Universitat de Lleida

DEGREE CURRICULUM

FOREST HYDROLOGY

Coordination: BALASCH SOLANES, JOSE CARLOS

Academic year 2021-22

FOREST HYDROLOGY 2021-22

Subject's general information

Subject name	FOREST HYDROLOGY
Code	102421
Semester	1st Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Bachelor's Degree in Forest Engineering	2	COMPULSORY	Attendance-based
Double degree: Bachelor's degree in Forest Engineering and Bachelor's degree in Nature Conservation	2	COMPULSORY	Attendance-based
Master's Degree in Forestry Engineering		COMPLEMENTARY TRAINING	Blended learning

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRALAB	PRAULA	TEORIA
Number of credits	0.4	1.4	4.2
Number of groups	2	1	1

Coordination	BALASCH SOLANES, JOSE CARLOS
Department	ENVIRONMENT AND SOIL SCIENCES
Important information on data processing	Consult this link for more information.
Language	Catalan and Spanish
Distribution of credits	Hydrology (60%) Soil erosion (40%)

FOREST HYDROLOGY 2021-22

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BALASCH SOLANES, JOSE CARLOS	josepcarles.balasch@udl.cat	2,8	
POCH CLARET, ROSA MARIA	rosa.poch@udl.cat	1,4	
RAMOS MARTÍN, MARÍA CONCEPCIÓN	mariaconcepcion.ramos@udl.cat	1,4	
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Subject's extra information

Water is a renewable but limited resource, and even more so in the Mediterranean environment where the involvement of plant cover plays an essential role in the generation and quality of runoff, and therefore of the water resources of a territory. The future of the availability of these resources in our society inevitably involves conscious and sound management of the forest environment as a strategic tool for the conservation and improvement of water and soil.

The course aims to provide the engineer who will develop his activity in the forest environment the basic knowledge needed to understand the water cycle in this system and the tools to evaluate runoff production and soil losses due to erosion on the mesoconcal scale. On the other hand, the mechanisms and techniques for evaluating and correcting problems related to the dynamics of surface and groundwater, as well as the problems of erosion-degraded areas and sediments generated, are explained.

The course is taught during the first semester of the second year of the Degree in Forest Engineering.

At the end of the studies of the Degree in Forest Engineering can complement the knowledge of this subject with those of the "Module of River and River Hydrology" which is part of the Master in Soil and Water Management (MAGSA) also in this School and is a master's degree in research and 90 credits made between several Catalan universities and the Ebro basin.

Requirements to complete it

Suitable Core Requirements: Forest Hydraulic Engineering (EHF)

Learning objectives

The student, when passing the subject, must be able to:

1.To know the components of the hydrological cycle in the forest environment, emphasizing the role of vegetation

as a regulating factor in the movement of water in the soil and the production of surface and underground runoff.

2. Estimate in terms of probability the frequency of extreme hydrological events.

3. Calculate the maximum expected hydrological response of a basin during an extraordinary event to design works for the correction and restoration of rivers and streams.

4. Identify and evaluate the symptoms of the different forms of erosion and degradation of the territory and formulate hypotheses about their causes.

5. Quantify potential soil losses by erosion using global empirical models.

6.Select and design forms of vegetation management and soil actions aimed at preventing, mitigating or correcting the effects of erosion that ensure sustainable use of the territory

7. Write up reports and reports on problems arising from the dynamics of surface water, groundwater and erosion processes, and recommend measures to minimize their impacts.

Competences

Basic skills

CB1. That students have demonstrated to possess and understand knowledge in an area of study that is based on the general secondary education, and is usually found at a level that, while supported by advanced textbooks, also includes some aspects involving knowledge from the forefront of their field of study

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their area of study

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific, or ethical issues.

CB4. That students can convey information, ideas, problems and solutions to both specialized and non-specialized audiences

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

Global competencies

CG1. Ability to understand the biological, chemical, physical, mathematical and representation systems necessary for the development of professional activity, as well as to identify the different biotic and physical elements of the forest environment and renewable natural resources susceptible to protection , conservation and uses in the forestry field.

CG3. Knowledge of the degradation processes that affect forest systems and resources (pollution, pests and diseases, fires, etc.) and ability to use the techniques of protection of the forest environment, forest hydrological restoration and biodiversity conservation .

