


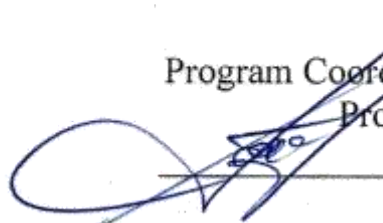
**NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES
OF UKRAINE
EDUCATION AND RESEARCH INSTITUTE OF FORESTRY AND
LANDSCAPE-PARK MANAGEMENT**

Department of Silviculture

“CONFIRMED”
Dean of the Faculty (Director of Institute)

Roman VASYLYSHYN
19 05 2023 p.


“APPROVED”
at the meeting of the department of Forestry
Protocol № 7 dated “15” 05 2023 p.

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Program Coordinator

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PROGRAM OF THE COURSE

PEST MANAGEMENT IN FORESTS OF EASTERN EUROPE

Specialization 205– „Forestry“

Educational program Forestry

Faculty (Institute) Education And Research Institute Of Forestry And Landscape-
Park Management

Developers: Associate Professor of Silviculture, PhD, Tokarieva O.V.
(position, academic degree, academic title)

Kyiv – 2023 p.

1. Description of the course

“PEST MANAGEMENT IN FORESTS OF EASTERN EUROPE”

Галузь знань, напрям підготовки, спеціальність, освітньо-кваліфікаційний рівень		
Educational program	<i>Forestry</i>	
Specialization	<i>205 Forestry</i>	
Educational degree	<i>Master's</i>	
Характеристика навчальної дисципліни		
Type	Elective	
Total number of hours	180	
Number of ECTS credits	6,0	
Number of content modules	2	
Course project (work) (if applicable)	<i>Exam</i>	
Indicators of the course for full-time and part-time forms of study		
	Full-time form of study	Part-time form of study
Course (year of study)	2023–2024	2023–2024
Semester	2	2
Lecture classes	30 hr.	12 hr.
Practical, seminar classes	15 hr.	12 hr.
Self-study	15 hr.	-
Individual assignments	120 hr.	156 hr.
Number of weekly classroom hours for the full-time form of study	4 hr.	

2. Purpose, objectives, and competencies of the course

The purpose of the discipline is to train masters of the English-language master's program on the ability to timely monitor and predict epiphytosis and outbreaks of pathogens and pests and prescribe appropriate measures to combat them. Objectives of the discipline: to ensure the timely assimilation of external signs of the pathological process of the disease on the tree plant; to teach masters to make a qualified short-term, long-term and long-term forecast for the main pathogens and pests.

The subject of the discipline is to study the basics of monitoring and forecasting epiphytosis and outbreaks of pathogens and pests, reasonable prediction of the timing, level of spread and development of the pest (disease) and possible phenomena and processes in the phytosanitary state of biocenoses in the future.

The purpose of the discipline is to train masters in the ability to timely monitor and predict epiphytosis and outbreaks of pathogens and pests and prescribe appropriate measures to combat them. Monitoring the spread and development of diseases is an integral part of integrated plant protection. Lack of monitoring makes it impossible to control and predict the phytosanitary situation in plantations, timely and effective application of protection systems. Without monitoring and forecasting, the epiphytosis of many dangerous diseases, significant losses, and overspending of material and technical means are inevitable. In limiting the prevalence of forest pathogens, the main role is played by increasing the natural immunity of woody plants against infections, creating stable phytocenoses, reducing the virulence of pathogens, as well as the destruction of pathogens. The main direction should be different ways of influencing the environment, taking into account the specific environmental characteristics of forest growth.

Disease prognosis and modeling of pathogens are based on knowledge of the causes of forest diseases, biological characteristics of their pathogens, patterns of environmental conditions and meteorological factors on the virulence of the pathogen and the resistance of the host plant, the stock of infectious minimum and more. In the systems of forest protection measures a significant role should be played by general organizational: supervision, forest pathological examinations, mapping of current and potential foci of infection, study of patterns of epiphytosis, their prediction. These measures should be carried out on a forest typological basis, taking into account natural areas, in the zonal section. Accurate and timely forecasting is one of the important links in monitoring. Predictions are theoretically possible for the vast majority of diseases and for different periods. As a rule, they are based on the materials of forest pathological examinations, analysis of climatic factors and weather forecasts.

