Course Outline 2013-2014

Environmental Economics and Natural Resources Group
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MSc Thesis Environmental Economics and Natural Resources

Course code	ENR-80418 – 18 ECTS ENR-80421 – 21 ECTS ENR-80424 – 24 ECTS ENR 80427 – 27 ECTS ENR 80430 – 30 ECTS ENR 80433 – 33 ECTS ENR 80436 – 36 ECTS ENR 80439 – 39 ECTS
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Contents	1. Introduction 2. Learning outcomes and exam 3. Prerequisites 4. A topic for your thesis 5. The research 6. Assessment procedure 7. Plagiarism 8. Submission requirements

WAGENINGEN UNIVERSITY
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1 Introduction

The overall goal of the MSc thesis is the development of research skills and the ability to analyze and present research results in a systematic and clear way. The thesis is the culmination of the MSc study program in which you show that you are able to design and conduct environmental economic research at an academic level, and are able to theoretically reflect on an environmental-economic topic.

Upon completion of the MSc thesis, you will be capable of independently conducting environmental economic research. Hence, the main responsibility for a successful thesis process rests with you, as you are expected to take an active role and to display growing independence and maturity. Nevertheless, you will consult regularly with your supervisor regarding progress.

2 Learning outcomes

The writing of a thesis is a process during which the student is expected to become competent in:
- Carrying out the different phases of research in an independent manner within a previously agreed time span
- Evaluating relevant theories and applying these theories to a relevant scientific problem
- Applying a work ethic appropriate to the performance of scientific research, the development of scientific understanding and its application
- Writing and editing a well-structured thesis.

3 Prerequisites

Before you start your thesis you need to satisfy the following requirements in order to obtain definite admission to the thesis (cf. article 4.5.3 of the Student Charter 2010/2011, p. 39):
- Successful completion of two prerequisite courses (see your study program for these courses)
- Successful completion of the research methodology courses and other supporting courses (if included in the individual study agreement and in agreement with the study adviser)
- Satisfactory overall study progress

To write an MSc thesis at ENR you are required to have completed one of the introductory courses:
ENR-20306 Environmental Economics and Policy
ENR-21306 Environmental Economics for environmental sciences

Moreover, it is strongly recommended to complete two of the advanced courses:
ENP-32306 Advanced environmental economics and policy
ENR-20806 Economics and management of natural resources
DEC-31306 Cost-Benefit Analysis and environmental valuation
ENR-30306 Theories and models in Environmental Sciences
ENR-50306 Selected topics in environmental and resource economics

Students who have not participated in one of the introductory Environmental Economics courses may update their knowledge with a self-study course. It is advisable to add other subjects to those stipulated as compulsory, as this may bring the thesis to a higher level. Students wishing to do quantitative research are recommended to include subjects such as Micro-economics (ECH-21804), Institutional economics and economic organisation theory (AEP-20804), Macroeconomics and international trade (ECH-20804) or Econometrics (AEP-21304). Consult your supervisor at an early stage.

4 A topic for your thesis

Your thesis could fit into the current research themes at ENR, or build on the results of earlier theses. Of course you can also propose a research topic.

4.1 Examples of topics

Suggested areas of the group include (but are not restricted to):
- economics of climate change
- economics of biodiversity and ecosystems
- economics of energy and material
- natural resource modelling
- general equilibrium modelling and the environment
- international environmental policy
- agriculture, environment and development
- water economics
- environmental valuation.

4.2 Finding a thesis topic

It is your own responsibility to find a thesis topic, but we can advise you on ongoing research, current topics, and other developments in your area of interest. If you have some idea of what you want your thesis topic to be, you can contact an ENR staff member whose work is close to your field of interest. If you have no concrete idea yet, or you don't know who is most familiar with your field of interest, you can also contact our thesis coordinator Edwin van der Werf (edwin.vanderwerf@wur.nl) or our education coordinator Rolf Groeneveld (rolf.groeneveld@wur.nl).

A list with specific research topics and ongoing research projects is available on the website of the Environmental Economics and Natural Resources Group (http://www.enr.wur.nl/) for your inspiration. Occasionally, we also get requests from other organisations (research institutes, policy makers, NGOs, private sector, etc.) for interns or thesis students. We post these requests on the ENR website and distribute them over e-mail to students subscribed to the ENR newsgroup. If you want to receive these announcements you can contact Rolf Groeneveld (rolf.groeneveld@wur.nl) or Gré Schurink (Gre.Schurink-Heitkonig@wur.nl).

5 The research

There are three phases to your thesis work: the starting phase, the executing phase and the completing phase.

