



Universitat de Lleida

DEGREE CURRICULUM
FOREST HYDROLOGY

Coordination: BALASCH SOLANES, JOSE CARLOS

Academic year 2020-21

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
Course number of credits (ECTS)	6			
Type of activity, credits, and groups	Activity type	PRAULA		TEORIA
	Number of credits	1.8		4.2
	Number of groups	2		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%)			

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BALASCH SOLANES, JOSE CARLOS	josepcarles.balasch@udl.cat	2,6	
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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

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 the renewable natural resources that can be protected and conserved. and exploitation in the forestry field.

CG2. Ability to analyze the ecological structure and function of forest systems and resources, including landscapes.

CG3. Knowledge of the degradation processes that affect forest systems and resources (pollution, pests and diseases, fires, etc.) | Ability to use the techniques of protection of the forest environment, hydrological forest restoration and biodiversity conservation. CG4. Ability to evaluate and correct the environmental impact, as well as apply the techniques

of audit and environmental management.

CG7. Ability to solve technical problems arising from the management of natural spaces.

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

CG10. Ability to apply the techniques of forest management and land planning, as well as the criteria and indicators of sustainable forest management in the framework of forest certification procedures.

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

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

CG15. Correction in oral and written expression

CG17. Mastery of Information and Communication Technologies

CG18. 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.

Subject contents

Programme of lessons:

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

<p>Aula d'informàtica</p>	<p>Pràctica d'aula de informàtica (Grup mitjà)</p>	<p>Execució de la pràctica: comprendre fenòmens, mesurar...</p>				

<p>Pràctiques de camp</p>	<p>Pràctica de camp (Grup mitjà)</p>	<p>Execució de la pràctica: comprendre fenòmens, mesurar...</p>	<p>6</p>		<p>9</p>	<p>15</p>
<p>Visites</p>	<p>Visita a explotacions o indústries</p>	<p>Realització de la visita</p>				
<p>Activitats dirigides</p>	<p>Pràctica de camp (Grup mitjà)</p>	<p>Orientar a l'alumne en el treball (en horari de tutories)</p>				

Altres	Visita a explotacions o indústries					14
Totals			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 and the second half), 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%

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.

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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. ; FOLLIOU, 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.

VISSMAN, 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.