Although prediction is currently well developed for entomological objects, it is clearly insufficient for pathogens. Thus, mathematical models for predicting disease epiphytosis have been developed for only a few species of pathogens. Disease prognosis and modeling of pathogens are based on knowledge of the causes of forest diseases, biological characteristics of their pathogens, patterns of environmental conditions and meteorological factors on the virulence of the pathogen and the resistance of the host plant, the stock of infectious origin and more.

The objectives of the discipline: to ensure the timely assimilation of external signs of the pathological process of the disease on a tree plant; to teach masters to make qualified short-term, long-term and long-term forecasts for the main pathogens and pests.

The subject of the discipline is to study the basics of monitoring and forecasting epiphytosis and outbreaks of pathogens and pests, reasonable prediction of timing, level of spread and development of pests (diseases) and possible phenomena and processes in the phytosanitary state of biocenoses in the future.

The main competencies of the student: the ability to use professional forestry knowledge and practical skills and scientific advice for the organization and effective operation of protective systems for various purposes.

Prerequisites for studying the course: studying the course requires that you have a basic knowledge of botany, entomology, phytopathology, soil science, meteorology, physics.

As a result of studying the discipline the student must:

Know:

- macroscopic, microscopic, physical and chemical methods for detecting pathogens of major diseases of trees and shrubs, methods of accounting for damage, general information about diseases and their pathogens, spread and preservation of these pathogens, stages of infection, methods of phytopathological surveys of forests, methods of forecasting.
- how to combine the simultaneous influence of different factors in this process and the obtained reliable data, using mathematical models – the only way to implement this program.
- features of ecology of forest pests and conditions of formation of centres of their mass reproduction;
- to master the means of forest pathological monitoring, to be able to supervise the main pests;
- to master the method of entomological surveys, methods of accounting for the number of pests and the forecast of their development;
- main entomophagous and pathogens of entomology pests, be able to use them for biological protection of forest plantations;
- modern biological preparations and insecticides; be able to use them properly in the fight against pests;
- modern integrated methods and means of forest protection against pests and be able to plan and design measures for forest protection, ensure their environmental and economic efficiency and feasibility.

Be able to: make a seasonal and long-term forecast of diseases of woody plants and changes in the number of pests, assess the factors influencing the development of the number of pathogens; timely prescribe preventive measures to combat them, plan and design cost-effective and environmentally effective forest protection methods. Choose the most appropriate methods of managing the population of forest pests and pathogenicity of pathogens.

Acquisition of competencies:

Integral competence (IC):

The ability to solve complex tasks and problems in the field of forestry and hunting or in the process of learning, which involves conducting research or implementing innovations and is characterized by the uncertainty of conditions and requirements.

General competencies

GC 7. Ability to work in an international context.

Special (professional, subject) competencies

GC 3. Ability to assess regional features of natural and climatic conditions for the organization of efficient forestry, the implementation of forest functions of various functions and increase forest area.

Program learning outcomes (PLO):

PLO 2. Fluently communicate orally and in writing in Ukrainian and foreign languages when discussing professional issues, research and innovation in the field of forestry.

3. Program and structure of the course for:

180 hours (6.0 ECTS credits) are allocated to the study of the academic discipline, of which 30 hours are lectures, 30 hours are practical classes, 120 hours are independent work, and the form of the final control measure is an exam.

CONTENT MODULE 1. PHYTOSANITARY MONITORING OF FOREST STANDS

TOPIC 1. Ecology and Dynamics of Forest Diseases

Basic terms and definitions. Causes of violation of the normal state of the forest. Penetration

of the pathogen into the plant. Interaction in the system "plant-pathogen".

