Geo-Information Science

Faculty of Agricultural and Environmental Sciences, Wageningen University

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CONTENTS

This report was finalized on 16 November 2012

Report on the master programme Geo-Information Science of Wageningen University

This report takes the NVAO's Assessment Framework for Limited Programme Assessments as a starting point.

Administrative data regarding the programme

Master programme Geo-Information Science

Name of the programme:	**Geo-Information Science**
CROHO number:	60108
Level of the programme:	master
Orientation of the programme:	academic
Number of credits:	120 EC
Specializations or tracks:	-
Location(s):	Wageningen
Mode(s) of study:	full time
Expiration of accreditation:	31-12-2013

The visit of the assessment committee Geo-Information Science to the Faculty of Agricultural and Environmental Sciences of Wageningen University took place on 21 June 2012.

Administrative data regarding the institution

Name of the institution:	Wageningen University
Status of the institution:	publicly funded institution
Result of institutional quality assurance assessment:	positive

Quantitative data regarding the programmes

The required quantitative data regarding the programmes are included in Appendix 5.

Composition of the assessment committee

The committee that assessed the master programme in Geo-Information Science consisted of:

- Prof. F. Zwarts (chair), professor at University of Groningen and professor and manager at University Campus Fryslân;
- Mrs. R.L. Prenen, MSc, independent educational adviser;
- Prof. Jochen Schiewe, professor for Geoinformatics and Geovisualization at HafenCity University Hamburg, Germany;
- Prof. Pierre Defourny; professor in Geomatics, president of the Earth and Life Institute, at Université catholique de Louvain, Belgium;
- Mrs. K. Bak Nielsen, master student in Geography and Mathematics of Roskilde University, Denmark.

The committee was supported by Mrs. M. Maarleveld, MSc, who acted as secretary. Appendix 1 contains the curricula vitae of the members of the committee.

General information regarding Wageningen University

Educational programme assessments in Life Sciences at Wageningen University
A total of 31 educational programmes of Wageningen University which could not be included in a national disciplinary assessment had to be assessed in 2012 in order to apply for reaccreditation. In consultation with QANU, Wageningen University decided to divide the work among fourteen committees in the period between March and July 2012. For each site visit different expert committee members were invited to assess the programmes. In addition to the expert committee members, two non-expert committee members were involved as core members in all site visits and programme assessments. These non-expert committee members were the chairman, Prof. F. Zwarts, and the educational expert, Mrs. R.L. Prenen, MSc. This construction was chosen to guarantee consistency between the fourteen assessments as well as to respect the diversity between the programmes. Prior to the site visits an extended kick-off meeting was held in February 2012, during which topics applicable to all programmes were discussed (for the programme, see Appendix 6). In addition to the core members of the committee, an expert member (Prof. E. Van Damme), a student member (Mrs. T.I.E. Veldkamp, BSc) and both secretaries to the committees (Dr M.J.V. Van Bogaert and Mrs. M. Maarleveld, MSc) were present. During the kick-off meeting, interviews were held with representatives of the Education Institute, Programmme Committees, study advisers, Examining Boards and alumni. The findings of the kick-off meeting were used as input for the fourteen site visits and are incorporated in the committee reports on the 31 educational programmes. Based on the information received in the first five site visits, the core committee members held another interview with the Examining Boards and a selection of study advisers. This meeting was held on 6 June 2012 and provided additional insight into the functioning of and relation between the Examining Boards and study advisers.

Wageningen University
Wageningen University is comprised of one faculty, the Faculty of Agricultural and Environmental Sciences. The Faculty consists of 80 chair groups, arranged in five departments. All educational programmes, bachelor and master, are organized by the Education Institute (OWI). The Board of the OWI is responsible for the content, quality and finances of the educational programmes. Every programme has a programme director and a Programme Committee, consisting of equal numbers of students and academic staff. The Programme Committee is responsible for the content and quality of the programme, though in a formal sense this is subject to approval by the Board of the OWI. The programme director is responsible for the realization of the programme.

