# COURSE DETAILS

## "ECOSYSTEM SERVICES AND ENVIRONMENTAL DAMAGE ASSESSMENT MODULE"

DEGREE PROGRAMME: **Forestry and Environmental Sciences**

ACADEMIC YEAR: **2021-2022**

## GENERAL INFORMATION – TEACHER REFERENCES

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## GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE (IF APPLICABLE): **Ecological Data Analysis**

MODULE (IF APPLICABLE): **Ecosystem Services and Environmental Damage Assessment**

CHANNEL (IF APPLICABLE):
https://teams.microsoft.com/l/team/19%3ae5d2adbb3f7c4d20bd030f58c55a0eed%40thread.tacv2/conversations?groupId=435102d6-9155-4d0c-88d7-9bcd36674572&tenantId=2fcfe26a-bb62-46b0-b1e3-28f9da0c45fd

YEAR OF THE DEGREE PROGRAMME (I, II, III): **I**

SEMESTER (I, II): **I**

CFU: **6**

## REQUIRED PRELIMINARY COURSES

None

## PREREQUISITES

Fundamentals of dendrometry, silviculture and forest ecology. Basic notions about the use of spreadsheets (e.g. Microsoft Office Excel).

## LEARNING GOALS

The course aims to provide specific knowledge about ecosystem services (SE) classification systems and on the most appropriate methods for their correct evaluation, particularly the CICES methodology of the European Environment Agency (EEA). The applications will focus on the SEs supplied by the forests and trees of natural and urban environments. The quantitative evaluations will be carried out through the above- and below-ground biomass estimation methods, using species-specific allometric equations. Applications to real case studies of forest contests constitute a qualifying part of the degree program and the professional profile of graduates in Forestry and Environmental Sciences.
The course will provide the students tools and experience in producing and evaluating technical reports and scientific results, with a focus on reporting and interpreting statistical aspects. Students should thus become confident in designing and selecting sampling methodologies, choosing and applying statistical techniques. All students will be solicited to suggest alternative and innovative approaches in resolving statistical problems and in evaluating the obtained results.

## EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

**Knowledge and understanding**

Knowledge and understanding of ecosystem services (SE) provided by forest systems, agroecosystems and urban forests represent a prerequisite for planning and appropriately managing the natural resources. The student will demonstrate that he can categorize and describe the SEs to measure, map, and evaluate them correctly. In other words, the student will need to show that he can classify and quantitatively estimate the ES provided by forest ecosystems and, in the case of disturbances or improper management, demonstrate that they can quantify both the loss of ES and the environmental damage.
Students have to demonstrate to I) master opportunities and challenges of data analysis in ecology; II) know the main families of statistical tests; III) evaluate methods and results from others' works, highlighting strong-points and weaknesses. The course will provide the students the theoretical background to build and select a sampling design and proper statistical analyses, as well as practical exercises to apply such knowledge. The course will thus strongly follow a "hands-on" approach, with exercises taking place in the informatics lab.

**Applying knowledge and understanding**

The student needs to show ability to apply the knowledge acquired during the course to real cases presented during practical exercises in the forests (Urban Park, protected areas, and Southern Apennine Forests). The field exercises and the preparation of technical reports allow the student to manipulate and interpret the quantitative data relating to the measured SEs and correctly read and analyze the data reported in the technical and scientific reference literature. The teaching aims to transfer the skills and methodological approaches practical to allow the student to independently proceed to SE estimates of forest for planning and management purposes and assess environmental damage following the detriment of ESs. Writing technical reports allows the student to structure the

survey carried out in the forest in an organized way and prepare and present the report using technical and scientific language, according to the purpose of the work (forest planning, carbon stock estimation, biomass estimation, Etc.).
Students will show the ability to properly select for sampling designs, methods and statistical tests according to the ecological question and data structure provided. The course will provide students with tools and know-hows to produce and evaluate scientific and technical reports, being also solicited to suggest alternative and innovative approaches.

