

**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF
UKRAINE**

Department of forest mensuration and forest management

APPROVED

by the Director of the Education and
Research Institute of Forestry and
Landscape-Park Management

_____ Roman Vasylyshyn

« _____ » _____ 2025

APPROVED

at the meeting of the Department of Forest
Mensuration and Forest Management
Protocol No 10 dated May 20, 2025

Head of the Department

_____ Andrii Bilous

REVIEWED

Guarantor of the AP H4 Forestry

_____ Oleksandr Bala

CURRICULUM OF ACADEMIC DISCIPLINE

Forest Inventory and Mapping

Area of knowledge _____ Agriculture, forestry, fisheries and veterinary medicine

Specialty _____ H4 Forestry

Academic programme _____ Forestry

Education and Research Institute of _____ Forestry and Landscape-Park Management

Developed by: _____ Professor, Doctor of Agricultural Sciences Viktor Myroniuk

(position, academic degree, academic title)

Kyiv – 2025

Description of the course The course is focused on the theoretical foundations of the sample-based forest inventory which in combination with remote sensing data provides a spatially explicit assessment of forest attributes. It is designed to provide students with training in forest inventory using fixed- and variable-area plots and introduce the approaches for optimization of sampling design as well as statistical computations in national forest inventory. The course also introduces the necessary knowledge to map forest attributes using machine learning and imputation techniques. Upon completion of the course, students will be able to develop workflows that integrate reference observations (field plots or photo interpretation) to map forest cover characteristics using satellite imagery.

Area of knowledge, specialty, academic programme, academic degree		
Educational degree	Master	
Specialization	H4 Forestry	
Educational program	Forestry	
Characteristics of the discipline		
Type	Elective	
Total number of hours	180	
Number of ECTS credits	6.0	
Number of modules	2	
Form of assessment	Exam	
Indicators of the discipline for full-time and part-time forms of university study		
	University study	
	Full-time	Part-time
Year of study	1	1
Term	2	2
Lectures	20 hr.	8 hr.
Practical classes and seminars	30 hr.	8 hr.
Laboratory classes	–	–
Self-study	120 hr.	164 hr.
Number of hours per week for full-time students	5 hr.	

1. Aim, competences and expected learning outcomes of the discipline

The study course is aimed at methodological foundations of forest resource assessment using sample-based forest inventory. The course discovers applied aspects of the sampling approach used to obtain accurate and timely information on forests to support effective forest management. The specific focus of the course is a remote sensing-based forest cover mapping that integrates field observations collected on sample plots and satellite imagery.

Objectives of the course are as follows:

- overviewing methods of national forest inventories used in various countries;
- studying the theory and practical applications of sample-based methods in forest resource assessment;
- getting skills in field surveys using sampling methods;
- gaining knowledge in forest attribute assessment using sample data;
- practicing in interpretation of remote sensing data using both visual and automated approaches.

Competences acquired:

Integral competence (IC):

- The ability to resolve complex tasks in forestry or during study process that require investigations or innovations (Здатність розв'язувати складні задачі і проблеми у галузі лісового та мисливського господарства або у процесі навчання, що передбачає проведення досліджень або здійснення інновацій та характеризується невизначеністю умов і вимог).

General competence (GC):

- The ability to search, process and analyze information from various sources (ЗК 2. Здатність до пошуку, оброблення та аналізу інформації з різних джерел)
- The ability to use information and communication technologies (ЗК 3. Здатність використовувати інформаційні та комунікаційні технології)
- The ability to work in an international context (ЗК 7. Здатність працювати в міжнародному контексті).

Special (professional) competence (SC):

- The ability to integrate knowledge and solve complex forestry issues in broad or multidisciplinary contexts (СК 5. Здатність інтегрувати знання та розв'язувати складні задачі лісового господарства у широких або мультидисциплінарних контекстах).