5.1 Starting phase

During the starting phase, which is the first step in writing the thesis, a research proposal has to be prepared. A research proposal should include:

- A description of the problem that is to be addressed in the thesis
- The objective of the research
- The research questions
- The method that will be used to address the research questions
- A provisional table of contents of the thesis
- A list of the literature already consulted
- A detailed time schedule

The research proposal is the basis of the thesis. In order to minimize the chance of setbacks it should therefore be sound. After the student has discussed the research proposal with the supervisor, the WU thesis contract form is filled in. Please make sure that the thesis code in your contract is the same as the one in your MSc Programme as approved by the Examining Board! The executing phase begins after the research proposal has been approved.

Most, if not all, MSc programmes require students to present their proposals. Check with your study advisor whether this is compulsory for you. Even if this is not compulsory, it is highly recommended! You may get a lot of good feedback from staff and fellow students that you can use in the rest of your thesis.

5.2 Executing phase

In the executing phase the literature search that was begun during the starting phase is elaborated on and the problem formulation, aim and working method are refined. Problems are solved and questions answered. This often requires the application of a specific part of economic theory. This particular theory must therefore be highlighted in at least one of the chapters. The theory described is then applied in the actual research. In this phase the core chapters are written. It is important that the latter are logically related to the problem formulation and working method. It is advised to start every chapter with a short introduction outlining the chapter's aim and structure.

During the executing phase draft parts of the thesis must be submitted regularly to the supervisor for discussion and approval. It is important to make proper arrangements with the supervisor about the number of consultations and their content.

5.3 Completion and assessment

In the completing phase the research results are written up, together with a discussion and conclusions. The conclusions present the answers to the research problem and the questions studied, and link these to the aim of the research. The thesis must have a title page, a preface (acknowledgements), a summary, contents, literature list (and appendices). (Work on this can be started at an earlier stage.)

The resulting draft thesis is submitted to the supervisor, in accordance with the time schedule. It is also submitted to the examiner and assessor. If the draft version is deemed to be unsatisfactory, the student will be given more time to produce a satisfactory result. If the thesis has been written to gain 13 or more credits, the student must give a colloquium after the draft thesis (after modification, if necessary) has been approved (see 3.1 below). Two copies of the final version of the thesis must be submitted to the

supervisor before the colloquium takes place. The supervisor awards the final mark during the discussion part of the colloquium.

6 Assessment procedure

6.1 Grading

The head of the supervising chair group (professor) is responsible for the examination of the thesis and is expected to conduct its final assessment together with the supervisor. The head may delegate this task to another knowledgeable staff member. In the case of co-supervision, all supervisors should be present at the final evaluation. When the head is the supervisor, an independent examiner has to be nominated.

6.2 Assessment criteria

Assessment will take place with regard to your research competence, the thesis report, the colloquium, and examination.

6.2.1 Research competence

This evaluation is based on the experience of your supervisor(s) with you during the process of doing research and writing the thesis report. Criteria are: the learning process, manifested professionalism as a prospective independent researcher, enthusiasm, commitment, effort and initiative, independency, originality and creativity.

6.3 The thesis report

The product of the scientific work of the student is the thesis report. This is a piece of scientific work that can be evaluated in the same way as any other written scientific work (like a journal article or a report). Based on the classical contents of a scientific report (Introduction-Materials and Methods-Results-Discussion-Conclusions) the aspects in this cluster assess the level of these different parts of the report.

6.4 Colloquium

During the colloquium you present the work to an audience consisting of fellow students and staff members. Both the quality of the slides (graphical presentation) and the verbal presentation and defense, based on critical questions from the audience, are evaluated.

6.5 Examination

During the examination you defend your thesis against critical comments of the examiner and the supervisor(s). In defending the thesis, you show that you have knowledge of the study domain.

6.6 Final assessment and special considerations

The final assessment is made with the help of the evaluation form used by all chair groups of Wageningen University. The meaning of the final grades is shown in the following table:

Grade		Definition
10	Excellent	Outstanding performance in all respects without any errors. The highest proficiency in ability and application. The thesis is of PhD quality and has the potential of at least one publishable article. The thesis has a solid theoretical basis and contributes to the advancement of theory.
9	Very good	Outstanding, exceptional and extraordinary performance with just some minor errors. Slightly less than the highest proficiency in ability and application. Superior mastery of subject matter, with evidence of independence and originality of thought. The thesis has a solid theoretical basis and contributes to the advancement of theory. The thesis may result in a publishable article.
8	Good	Generally sound work with a limited number of minor errors. Outstanding proficiency of research competencies and clear above-average mastery of subject matter. No major weaknesses.
7	Satisfactory	Thesis fair, acceptable and adequate. Acceptable mastery of research skills, but with some significant shortcomings. Satisfactory ability and achievement of a high but second order.
6	Sufficient	Performance meets the minimum criteria but below average. Limited mastery of subject matter.
5	Fail	Some more work required to be sufficient; poor but with pass potential.
<5	Fail	Considerable further work is required; unacceptable.