The courses are provided by staff of the chair groups, the 'supply side'. The Programme Committees are considered the 'demand side', with the programme director being the 'matchmaker'.

Wageningen has four Examining Boards, usually consisting of five to eight people from different disciplines. Before the site visit period, these boards were in the process of strengthening the quality management of assessment processes and procedures.
Each programme has one or more study advisers, who are tasked with supporting students throughout their study career. Study advisers provide information and invite students for

progress evaluations and meetings to plan the student's individual curriculum. Each student needs the study adviser's approval for the elective parts of the programme s/he has chosen.

Internationalization
Wageningen University has an international reputation, in terms of both research qualities and the number of international master students. The committee especially considered the latter point since there are both possible drawbacks and advantages to having many international students. Extensive discussions during the site visits made it clear to the committee that despite the fact that it will always be difficult to assess the quality of enrolling international students, the programme managements are well aware of the imperfections of its procedures and have tightened the selection in the past few years. Overall the committee thinks that the advantages of having many international students outweigh the disadvantages.

Working method of the assessment committee

Preparation
After receiving the critical reflection, the project manager checked the quality and completeness of the information provided. After approval, the critical reflection was forwarded to the committee, in both printed form and digitally. In addition, the committee members selected and read a total of 15 theses for each programme that was assessed (see Appendix 7).

Before the site visit the project manager created a draft programme for the interviews (see Appendix 6). The draft programme was discussed with the chair of the committee and the coordinator of the educational institute. As requested by QANU, the coordinators of the programmes carefully composed a select and representative panel for all interviews.

Site visit
During the initial meeting at the start of each site visit, the committee members discussed among themselves their findings regarding the critical reflection and the theses. They also discussed their task and working methods and the proposed domain-specific requirements (see Appendix 2).

During the site visit, interviews were held with representatives of the programme, students, staff members, the Educational Committee, and a study advisor. The Examining Boards were interviewed in the extended kick-off meeting, as can be read on page 6. The committee also received additional information, for example, study books and reports from the meetings of the Educational Committee. This information was examined during the site visit. When considered necessary, committee members could read additional theses during the site visit. A consultation hour was scheduled to give students and staff of the programmes the opportunity to talk to the committee. No requests were received for the consultation hour.

The committee used part of the site visit to discuss the assessment of the programmes and to prepare a preliminary presentation of the findings. The site visit concluded with an oral presentation by the chairman of the general assessment and several specific findings and impressions of the programme.

Report
After the site visit the project manager wrote a draft report based on the committee's findings. The draft was first commented upon by the committee members and then sent to

the faculty to check for factual irregularities. All comments made by the faculty were discussed with the chair of the committee and, if necessary, with the other committee members. After revision, the report became official.

Decision rules
In accordance with the NVAO's Assessment Framework for Limited Programme Assessments (as of 22 November 2011), the committee used the following definitions for the assessment of each individual programme, both of the standards and the total programme.

Generic quality
The quality that can reasonably be expected in an international perspective from a higher education bachelor's or master's programme.

Unsatisfactory
The programme does not meet the current generic quality standards and shows serious shortcomings in several areas.

Satisfactory
The programme meets the current generic quality standards and shows an acceptable level across its entire spectrum.

Good
The programme systematically surpasses the current generic quality standards across its entire spectrum.

Excellent
The programme systematically well surpasses the current generic quality standards across its entire spectrum and is regarded as an (inter)national example.

Summary judgement

This report provides the findings and considerations of the Life Sciences committee on the master programme in Geo-Information Science at Wageningen University. The assessment is based on information provided in the critical reflection, interviews held during the site visit and a selection of theses.

Standard 1: Intended learning outcomes
Geo-information systems and remote sensing deal with capturing, storing, analysing, presenting and exchanging geo-data through the use of computer technology. The master programme in Geo-Information Science educates the next generation of researchers and academic professionals in that domain. The international requirements of the professional field and discipline are met. The focus is on the integrated use of earth observation techniques (Remote Sensing) and Geographic Information Systems (GIS) for problem-solving within the environmental disciplines. The committee feels it has a unique profile and objective, but the programme has difficulty expressing this explicitly in the documentation. To 'brand' the programme more actively, the committee believes a well-defined objective and profile form the starting point. The intended learning outcomes are at the master level and represent an academic orientation.

