



Course syllabus

Faculty of Technology

Department of Forestry and Wood Technology

4TS021 Skogens klimatnytta och anpassningar i ett förändrat klimat,
15 högskolepoäng

Forest climate mitigation and adaptation, 15 credits

Main field of study

Forest and Wood Engineering

Subject

Forest Science

Level

Second cycle

Progression

A1N

Date of Ratification

Approved 2023-11-20.

The course syllabus is valid from spring semester 2024.

Objectives

After the course the student should know:

Knowledge and understanding

- Describe the basics of why the climate is changing, how it is likely to change, how climate models are used and uncertainties in different scenarios and climate effects.
- Explain concepts such as LULUCF, REDD+ and BECCs and understand agreements, reporting of greenhouse gas emissions (GHG), trading of emission rights GHG protocol.
- Account for various anthropogenic and natural sources, as well as sinks of greenhouse gases.
- Describe how environmental factors and climate affect the forest's uptake and release of carbon dioxide and other GHGs, and how GHGs can be measured.
- Explain how climate change means new conditions for Swedish forestry and

how forestry can be adapted with regard to potential risks.

Skills and ability

- Calculate substitution effects and be able to compare different use alternatives, the importance of energy systems, carbon storage in products, product lifetimes and reuse.
- Carry out carbon balance calculations based on a system perspective and compare how different forest management options affect the use of forest raw materials and the climate benefit.
- Understand differences between stocks and flows of carbon and understand how it differs between stock, landscape and national levels.
- To be able to adapt forestry plans for forest properties to the climate, taking damage risks into account and calculate effects on climate benefit, biodiversity and economy. Carry out literature studies.

Judgement and approach

- Evaluate how different forest management methods, tree species, forest production, stand age and deposition of forest affect the forest's carbon balance.
- Evaluate scientific results.
- Value and estimate how climate adaptations and options for increased climate benefit affect the forest's other ecosystem services.
- Evaluate how different forestry methods/action alternatives can create a more sustainable and resilient forestry.

Content

The course consists of four different modules.

Module I focus on climate change in a national and global perspective and basic concepts in meteorology/climatology and the occurrence of greenhouse gases. This module also includes climate policy and how climate change can affect the forest.

Module II deals with how to deal with climate change and options for creating more sustainable and resilient forests. (drought, fire, storm, game, frost, insects, fungal diseases, genetics, tree species etc). In this module, forestry plans for various forest properties will also be adapted to the climate.

Module III is the theme of the forest's carbon balance and how to measure/estimate it for different time and space scales. The course also focuses on how different system boundaries affect the carbon balance and how different forest management options affect the carbon balance.

Module IV deals with the use of forest raw materials, where you learn to calculate substitution effects and how bio-based products' lifespan and reuse affect climate benefits. The module includes trade-offs between different ecosystem services and calculates and reports carbon balance calculations for a forest property.

The course will also include two excursions (Module II), one of which will take place in Europe. Through varied learning activities and contacts with forestry representatives and other experts, the student receives training in critical thinking, practically oriented problem solving, as well as oral and written communication.

Type of Instruction

The course consists of lectures, seminars, excursions, and project work, where teachers from both Linnaeus University and experts in the forestry industry and authorities will participate. During Module I, there will be a seminar on global climate policy and climate adaptation measures, as well as the role of forests to mitigate climate change. A literature study will be included in Module III with the aim of compiling different approaches and system perspectives with regard to the forest's climate benefits. The teaching takes place through exercises in connection with climate-adapted forestry plans (Module II) and carbon balance calculations (Module IV). In addition, it includes developing adapted forestry plans (Module II) with regard to reducing the risks of future damage and how it affects other ecosystem services and the economy, as well as carbon balance calculations for a property (Module IV). The students will work on these tasks either in groups or individually.

The above sections are mandatory and will be graded. The course is given in English, but parts and examinations can in many cases also be possible in Swedish.

Examination

The course is assessed with the grades U, 3, 4 or 5.