Expected learning outcomes (ELO):

- Fluent oral communication and writing skills in Ukrainian and foreign languages during professional discussion, research and innovations in forestry (РН 2. Вільно спілкуватись усно і письмово українською та іноземною мовами при обговоренні професійних питань, досліджень та інновацій у сфері лісового господарства)
- Searching for the necessary data in scientific literature, databases and other sources, experience in analysis and evaluation of obtained data (РН 4. Відшукувати необхідні дані в науковій літературі, базах даних та інших джерелах, аналізувати та оцінювати ці дані)
- Assessing state of forest stands, forest resources in specific forest vegetation conditions, forecasting their potential usage (РН 6. Оцінювати стан лісових фітоценозів, лісові ресурси в конкретних лісорослинних умовах, їх потенціал та прогнозувати можливості використання)
- Developing and improving technological and production processes, implementing modern digital technologies (РН 8. Розробляти та вдосконалювати технологічні і виробничі процеси, впроваджувати сучасні цифрові технології)
- Applying modern experimental and mathematical methods, digital technologies, and specialized software to solve complex issues in forestry and game management (РН 11. Застосовувати сучасні експериментальні та математичні методи, цифрові технології та спеціалізоване програмне забезпечення для розв'язання складних задач лісового та мисливського господарства)..

2. Program and structure of the discipline

Modules and topics	Number of hours												
	full-time							part-time					
	weeks	total	including					total	including				
			l	p	lab	ind	self		l	p	lab	ind	self
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Module 1. Methodology of sample-based forest inventory													
Topic 1. National forest inventory: historical background and emerging challenges	1	14	2	2			10	15					15
Topic 2. Sampling design in forest inventories	2	16	2	4			10	15	2				13
Topic 3. Overview of sampling units	3	14	2	2			10	15			2		13
Topic 4. Measuring live trees and dead wood on sample plots	4	16	2	4			10	15			2		13
Topic 5. Inventory of standing trees using sampling with varying probability	5	14	2	2			10	15	2				13
Topic 6. Estimation of areal means and variances of forest attributes	6	16	2	4			10	15					15
Total for module 1		90	12	18			60	90	4		4		82
Module 2. From sample plots to forest maps													
Topic 7. Remote sensing technologies for enhancing forest inventories	7	14	2	2			10	15			2		13
Topic 8. Reference data for image classification	8	16	2	4			10	15	2				13
Topic 9. Mapping discrete and continuous forest attributes	9	14	2	2			10	15			2		13
Topic 10. Map accuracy assessment	10	16	2	4			10	15	2				13
Total for module 2	–	60	8	12			40	60	4		4		52
Total hours	–	150	20	30			100	150	8		8		134

2. Topic of lecture

№	Topic	Hours
1.	National forest inventory: historical background and emerging challenges	2
2.	Sampling design in forest inventories	2
3.	Overview of sampling units	2
4.	Measuring live trees and dead wood on sample plots	2
5.	Inventory of standing trees using sampling with varying probability	2
6.	Estimation of areal means and variances of forest attributes	2
7.	Remote sensing technologies for enhancing forest inventories	2
8.	Reference data for image classification	2
9.	Mapping discrete and continuous forest attributes	2
10.	Map accuracy assessment	4
	Total	20

3. Topic of laboratory classes

№	Topic	Hours
1	Sampling frame design	2
2	Importing surveys into Open Foris Collect	2
3	Preparing custom code lists for interpretation	4
4	Creating land cover interpretation scheme	4
5	Land cover interpretation	4
6	Analyzing data with Saiku Server	2
7	Satellite image mosaicking	4
8	Land cover classification	4
9	Map accuracy assessment	2
10	Estimation of forested area	2
	Total	30

4. Topics of self-study

№	Topic	Hours
1	Exploring Quantum GIS	60
2	Land cover atlas	60
	Total	120

5. Methods of assessing expected learning outcomes

- examination;
- module tests;
- practical assignments.

6. Teaching methods

All tasks and assignments are completed in a computer lab using relevant software and algorithms. The instructions for completing tasks are provided on Elearn online platform.

7. Results assessment

Lab assignments (10), self-study assignments (2), midterm tests (2), final exam.