7 Plagiarism

Plagiarism, or using the work of someone else without acknowledging it, is considered theft of intellectual property. It is the policy of the ENR group to check ALL final theses for plagiarism. If you are caught with having copied text from other sources without giving the proper references, you can be punished with not being able to take exams or submitting papers for up to one year!

You are expected to be familiar with proper referencing techniques and to have consulted one of these sites before they start writing the thesis:
http://www.enp.wur.nl/UK/education/Plagiarism
http://www.indiana.edu/~wts/pamphlets/plagiarism.shtml
http://www.lib.monash.edu.au/tutorials/citing

An interesting book on referencing techniques is suggested by Reena Bakker-Dhaliwal who is the lecture of the MOS-module Scientific Writing (ECS 65600): Pears, Richard and Shields, Graham. Cite Them Right: the essential referencing guide. Durham, England: Pear Tree Books, 2009.

8 Submission requirements and procedures

We can only give you a grade if we have your final thesis in pdf as well as in hard copy - no exceptions made. Submit your thesis at least one week before the date of the final assessment (defense).

The expenses for printing and copying of a maximum of three copies of the thesis can be submitted for reimbursement to ENR, but only within reasonable limitations (the maximum reimbursement is €7,50 per copy). If you want to spend more than is absolutely necessary, for example to improve the appearance of your thesis, you pay the additional expenses.

The thesis is public and can be used by third parties. A study can be carried out for a third party and the results may be undisclosed and treated as confidential for a maximum period of 5 years, but a review committee must have access even to the confidential reports. This has to be specified in a special agreement. The oral presentation remains mandatory, but in the case of a confidential study the oral presentation can be given at the company's place (in presence of the supervisor(s)).

Appendix A Wageningen University Master Thesis Agreement

This Wageningen University (WU) master thesis agreement serves to lay down agreements between a master student and a chair group. The agreement registers rights and duties of both parties and is a further supplementation and elaboration of the Higher Education and Research Act (WHW), Education and Examining Regulations and the Student Charter.

The form has to be completed for each master thesis by the student and a representative of the chair group before the start of the study activities.

Student and representative sign three copies of the form. Both receive a copy. A third one is sent to a representative of the programme: the study advisor mentioned below.

When the agreement is modified the student will receive a copy of the adjusted form.

For complaints on the supervision or assessment the student can appeal to:
- The study advisor for advice and support
- The Examining Board for advice on procedures or an official complaint.
- The Examination Appeals Board.
- A dean or a Confidential advisor for students

For additional information see the explanation on page A3.

1. Information on student and chair group

Student: .....
Study programme: .....
Registration number: .....
Study advisor: .....

Chair group: .....
Course code: .....
Supervisor(s): .....
Examiner a[1]: .....
Examiner b[2]: .....

The student is informed upon the (written) guidelines and rules of the chair group for thesis students: yes/no

2. Prerequisite course(s)

Course code:	.....	Passed:	yes/no
Course code:	.....	Passed:	yes/no

3. Admission to the thesis

Study advisor _____ has stated that the student is qualified[3] for a master thesis and that the thesis is part of the programme of the student.

4. Title and planning

Title of the thesis project: .....
Date of completion parts of thesis: .....
Date of start: .....

Date of finish: .....
Special arrangements for planning: .....

5. Arrangements on supervision

(Arrangements on the type and intensity of meetings of student and supervisor on role and responsibilities when more supervisors or more chair groups are involved)

6. Arrangements on facilities

[1] This can be the supervisor.
[2] This name can be entered later.
[3] This means that the student has completed all requirements for starting with this master thesis.

(Work place (office/lab), access to buildings and locations. Availability and use of equipment, materials and facilities)

7. Arrangements on report

(Language and lay out, time and format of transfer of results and data, agreements on secrecy of results and publicity of the thesis report)

8. Arrangements for individual situations.

(Circumstances beyond one's control, disability, absence for special reasons)

9. Assessment

The assessment form[4] for theses of WU has to be used.

The percentages in the assessment form that will be used are:

Learning outcomes (assessment criteria)	**percentage**
A. Research competence	
B. Thesis report	
C. Colloquium	
D. Examination	

The assessment will be done in week (on) .....

10. Confidentiality

Should the information in the thesis report be treated as confidential, at the request of a third party?

YES / NO (Please put a circle around the applicable answer. More information can be found in the 'ENR Chairgroup protocol confidential information in theses and internship reports'.)

