



COURSE SYLLABUS

«Impact of natural disturbances on growth and yield»

Degree of higher education – Master
Specialty 205 "Forestry"
Educational-professional program "Forestry"
Year of study 2, semester 3
Form of education: Full-time
Number of ECTS credits 5
Tuition language English

Course lecturers

Professor Andrii Bilous

Lecturers' contact information (e-mail)

bilous@nubip.edu.ua

Course page at eLearn platform

<https://elearn.nubip.edu.ua/course/view.php?id=4320>

COURSE DESCRIPTION

The course " Impact of natural disturbances on growth and yield " considers the causes and impact consequences of biotic, abiotic and anthropogenic disturbances on the growth of stands, development of forest ecosystems and the dynamics of their services and forest management of different disturbances regimes.

How can foresters reduce the risk of disturbances and minimize their negative impact on forest ecosystems and forestry?

In this class, the enduring understanding of both opposite processes: 1) forming of global challenges in forestry as a result of accumulation and increasing disturbances, and 2) implementation of experience and technologies for the management of disturbed forests. The specific ways to accomplish these goals are through the following course learning objectives.

Upon successful completion of this course, the student will be able to do:

I. System analysis trends and global processes in forest cover and forestry.

II. Identify the type of disturbances, identify the agent and the cause, assess the impact and

plan the management of disturbed forest ecosystems.

III. Predict challenges in forestry and takes preventive measures to prevent disturbances in forest ecosystems.

IV. Make strategic decisions that unite efforts among foresters, scientists, policy makers to solve regional and global disturbances.

Competencies of the educational program:

Integrative competency (IC):

- the ability to resolve complex tasks in forestry or during study process that require investigations or innovations.

General competencies (GC):

- the ability to generate new ideas (creativity);

- the ability to work in an international context.

Professional (special) competencies (SC):

- the ability to support sustainable forest development;
- the ability to fulfill current and strategic objectives of forest enterprises taking into account economical, law, and environmental issues;
- the ability to communicate with society to form environmental-related thinking, conscience, and responsibility for environment.

Program learning outcomes (PLO):

- specialized conceptual knowledge including recent findings in forestry;
- fluent oral communication and writing skills in Ukrainian and foreign languages during professional discussion, research and innovations in forestry;
- effective decision-making in forestry including difficult and unexpected situations; forecasting its development; identification of factors influencing goals achievement; risk assessment and prognosis of possible consequences;
- developing and improving technological and production processes, implementing modern digital technologies;
- applying modern experimental and mathematical methods, digital technologies, and specialized software to solve complex issues in forestry and game management.

COURSE STRUCTURE

Topic	Hours (lectures/practicals)	Learning outcomes	Assignments	Grading
Module 1: Classification of disturbances of forest ecosystems				
Topic 1 The state of the world's forests	2/2	According to statistical reports of different countries, the state of forests on different continents for the period 2012-2021. Forest species and genetic diversity. Relationships between humans, biodiversity and forest ecosystems. Limitation of deforestation and forest degradation. Forest conservation and sustainable forestry development. International initiatives and decisions on the way to sustainable forestry development.	Submission of practical assignment Submission of independent assignments	10 2
Topic 2 The main challenges for forests and forestry	2/-	Global, regional and local land-use problems and trends in climate change, food security and	Submission of independent assignments	2

Topic	Hours (lectures/practicals)	Learning outcomes	Assignments	Grading
		urbanization. The main challenges and threats to forests and sustainable forestry development at the present stage. Historical aspects of the impact of agricultural development and forest loss. Primary and secondary degradation of forests and primary and secondary deforestation.		
Topic 3 The main drivers of forest loss in the world and Ukraine	2/2	Features of forest loss on different continents of the planet. Conceptual problems of forest loss under the influence of large-scale agriculture and farming, particularly crop and livestock production with regional development features and cultural traditions. Impact of large-scale logging, infrastructure development, and mining on forest loss in global and local dimensions.	Submission of practical assignment Submission of independent assignments	10 2
Topic 4 Abiotic disturbance agents	2/2	General features of occurrence and course of disturbances in forest ecosystems of abiotic genesis. Structure and characteristics of climatological agents of forest ecosystem disturbances. General design and attributes of geophysical agents of forest ecosystem	Submission of practical assignment Submission of independent assignments	10 3