Standard 2: Teaching-learning environment
Overall the committee believes the teaching-learning environment enables students to achieve the intended learning outcomes very well. The main challenge for this programme is the balance between accommodating the diversity in backgrounds of the students who enter the programme and offering a coherent curriculum within the broad domain of Geo-Information Science. The committee is of the opinion that this is a difficult task which the programme handles well. Different teaching methods are used in the programme, with an emphasis on practical work. The study load is reasonable, the programme has a good staff, and the student support is well organized.

Standard 3: Assessment and achieved learning outcomes
The committee is very positive with regard to the initiatives the Examining Boards of Wageningen University are currently implementing in its programmes. The Examining Boards are in the process of strengthening their role in ensuring the quality of assessment and are committed to formalizing the assessment system. The programme is on schedule to implement the new initiatives. The use of course guides makes the assessment procedures very clear and transparent, and they are very useful to the students. The committee especially values the use of the rubric for the master thesis.

The matrix in the critical reflection, which shows the balance between the assessment methods on the course level and on the programme level, was designated as a best practice by the committee. The assessment strategies of the different courses are good, and all intended learning outcomes are assessed properly. The quality of the theses is very good, and the process of assessing the quality of the thesis is strengthened by involving a 3rd assessor. The success rates are reasonably high. Graduates of the master programme are well prepared for jobs in research and in the professional field.

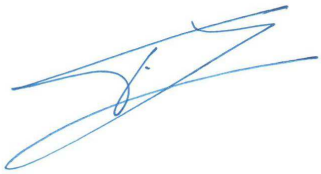
The committee is of the opinion that with the current pressure on graduating in time in the Netherlands, the large number of possible resits at Wageningen University is outdated. If students don't feel the need to pass an exam, they might not take it seriously. This is likely to lead to study delays.

The committee assesses the standards from the Assessment Framework for Limited Programme Assessments in the following way:

Standard 1: Intended learning outcomes	satisfactory
Standard 2: Teaching-learning environment	good
Standard 3: Assessment and achieved learning outcomes	good
General conclusion	good

The chair and the secretary of the committee hereby declare that all members of the committee have studied this report and that they agree with the judgements laid down in the report. They confirm that the assessment has been conducted in accordance with the demands relating to independence.

Date: 16 November 2012



Prof. F. Zwarts

M. Maarleveld, MSc

Description of the standards from the Assessment framework for limited programme assessments

Standard 1: Intended learning outcomes

The intended learning outcomes of the programme have been concretised with regard to content, level and orientation; they meet international requirements.

Explanation:
As for level and orientation (bachelor's or master's; professional or academic), the intended learning outcomes fit into the Dutch qualifications framework. In addition, they tie in with the international perspective of the requirements currently set by the professional field and the discipline with regard to the contents of the programme.

1.1 Findings

In this standard the committee assesses the programme's objectives and profile, intended learning outcomes, level and orientation. It also describes the requirements of the professional field and discipline.

Programme objective and profile

Geo-information systems and remote sensing deal with capturing, storing, analysing, presenting and exchanging geo-data through the use of computer technology. The master programme in Geo-Information Science educates the next generation of researchers and academic professionals in this challenging domain. They are taught to investigate specific geo-information topics, integrate and apply data, and create solutions for geo-spatial problems in the Agricultural and Environmental sciences in their current societal context.