11. Signature

The student agrees to report any relevant change in circumstances which may affect the results of the project to the supervisor.
The student declares to be acquainted with rules and procedures of the chair group and with the assessment form. The chair group declares to have provided the student with all relevant information (including rules, regulations, safety issues).

Wageningen,

	Name	Date	Signature
Student:	.....	.....	.....
Supervisor(s):	.....	.....	.....
Examiner a:	.....	.....	.....
Examiner b:	.....	.....	.....

[4] https://portal2.wur.nl/sites/owi/kwaliteitszorg/Policy_Documents_and_Forms/Thesis_assessment_form WU uk v10

Explanation[5]

1. Information student and chair group
The study advisor has to be asked for advice on the progress of the student and qualification for a master thesis. The study programme (study advisor) has to be informed about the arrangements students want to make for thesis projects in order to establish whether the programme allows the student to take this thesis and to keep record of the student's progress.
The examiner will be the chair holder being responsible for the thesis. The supervisor takes care of daily supervision. A supervisor from an external organization can not have a formal role, and can not be involved in the marking because he is not a qualified lecturer. If more supervisors and chair groups are involved each role should be explained under item 5. WUR employees outside the university section (e.g. researchers) can be regarded as supervisor like a WU lecturer.

2. Prerequisites
Chairs can require a maximum of two prerequisite courses (in total 12 credits) for starting a thesis. These prerequisites have to be published in the study handbook. The student has to pass the exam(s) to gain access to the thesis.

3. Admission to the thesis
The chair group (supervisor, coordinator education) should contact the study advisor personally to be informed about the student being qualified for starting with the master thesis.

4. Description and planning
In general reference can be made to a previously described project proposal of the chair group with subject and type of activities. It is considered very important that the student writes a detailed project description and is aware of all consequences with respect to type of activities, intensity and planning of work. If the student intends to interrupt the project for exams or leave the supervisor should agree in advance.

5. Arrangements on supervision
A supervisor will have his own rules for planning meetings with students, for involvement of co-workers. Especially when more supervisors and chair groups are involved it should be avoided that the student is confronted with conflicting rules and opinions. Only one supervisor should be the focal point for the student.

6. Arrangements on facilities
The chair group takes care of the facilities the student needs. In general it should be assumed that the student is not familiar with the policy concerning priorities for use of equipment and facilities, and is not aware who is in charge of them. It should be explained to the student that arrangements can never be a guarantee for availability and that because of unpredictable circumstances the thesis project may have to be adapted with respect to time planning and/or content. Chair group and student have to find solutions together.

7. Arrangements on report
Specific rules on the lay-out of a report, the transfer of data sets and processed results have to be agreed.
The thesis project can be part of a larger project in which external partners are involved, or in which results may be generated that require confidentially. The university has rules on protection and embargo of scientific results. Thesis reports can be registered with a restriction on disclosure of contents. The examiners and supervisor(s), however, always need a full copy to assess the student.
From October 2009 all master theses have to be uploaded to the Wageningen UR Digital Library through the AIR (Administration Enrolment data and Results). It is up to the involved chair group and student to decide whether the thesis will be made public or not in the Digital Library.

8. Arrangement for individual situations
Students can ask for specific facilities e.g. to work with a disability. Student and chair group can ask study advisor or dean for students for advice.

9. Assessment procedure
Examining Boards and Board of the Education Institute have decided[6] in 2006 that all chair groups of WU have to use the standard assessment form for theses and two examiners. The chair group can adjust the weight (percentages) of the assessment criteria on the excel-form. The student should be informed on this (item 9 of this agreement).
The completed assessment form for the thesis has to be uploaded to the AIR.

[5] This Master Thesis Agreement form is established by the Board of the Education Institute in September 2009: it is a revision of the Thesis Contract used at WU since January 1996.
[6] https://portal2.wur.nl/sites/owi/kwaliteitszorg/Policy Documents and Forms/thesis-letter-061102.pdf

Appendix B Manual for use of the thesis evaluation form and the MSc-thesis assessment rubric (version 1.1) of Wageningen University