The basics of forest biocenology as a component of forest protection. The causes of non-infectious pathologies of forests: windbreaks and snowdrifts, snow, frost and ice, excessive moisture, drought, erosion processes, industrial emissions, recreational loads, forestry activities. Cancer and vascular diseases. Recreation load. Human forestry activities.

TOPIC 2. Ecological groups of microorganisms of forest biosensors: theoretical and applied aspect

Fungi - the main pathogens of diseases of woody plants. The role of insects in plant damage. Bacteria, viruses, rickettsia, mycoplasmas as integral components of the forest biocenosis. Interaction of plants, fungi, bacteria and their role in ecosystems.

Ways to preserve pathogens in adverse conditions and winter. There are primary and secondary infections. Place the types and periods of penetration of pathogens in the resident plant: through intact external protected tissue, root hairs, roots, flowers, seeds, through natural holes (stomata, lentils, etc.) through various mechanical damage and wounds. Learn the terms: inoculation, infectious downloads.

TOPIC 3. Phytosanitary monitoring of dominant pests

Ecological groups of microorganisms: soil saprotrophs, forest soil saprotrophs, xylophages, saprotrophs, xylophages-parasites. Distinguish mycorrhizal fungi, fungi-caprotrophs, fungi-carbonyls, fungi-mycophiles. Know the peculiarities of the nutrition of microorganisms. To study the ecology and dynamics of pathogens of woody plants and terminology in forest pathology. Phytosanitary monitoring and methods of its implementation. Environmental monitoring system in Ukraine. Pheromone monitoring. Phenological and synoptic forecast.

TOPIC 4. Monitoring of dominant pathogens of woody plants

Classification of diseases. Types of diseases. Survey of forest crops. Survey of middle-ripe and overripe stands. Know bacteria, viruses, rickettsia, mycoplasmas as integral components of the forest biocenosis. Know the role of microorganisms in the processes of small circulation and in forest pathology and trophic connections. Features of distribution and differences of bacterioses, viruses, rickettsiosis, mycoplasmosis. Know the basic research methods.

TOPIC 5. Methods and technology of pathological examinations

Forest pathology examinations. Survey of the soil for the infestation of harmful insects. Examination of nurseries. Know the features of monitoring, ferromonitoring. Get acquainted with traditional methods of monitoring pathogens, the nature of the formation and localization of diapause stages, critical periods of development of pathogens. Distinguish between phenological and synoptic forecast.

TOPIC 6. Basics of forecasting. Types of forecasts

Short-term forecast. Long-term forecast. Long-term-years forecast. The features of monitoring, development and harmfulness of the dominant pathogens. Be able to predict the spread and harmfulness. Know sampling methods.

The general basics of forecasting. Distinguish types of forecast, their purpose. Acquaintance with the rules of forecasting: short-term, long-term, long-term. Assess the factors that affect the intensity of plant damage and the course of the disease. To study the types of infectious chains. Be able to develop a mathematical model for long-term prediction of pathogens, taking into account the

conditions for their favourable development.

TOPIC 7. Prediction of mass outbreaks of insect number

Theories of mass reproduction of insects. Integrated-dynamic theory of insect outbreaks. Short-horned grasshoppers and locusts. Mass reproduction of webworm beetle. To study the features of monitoring pathogens on buds, leaves and fruits.

Be able to conduct surveys of forest crops and young growth, medieval plantations. Know the basics of forest pathological monitoring. Analysis of world trends in modern technologies of biotechnology development.

CONTENT MODULE 2. INTEGRATED FOREST PROTECTION IN EASTERN EUROPE

TOPIC 8. Leaf Defoliation and Discoloration

The crown canopy classes. The crown canopy classes (after Kraft) are used as a criterion for selecting the trees, but only if the trees lack significant mechanical injuries. Leaf defoliation. Leaf discoloration. Leaf Discoloration is the percentage of total leaf surface area with different coloration than a healthy tree of the same species. Possible symptoms include dark spots on leaves, leaves that are yellow, brown, or lighter in color than a healthy tree of that species.