CG9. Knowledge of hydraulics, construction, electrification, forest roads, machinery and mechanization necessary both for the management of forest systems and for their conservation.

CG13. Ability to design, direct, develop, implement and interpret projects and plans, as well as to write technical reports, recognition reports, assessments, appraisals and appraisals.

CG14. Ability to understand, interpret and adopt scientific advances in the field of forestry, to develop and transfer technology and to work in a multilingual and multidisciplinary environment.

Transversal skills

CT1. Correction in oral and written expression

CT2. Proficiency in a foreign language

CT3. Mastery of Information and Communication Technologies

CT4. Respect for the fundamental rights of equality between men and women, the promotion of human rights and the values of a culture of peace and democratic values

CT5. Apply the gender perspective to the functions of the professional field

Specific skills

CEFB1. Ability to solve mathematical problems that may arise in engineering. Ability to apply knowledge about: linear algebra; geometry; differential geometry; differential and integral calculus; differential equations and partial derivatives; numerical methods, numerical algorithms; statistics and optimization.

CEFB2. Spatial vision and knowledge of graphic representation techniques, both by traditional methods of metric geometry and descriptive geometry, and by computer aided design applications.

CEFB3. Basic knowledge of the use and programming of computers, operating systems, databases and computer programs with application in engineering.

CEFB5. Understanding and mastery of the basic concepts about the general laws of mechanics, thermodynamics, fields, and waves and electromagnetism and their application for solving problems specific to engineering.

CEFB6. Basic knowledge of geology and morphology of the terrain and its application in engineering-related problems. Climatology.

CEMC3. Ability to know, understand and use the principles of Physical Environmental Sciences: Geology, Climatology and Soil Science

CEMC6. Ability to know, understand and use the principles of Topography, Geographic Information Systems and Remote Sensing

CEMC7. Ability to know, understand and use the principles of Forest Hydraulics

CEEF10. Ability to know, understand and use the principles of Hydrology and Hydrological-Forest Restoration.

Subject contents

Programme of lectures:

1. Hydrological cycle

1.1 General concepts. Global water cycle. Reservoirs and hydrological processes. Hydrological balance of the drainage basin. Watershed morphometry elements

1.2 Precipitation. Construction of IDF-ADF curves. Design storms. Frequency of extreme events

1.3 Interception by vegetation

1.4 Evapotranspiration

1.5 The water in the soil

1.6 Infiltration. Horton model. Model by Green & Ampt. Curve Number method.

1.7 Forests and waters

2. Surface runoff

2.1 Runoff formation processes. Hortonian runoff. Saturation runoff. Subsurface runoff. Return flow. Background conditions of soil moisture

2.2 Measurement of runoff. Capacity stations. Hydrogram analysis.

2.3 Relations between precipitation and flow. Hydrological models

3. Underground runoff

3.1 Basic hydrogeology: aquifers and hydraulic parameters

3.2 Separation of the base flow of the hydrograms

3.2 Hydrogeochemistry and groundwater pollution

4. Erosion

4.1 Erosive processes

4.2 Mapping of erosive processes and conditioning factors

4.3 Global estimation of erosion. The USLE model. The RUSLE review

5. Soil and drainage conservation

5.1 Erosion control strategies and measures. Terraces and drains

5.2 Restoration of soils. Bioengineering

5.3 Correction of torrents. Solid flow. Restoration of rivers and banks

Practical activities

The practical program includes activities to be done in the classroom and other non-contact activities.

The practices will consist of solving exercises and problems related to the theoretical contents explained above. The case study and critical discussion of the examples shown will also form part of the practical body of the subject.

List of practices

1.- Situation of the geographical, hydrographic and administrative basin. Delimitation of the basin from the exit point and the drainage network. Aspects of basin morphometry.

2.- Climatic data. Rainfall and temperature data. Restoration of absent rainfall data. Average monthly and annual rainfall. Rainfall correction by height (with regional rainfall gradient).

3.- Maximum rainfall in 24 hours. for different return periods. IDF-ADF curves. Calculation water.

4.- Estimation of the potential interception according to the vegetation. Potential evapotranspiration. Land reserve (CRAD). Water balance of the basin.

5.- Estimation of the water resources of the basin. Basin soil uses. Curve number (NC). Estimation of net rainfall.