User instructions

- Grading the thesis work is generally done by two persons, the daily supervisor and the second reviewer/examiner. For the sake of grading uniformity, it is highly recommended by the Exam Boards that the second reviewer within a chair group is always the same person. Preferably it is the head of the group.
- The thesis evaluation form has four categories. The research competence category can only be filled in by the daily supervisor as this person has worked with the student. The Thesis report category can most objectively be filled in by the second reviewer who was not involved in the thesis process, as grading the thesis report should not be biased by positive or negative experiences with the student. The daily supervisor who has these experiences can take these into account when grading the research competence.
- Use of the comment fields on the thesis evaluation form is highly recommended. It is an extra feedback for the student.
- The assessment rubric has the form of an analytic rubric (see e.g. Andrade (2005), Reynolds *et al.* (2009), URL1, URL2). Each line discusses one **criterion** for assessment. Each column gives a **level** for the grading. Each cell contains the **descriptor** of the level for that criterion.
- The criteria in the rubric exactly follow the items presented in the Excel worksheet "Thesis evaluation Wageningen University" constructed by the Exam Boards. In a few cases the criteria in the original thesis evaluation document were split into two or more parts because the description of the criteria clearly covered different subjects.
- Since the final mark is composed of so many criteria, the scores on individual criteria should be discriminative. Not all levels are equally broad in marks. Since the final marks of theses usually range between 6 and 9, in the rubric individual levels have been established for the marks of 6, 7 and 8. When performance is at the 9-10 level, decide whether the student is on the low edge (9) or high edge (10) of this level. Descriptions at the 9-10 level tend to describe the ultimate performance (10). Hence, if a student performs well above 8, but below the description at the 9-10 level, a 9 would be the appropriate mark.
- Keep in mind that each line in the rubric should be read independently: it could be that a student scores a 2-3 on one criterion and a 9-10 on another.
- Always start at the lowest mark in the rubric, and test if the student should be awarded the next higher mark. In some cases achievements of a next lower level are not repeated at the higher level (i.e. the lower level achievements are implicit in the higher levels). Furthermore, if a level has a range of marks, choose the most appropriate one (consider the description of the level of performance as a continuum, rather than a discrete description).
- Wherever the student is indicated as ´he´, one can also read ´she´.

Remarks

- This rubric has been validated by a number of supervisors by comparing the original grade of a number of theses to the grade resulting from this rubric.
- The main intention of using a rubric is enhance homogeneity of assessments and the ability to communicate about assessments both with students and with colleagues. Furthermore, it clarifies to students the expectations of the supervisor and helps the supervisor to structure feedback during the process of thesis research.
  Although the intention is to homogenize the process of assessment, it should be noted that even with the use of a rubric some arbitrariness will remain.
- The two main categories on the thesis evaluation form (research competence and thesis report) should have an assessment of 'sufficient' (i.e. ≥ 5.5) before the total thesis work can be considered as sufficient. So, no compensation between these main categories is possible to obtain the lowest final mark of 6.0.
- Please report any positive or negative experiences with and suggestions for the rubric to arnold.moene@wur.nl.
- Author of the rubric: Arnold F. Moene (Meteorology and Air Quality Group, Wageningen University), with valuable contributions from Ellis Hofland, Edwin Peeters, Tamar Nieuwenhuizen, Maarten Holtslag, George Bier, Gerard Ros, Lijbert Brussaard, Judith Gulikers and Paul Berentsen.

References

Andrade, H.G, 2005. Teaching With Rubrics: The Good, the Bad, and the Ugly. *College Teaching* **53**, p. 27-31.

Reynolds, J., R. Smith, C. Moskovitz and A. Sayle, 2009. BioTAP: A Systematic Approach to Teaching Scientific Writing and Evaluating Undergraduate Theses. *Bioscience* **59**, p. 896-903.

URL1: http://jonathan.mueller.faculty.noctrl.edu/toolbox/rubrics.htm (last visited November 17, 2009).

URL2: http://en.wikipedia.org/wiki/Rubric_(academic) (last visited November 17, 2009).

Appendix C Rubric for assessment of MSc-thesis

Author: Arnold F. Moene, Meteorology and Air Quality Group, Wageningen University
Version: 1.1 (December 15, 2010)

Item	**Mark for item**				
	2-3	**4-5**	**6**	**7**	**8**
1. Research competence (30-60%) *					
1.1. Commitment and perseverance	Student is not motivated. Student escapes work and gives up regularly	Student has little motivation. Tends to be distracted easily. Has given up once or twice	Student is motivated at times, but often, sees the work as a compulsory task. Is distracted from thesis work now and then.	The student is motivated. Overcomes an occasional setback with help of the supervisor.	The student motivated a overcomes a occasional s his own and the work as project.
1.2. Initiative and creativity	Student shows no initiative or new ideas at all.	Student picks up some initiatives and/or new ideas suggested by others (e.g. supervisor), but the selection is not motivated.	Student shows some initiative and/or together with the supervisor develops one or two new ideas on minor parts of the research.	Student initiates discussions on new ideas with supervisor and develops one or two own ideas on minor parts of the research.	Student has creative ide hypothesis f design or da processing.
1.3. Independence	The student can only perform the project properly after repeated detailed instructions and with direct help from the supervisor.	The student needs frequent instructions and well-defined tasks from the supervisor and the supervisor needs careful checks to see if all tasks have been performed.	The supervisor is the main responsible for setting out the tasks, but the student is able to perform them mostly independently	Student selects and plans the tasks together with the supervisor and performs these tasks on his own	Student pla performs ta independen help from th supervisor w needed.
	No critical self-reflection at all.	No critical self-reflection at all.	Student is able to reflect on his functioning with the help of the supervisor only.	The student occasionally shows critical self-reflection.	Student act performs cr reflection or aspects of h functioning