Grade 5 is the highest grade level, the remaining grades follow in descending order where grade 3 is the lowest grade level to be passed. The grade U means that the student's performance has been assessed as not passed.

The seminar in **Module I** and the literature study in **Module III** are graded with U or G. Examination for **Module II** and **Module IV** is the submission and presentation of adapted forestry plans and carbon balance calculations for a forest property, where we also assess the quality of the submitted work (U, 3, 4 or 5). Otherwise, participation in field trips (U or G) is required, where non-attendance can be supplemented with participation the following year or a submission task (extra literature study/abstract). Participation in the excursions (or extra literature study/report) gives 1 credit per excursion. Each module can be seen as separate courses, where **Module I** and **Module III** correspond to 3.5 credits each, while **Module II** and **Module IV** correspond to 3 credits each. Renewed examination is given in accordance with Local rules for courses and examinations at first level and second level at Linnaeus University.

Resit examination is offered in accordance with Linnaeus University's Local regulations for courses and examination at the first- and second-cycle levels. In the event that a student with a disability is entitled to special study support, the examiner will decide on adapted or alternative examination arrangements.

Course Evaluation

A course evaluation should be conducted during the course or in connection with its conclusion. The results and analysis of the completed course evaluation should be promptly communicated to students who have completed the course. Students participating in the next course instance should be informed of the results of the previous course evaluation and any improvements that have been made, no later than at the start of the course.

Overlap

The course cannot be included in a degree along with the following course/courses of which the content fully, or partly, corresponds to the content of this course: 4TS016 (module 2), 3, credits, 4TS015 (module 3), 3.5 credits

Other Information

The course material is presented on a web study site that the students reach via the Internet. Access to the Internet and computers is available in the university's computer rooms and in the university library.

The course contains mandatory elements, such as study trips and fieldwork, which may involve a cost for the student.

Required Reading and Additional Study Material

Eriksson H, Bergqvist J, Hazell P, Isacson G, Lomander A & Black-Samuelsson S. Effekter av klimatförändringar på skogen och behov av anpassning i skogsbruket. Skogsstyrelsen, rapport 2/2016.

IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3-32, doi:10.1017/9781009157896.001.

Kellomäki, S. 2017. Managing Boreal Forests in the Context of Climate Change, Impacts, adaptation, and climate change mitigation. ISBN 9780367782450 368 Pages.

Keskitalo, E. C. H., Bergh, J., Felton, A., Björkman, C., Berlin, M., Axelsson, P., Ring, E., Ågren, A., Roberge, J.-M., Klapwijk, M. J., Boberg, J. 2016. Adaptation to Climate Change in Swedish Forestry. *Forests*. 7, 28.

Mistra-SWECIA. 2015. Klimatanpassat skogsbruk: Drivkrafter, risker och möjligheter, Stockholm: Mistra-SWECIA.

Rummukainen, M., Johansson, D. J. A., Azar, C., Langner, J., Döscher, R., & Smith, H. (2011). Uppdatering av den vetenskapliga grunden för klimatarbetet. En översyn av naturvetenskapliga aspekter. (Klimatologi; Vol. 4). SMHI.

<http://www.smhi.se/publikationer/uppdatering-av-den-vetenskapliga-grunden-for-klimatarbetet-1.17827>

Skogsskötselserien kapitel 21, Skogens kolbalans och klimatet © Skogsstyrelsen, Johan Bergh, Gustaf Egnell, Tomas Lundmark, oktober 2020.

<https://www.skogsstyrelsen.se/globalassets/mer-om-skog/skogsskotselserien/skogsskotselserien-21-skogens-kolbalans-och-klimatet-2020.pdf>

Subramanian N, Nilsson U, Mossberg M, Bergh J. 2019. Impacts of climate change, weather extremes and alternative strategies in managed forests, *Écoscience*, 26:1, 53-70, DOI: 10.1080/11956860.2018.1515597

United Nations Environment Programme (2022). Emissions Gap Report 2022: The Closing Window — Climate crisis calls for rapid transformation of societies. Nairobi.

<https://www.unep.org/emissions-gap-report-2022>