Grading criteria based on learning outcomes in the course: Silviculture – the science of forest stand management

grade	**Learning outcome 1** Explain and apply the ecological and silvicultural principles underlying tree and stand development over time—including the role of site characteristics, self-thinning, resource competition, resource dynamics, light-use efficiency, and respiration at tree- and stand-levels and how silvicultural practices govern stand development under contrasting environmental conditions. (Assignment 2, 3, 4 and 5)	**Learning outcome 2 and 3** Analyse -forest stand dynamics under varying management strategies, site conditions, and climatic conditions. - the consequences of management interventions and their impacts on tree/forest growth, soils, and energy and water balances. (Assignment 2, 3 and 5)	**Learning outcome 4** Design silvicultural field and computer experiments and sampling strategies to test fundamental scientific questions and hypotheses, draw conclusions. (Assignment 4 and 5)
5	The student can **evaluate…**	The student can **evaluate** …	The student can **evaluate** silvicultural field and computer experiments and sampling strategies to test fundamental scientific questions and hypotheses, draw conclusions.
4	The student can **apply**…	The student can **synthesize** …	The student can **synthesize results** from field and computer experiments and sampling strategies to test fundamental scientific questions and hypotheses, draw conclusions.
3	The student can **explain** the ecological and silvicultural principles underlying tree and stand development over time—including the role of site characteristics, self-thinning, resource competition, resource dynamics, light-use efficiency, and respiration at tree- and stand-levels and how silvicultural practices govern stand development under contrasting environmental conditions.	The student can **analyze**: -forest stand dynamics under varying management strategies, site conditions, and climatic conditions. - the consequences of management interventions and their impacts on tree/forest growth, soils, and energy and water balances.	The student can design silvicultural field and computer experiments and sampling strategies to test fundamental scientific questions and hypotheses, draw conclusions.
U	Does not show ability…	Does not show ability…	Does not show ability…

Continued…

grade	**Learning outcome 5** Evaluate the scientific basis for present and emerging silvicultural practices such as mixed species silviculture, continuous cover forestry, agroforestry, and uneven-aged forest management. (Assignment 2, 3 and 5)	**Learning outcome 6 and 7** -Follow and participate in current discussions on silviculture and forest management. -Search, critically evaluate, and synthesise relevant scientific literature on ongoing discussions in silviculture and forest management. (Assignment 1 and 2)	**Learning outcome 8** Communicate efficiently to a wide range of stakeholders using different formats (e.g., research reports, oral presentations, posters). (Assignment 1, 2 and 5)
5	The student can **evaluate** …	The student can **evaluate** relevant scientific literature on ongoing discussions in silviculture and forest management.	The student **strictly follows guidelines** for scientific presentation, communicate **clearly, concisely**, and **does not use irrelevant information**.
4	Shows a capacity to **synthesize** …	The student can **synthesize** relevant scientific literature on ongoing discussions in silviculture and forest management.	The student **follows guidelines** for scientific presentation and **mostly communicate clearly** and use only minor irrelevant information.
3	The student can **analyze**: -the scientific basis for present and emerging silvicultural practices such as mixed species silviculture, continuous cover forestry, agroforestry, and uneven-aged forest management.	The student can -**follow and participate** in current discussions on silviculture and forest management. -**search** relevant scientific literature on ongoing discussions in silviculture and forest management.	Communicate efficiently to a wide range of stakeholders using different formats The student **by large follows guidelines for scientific presentation**
U	Does not show ability…	Does not show ability…	Does not show ability…

Grading guidelines:

Grading will be based on 5 assignments. The assignments have different weights 10% (1), 15% (4), and 25% (2, 3 and 5). To pass the course the student must get at least grade 3 on all assignments. The first row of the grading criteria tables indicates which of the learning outcomes are tested in each assignment.

The taxonomy in the grading criteria follows Blooms taxonomy (Table 2).

Knowledge: Knowledge is defined as the remembering of previously learned material. This may involve the recall of a wide range of material, from specific facts to complete theories, but all that is required is the bringing to mind of the appropriate information. Knowledge represents the lowest level of learning outcomes in the cognitive domain.

Comprehension: Comprehension is defined as the ability to grasp the meaning of material. This may be shown by translating material from one form to another (words to numbers), by interpreting material (explaining or summarizing), and by estimating future trends (predicting consequences or effects). These learning outcomes go one step beyond the simple remembering of material, and represent the lowest level of understanding.

Application: Application refers to the ability to use learned material in new and concrete situations. This may include the application of such things as rules, methods, concepts, principles, laws, and theories. Learning outcomes in this area require a higher level of understanding than those under comprehension.

Analysis: Analysis refers to the ability to break down material into its component parts so that its organizational structure may be understood. This may include the identification of parts, analysis of the relationship between parts, and recognition of the organizational principles involved. Learning outcomes here represent a higher intellectual level than comprehension and application because they require an understanding of both the content and the structural form of the material.

Synthesis: Synthesis refers to the ability to put parts together to form a new whole. This may involve the production of a unique communication, a plan of operations (research proposal), or a set of abstract relations (scheme for classifying information). Learning outcomes in this area stress creative behaviors, with major emphasis on the formulation of new patterns or structure.

Evaluation: Evaluation is concerned with the ability to judge the value of material for a given purpose. The judgments are to be based on definite criteria. These may be internal criteria (organization) or external criteria (relevance to the purpose) and the student may determine the criteria or be given them. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all the other categories, plus conscious value judgments based on clearly defined criteria.

Table 2. Blooms Taxonomy* for learning outcomes (Educational objectives) applied to the grading in the course 'Silviculture – the science of forest stand management'.

Grade	Competence	Skills Demonstrated	Assessment Cues:
Pre-required	**Knowledge**	-observation and recall of information -knowledge of dates, events, places -knowledge of major ideas -mastery of subject matter	list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where
Pre-required	**Comprehension**	-understanding information -grasp meaning -translate knowledge into new context -interpret facts, compare, contrast -order, group, infer causes -predict consequences	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss
Pre-required/ 3	**Application**	-use information -use methods, concepts, theories in new situations -solve problems using required skills or knowledge	apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover
3	**Analysis**	-seeing patterns -organization of parts -recognition of hidden meanings -identification of components	analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer
4	**Synthesis**	-use old ideas to create new ones -generalize from given facts -relate knowledge from several areas -predict, draw conclusions	combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite
5	**Evaluation**	-compare and discriminate between ideas -assess value of theories, presentations -make choices based on reasoned argument -verify value of evidence -recognize subjectivity	assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize

* From Benjamin S. Bloom *Taxonomy of educational objectives*. Published by Allyn and Bacon, Boston, MA. Copyright (c) 1984 by Pearson Education. Adapted from; http://www.coun.uvic.ca/learning/exams/blooms-taxonomy.html