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
1.4. Efficiency in working with data Note: depending on the characteristics of the thesis work, not all three aspects (experimental work, data analysis and model development) may be relevant and some may be omitted	**Experimental work** Student is not able to setup and/or execute an experiment.	Student is able to execute detailed instructions to some extent, but errors are made often, invalidating (part of) the experiment.	Student is able to execute an experiment that has been designed by someone else (without critical assessment of sources of error and uncertainty).	Student is able to execute an experiment that has been designed by someone else. Takes sources of error and uncertainty into account in a qualitative sense.	Student is able to judge the setup of an existing experiment and to include modifications if needed. Takes into account sources of error and uncertainty quantitatively.	Student is able to setup or modify an experiment exactly tailored to answering the research questions. Quantitative consideration of sources of error and uncertainty. Execution of the experiment is flawless.
	Data analysis Student is lost when using data. Is not able to use a spreadsheet program or any other appropriate data-processing program.	Student is able to organize the data, but is not able to perform checks and/or simple analyses	Student is able to organize data and perform some simple checks; but the way the data are used does not clearly contribute to answering of the research questions and/or he is unable to analyze the data independently.	Student is able to organize the data, perform some basic checks and perform basic analyses that contribute to the research question	Student is able to organize the data, perform commonly used checks and perform some advanced analyses on the data	Student is able to organize the data, perform thorough checks and perform advanced and original analyses on the data.
	Model development Student is not able to make any modification/addition to an existing model.	Student modifies an existing model, but errors occur and persist. No validation.	Student is able to make minor modifications (say a single formula) to an existing model. Superficial validation or no validation at all.	Student is able to make major modifications to an existing model, based on literature. Validation using some basic measures of quality.	Student is able to make major modifications to an existing model, based on literature or own analyses. Validation using appropriate statistical measures.	Student is able to develop a model from scratch, or add an important new part to an existing model. Excellent theoretical basis for modelling as well as use of advanced validation methods.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
1.5. Handling supervisor's comments and development of research skills	Student does not pick up suggestions and ideas of the supervisor	The supervisor needs to act as an instructor and/or supervisor needs to suggest solutions for problems	Student incorporates some of the comments of the supervisor, but ignores others without arguments	Student incorporates most or all of the supervisor's comments.	Supervisor's comments are weighed by the student and asked for when needed.	Supervisor's comments are critically weighed by the student and asked for when needed, also from other staff members or students.
	Knowledge and insight of the student (in relation to the prerequisites) is insufficient and the student is not able to take appropriate action to remedy this	There is some progress in the research skills of the student, but suggestions of the supervisor are also ignored occasionally.	The student is able to adopt some skills as they are presented during supervision	The student is able to adopt skills as they are presented during supervision and develops some skills independently as well	The student is able to adopt new skills mostly independently, and asks for assistance from the supervisor if needed.	The student has knowledge and insight on a scientific level, i.e. he explores solutions on his own, increases skills and knowledge where necessary.
1.6. Keeping to the time schedule	Final version of thesis or colloquium more than 50% of the nominal period overdue without a valid reason (force majeure)	Final version of thesis or colloquium at most 50% of the nominal period overdue (without a valid reason).	Final version of thesis or colloquium at most 25% of nominal period overdue (without valid reason)	Final version of thesis or colloquium at most 10% of nominal period overdue (without valid reasons)	Final version of thesis or colloquium at most 5% of nominal period overdue (without good reasons)	Final version of thesis and colloquium finished within planned period (or overdue but with good reason).
	No time schedule made.	No realistic time schedule.	Mostly realistic time schedule, but no timely adjustment of time schedule.	Realistic time schedule, with some adjustments (but not enough or not all in time) in times only.	Realistic time schedule, with timely adjustments. of times only.	Realistic time schedule, with timely adjustments of both time and tasks.
2. Thesis report (30-60%) *						
2.1. Relevance research, clearness goals, delineation research	No link is made to existing research on the topic. No research context is described.	The context of the topic at hand is described in broad terms but there is no link between what is known and what will be researched.	The link between the thesis research and existing research does not go beyond the information provided by the supervisor.	Context of the research is defined well, with input from the student. There is a link between the context and research questions.	Context of the research is defined sharply and to-the-point. Research questions emerge directly from the described context.	Thesis research is positioned sharply in the relevant scientific field. Novelty and innovation of the research are indicated.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
