;
- Economical evaluation of strategy for mitigation.

A similar structure can be calibrated/modified (in terms of teaching hours and related activities) for the professional figures that the Master in Soil Erosion and Torrent intends to create.

### **References**

INFC (2005). Inventario Nazionale delle Foreste e dei serbatoi forestali di Carbonio