The programme offers a unique mix of Geo-Information Science methods, technologies and applications. The focus on the integrated use of earth observation techniques (remote sensing) and Geographic Information Systems (GIS) for problem-solving within the environmental disciplines is a special asset of the Wageningen approach. The programme aims to have an outstanding international reputation. Students are encouraged to develop a critical and independent attitude towards science and the development of scientific ideas. Important aspects of the courses are their scientific approach and strong link to current societal problems regarding environmental issues for instance climate change, impact on natural resources and biodiversity, and land use and landscape transition challenges. The shift from a technical to a sociotechnical approach is part of the programme's profile. After completing the programme, students have acquired competences which are relevant for careers in performing fundamental research, developing and prototyping geo-information system solutions, advisory and consultancy tasks, managing applied research projects and transferring geo-information knowledge.

At first, the committee doubted whether the name reflects the programme in the best way possible, but it concluded that Geo-Information Science is the proper term used internationally and emphasising it will set the standard for programmes in this domain. The programme is unique in the Netherlands. During the site visit, the move from a technological to sociotechnical approach was discussed. The Wageningen approach is to use remote sensing and GIS to solve environmental problems. The committee understands the importance of societal aspects and agrees they should be addressed in the programme, but the students' background is generally in the environmental sciences. The committee recommends keeping a clear focus on the environmental sciences because they are at the heart of the programme. The committee is of the opinion that the profile and scope are clear, but not very well

documented. The interviews during the site visit helped to produce a better view of the specifics of this programme. The programme indicated it is thinking about implementing more active branding. The committee advises to make the objectives more explicit in the documentation, as a first step toward active branding.

Intended learning outcomes
An overview of the intended learning outcomes is given in Appendix 3. Intended learning outcomes 1-4 concern the domains of Geo-Information Science and Remote Sensing, the scientific research in these domains is represented by outcomes 5-7, and the generic academic skills and attitudes are reflected in outcomes 8-12. The committee is of the opinion that the intended learning outcomes are well written, they represent the academic orientation at the master level and also prepare students for jobs in the domain of Geo-Information Science.

Level and orientation
The programme has an academic orientation. According to the critical reflection, the international and multi-disciplinary setting, including options for close cooperation with researchers, offers students an excellent opportunity to improve the competences that enable them to function at an academic level in a professional world. Students learn how to use and evaluate state-of-the-art research methods and acquire the ability to conduct analysis and simulation-oriented (research) projects, including the acquisition and processing of (geo-)data without supervision. The committee confirmed that the intended learning outcomes correspond to the Dublin descriptors for master programmes. The committee agrees that students obtain knowledge, understanding, skills and attitude at an advanced level.

Requirements of the professional field and discipline
The requirements of the professional field and discipline have been laid down in the subject-specific reference framework (see Appendix 2). The External Advisory Committee (EAC), consisting of external professionals in the field of Geo-Information Science, concluded that the intended learning outcomes are very applicable to a range of jobs. The committee was somewhat surprised to hear from the students that employers generally know what to expect of a graduate from this programme. This indicates that the profile is clear enough for the professional field.

According to the critical reflection, the learning outcomes address all categories defined by the 2006 agenda of the US university consortium for geographic information science. The categories *Analytical methods* and *Geospatial data*, including the special emphasis on *Remote Sensing*, form the programme's core. The categories *Data manipulation*, *GIS&T and society* and *Organizational and institutional aspects* can be taken as electives. The learning outcomes highlight the trends from practice to theory and from spatial data structuring to meaningful spatial data integration. For remote sensing, the programme also covers the trends of spectro-directional research, applications for societal benefits and use of ground-based observations like LIDAR (Light Detection and Ranging).

1.2 Considerations
After some initial discussion, the committee concluded that Geo-Information Science is the appropriate name for this programme. It believes the intended learning outcomes are good and represent the academic orientation at the master level. It has established that the programme meets the international requirements of the professional field and discipline.

The committee believes the master programme in Geo-Information Science is a unique programme in the Netherlands, and has great potential. The committee recommends keeping a clear focus on the environmental sciences, because they are at the heart of the programme.

Although students indicated that employers know what to expect of a graduate from this programme, the programme is thinking about implementing more active branding. During the site visit interviews, the committee learned that the programme management has very clear views on the programme; this can and should be translated in the documents that form the basis of the programme. Therefore, the committee suggests the first step towards active branding is to start with writing down the profile and objective more clearly.