Foliage eaten wholly or partially is generally referred to as defoliation. The extent of defoliation is often related to the severity of infestation. Foliage feeding can be recognized by the absence of foliage or from uneaten leaf or needle parts. Many insects feed by eating only the softer parts of leaves, resulting in a skeletonizing effect. Leaf miners bore inside the foliage and eat the tissues between the foliage surfaces, resulting in serpentine or blotchy areas.

TOPIC 9. Integrated pest management (part 1)

Foundation of Integrated pest management. Use pesticides to control pest population. Managing Pests with Healthy Soils. The concept of pathological process in plants.

Phytosanitary and climatic information for forecasting. Ecological and biological features of the causative agents of major diseases of needles and leaves. Drawing up a protection system based on the results of the forecast. Drawing up a protection system based on the results of the forecast. Compilation of nomograms to determine the timing of chemical treatments against diseases of pine needles and leaves according to meteorological data. Construction of prognostic models of epiphytosis of pine and leaf diseases.

TOPIC 10. Integrated pest management (part 2)

Model of continual improvement. Cultural methods. Global review of forest pests. Measures to combat pathogens.

Phytosanitary and climatic information for forecasting. Study of ecological and biological features of pathogens of major vascular diseases. Study of ecological and biological features of the causative agents of major cancers. Make a prognosis for the development of the causative agent of poplar cytosporosis, infectious drying of oak, pine sulphur cancer, larch cancer, vascular mycosis of oak, elm graphosis, pine cancer. Drawing up a protection system based on the results of the forecast. Forecasting the spread of vascular and root diseases on the basis of phytosanitary and meteorological information.

TOPIC 11. Beneficial insects in the forest

Categories of beneficial insects. Common beneficial species. Attractive plants. Why Use Beneficial Insects. Rules of Introducing Beneficial Insects.

The integrated-dynamic theory of mass reproduction of pests. Know the regulatory mechanisms of the dynamics of the number of major coniferous and leaf-eating species of pests. Know the basics of predicting mass outbreaks of leaf-eating, coniferous rodents, stem and polyphagous pests. Drawing up a protection system based on the results of the forecast. Construction of prognostic models of mass outbreaks of pests.

TOPIC 12. Birds and bats for pest suppression

Controlling pests with birds. Controlling pests with bats. Attracting of natural insect predators. Bushes to attract birds.

The problems facing forest protection in terms of modeling. To have an idea of the mathematical model and the universal method of cognition of reality – the method of mathematical modeling. Know the main parameters of the model – realism, accuracy, generality. Identify the main stages of modeling complex systems: problem selection; setting a task and limiting the degree of its complexity; defining a hierarchy of goals and objectives; choice of ways to solve the problem; modeling; evaluation of possible strategies; implementation of results.

TOPIC 13. Weeds in the forest

The concept of weeds in forestry. The properties of weed species. Highly invasive plant species of Ukraine. Weed control in forestry. Treatment alternatives of weed types.

Mathematically formalize a real object. Know the main types of mathematical models: deterministic and stochastic; static and dynamic; constructive and descriptive (descriptive); matrix; optimization; self-organizing; simulation models and their general characteristics.

TOPIC 14. Plant quarantine

History of plant quarantine. The Law of Ukraine on plant quarantine. The main factors of population size: initial (initial) population size (density); weather conditions (biohydrothermal index (BHTI); entomophages and pathogens; resistance and protective reaction of the plantation). Know the critical periods in the development of major coniferous and leaf-eating pests and the number of generations required to analyse the weather conditions that have developed for them. Be able to calculate BHTI conditions for the development of coniferous and leaf-eating forest pests and the appropriate level of threat to plantations.

