



## COURSE DETAILS

### "FOREST MENSURATION AND FOREST PLANNING"

SSD AGR/05 Forest management and Silviculture

DEGREE PROGRAMME: FORESTRY AND ENVIRONMENTAL SCIENCES

ACADEMIC YEAR 2021-2022

## GENERAL INFORMATION – TEACHER REFERENCES

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## GENERAL INFORMATION ABOUT THE COURSE

CHANNEL:

[HTTPS://TEAMS.MICROSOFT.COM/L/CHANNEL/19%3AD2C6F6775B284ABDB43F6D6CBD9D38CB%40THREAD.TACV2/GENERALE?GROUPLID=985FA2C6-1E60-4620-9877-E09514AAA555&TENANTID=2FCFE26A-BB62-46B0-B1E3-28F9DA0C45FD](https://teams.microsoft.com/l/channel/19%3AD2C6F6775B284ABDB43F6D6CBD9D38CB%40THREAD.TACV2/GENERALE?GROUPLID=985FA2C6-1E60-4620-9877-E09514AAA555&TENANTID=2FCFE26A-BB62-46B0-B1E3-28F9DA0C45FD)

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”)

None

## PREREQUISITES (IF APPLICABLE)

Basics of Silviculture

## LEARNING GOALS

*The course provides technical knowledge on the use of dendrometric tools and methods for measuring the dimensional variables of trees (diameter and height of the stems) and forests (basal area, volume, biomass, etc.). The methods of estimating the volume and the biomass and the dead wood of the forest stands are based on allometric equations, also useful for the conversion into carbon stocks. The knowledges related to the temporal variations of the dimensional parameters of the forests, together with the knowledges related to the criteria and methods of calculation of yield, are applied to the drafting of a forest management plan (FMP). The FMP represents the planning tool for sustainable forest management at company and regional scale, and constitutes one of the main technical and professional goals for those who work in the planning and management of the silvopastoral territory.*

*The methods for estimating the volume of the forest and the planning criteria of the silvopastoral territory are preparatory to the economic estimation of the ecosystem services of supply (wood and non-wood products), of regulation and maintenance (carbon stock, etc.) and cultural services. The medium-term planning of the FMP is useful to quantify the forest resources and insert them correctly in the territorial context and in the supply chains that feed the industrial transformation of wood.*

## EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

### Knowledge and understanding

*The student must demonstrate knowledge and ability to use the tools for measuring and estimating the quantitative parameters of tree populations (number, density, diameter, height, biomass). This specialist knowledge will allow the student to apply them to the planning, management and sustainable use of forest resources, modulated at different spatial scales. The student will have to acquire knowledge of the specialized methodological tools and define the most suitable management options, which vary according to the forest use (productive, protective, naturalistic, etc.). This knowledge is aimed at identifying and optimizing the ecosystem services provided by the forests to man, the provision of which must be consistent with the framework of existing regulatory constraints, with the prevailing functions recognized to the different forest sectors and with the requests that come from local communities, social groups and stakeholders.*

### Applying knowledge and understanding

*The student must be able to apply the knowledge acquired during the course to concrete cases presented during practical trainings in the forests (e.g. Gussone Park annexed to the Department of Agricultural Sciences and forests of the Southern Apennines). The trainings in the field are focused on the application of methods for estimating above-ground volume, and above- and below-ground biomass and its conversion into carbon stocks. The measurements in the forest for planning purposes concern the application of silvicultural methods for the estimation of yield and their verification of sustainability in the forest sectors dedicated to the production of wood. The ability to use the methodological tools acquired is verified through didactic reports; these are structured in the form of synthetic technical-professional reports in which the student documents the purpose of his/her work, the materials and methods used to solve the question posed and learning to communicate the results of his/her future work.*

## COURSE CONTENT/SYLLABUS

### Forest mensuration (6 ECTS)

1. Diameter-measuring and instruments. Standing tree height measurement and instruments. Errors associated with diameter and height measurements.
2. Volume of felled trees and logs. Dendrometric prototypes and geometric volume of stems. Log volume: mid (Huber's formula) and mean section (Smalian's formula). Sectionwise measurements on felled trees.
3. Dendrometric parameters of stands: tree number, basal area, quadratic mean diameter, height curve, mean height, dominant height.
4. Stand volume estimates. Tables and volume equations with one and two predictor variables. Tree form factor method. Subjective and fixed-area plot sampling method. Volume estimation of wood pile, charcoal and cork. Weight-volume ratio (stem specific density, wood specific density).