1.3 Conclusion

According to the committee, Standard 1 has the potential to be 'good'. At the moment, the committee believes the profile could be sharpened and this should be documented carefully. Therefore the committee assesses Standard 1 as 'satisfactory'.

Master programme Geo-Information Science: the committee assesses Standard 1 as **satisfactory**.

Standard 2: Teaching-learning environment

The curriculum, staff and programme-specific services and facilities enable the incoming students to achieve the intended learning outcomes.

Explanation:
The contents and structure of the curriculum enable the students admitted to achieve the intended learning outcomes. The quality of the staff and of the programme-specific services and facilities is essential to that end. Curriculum, staff, services and facilities constitute a coherent teaching-learning environment for the students.

2.1 Findings

Curriculum and coherency of the programme

The academic year of Wageningen University consists of two semesters, each with 3 periods. In periods 1, 2 and 5 (six weeks each) two courses are taught, one in the morning and one in the afternoon. Periods 3 and 4 are short periods with 4 weeks of teaching and only one course each. Period 6 lasts nine weeks. Each year students can take one exam and two resits for each course. Currently, this system is being reviewed, concerning the number of resits and the timing of the exams.

The curriculum consists of a two-year programme (120 credits) that offers a range of courses enabling students to achieve the desired learning outcomes. Appendix 4 presents an overview of the curriculum. It is closely related to the research themes of the Geo-Information Science and Remote Sensing Chair Groups. The programme is thesis-oriented with individual research projects (thesis, academic internship) at its core.

The first year gives students the opportunity to find their personal interest, based on a solid fundamental level of knowledge and skills. Students need to give direction to and take responsibility for their own learning process within the framework of the programme. In the first and second period, students harmonize their domain-specific knowledge and skills with basic- and intermediate-level courses. These courses are: *Introduction to Geo-Information Science*, *Research Methods in Environmental Science, Remote Sensing* and *Geo-Information tools*. The introduction course is compulsory in some bachelor programmes, and the two latter courses are also part of the new bachelor GIS minor. This means that some of the students have already participated in these courses when they enter the master programme. They can choose other courses. Students can select free choice options (from the RO2 list of courses) along with the compulsory *Modular Skills Training* modules in all periods. In this way the programme accommodates students with different backgrounds.

In the third, fourth and fifth period, students have to select at least two advanced courses among *Spatial modelling and statistics, Spatial data infrastructure, Advanced earth observation* and *Advanced GIS for Earth and the environment*. The management team stated during the site visit interview that 100% of the students chose 3 out of 4 courses, and about 40% chose all four courses in their curriculum. Finally, in the sixth period of the first year, all students follow the compulsory *Remote sensing and GIS integration* course.

From the interviews held during the site visit, the committee learned that extra advanced courses were developed at the students' request by the Programme Committee. The integrating course (*Remote Sensing and GIS Integration*) is similar to the Academic Consultancy Training (ACT) course offered across the university, but tailored for students in the master programme in Geo-Information Science. It was explained that before the programme incorporated advanced courses in the curriculum, an additional course was needed to offer

students extra domain-specific knowledge and skills for a better understanding of the domain, and students had asked for more integration. The student population in the master programme is already diverse, and diversity is one of the advantages of the regular ACT course for many students from other programmes. Thus, it was decided to integrate GI knowledge and make a domain-specific ACT course in which students learn to think about the application of GI knowledge. Students integrate knowledge and practice academic consultancy skills in project groups. Topics are provided by different institutions, companies and organisations, and they often concern new developments in GIS and remote sensing. The committee likes the integration course very much and believes that it adds value to the curriculum.

The second year is fully dedicated to individual work: the compulsory thesis and the academic internship. Students who opt for a PhD study and those with work experience may exchange the internship for a second thesis. To guarantee an optimal level of supervision, thesis research subjects should preferably be related to the Chair Group's research programmes.