STRUCTURE OF THE EDUCATIONAL DISCIPLINE

Names of content modules and topics	Number of hours											
	Full-time form						Part-time form					
	weeks	у тому числі					total	у тому числі				
		l	p	lab	ind	self		l	p	lab	ind	self
Content Module №1. PHYTOSANITARY MONITORING OF FOREST STANDS												
Topic 1. Ecology and Dynamics of Forest Diseases	14	3	2	1		9	14	1	1			12
Topic 2. Ecological groups of microorganisms of forest biocenoses: theoretical and applied aspect	13	2	1	1		9	13	1	1			11
Topic 3. Phytosanitary monitoring of dominant pests	13	2	1	1		9	13	1	1			11
Topic 4. Monitoring of dominant pathogens of woody plants	13	2	1	1		9	13	1	1			11
Topic 5. Methods and technology of pathological examinations	12	2	1	1		8	13	1	1			11
Topic 6. Basics of forecasting. Types of forecasts	12	2	1	1		8	12	0.5	0.5			11
Topic 7. Prediction of mass outbreaks of insect number	12	2	1	1		8	12	0.5	0.5			11
Total Content Module 1	90	15	8	7		60	90	6	6			78
Content Module №2. INTEGRATED FOREST PROTECTION IN EASTERN EUROPE												
Topic 8. Leaf Defoliation and Discoloration	13	2	1	1		9	13	1	1			11
Topic 9 Integrated pest management (part 1)	13	2	1	1		9	13	1	1			11
Topic 10. Integrated pest management (part 2)	13	2	1	1		9	13	1	1			11
Topic 11. Beneficial insects in the forest	13	2	1	1		9	13	1	1			11
Topic 12. Birds and bats for pest suppression	12	2	1	1		8	12	0.5	0.5			11
Topic 13. Weeds in the forest	12	2	1	1		8	12	0.5	0.5			11
Topic 14. Plant quarantine	14	3	1	2		8	14	1	1			12
Total Content Module 2	90	15	7	8		15	90	6	6			78
Total hours	180	15	15	15		30	180	12	12			156

4. Practical class topics

№ з/п	Назва теми	Кількість годин
1	Different types of pests	3
2	Pests on different parts of trees	2
3	Classification of diseases	2
4	Classification of fungi	2
5	Classification of weeds	2
6	Forecasting the spread of rots of woody plants	2
7	Forecasting the development of diseases of woody plants	2
8	Insects and diseases of <i>Quercus robur</i> L.	2
9	Insects and diseases of <i>Pinus sylvestris</i> L.	2
10	Insects and diseases of <i>Betula pendula</i> L.	2
11	Insects and diseases of <i>Acer platanoides</i> L.	2
12	Insects and diseases of <i>Aesculus hippocastanum</i> L.	2
13	Methods of IPM	3
14	The crown canopy classes, leaf defoliation and discoloration	2
Всього:		30

5. Independent work topics

6.

№ з/п	Назва теми	Кількість годин
1	Forecasting the spread of insects of woody plants	60
2	Features of monitoring pests of ornamental plants	60
Всього:		120

6. Samples of control questions, tests for assessing the level of knowledge acquisition by students

- List and describe the main causes of non-communicable diseases.
- Is there a link between non-communicable and communicable diseases?
- What does an excess of nutrients in the soil lead to woody plants?
- How do you understand the terms "squeezing" and "sprouting" of seedlings?
- Under what conditions are formed frostbite and flake cracks? What is the difference between them?
- What is the harmfulness of early autumn and late spring frosts? Give examples.
- Windswept and windbreaks. What is their difference and under what conditions do they occur?
- What are the features of the fight against non-communicable forest diseases? Give examples.
- Define the term "plant disease".
- What is the difference between "types" and "symptoms" of woody plant diseases?
- List the groups of types of diseases and give their main characteristics.
- What does the prevalence, harmfulness and harm of diseases of woody plants? Explain these concepts by a concrete example.
- Explain the essence and importance of diagnosing plant diseases.
- Give some examples of morphological changes in a diseased plant.
- What do you know about teratological phenomena in woody plants?
- Give specific examples of infectious and non-infectious diseases.
- Coordination of works of forestry bodies on realization of practical measures of optimization of phytosanitary condition of forest stands.
- The concept, purpose and objectives of the forecast in integrated forest protection systems.
- Types of forecast. Forest pathological examinations of pests and pathogens in nurseries.
- Forest pathological examinations of pests and pathogens in open forest crops.