5. Angle-count sampling and Bitterlich's mirror relascope. Relascope as ipsometer and dendrometer.

### **Forest planning (6 ECTS)**

1. Even-aged standing volume over time: stocking and increment types. Yield tables.
2. Concept and role of forest planning. Hierarchic levels of forest planning. Relationship and integration with other tools of land planning.
3. Organization-specific plan and Forest Management Plan.
4. Partitioning and description of forest and rangeland. Forest management units and cutting series. Topographic measurements and mapping. Measurement methods of standing volume and increments.
5. Yield models. Types of yields (intermittent, intermediate, final). Yield determination methods for coppices and even- and uneven-aged high forests. Even-aged stand rotation. Control by volume and increment methods.

### **READINGS/BIBLIOGRAPHY**

#### **Textbooks of Forest mensuration**

**Corona Piermaria** (2007). *Metodi di inventariazione delle masse e degli incrementi legnosi in assestamento forestale*. Dispense didattiche. Aracne Editrice, Roma.

**la Marca Orazio** (2017). *Elementi di Dendrometria*. Terza edizione. Pàtron Editore, Bologna.

**Van Laar Anthoine, Akça Alparslan** (2007). *Forest Mensuration*. Springer, Dordrecht, The Netherlands.

**West, P.W.** (2009). *Tree and forest measurement*. 2<sup>nd</sup> Edition. Springer-Verlag, Berlin Heidelberg.

#### **Textbooks of Forest planning**

**AA.VV.** (1986). *Nuove metodologie nella elaborazione dei piani di assestamento dei boschi*. ISEA, Bologna. (out of commerce and available on the teacher's website).

**AA.VV. Manuale per l'Assestamento forestale**. Progetto Bosco <http://www.progettobosco.it/manuale/indice.htm>

**Bernetti G.** (1989). *Assestamento Forestale: i piani particolareggiati forestali*. DREAM Italia Edizioni, Firenze.

**Bettinger P., Boston K., Siry J.P., Grebner D.L.** (2017). *Forest management and planning*. 2<sup>nd</sup> Edition. Academic Press.

**Cantiani M.** (1985). *Appunti di Assestamento forestale*. Coordinati da L. Hermanin e O. la Marca, Istituto di Selvicoltura e Assestamento Forestale. Università degli Studi di Firenze, Edizioni A-Zeta, Firenze. (out of commerce and available on the teacher's website).

**Colpi C., De Mas G.** (1992). *Appunti di Dendroauxonomia raccolti dalle lezioni del Prof. Bernardo Hellrigl*. Edizioni Libreria Progetto, Padova.

**Office National des Forêts** (1989). *Manuale di Assestamento*. Traduzione a cura di G. Bovio e O. la Marca. Bosco e Ambiente Editore, Frontone (PS).

Slides of the lessons of Forest mensuration and Forest planning available on the institutional website of the teacher for students enrolled in the course.

### **TEACHING METHODS**

The course includes about 60% (equal to about 50 hours) of lectures and 40% (equal to about 34 hours) of exercises in the woods and in the didactic laboratory for the correct use of spreadsheets. The use of free access software is also envisaged for the three-dimensional representation of the spatial arrangement of trees in the stands.

### **EXAMINATION/EVALUATION CRITERIA**

The oral exam verifies the learning results relating to: *i)* operation and correct use of tools for measuring dimensional variables of trees and woods; *ii)* methods of estimating the volume of trees and forests; *iii)* temporal variations in the growth of the forests; *iv)* forest planning tools on a farm scale; *v)* methods for calculating yield in even-aged and uneven-aged forests and verifications of sustainable management.

The student must demonstrate that he has acquired adequate technical-scientific terminology, as well as the ability to apply the knowledge acquired to specific cases. The average number of topics in the oral exam is four, the average time per oral exam is 30 minutes and will be assessed on the basis of the following indicators: completeness, exposure, relevance.

#### **a) Exam type:**

<b>Exam type</b>	
<b>written and oral</b>	
<b>only written</b>	
<b>only oral</b>	X
<b>Discussion of the written reports</b>	X
<b>other</b>	

The oral exam accounts for 80% of the grade, while 20% is reserved for the discussion of the written reports.