Topic	Hours (lectures/practicals)	Learning outcomes	Assignments	Grading
		<p>disturbances. Classification and determination of hydrological agents of forest disturbances. Patterns of origin and available information on the impact of meteorological disturbances on forest ecosystems.</p>		
<p>Topic 5 Biotic disturbance agents</p>	<p>2/-</p>	<p>General features and patterns of occurrence and course of disturbances in forest ecosystems of biotic genesis. Characteristics of the impact of insects on the event of disturbances in forest ecosystems. Characteristics of disturbances of forest ecosystems under the influence of diseases. Definition and features of the effects of grazing livestock on forests. Regularities of hunting fauna (wild animals) influence forest ecosystems.</p>	<p>Submission of independent assignments</p>	<p>4</p>
<p>Topic 6 Impact of anthropogenic disturbances on forests</p>	<p>2/2</p>	<p>General characteristics and features of the influence of agents of forest disturbances of anthropogenic origin. Parts of emissions and air pollution. The negative impact of oil spills on forest ecosystems. Forest fires and specific features of</p>	<p>Submission of practical assignment Submission of independent assignments</p>	<p>10 3</p>

Topic	Hours (lectures/practicals)	Learning outcomes	Assignments	Grading
		ecosystem disturbances. Radiation pollution due to anthropogenic activities. Mining is a crucial driver of forest loss. Built-up forest areas. Logging and its negative impact on the environment.		
Topic 7 Interaction of disturbances in forest ecosystems	2/2	An integrated approach to assessing the preconditions, causes and consequences of disturbances in forest ecosystems. The joint action of agents and patterns of disturbances of forest ecosystems of biotic, abiotic and anthropogenic origin.	Submission of practical assignment Submission of independent assignments	10 4
Module test				30
Module 1 Total				100
Module 2: Assessment of the impact disturbances on forests				
Topic 8 Direct and indirect impact of disturbances on forest ecosystems	2/-	Regularities of manifestation of the direct and indirect impact of abiotic, biotic and anthropogenic agents of disturbances on the growth and development of forest ecosystems and their biodiversity. Direct and indirect effects of insects, pathogens, forest fires, droughts, storms, snow and icing on disturbances in forest ecosystems, their productivity	Submission of independent assignments	3

Topic	Hours (lectures/practicals)	Learning outcomes	Assignments	Grading
		and biomass reserves.		
Topic 9 Impact of disturbances on the ecosystem services of forests	2/2	Relationships and patterns of impacts and biodiversity. Features of the effect of biotic disturbances on the biodiversity of ecosystems, in particular the relationship between insect activity and the population of Red List plants. Regularities of the impact of abiotic and anthropogenic disturbances on biodiversity.	Submission of practical assignment Submission of independent assignments	10 2
Topic 10 Wildland or Wasteland: What is the Chernobyl Forest Silent About?	2/2	Retrospective analysis of the transformation of forest ecosystems of the Chernobyl Exclusion Zone in the post-accident period. Features of disturbed forest ecosystems of the Chernobyl Exclusion Zone.	Submission of practical assignment Submission of independent assignments	10 3
Topic 11 Management of impact of forest disturbances	2/-	Theoretical principles and applied solutions for the management of disturbed forest ecosystems. Management of risks of disturbances in the forest fund. Development of forest management focused on natural disturbances as an integral part of the life of forest ecosystems. Features of restoration of disturbed forest areas. International ecosystem	Submission of independent assignments	2

Topic	Hours (lectures/practicals)	Learning outcomes	Assignments	Grading
		restoration initiatives.		
Topic 12 Impact of disturbances on the hunting economy	2/2	Influence of abiotic, biotic and anthropogenic disturbances on the transformation of hunting grounds. Dynamics of hunting fauna population under the influence of disturbances in forest ecosystems and changing the optimal density of game and the optimal capacity of land under the result of logging and large forest fires.	Submission of practical assignment Submission of independent assignments	10 3
Topic 13 Risks and forecast of disturbances in forest ecosystems of Ukraine	2/2	Vulnerability of Ukraine's forests and forecast data on climate change in Ukraine. Forecasted scenarios for the transformation of forest vegetation conditions for the main forest-forming species of Ukraine and risks of forest loss due to deteriorating climatic conditions and increasing vulnerability of forests.	Submission of practical assignment Submission of independent assignments	10 2
Topic 14 Impact of forest disturbances on the environment	2/-	Biophysical indicators of environmental changes under the influence of disturbances on forest ecosystems. Regularities of carbon emission due to biomass loss of forests and decomposition of dead biomass.	Submission of independent assignments	3
Topic 15	2/2	Strategies for adapting forests and	Submission of	10

Topic	Hours (lectures/practicals)	Learning outcomes	Assignments	Grading
Adaptation of forests to climate change as a tool to minimize large-scale disturbances		forestry to climate change. Biological approaches and tools for adapting tree species to global and regional warming. Reforestation and forest management for forming resistance of forests to insects, diseases, forest fires and other biotic, abiotic and anthropogenic disturbances in forest ecosystems.	practical assignment Submission of independent assignments	2
Module test				30
Module 2 Total				100
Training activity Total				70
Exam				30
Course Total				100

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).

SCALE OF ASSESSMENT OF STUDENT KNOWLEDGE

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

RECOMMENDED INFORMATION SOURCES

1. Bilous, A.; Holiaka, D.; Matsala, M.; Kashparov, V.; Schepaschenko, D.; Lakyda, P.; Shvidenko, A.; Myroniuk, V.; Otrushko, L. 90Sr Content in the Stemwood of Forests within Ukrainian Polissya. *Forests* 2020, 11, 270. <https://doi.org/10.3390/f11030270>
2. Lakyda P., Shvidenko A., Bilous A., Myroniuk V., Matsala M., Zibtsev S., Schepaschenko D., Holiaka D., Vasylyshyn R., Lakyda I., Diachuk P., Kraxner F. Impact of Disturbances on the Carbon Cycle of Forest Ecosystems in Ukrainian Polissya. *Forests*. 2019. 10 (4). 337. doi.org/10.3390/f10040337
3. Lindner, Marcus & Garcia-Gonzalo, Jordi & Kolström, Marja & Green, Tim & Reguera,

R. & Maroschek, M. & Seidl, Rupert & Lexer, Manfred & Netherer, Sigrid & Schopf, Axel. (2008). Impacts of climate change on European forests and options for adaptation. *Impacts of climate change on European forests and options for adaptation*. 1-173.

4. Matsala, M., Senf, C., Bilous, A., Diachuk, P., Zadorozhniuk, R., Burianchuk, M., & Seidl, R. (2022). The impact of radioactive contamination on tree regeneration and forest development in the chernobyl exclusion zone. *Applied Vegetation Science*, 25(1) doi:10.1111/avsc.12631

5. 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 doi:10.1016/j.foreco.2022.120184

6. Myroniuk, V.; Bilous, A.; Khan, Y.; Terentiev, A.; Kravets, P.; Kovalevskiy, S.; See, L. Tracking Rates of Forest Disturbance and Associated Carbon Loss in Areas of Illegal Amber Mining in Ukraine Using Landsat Time Series. *Remote Sens.* 2020, 12, 2235. <https://doi.org/10.3390/rs12142235>

7. Seidl, R.; Fernandes, P.M.; Fonseca, T.F.; Gillet, F.; Jönsson, A.M.; Merganičová, K.; Netherer, S.; Arpacı, A.; Bontemps, J.-D.; Bugmann, H.; et al. Modelling natural disturbances in forest ecosystems: a review. *Ecological Modelling* 2011, 222, 903–924.

8. Seidl, R.; Rammer, W.; Spies, T.A. Disturbance legacies increase the resilience of forest ecosystem structure, composition, and functioning. *Ecological Applications* 2014, 24, 2063–2077.

9. Seidl, R.; Thom, D.; Kautz, M.; Martin-Benito, D.; Peltoniemi, M.; Vacchiano, G.; Wild, J.; Ascoli, D.; Petr, M.; Honkaniemi, J.; et al. Forest disturbances under climate change. *Nature Climate Change* 2017, 7, 395–402.

10. Zibtsev, S.V.; Goldammer, J.G.; Robinson, S.; Borsuk, O.A. Fires in nuclear forests: Silent threats to the environment and human security. *Unasylva* 2015, 66, 40–51.

11. Білоус А. М. Деревний детрит лісів Українського Полісся: монографія / А. М. Білоус – К. : НУБіП України, 2018. – 170 с.

12. Лакида П. І., Лашенко А. Г., Терентьев А. Ю. Білоус А. М. та інші, всього 14 осіб. Нормативи оцінки компонентів надземної фітомаси дерев головних лісотвірних порід України : [довідник]. Видавничий дім «ЕКО-інформ», 2011. 192 с.

13. Лакида П. І., Білоус А. М., Блищик В. І., Васишин Р. Д., Васишин О.М., Домашовець Г. С., Ковалевський С. С., Лакида І. П., Лашенко А. Г., Матейко І. М., Матушевич Л. М., Морозюк О. В., Фомін В. І., Швець Ю. П. Нормативи оцінки компонентів надземної фітомаси деревостанів головних лісотвірних порід України : [довідник]. Корсунь-Шевченківський : ФОП Гавришенко В. М., 2013. 457 с.

14. Лісотаксаційний довідник (доповнене видання) / уклад. А.М. Білоус, С.М. Кашпор, В.В. Миронюк, В.А. Свинчук, О.М. Леснік. – Київ : Видавничий дім «Вініченко», 2021. 420 с.

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17. Matsala, M., Myroniuk, V., Bilous, A., Terentiev, A., Diachuk, P., Zadorozhniuk, R. 2020. An indirect approach to predict deadwood biomass in forests of Ukrainian Polissya using Landsat images and terrestrial data. – *Forestry Studies | Metsanduslikud Uurimused* 73, 107–124, ISSN 1406-9954. Journal homepage: <http://mi.emu.ee/forestry.studie>

18. Matsala M., Bilous A., Myroniuk V., Diachuk P., Burianchuk M. & Zadorozhniuk R. (2021) Natural forest regeneration in Chernobyl Exclusion Zone: predictive mapping and model diagnostics, *Scandinavian Journal of Forest Research*, DOI:10.1080/02827581.2021.1890816

19. Matsala, M., Bilous, A., Myroniuk, V., Holiaka, D., Schepaschenko, D., See, L., & Kraxner, F. (2021). The return of nature to the chernobyl exclusion zone: Increases in forest cover of 1.5 times since the 1986 disaster. *Forests*, 12(8) doi:10.3390/f12081024

20. FAOSTAT: веб-сайт. URL: https://www.fao.org/faostat/en/?fbclid=IwAR1gJvWISDv6y75RSpdn2fWK5vTKD9etO2JVOrc0YKtcUqU4RFIFa_a_xss#data (дата звернення 01.06.2022 р.).

21. Restor: веб-сайт. URL: <https://restor.eco/> (дата звернення 01.06.2022 р.).

22. Закон України «Про оцінку впливу на довкілля»: веб-сайт.
URL: <https://zakon.rada.gov.ua/laws/show/2059-19#Text> (дата звернення 01.06.2022 р.).

23. Екозагроза: веб-сайт. URL: <https://ecozagroza.gov.ua/> (дата звернення 01.06.2022 р.).