Overall, the committee thinks the programme is well-structured, but its coherence is challenged by the large number of electives. Offering many electives is a good solution to accommodate the different backgrounds of the students, however. From the critical reflection and the interviews, it became clear that the study adviser has a major regulatory role in the selection of courses. The study adviser and student discuss the students' wishes and possible plans. The study adviser might ask feedback from one of the chair holders prior to advising the student's request of electives. If a request deviates from the standard, the study adviser will assess the programme for coherency, and the Examining Board has to approve it explicitly. The study adviser plays an important role in ensuring coherent programmes for all students.

When reviewing the curriculum, the committee noted a few, minor aspects were missing, like programming skills and database management. Students and lecturers the committee talked to during the site visit explained that the basics of programming and database management are addressed, but they are scattered throughout the programme. In addition, in the restricted optional part, students can choose to specialize in them. The committee understands that in the broad field of Geo-Information Science, choices have to be made about what topics to address, especially in the approach that has been chosen: solving environmental problems, with an integrated use of earth observation techniques and GIS. The committee believes the curriculum is well designed to achieve the intended learning outcomes. For further improvement, the committee suggests a coherent path in programming or geo-database management for those students who are interested in it.

Multidisciplinarity

Wageningen University aims to offer programmes with a multidisciplinary and holistic approach. This is meant to stimulate students to develop a broad view and a wide range of interests. Most of the courses are attended by students from different programmes, creating a setting that favours multidisciplinary education. This could also lead to a possible friction between breadth and depth. The committee assessed whether students receive a multidisciplinary programme with sufficient depth, making them experts in a specific discipline.

Intended learning outcome 9 states that after successful completion of the programme, students are able to function effectively in international multidisciplinary teams. This is mainly addressed in the integration course, *Remote Sensing and GIS Integration*, which focuses on the

correct use of GIS and remote sensing concepts, methods and data within a multidisciplinary group.

The balance between breadth and depth is a relevant theme in this programme, for two reasons. First, the field of Geo-Information Science is very broad; it is related to a lot of disciplines. Choices have to be made about what to offer in the programme. Looking at the intended learning outcomes, the committee believes the programme has chosen its topics well. The second reason is the diverse backgrounds of the students; to accommodate differences in knowledge, skills and experience, the programme has to offer a broad range of courses. The structure of the programme helps to accomplish this. Students can choose from a wide range of restricted electives in addition to the fundamental courses in the first two semesters that get all students on the same level and the advanced courses in the second half of the first year. The students the committee talked to during the site visit indicated that lecturers manage to differentiate between students with different backgrounds within courses. The committee established that breadth and depth are balanced in the curriculum, but there is a potential threat of insufficient depth for students who may lack knowledge at the start of the programme. This should be constantly monitored.

Teaching methods
Wageningen University strives to train its students to become academics with domain knowledge, a multidisciplinary attitude, interested in problem-solving, and an international orientation with a multicultural attitude. The programmes therefore work with small, diverse student groups to stimulate the interaction between students and lecturers. A variety of didactic and learning methods are offered, including lectures, tutorials, group work, practical training, excursion and individual papers. According to the critical reflection, the teaching methods prepare graduates to work in multidisciplinary teams as well as individually, and often in a global context.

The teaching method 'practical' dominates the first year (54% of total average contact hours). Lecturing accounts for 22% of the contact hours, tutorials for 10%, fieldwork for 6%, and group work for 8%. The strong emphasis on practical work is a typical requirement of the domain of Geo-Information Science. The committee believes the programme has a nicely balanced range of teaching methods.

Improvements to the curriculum
The individual Programme Committees are responsible for improving the curricula, although occasionally improvements are introduced for all programmes jointly. One example is the introduction of the scheduling of electives in one semester, including minors.

Ideas for improvement usually come from online course evaluations. Detailed results are reported to the lecturers and Programme Committees. Summaries of the results are published on the intranet. In addition to the course evaluations, there are master graduate evaluations, career surveys among alumni, and the Education Monitor.