## COURSE CONTENT/SYLLABUS

**Ecosystem Services and Environmental Damage Assessment module (6 CFU)**

1. Ecosystem Services (ES) and Natural Capital: definitions
2. ES classification systems for planning and management purposes in forest environment
3. ES to support the sustainable forest management
4. Examples and classification exercises of ES with special regard to forest and urban forest
5. Loss of ES due to natural and anthropogenic disturbances in the forest and urban environment
6. Methods for estimating loss of ES of forests and urban forests
7. Examples and exercises for the assessment of environmental damage with special reference to forest and urban ecosystems

## READINGS/BIBLIOGRAPHY

**Books, reports and scientific papers**
**(Ecosystem Services and Environmental Damage Assessment module)**

Daily, G. C. (1997). Nature's services. Island Press, Washington, DC.
Geneletti, D., Cortinovis, C., Zardo, L., & Adem Esmail, B. (2020). Planning for ecosystem services in cities. Springer International Publishing.
Haines-Young, R. & M. Potschin (2010). The links between biodiversity, ecosystem services and human well- being. In: Raffaelli, D.G & C.L.J. Frid (eds.): Ecosystem Ecology: A New Synthesis. Cambridge University Press.
Leemans, R., & De Groot, R. S. (2003). Millennium Ecosystem Assessment: Ecosystems and human well-being: a framework for assessment. Island press.
Millennium Ecosystem Assessment (2005). "Synthesis report". Island Press, Washington, DC.

Costanza et al. (1997). The value of the world's ecosystem services and natural capital. Nature, 387: 253-260.
Felix Müller, Benjamin Burkhard, (2012). The indicator side of ecosystem services, Ecosystem Services, 1: 26-30.
Joshua Farley, (2012). Ecosystem services: The economics debate, Ecosystem Services, 1: 40-49.
Leon C. Braat, Rudolf de Groot, (2012). The ecosystem services agenda: bridging the worlds of natural science and economics, conservation and development, and public and private policy, Ecosystem Services, 1: 4-15.
Robert Costanza, Ida Kubiszewski, (2012). The authorship structure of "ecosystem services" as a transdisciplinary field of scholarship, Ecosystem Services, 1: 16-25.
Rudolf de Groot, Luke Brander, Sander van der Ploeg, Robert Costanza, Florence Bernard, Leon Braat, Mike Christie, Neville Crossman, Andrea Ghermandi, Lars Hein, Salman Hussain, Pushpam Kumar,

Alistair McVittie, Rosimeiry Portela, Luis C. Rodriguez, Patrick ten Brink, Pieter van Beukering, (2012). Global estimates of the value of ecosystems and their services in monetary units, Ecosystem Services, 1: 50-61.

## TEACHING METHODS

The teacher of the Ecosystem Services and Environmental Damage Assessment module will use: a) lectures for about 60% of the total hours available, b) practical exercises in the laboratory and the field for in-depth analysis and applications to concrete cases of theoretical aspects for 15% of total hours, and c) 5% will be dedicated to seminars held by researchers.

## EXAMINATION/EVALUATION CRITERIA

The final evaluation consists of two tests: i) a final oral exam and ii) a single written intermediate exam.

i) The final exam aims to verify the learning outcomes through an oral interview. The student must demonstrate that he had acquired the ability to present the topics with completeness and relevance. The subject of the oral exam will be at least three of the topics covered during the lessons. The minimum duration of the oral interview is 20 minutes up to a maximum of 40 minutes.

ii) The single exam will consist of the performance of a multiple choice and open answer written, supplemented by numerical calculation exercises. It will be temporally placed in the middle of the course and will last 1 hour. The test will focus on the topics covered during the course that require numerical quantification elements to verify the students' ability to manipulate and interpret data and processing results.

Similar weight is attributed to each of the two tests, oral final and written intermediate, which make up the final judgment.

**a) Exam type:**

| Exam type | |
|---|---|
| **written and oral** | X |
| **only written** | |
| **only oral** | |
| **project discussion** | |
| **other** | |

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

(*) multiple options are possible