21. Forest pathological examinations of plantations for the population of coniferous and leaf-eating pests. Objects of forest pathological supervision.
22. The concept of phytosanitary monitoring. Main tasks and types.
23. Forest pathological examinations of pests and pathogens in nurseries.
24. Forest pathological examinations of pests and pathogens in open forest crops. Forest pathological examinations of areas subject to afforestation.
25. Forest pathological surveys of areas for infection by stem pests. Forest pathological examinations of plantations for the population of coniferous and leaf-eating pests.
26. What consequences of pest activity do you know?
27. Describe the stages of forest digression.
28. What different between biotic, abiotic and anthropogenic factors?
29. Give the negative aspects of the impact of human activities on the forest.
30. How it possible to warn spread of pests in forest?
31. What different between high and low forest?
32. What do you reckon what better to plant: mixed or pure forest?
33. Describe how does penetration of the pathogen happen into the plant?
34. What kind of natural regeneration do you know?
35. Give the systematic of tending in forest.
36. What the most popular pests in forest do you know?
37. Explain the negative impact of chemical care and application of pesticides on the forest.
38. Explain the negative impact of cattle grazing on the forest.
39. Explain the negative impact of tapping on the forest.
40. How logging residues should be removed?
41. What characteristic cause that places fungi in a different kingdom?
42. Describe the main role of fungi in nature?
43. How does fungi are divided according to the method of nutrition?
44. What is the great aim of Pest management?
45. Where are sites where borers are most likely to enter a tree?
46. Describe beneficial insects in the forest.
47. What categories of beneficial insects do you know?
48. List and describe the crown canopy classes.
49. How do you understand the terms "Leaf defoliation" and "Leaf discoloration"?
50. Give the damage classes for foliage (Hanisch and Kilz, 1991).
51. Identify stress factors for root.
52. How to use pesticides to control pest population.
53. Define ways of cultural pest control.
54. Define ways of mechanical method of IPM.
55. Define ways of chemical method of IPM.
56. Define ways of biological method of IPM.
57. What do you know birds and bats for pest suppression for pest suppression?
58. Describe managing pests with healthy soils.
59. Give a foundation of integrated pest management. What are the main measures?
60. What is the concept of pathological process in plants?
61. Give a global review of forest pests.
62. What are the measures to combat pathogens?
63. What are the steps of model of continual improvement?
64. List and describe the common beneficial species of insects.
65. List plants that attract beneficial insects.
66. What rules of introducing beneficial insects do you know of introducing beneficial insects do you know?
67. How to control pests due to birds?
68. How to control pests due to bats?
69. How to attract of natural insect predators?
70. List the bushes to attract birds?
71. What is the concept of weeds in forestry?
72. Give the properties of weed species.
73. List and describe highly invasive plant species of Ukraine.

74. Give a foundation of weed control in forestry.
 75. What are the treatment alternatives of weed types?

7. Teaching methods

Teaching method is an interrelated activity of the teacher and students aimed at mastering the system of knowledge, acquiring skills, their education and general development

There are three groups of teaching methods: verbal, visual, and practical.

Verbal teaching methods:

- A lecture is a teaching method that involves the disclosure in verbal form of the essence of phenomena, scientific concepts, processes that are logically related to each other and united by a common theme. The lecture is usually used in high school and higher education. In addition to educational (academic) lectures, there are public lectures. Each type of lecture has certain requirements for its preparation and delivery.

A prominent place in the group of verbal methods is occupied by the method of working with a book. Its belonging to this group is somewhat conditional. Students should realise that the main source of scientific information is a book. That is why it is so important to teach students the methods and techniques of independent work with it: reading, retelling, writing out, drawing up a plan, tables, diagrams, etc.

Visual methods involve, first of all, the use of demonstration and illustration.

- demonstration is a teaching method that involves showing objects and processes in their natural form, in dynamics.