The Programme Committees regularly discuss the outcomes of the evaluations and take action when considered necessary. In addition to the online evaluations, many programmes hold panel meetings with students to obtain oral feedback on the courses and the programmes. Since many of the programmes are small and the attitude between students and lecturers is informal, many issues are often dealt with informally rather than in a formal procedure.

Several changes have been made that favour the development of the more instrumental approach into a more scientific approach (from practice to theory). The curriculum has additional advanced courses, and several basic courses are no longer compulsory, like *Introduction to Geo-information Science*, *Geo-information Tools* and *Remote Sensing* (since 2009-2010). Currently, the introduction course is compulsory in some bachelor programmes. The other two courses are part of the GIS for Environment and Society minor. This set-up supports the intended entrance level of the programme. The committee believes these changes have improved the programme. Furthermore, improvements have been made with regard to the transparency of assessments, the link to previously offered knowledge, more individual assessments, more extensive teaching methods that support independent study, acceptable workload, quality of written material and more options for practising concepts. This shows that the programme is continuously improving.

Staff

Wageningen University staff generally teach in several programmes, making it difficult to provide exact student-staff ratios. The estimated student-staff ratio of the master programme in Geo-Information Science is 6.55; this reflects frequent interaction between staff and students. PhD candidates and/or student assistants under the supervision of staff help to manage the practical work.

The current teaching staff has a broad diversity of backgrounds in environmental sciences, ranging from soil sciences to landscape planning, and from applied mathematics to didactics. The majority of the staff works at the Geo-Information Science and Remote Sensing (GRS) Chair Groups.

Staff members are required to be both an expert in their discipline and a skilful lecturer. This combination allows them to make use of new scientific insights in their teaching. Most lecturers hold a PhD degree. The quality of the staff is very good.

Wageningen University introduced the University Teaching Qualification (Basis Kwalificatie Onderwijs, BKO) for new permanent staff and staff on tenured track positions. Quality of teaching is evaluated after each course, which also evaluates the course content, position of the course in the curriculum, presentation and examinations. Results of these evaluations form the input for the annual performance and development interviews of staff members. Tailor-made training courses are provided by the Educational Staff Development unit for those interested, or as a result of the course evaluation. The committee greatly values the attention paid to the pedagogical and didactic skills of the lecturers.

Programme-specific services and student support

Wageningen University has chosen to centralize all teaching facilities like lecture rooms, labs, rooms for group work and the university library on the new campus. The main education building is the Forum. The Orion education building is under construction and will add to the existing facilities in 2013. Education in the Social Sciences is concentrated in the Leeuwenborch building. Most chair groups are – or will be – located on the campus. The Gaia building is the workplace for most students and staff in the master programme in Geo-Information Science. This location promotes the interaction between students as well as with university scientists, technical staff (including Geodesk) and researchers from Alterra. The students the committee talked to confirmed this. They indicated that they like the close interaction with staff.

The critical reflection documented that the technical staff is key to preparing fieldwork and developing applications. They support the use of RTK-GPS, LBS facilities (smart phones and apps on Android and Windows mobile OS), map tables, total station, terrestrial Lidar (Leica) equipment, spectrometer and goniometer laboratory, and the sensorweb network and related software. Geodesk offers student access to campus licenses for ESRI, ENVI and ERDAS products, the support of dedicated scripting and the use of licensed geo-data like the data of National Dutch Ordnance survey (Topografische Dienst) and other national and international geo-data-providing organisations. Two rooms for practical work and one for master thesis projects (each with 15 desks with workstations) are available in the Gaia building. The committee believes the programme has good programme-specific facilities. It recognises the importance of the Gaia building for the teaching-learning environment.

Although differences exist between programmes, all Wageningen programmes provide a lot of freedom for the individual student, making the programmes student-centred. The chair groups and their research strongly influence the courses offered, making the programmes also course-oriented. This makes the position of the study adviser crucial and demands certain qualities of him/her. The committee thinks that the study adviser should be a member of the academic staff to be able to support students in their choice for certain courses. Regarding this master programme, the study adviser is a staff member of the Geo-Information Science and Remote Sensing Chair Group. From the interviews held during the site visit, the committee learned that the study adviser plays an important role in the programme and students value it very much.