8. Evaluation of knowledge

Evaluation of student knowledge is carried out on a 100-point scale and is converted to national grades according to the "Regulations and Examinations and Credits at NUBiP of Ukraine".

8.1. Distribution of grades by activities

Educational activity	Results	Assessment
Module 1. Methodology of sample-based forest inventory		
Practical assignment 1	<i>To know</i> the historical background of forest inventories and sampling strategies that are utilized in various countries of the world, configurations of sample units of forest inventories, and associated estimation procedure of key forest attributes. <i>To be able</i> to design sampling frame in GIS; to perform an evaluation of areal means of forest attributes.	10
Practical assignment 2		10
Practical assignment 3		10
Practical assignment 4		10
Practical assignment 5		10
Self-study assignment 1		5
Module test 1		45
Total 1		100
Module 2. From sample plots to forest maps		
Practical assignment 6	<i>To know</i> the physical principles of passive and active remote sensing; satellite-based sensors and their use in forest inventory; algorithms for image classification including the imputation of forest attributes <i>To be able</i> to combine forest attribute measurements on sample plots and satellite imagery to map species distribution and growing volume of forest stands; assess the accuracy of discrete and continuous maps.	10
Practical assignment 7		10
Practical assignment 8		10
Practical assignment 9		10
Practical assignment 10		10
Self-study assignment 2		5
Module test 2		45
Total 2		100
Total for year	$(M1 + M2)/2 \cdot 0.7 \leq 70$	
Exam	30	
Grand total	$(Total + Exam) \leq 100$	

8.2. Scale for assessing student's knowledge

Student rating, points	National grading
90-100	excellent
74-89	good
60-73	satisfactory
0-59	unsatisfactory

8.2. Assessment policy

<i>Policy regarding deadlines and results:</i>	Deadlines are set for all the assignments. Practical works submitted in violation of deadlines without a good reason will be penalized by lower grade. Re-takes of module tests in presence of good reasons (e.g.: sick leave) take place on lecturer's permission.
<i>Academic honesty policy:</i>	Cheating during tests and examinations is strictly forbidden (including using mobile phones and tablets). All written works are checked for plagiarism and are allowed to be defended when the total share of properly referenced text is up to 20%.
<i>Attendance policy:</i>	Attendance is mandatory. For objective reasons (e.g.: sick leave, international internship) teaching can take place individually (online, under a warrant from the Institute's Director).

9. Teaching and learning aids

E-learning course of the discipline <https://elearn.nubip.edu.ua/course/view.php?id=872>.

10. Recommended sources of information

1. Congalton, R. G., & Green, K. (2008). *Assessing the Accuracy of Remotely Sensed Data: Principles and Practices, Second Edition*.
2. Kangas, A., & Maltamo, M. (Eds.). (2006). *Forest inventory: Methodology and applications*. Springer.
3. Kershaw, J. A., Ducey, M. J., Beers, T., & Hush, B. (2016). *Forest Mensuration*, 5th ed.
4. Myroniuk, V., Bell, D. M., Gregory, M. J., Vasylyshyn, R., & Bilous, A. (2022). Uncovering forest dynamics using historical forest inventory data and Landsat time series. *Forest Ecology and Management*, 513, 120184. <https://doi.org/10.1016/j.foreco.2022.120184>.
5. Myroniuk, V., Weinreich, A., Von Dosky, V., Melnychenko, V., Shamrai, A., Matsala, M., Gregory, M. J., Bell, D. M., & Davis, R. (2024). Nationwide remote sensing framework for forest resource assessment in war-affected Ukraine. *Forest Ecology and Management*, 569, 122156. <https://doi.org/10.1016/j.foreco.2024.122156>.
6. Tomppo, E., Gschwantner, T., Lawrence, M., & McRoberts, R. E. (Eds.). (2010). *National forest inventories: Pathways for common reporting*. Springer.
7. Tutorials – Open Foris. (n.d.). Retrieved May 15, 2025, from <https://openforis.org/collect-earth-tutorials/>.