- Illustration is a teaching method that involves showing objects and processes in their symbolic representation (photographs, drawings, diagrams, graphs, etc.).

Practical teaching methods are aimed at achieving the final stage of the cognitive process. They contribute to the formation of skills and abilities, the logical completion of the cognitive process in relation to a particular section or topic.

- Laboratory work involves the organisation of educational work using special equipment and a certain technology to obtain new knowledge or test certain scientific hypotheses at the research level.

8. Forms of assessment

The main forms of control of students' knowledge are control during lectures, seminars and practical classes, during extracurricular activities, consultations, tests and examinations.

I. Control during the lecture may be conducted as a selective oral questioning of students or with the use of tests on previously presented material, especially on the sections of the course that are necessary for understanding the topic of the lecture or to determine the degree of mastery of the lecture (usually held at the end of the first or beginning of the second hour of the lecture).

The current control at the lecture is designed to accustom students to systematically study the material covered and prepare for the upcoming lecture, to establish the degree of mastery of the theory, to identify the most difficult sections for students to understand with their subsequent explanation. Controlling a lecture should not be time-consuming.

In terms of time spent on control, oral questioning is inferior to card-based control.

II. Current control at practical, seminar and laboratory classes is carried out to determine the readiness of students for classes in the following forms:

1. Written (up to 45 minutes) control work.

2. Colloquium on independent sections of the theoretical course (topics or modules).

IV. Exams. Exams are the final stage of studying the whole discipline or part of it and are aimed at testing students' knowledge of theory and identifying skills in applying the acquired knowledge in solving practical problems, as well as skills in working independently with educational and scientific literature.

9. Distribution of grades received by students

Evaluation of student knowledge is carried out on a 100-point scale and is converted to national grades according to Table 1 "Regulations and Examinations and Credits at NULES of Ukraine".

Student rating, points	National grade based on exam results	
	Exams	Credits
90-100	Excellent	Passed
74-89	Good	
60-73	Satisfactory	
0-59	Unsatisfactory	Not passed

In order to determine the rating of a student (listener) in the discipline R_{dis} (up to 100 points), the rating from the exam R_{ex} (up to 30 points) is added to the rating of a student's academic work R_{aw} (up to 70 points):

$$R_{dis} = R_{aw} + R_{ex}.$$

10. Educational and methodological support.

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2. Пузріна Н. В. Математичне моделювання чисельності шкідників та збудників хвороб лісу. Київ : Видавничий цент НАУ, 2014. 38 с.
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4. Токарева О.В., Мешкова В.Л., Пузріна Н.В. Pest management in forests of Eastern Europe: manual. Київ : КОМПРИНТ, 2022. 320с.

11. Recommended sources of information

1. Bohumil Stary. Atlas of Insects Beneficial to Forest Trees, Elsevier . 1988. 100 p.
2. David G. James. Beneficial Insects, Spiders, and Other Mini-Creatures in Your Garden. Washington : Washington State University, 2014. 21 p.
3. Hanisch B., Kilz E. Monitoring of Forest Damage: Spruce and Pine, 1991. 334 p.
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5. Marshall Bradley, Fern, Barbara W. Ellis, and Deborah L. Martin, eds. The Organic Gardener's Handbook of Natural Pest and Disease Control: A Complete Guide to Maintaining a Healthy Garden and Yard the Earth-Friendly Way. New York: Rodale Press, 2010. 408 p.
6. Miller K. V., Miller J. H. Forestry herbicide influences on biodiversity and wildlife habitat in southern forests. Wildlife Society Bulletin, 2004. Vol.32, No. 4, 1049–1060.
7. Morris J. M. The use of plant pathogens for biological weed control in South Africa. Agriculture Ecosystems & Environment, 1991. Vol.37, No.1-3, 239–255.
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10. Vasic V., Konstantinovic B., Orlovic S. Weeds in Forestry and Possibilities of Their Control, 2012. 26 p.
11. Гойчук А. Ф. Лісова фітопатологія у визначеннях, рисунках, схемах. Житомир : Полісся, 2009. 156 с.
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