	There is no researchable research question and the delineation of the research is absent	Most research questions are unclear, or not researchable and the delineation of the research is weak	At least either the research questions or the delineation of the research are clear	The research questions and the delineation are mostly clear but could have been defined sharper at some points	The research questions are clear and researchable and the delineation is clear.	The research questions are clear and formulated to-the-point and limits of the research are well-defined.
2.2. Theoretical underpinning, use of literature	No discussion of underlying theory.	There is some discussion of underlying theory, but the description shows serious errors.	The relevant theory is used, but the description has not been tailored to the research at hand or shows occasional errors.	The relevant theory is used, and the description has been tailored partially successful to the research at hand. Few errors occur.	The relevant theory is used, it is nicely synthesized, and it is successfully tailored to the research at hand.	Clear, complete and coherent overview of relevant theory on the level of an up-to-date review paper. Exactly tailored to the research at hand.
	No peer-reviewed/primary scientific papers in reference list except for those already suggested by the supervisor	Only a couple of peer-reviewed papers in reference list.	Some peer-reviewed papers in reference list but also a significant body of grey literature.	Relevant peer-reviewed papers in reference list but also some grey literature or text books. Some included references less relevant.	Mostly peer-reviewed papers or specialized monographs in reference list. An occasional reference may be less relevant.	Almost exclusively peer-reviewed papers in reference list or specialized monographs (not text books). All papers included are relevant.
2.3. Use of methods and data	No description of methods and/or data.	Research is not reproducible due to insufficient information on data (collection and/or treatment) and analysis methods	Some aspects of the research regarding data-collection, data-treatment, models or the analysis methods are described insufficiently so that that particular aspect of the research is not reproducible.	Description of the data (collection, treatment) or models as well as the analysis methods used is lacking in a number of places so that at most a more or less similar research could be performed.	Description of the data (collection, treatment) or models as well as the analysis methods used is mostly complete, but exact reproduction of the research is not possible due to lack of some details.	Description of the data (collection, treatment) or models as well as the analysis methods is complete and clear so that exact reproduction of the research is possible.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
2.4. Critical reflection on the research performed (discussion)	No discussion and/or reflection on the research. Discussion only touches trivial or very general points of criticism.	Only some possible weaknesses and/or weaknesses which are in reality irrelevant or non-existent have been identified.	Most weaknesses in the research are indicated, but impacts on the main results are not weighed relative to each other.	Most weaknesses in the research are indicated and impacts on the main results are weighed relative to each other.	All weaknesses in the research are indicated and weighed relative to each other. Furthermore, (better) alternatives for the methods used are indicated.	Not only all possible weaknesses in the research are indicated, but also it is indicated which weaknesses affect the conclusions most.
	No confrontation with existing literature.	Confrontation with irrelevant existing literature.	Only trivial reflection vis-a-vis existing literature.	Only most obvious conflicts and correspondences with existing literature are identified. The value of the study is described, but it is not related to existing research.	Minor and major conflicts and correspondences with literature are shown. The added value of the research relative to existing literature is identified.	Results are critically confronted with existing literature. In case of conflicts, the relative weight of own results and existing literature is assessed. The contribution of his work to the development of scientific concepts is identified.
2.5. Clarity of conclusions and recommendations	No link between research questions, results and conclusions.	Conclusions are drawn, but in many cases these are only partial answers to the research question. Conclusions merely repeat results.	Conclusions are linked to the research questions, but not all questions are addressed. Some conclusions are not substantiated by results or merely repeat results.	Most conclusions well-linked to research questions and substantiated by results. Conclusions are mostly formulated clearly but with some vagueness in wording.	Clear link between research questions and conclusions. All conclusions substantiated by results. Conclusions are formulated exact.	Clear link between research questions and conclusions. Conclusions substantiated by results. Conclusions are formulated exact and concise. Conclusions are grouped/ordered in a logical way.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
	No recommendations given.	Recommendations are absent or trivial.	Some recommendations are given, but the link of those to the conclusions is not always clear.	Recommendations are well-linked to the conclusions.	Recommendations are to-the-point, well-linked to the conclusions and original.	Recommendations are to-the-point, well-linked to the conclusions, original and are extensive enough to serve as project description for a new thesis project.
