COURSE DETAILS

"LAND PROTECTION FROM HYDRAULIC HAZARDS AND SOIL BIOENGINEERING TECHNIQUES"

SSD: AGR/08

DEGREE PROGRAMME: M.SC. IN FOREST AND ENVIRONMENTAL SCIENCES

ACADEMIC YEAR: 2021-2022

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE (IF APPLICABLE):
MODULE (IF APPLICABLE):
CHANNEL (IF APPLICABLE):
YEAR OF THE DEGREE PROGRAMME (I, II, III): I
SEMESTER (I, II): II
CFU: 12

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "ORDINAMENTO")

PREREQUISITES (IF APPLICABLE)

LEARNING GOALS

The general goal of this course is to provide the students with notions and advanced tools in the field of environmental monitoring and the hydraulic protection of an agroforestry territory. The educational objectives aim at implementing the information and notions given during the course into operational aspects. The course combines the transfer of knowledge on the subject with adequate knowledge, skills, and competencies gained during lessons, and laboratory and field activities, as well as through the critical review of case studies and technical visits.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

Students are required to be able to critically apply the knowledge acquired during the course, to frame them technically in different agro-forestry systems, and to provide an assessment of the methods for maintenance and management of the territory. Particular attention is paid to the students' acquisition of the correct scientific and technical terms and their use in various environmental contexts. In addition, the student should have developed the ability to well present and explain the exercises and problems carried out during the course. The student should also demonstrate that have acquired the basic knowledge of the discipline, but also have gained the ability to update and upgrade their basic knowledge. Furthermore, he must have the ability to integrate the notions acquired in this course with those relevant to other courses.

Applying knowledge and understanding

The student will have to understand the particular features of an agro-forestry environmental system and be able to acquire territorial data, especially the climatic and hydrological ones related to the soil-vegetation-atmosphere system, to reach the ultimate goal of gaining a suitable description and characterization of the system under study. He should be able to identify and implement the more effective monitoring techniques to collect information on the major environmental variables evolving in the system under study, as well as use the most suitable methods, including advanced analytical tools, for land protection, management, and maintenance, especially concerning the spatial scales of interest of the problem at hand. The student should also demonstrate that can apply the most effective techniques for evaluating the goods and services offered by a certain ecosystem.

COURSE CONTENT/SYLLABUS

CFU1: Course introduction and general issues. Ecosystem services and vulnerability of environmental functions. General issues on simulation and predictions models.

CFU2: Hydraulic and hydrological variables, and relevant measuring devices. Measurement accuracy and precision. Methods and techniques for monitoring environmental variables. Numerical and laboratory exercises.

CFU3: Soil hydrology and basic hydrological processes. Concepts of field capacity and available water. Water balance in the soil-vegetation-atmosphere system. Numerical exercises and demo lab.

CFU4: Identification of environmentally sensitive and vulnerable zones. The concept of environmental risk. Structural and non-structural interventions for risk mitigation.

CFU5: Degradation problems in hilly and mountain areas. Analysis of meteorological extreme events. Return period and hazard forecasting. Numerical exercises.

CFU6: Soil erosion. Monitoring and modeling soil loss by water erosion. Effects of Mediterranean seasonality and post-fire hazard increase. Numerical exercises.

CFU7: Hillslope stability analysis. The role of vegetation in hillslope stability and effects of riparian vegetation. Numerical exercises.

CFU8: Hydro-forestry works and defense of hilly-mountain territory. Classification of the interventions. Retaining and bank-pile walls. Dry-stone walls and protection of terraces. Maintenance and restructuring plans. Exercises on the design of retaining structures.

CFU9: Soil bio-engineering techniques for slope and river protection. Maintenance and recovery of degraded elements. Exercises on the design of wooden crib and bank-pile walls; technical visits.

CFU10: Forest roads. Drainage systems to protect roads and hillslopes. Stream crossing with culverts and fords.

CFU11: Hydro-forestry issues for the Strategic Environmental Assessment (SEA): the DPSIR system. Monitoring issues, indicators, and indices. Discussion of case-studies.

CFU12: Laws and technical rules for land and water protection and discussion of case-studies. Summary of the main contents of each lecture. Assessment criteria and how the exam is held.

READINGS/BIBLIOGRAPHY

Ferro, V. 2019.Opere di sistemazione idraulico-forestale. McGraw-Hill (Milano).
Ferro, V. 2006. La sistemazione dei bacini idrografici, 2a edizione. McGraw-Hill (Milano).
Bagarello, V. & V. Ferro, 2006. Erosione e conservazione del suolo. McGraw-Hill (Milano).
Ferro, V., G. Dalla Fontana, et al. 2004. Opere di sistemazione idraulico-forestale a basso impatto ambientale. McGraw-Hill (Milano).
Da Deppo, L., C. Datei & P. Salandin, 2004. Sistemazione dei corsi d'acqua. Cortina (Padova).
Lecture notes.

TEACHING METHODS

The course is split into a series of lectures, using slides, and exercises both in a computer room [using the Excel spreadsheet and software available on the net (e.g. HYDRUS-1D] and in the laboratory or in-situ. The lecturer will use: a) lectures for about 70% of the total hours, b) laboratory/field exercises and technical visits, for practical implementation of the notions, for about 30% of the total hours. Seminars held by experts can be envisaged.

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type	
written and oral	
only written	
only oral	X
project discussion	X
other	

In case of a written exam, questions refer to: (*)	**Multiple choice answers**	
	Open answers	
	Numerical exercises	

(*) multiple options are possible

b) Evaluation pattern: