

Course name:**DENDROCLIMATOLOGY**

ECTS	2
Course status	optional
Course final assesement/evaluation of outcomes	exam
Prerequisites	Graduated first degree programs such as Bachelor (BA or BSc.) in forestry, environmental protection and related fields. Basics knowledge in wood anatomy, climatology, familiarity with MS Office package

Main field of study:**Forestry**

Profile of study	General academic
The code of studies (education level)	MSc.
Semester of studies	winter / summer
Language of instruction	English

Course offered by:

Name of faculty offering the course	Faculty of Forestry
Name of department offering the course	Department of Forest Ecosystems Protection
Course coordinator	Bartłomiej Bednarz, PhD, DSc. Eng

Learning outcomes of the course:

Symbol of outcome	Description of learning outcome	Reference to	
		main field of study outcomes	discipline #
KNOWLEDGE – student knows and/or understands:			
LES_DEKL_W1	relations of forestry with other scientific disciplines providing a theoretical basis for formulating and solving research problems and applying natural knowledge in economic practice	LES2_W01	RL
LES_DEKL_W2	in-depth degree facts and phenomena as well as theories explaining the relationships occurring in the forest environment and development trends in the management and preservation of natural resources	LES2_W02	RL
SKILLS – student is able to:			
LES_DEKL_U1	use advanced techniques and research tools in the field of forestry and related sciences	LES2_U01	RL
LES_DEKL_U2	in the field of forest sciences, independently plan and carry out experiments, measurements and interpret the results obtained and draw conclusions	LES2_U02	RL
SOCIAL COMPETENCE- student is ready to:			
LES_DEKL_K1	critical evaluation and discussion of the cognitive and practical value of modern knowledge	LES2_K01	RL

Teaching contents:

Lectures		6	hours
Topics of the lectures	<p>Subject and scope of research in dendrochronology and dendroclimatology. Dendrochronology research history. The rhythm of activity and rest of the tree, periodization of cambium activity as an adaptive strategy. Factors shaping the formation of tree-ring widths. Biological basis of dendrochronology and dendroclimatology: early, late and reactive wood, features of tree rings: density, width of rings, share of early and late wood. Measurement of various features of tree-rings. Preparation of wood for measurement, measurement strategies, mistakes made and their verification. Methodology of dendroclimatological research: selection of research sites, sample trees, choosing of drilling places, types of samples (systematic, random, subjective). Number of stands and collected cores sampled. Stand plots documentation. Collection and storage of cores. Dendrochronological terminology: series, sequence, dendroscale, chronology (model, individual, site, local, regional, pan-regional, species chronology). Homogeneity of growth behavior of trees and their causes. Pointer years - types. Distribution of the dendrochronological signal in space and time. Teleconnection, heteroconnection, similarity of growth rhythm of trees in spatial and interspecific scale. The role of the regional meteorological station in dendroclimatic research. Dependence of radial growth of trees of native and introduced species on various climatic elements. Climate-radial growth models, convergence method, correlation method and response function. The specificity of mountain regions, border zones and extreme habitats in dendroclimatic research. Application of dendrochronological methods to solve ecological problems and climatic valorization of the areas. Differentiation of radial growth behavior of various tree species and their role as an indicator of environment changes.</p>		
Accomplished learning outcomes	LES_DEKL_W1 LES_DEKL_W2 LES_DEKL_K1		
Verification methods, rules and criteria of outcome assessment	Exam passing - the basis of attendance at lectures, together with participation in the final assesement in 10%		
Classes		12	hours
Topics of the classes	<p>Preparation and protection of collected cores, equipment and devices for material processing and measurement. Measurement of tree-ring widths with various instruments and methods: analaog and based on dygitalizing methods - CooRecorder and CDendro program. Construction and recording of the tree-ring widths measurement database in the Tucson format. Incremental and climate data transformations - DendroClim2002 program. Getting to know and using specialized software for dendrochronological analysis. Testing the correctness of dendrochronologies synchronization with the use of statistical coefficients. Construction of individual, site, local, regional and pan-regional chronologies. Short-term and long-term variability of tree-ring chronologies. Standardization of tree-ring widths series. Construction of a standardized chronology. Determination of pointer years and their typing. Preparation and evaluation of climatic data: data verification, calculation and use of climatic indicators in dendroclimatic analyzes with the use of DendroClim2002 program. Analysis of the variability of radial growth reactions of trees within the population, between partial populations, within species and between species. Construction of the "growth-climate" model for various tree species. Reconstruction of the climate base on the relation of tree-ring widths and chosen climatic elements.</p>		
Classes using additionally e-learning teaching tools - CooRecorder&Cdendro-Cybis.se			
Accomplished learning outcomes	LES_DEKL_U1 LES_DEKL_U2 LES_DEKL_K1		
Verification methods, rules and criteria of outcome assessment	Implementation of dendroclimatic projects (for selected tree species) together with activity and skills evaluation. Participation in the final assesement is 70%		
Field exercises		6	hours
Topics of the excercises	<p>Getting to know the methods of selecting research sites, sample trees. Methods and devices used during collecting research material for dendroclimatic purposes. Principles of proper sampling of trees by use of Pressler drill. Principles of storage, labeling and transporting of cores.</p>		
Accomplished learning outcomes	LES_DEKL_U1 LES_DEKL_U2 LES_DEKL_K1		
Verification methods, rules and criteria of outcome assessment	Assessment of activity, demonstration of practical skills. The participation of the outdoor exercises evaluation in the final assesement is 20%.		

References:

Basic	<p>Zielski A., Krapiec M. 1999. <i>Dendrochronologia</i>. PWN, Warszawa.</p> <p>Cook, E.R. and Kairiukstis, L.A. 1990. <i>Methods of Dendrochronology. Applications in the Environmental Sciences</i>. International Institute for Applied Systems Analysis. Kluwer Academic Publishers, Dordrecht, Boston, 394 pp.</p> <p>Fritts, H. C. 1976: <i>Tree rings and climate</i>. London, New York and San Francisco: Academic Press. 567 pp.</p>
Supplementary	<p>Kaennel M., Schweingruber F.H. 1995. <i>Multilingual glossary of dendrochronology. Terms and definitions in English, German, French, Spanish, Italian, Portuguese, and Russian</i>. Birmensdorf; Berne, Stuttgart, Vienna, Swiss Federal Institute for Forest, Snow and Landscape Research; Haupt.</p> <p>Schweingruber F.H. 1983. <i>Der Jahrring. Standort, Methodik, Zeit und Klima in der Dendrochronologie</i>. Bern und Stuttgart, Verlag Paul Haupt.</p> <p>Schweingruber, F. H. 1993. <i>Trees and wood in dendrochronology. Morphological, anatomical, and tree-ring analytical characteristics of trees frequently used in dendrochronology</i>. Springer series in wood science.</p>

Structure of learning outcomes:

Discipline: R – Agricultural sciences, L -Forestry	2	ECTS**
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Structure of student activities:

Contact hours	35	hours	1,4	ECTS**
including:				
lectures	6	hours		
classes and seminars	18	hours		
consultations	6	hours		
participation in research	...	hours		
mandatory traineeships		hours		
participation in examinations	5	hours		
e-learning		hours	...	ECTS**
student own work	15	hours	0,6	ECTS**

Syllabus valid from the academic year 2024/2025

* where 10 hours of classes = 1 ECTC (in case of 15 h → 2 ECTS)

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25 - 30 hours of classes

academic discipline code: RZ - animal science and fishery, PB - biological sciences, etc.