2.6. Writing skills	Thesis is badly structured. In many cases information appears in wrong locations. Level of detail is inappropriate throughout.	Main structure incorrect in some places, and placement of material in different chapters illogical in many places. Level of detail varies widely (information missing, or irrelevant information given).	Main structure is correct, but lower level hierarchy of sections is not logical in places. Some sections have overlapping functions leading to ambiguity in placement of information. Level of detail varies widely (information missing, or irrelevant information given).	Main structure correct, but placement of material in different chapters illogical in places. Level of detail inappropriate in a number of places (irrelevant information given).	Most sections have a clear and unique function. Hierarchy of sections is mostly correct. Ordering of sections is mostly logical. All information occurs at the correct place, with few exceptions. In most places level of detail is appropriate.	Well-structured: each section has a clear and unique function. Hierarchy of sections is correct. Ordering of sections is logical. All information occurs at the correct place. Level of detail is appropriate throughout.
	Formulations in the text are often incorrect/inexact inhibiting a correct interpretation of the text.	Vagueness and/or inexactness in wording occur regularly and it affects the interpretation of the text.	The text is ambiguous in some places but this does not always inhibit a correct interpretation of the text.	Formulations in text are predominantly clear and exact. Thesis could have been written more concisely.	Formulations in text are clear and exact, as well as concise.	*Textual* quality of thesis (or manuscript in the form of a journal paper) is such that it could be acceptable for a pear-reviewed journal.
3. Colloquium (5%) *						
3.1. Graphical presentation	Presentation has no structure.	Presentation has unclear structure.	Presentation is structured, though the audience gets lost in some places.	Presentation has a clear structure with only few exceptions.	Presentation has a clear structure. Mostly a good separation between the main message and side-steps.	Presentation clearly structured, concise and to-the-point. Good separation between the main message and side-steps.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
	Unclear lay-out. Unbalanced use of text, graphs, tables or graphics throughout. Too small font size, too many or too few slides.	Lay-out in many places insufficient: too much text and too few graphics (or graphs, tables) or vice versa.	Quality of the layout of the slides is mixed. Inappropriate use of text, tables, graphs and graphics in some places.	Lay-out is mostly clear, with unbalanced use of text, tables, graphs and graphics in few places only.	Lay-out is clear. Appropriate use of text, tables, graphs and graphics.	Lay-out is functional and clear. Clever use of graphs and graphics.
3.2. Verbal presentation and defense	Spoken in such a way that majority of audience could not follow the presentation.	Presentation is uninspired and/or monotonous and/or student reads from slides: attention of audience not captured	Quality of presentation is mixed: sometimes clear, sometimes hard to follow.	Mostly clearly spoken. Perhaps monotonous in some places.	Clearly spoken.	Relaxed and lively though concentrated presentation. Clearly spoken.
	Level of audience not taken into consideration at all.	Level of audience hardly taken intro consideration.	Presentation not at appropriate level of audience.	Level of presentation mostly targeted at audience.	Level of presentation well-targeted at audience. Student is able to adjust to some extent to signals from audience that certain parts are not understood.	Clear take-home message. Level well-targeted at audience. Student is able to adjust to signals from audience that certain parts are not understood.
	Bad timing (way too short or too long).	Timing not well kept (at most 30% deviation from planned time).	Timing not well kept (at most 20% deviation from planned time).	Timing is OK (at most 10% deviation from planned time).	Timing is OK.	Presentation finished well in time.
	Student is not able to answer questions.	Student is able to answer only the simplest questions	Student answers at least half of the questions appropriately.	Student is able to answer nearly all questions in an appropriate way.	Student is able to answer all questions in an appropriate way, although not to-the-point in some cases.	Student is able to give appropriate, clear and to-the-point answers to all questions.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
4. Examination (5%) *						
4.1. Defense of the thesis	Student is not able to defend/discuss his thesis. He does not master the contents	The student has difficulty to explain the subject matter of the thesis.	Student is able to defend his thesis. He mostly masters the contents of what he wrote, but for a limited number of items he is not able to explain what he did, or why.	Student is able to defend his thesis. He masters the contents of what he wrote, but not beyond that. Is not able to place thesis in scientific or practical context.	Student is able to defend his thesis, including indications where the work could have been done better. Student is able to place thesis in either scientific or practical context.	Student is able to freely discuss the contents of the thesis and to place the thesis in the context of current scientific literature and practical contexts.
4.2. Knowledge of study domain	Student does not master the most basic knowledge (even below the starting level for the thesis).	The student does not understand all of the subject matter discussed in the thesis.	The student understands the subject matter of the thesis on a textbook level.	The student understands the subject matter of the thesis including the literature used in the thesis.	Student is well on top of subjects discussed in thesis: not only does he understand but he is also aware of current discussions in the literature related to the thesis topic.	Student is well on top of subjects discussed in thesis: not only does he understand but he is also aware of discussions in the literature beyond the topic (but related to) of the thesis.