6.- Unit Hydrogram (HU) and convolution with clean rain. Complex hydrograph. Maximum flow for the return period of 500 years

7.- Calculation of the factors rain erosion (R) and soil erosion (K)

8.- Calculation of topographic factors (LS), vegetation cover (C) and anthropogenic practices (P)

9.- Hydrogeological resources

Methodology

Activities	Academic time (hours)	Student homework (hours)	TOTAL (hours)
Master classes	42	63	105
Practices and cases	14	21	35
Seminars			
Laboratory			
Informatics	4	6	10
Fieldtrip practices			
External visites			
TOTAL	60	90	150

Development plan

The development of the subject arises initially from the monitoring of the theoretical activities and classroom practices. Therefore, participation and monitoring of classes and related activities will be valued.

For causes derived from the health crisis caused by the Covid-19, the activities in face-to-face mode can be replaced by other equivalents in distance mode

Participation and monitoring of classes and related activities will be valued

Evaluation

Remarks

The continuous evaluation of the subject will be weighed between several parts:

-Two written tests on the theory part (the first half of the program (30%) and the second half (30%), with a weight of

60% of the final mark. Each part must be surpassed with a minimum mark of 4/10.

- Delivery of the practical work on a real drainage basin, which will have a weight of 40%

Evaluation	Pes en la nota global
First test about theory and exercises	30%
Second test about theory and exercises	30%
Final report on a real watershed	40%

In the evaluation of written works or reports the formal aspects, of expressive clarity, of the spelling correction, of the creation of figures and tables and of the global presentation will be evaluated specifically.

Attendance and participation by students in classes is considered very important. In that sense, such attendance will be monitored and evaluated positively.

In very specific cases, at the discretion of the teacher, some students may be offered the possibility of completing additional bibliographic works to improve some knowledge deficiencies or as an extension of the syllabus of the subject.

In the last week corresponding to the first semester there will be a test of recovery of the theoretical and practical subjects previously examined and in which they will also be able to deliver those works that have not been presented in the terms established initially by the teachers.

Bibliography

Basic bibliography

CHOW, V.T .; MAIDMENT, D.R. & MAYS, L.W. (1994): Applied Hydrology. McGraw-Hill, Santafé de Bogotá (Colombia), 584 p.

MORGAN, R.P.C. (1995): Soil erosion and conservation. 2nd edition. Longman, Harlow, Essex, 198 p.

NANÍA, L. S. & GÓMEZ-VALENTÍN, M. (2007): Hydrological Engineering. 2nd edition. University Editorial Group, Granada, 278 p.

SHAW, E.M. (1994): Hydrology in Practice. 3rd edition. Chapman & Hall, London, 569 p. THOMPSON, S.A. (1999): Hydrology for water management. AA Balkema, Rotterdam, 362 p.

TRAGSA (1998): Hydrological restoration of river basins and erosion control. Environmental engineering. 2nd ed. Mundi-Press. Madrid, 945 p.

Complementary bibliography

BLACK, P.E. (1991): Watershed hydrology. Prentice Hall.

BROOKS, K.N .; FOLLIOT, P.F .; GREGERSEN, H.M. & THAMES, J.L. (1992): Hydrology and the management of watersheds. Iowa State University Press.

DUNNE, T. & LEOPOLD, L.B. (1978): Water in environmental planning. W.H. Freeman. LINSLEY, R.K .; KOHLER, M.A. & PAULUS, J.L.H. (1988): Hydrology for Engineers, S.I. Metric

edition. McGraw-Hill, Singapore, 492 p.

POCH, R.M. (1993): Soil conservation techniques. Tools Collection, 3. Publ. Univ of Lleida, Lleida, 82 p.

POCH, R.M. & BALASCH, J.C. (2011): Problems solved of Surface Hydrology. Tools Collection. Publ. Univ of Lleida, Lleida, 101 p.

SCHWAB, G.O .; FREVERT, R.K .; EDMISTER, T.W .; BARNES, K.K. (1981): Soil and water conservation engineering. J. Wiley & Sons.

VIESSMAN, W.; LEWIS, G.L. & KNAPP, J.W. (1989): Introduction to Hydrology. 3rd edition. Harper & Row, New York, 780 p.

Other bibliographic or peer-reviewed literature references that are of interest in supplementing specific topics in theory or in the illustration of case studies will be provided during the theoretical classes or in the classroom practices and will be made available. among the digital resources of the subject.