UCLouvain

lbirf2101

2026

Forest mensuration

4.00 credits	30.0 h + 22.5 h	Q2

Teacher(s)	Jonard Mathieu ;Ponette Quentin (coordinator) ;
Language :	French > English-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Supplementory courses: The course focuses on ground-based assessment methods. Air-borne methods for natural resource assessment are developed in the courses of geomatics, surveying and photogrammetry.
Main themes	1. Main concepts: - Definitions, interest, measurement and / or estimation of static characteristics of trees (e.g. diameters, heights, volumes, tree form) and stands (e.g. distributions, density and stocking, productivity and site quality); - Growth of trees and stands: concepts, estimation, production tables, modeling principles; - Complete inventory and sampling methods: (i) basic concepts of sampling, (ii) sampling units, (iii) programming, implementation and processing of inventory results, (iv) inventory methods (e.g. systematic inventory, simple random sampling, point sampling, stratified random sampling, single-stage cluster sampling, double sampling).
Learning outcomes	**At the end of this learning unit, the student is able to :** a. Contribution de l'activité au référentiel AA (AA du programme) M1.1, M1.2, M1.4, M2.1, M2.2, M2.4, M3.5, M3.6, M3.7, M3.8, M6.2, M6.5, M6.8, b. Formulation spécifique pour cette activité des AA du programme At the end of this course, the student: - knows the principles of operation of the main dendrometric instruments and is able to use them appropriately in the field; - knows how to characterize the trees and stands in terms of stocking and growth; - is able to understand the dynamics of forest stands and to formalize the factors involved in a quantitative way; - knows the main 'tools' used to characterize the growing stock (individual tree, stand) ; is able to use existing tools appropriately, and to build them from raw data; - knows and understands the main methods used to estimate the growth of trees and stands ; is capable to use them in a management context; - knows the principles of sampling and is able to establish appropriate sampling strategies to address a management issue related to forestry, forest management and planning; - is able to formalize and synthesize a forest mensuration analysis in a technical report respecting scientific rigor; - knows the range of existing forest models, and is able to select the most appropriate one(s) depending on the objectives of the study ; - is able to formalize, in mathematical terms, fundamental silvicultural concepts ; - is able to build a yield table from a growth dataset.
Evaluation methods	The presence of the students (participation in at least 80% of the courses; the only absences accepted will be those validated by a medical certificate, a case of "force majeure", or a demonstrated time conflict), participation in practical work and submission of reports (forest mesuration practical work, yield table) are required for this course. In agreement with Article 72 of the General Regulations for Studies and Examinations, the lecturers may propose to the jury to oppose the registration for the examination of a student who has not complied with these obligations. The assessment consists of 3 parts: (i) closed-book written exam for the dendrometry part; (ii) individual report and exam for the modeling part; (iii) individual report for the dendrometry project. In the absence of major deficiencies (overall mark <8/20) for module 1 ([i] + [ii]), the final mark is obtained by taking the weighted average of the written exam (49%), the dendrometry report (35%) and the modeling part (16%); otherwise, the final mark corresponds to the mark of module 1.
Teaching methods	- Lectures, including concrete examples, case studies and exercises - Realization of a project involving the acquisition of field measurements, a computer-aided processing and the writing of an argued report. This report is illustrated with graphs and tables.
Content	a. Table of contents **Part I – Tree-level characterics** - volumes and biomasses : wood density, stem form assessment; stem form and volume ; log rules; volume tables

	- individual tree size and height **Part II – Stand-level characteristics** - mean tree characteristics: size, heights, volumes - cumulative variables: basal area, volumes - distributions - relationships between dendrometric characteristics: dominant height - age - site fertility; total height - size - age **Part III - Growth of trees and stands** - tree growth: size (circumference, radius, diameter, basal area); height and volume increment; stem analysis - stand growth: repeated stand inventories; increment core method; applications **Part IV - Inventories** - fundamentals of sampling: context; variables, scales, units; populations and samples; sampling; types of estimators and tree/plot factors - sampling units : types of sampling units; comparison between sampling units; sampling units over time and space - sampling methods: simple random sampling; systematic sampling; point sampling; stratified random sampling; single- and multi-stage sampling; double sampling **Partie V – Forest modeling** - introduction to forest modeling: why do we need models, definition and features of a model, modeling steps and methodology, modeling approaches: empirical *vs* process-based - empirical growth and yield models: model classification based on the spatial scale (stand, cohort and tree level, distance dependent *vs* independent), mathematical formalization of silvicultural concepts, development of a yield table, application to a case study (Patula pine plantation in the Peruvian Andes) b. Additional information This course consists of two modules: - Module 1 (30h): Theoretical course - 14 sessions of 2 hours on the methods of measurement and sampling as well as on the main tools used for the quantification of trees and forest stands, including modeling. - Module 2 (22.5 h): The principles studied in theoretical courses are implemented in the form of a mini-project involving the acquisition of field measurements and their computer-aided processing.
Inline resources	Moodle
Bibliography	Les supports de cours obligatoires (diapositives power point, documents de référence) sont mis à disposition de l'étudiant sur Moodle Pour en savoir plus, l'étudiant pourra consulter utilement les ouvrages de référence suivants : - Rondeux, J. 1999. La mesure des arbres et des peuplements forestiers. Les Presses Agronomiques de Gembloux, Gembloux, Belgique, 521 p. - Shiver, B.D., Borders, B.E. 1996. Sampling techniques for forest resource inventory. John Wiley & Sons, New York, USA, 356 p.
Other infos	This course can be given in English. By enabling students to acquire quantitative methods for characterizing trees and forests and understanding their temporal dynamics, this course contributes to the sustainable management of forests. This course is committed to transition and sustainable development.
Faculty or entity in charge	AGRO

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Forests and Natural Areas Engineering	BIRF2M	4		🔍