During the introduction days, students are informed about the details of the programme and other kinds of study-related issues. Before the start of the first period, all students make an appointment with the study adviser to plan their individual programme, which finally results in a study contract. The study contract must be approved by the Examining Board. Three-quarters of way through the first year, a second individual consultation moment is scheduled with the study adviser, in which students discuss their personal research focus. This discussion leads to options for a thesis and academic internship. Contacts take place by e-mail and individual meetings at the request of the student or study adviser.

The critical reflection states that 45% of the first-year students meet their study adviser more than twice. Students are very satisfied with the information given and the coaching by the study adviser. There is no specific programme-oriented study organization. The students are mainly members of the study association Pyrus, an organization for students in the fields of soil, water, atmosphere, climate and GIS.

Student intake, study load

The general admission requirements of master students are published on the internet, including detailed information on admission procedures. These requirements include a relevant bachelor degree, a grade point average of 70%, fluency in English, good skills in mathematics and statistics, and fundamental computer skills. Master students are admitted following approval by the Admission Committee. In total, there are four Admission Committees, reflecting the four domains. These Admission Committees consist of the relevant Programme Directors, supported by central staff. The four Admission Committees participate in the joint Admission Policy Committee. In total, approximately 5,600 applications are handled each year.

About 20 students start the programme each year. According to the critical reflection, more active branding of the programme is necessary to ensure sufficient enrolment. The

programme especially aims to recruit students with a background in agricultural and environmental sciences. However, students with a background in social sciences or computer sciences with a basic understanding of geo-information and remote sensing items are both welcome and admissible. There has been a recent increase in students with a geo-computation background looking for typical Wageningen applications. Since 2010-2011 the bachelor minor *Geo-Information for Environment and Society* and the compulsory bachelor course *Introduction in Geo-Information Science* ensure the required entrance level. The combination of fundamental courses and restricted optionals in the first two semesters help to differentiate between students with different backgrounds. The committee believes the programme accommodates students with different backgrounds very well.

Between 2005 and 2010, international students were in the majority. Over 145 students from 38 different nationalities started the programme; the remaining 44% were Dutch. Of the international students, 25% came from other European countries, and 31% came from outside Europe. Some students make use of the NUFFIC Netherlands Fellowship Programmes (NFP) (around 5 per year), but the majority of international students pay for themselves or find other scholarships. There is a large discrepancy between the number of registered students (116 since 2006) and the original number of accepted applicants (982 since 2006), primarily caused by a lack of financial support for potential students. Approximately 30% of the currently registered students are female.

The programme has been designed so that the total study load of 120 credits is evenly distributed over two years (1680 hours/year). According to the critical reflection, students and alumni think the study load of the programme is reasonable. The students the committee talked to indicated that the programme is quite intensive, but not excessively so.

2.2 Considerations

The committee has studied the various aspects of the teaching and learning environment of the master programme Geo-Information Science. Overall, the committee believes the teaching-learning environment enables students to achieve the intended learning outcomes very well.

The main challenge of this programme is the balance between accommodating the diversity in backgrounds of the students who enter the programme and offering a coherent curriculum within the broad domain of Geo-Information Science. The committee is of the opinion that this is a difficult task which the programme handles well. Students come from different bachelor programmes and from different countries. The basic courses get all students to the desired level, the advanced restricted electives ensure the master level of the programme, and the free choice options offer students the possibility to broaden their knowledge. This way the programme accommodates for students with different backgrounds very well. The committee especially likes the *Remote sensing and GIS integration* course as it promotes the integration of domain-specific knowledge and skills. The committee believes that this structure enables the programme to rise to this challenge.

The programme aims to focus not only on the Geo-Information Science discipline, but also on using it to solve environmental problems. The committee understands that this requires making choices in what content to offer. Overall, it believes the programme has chosen well. A minor remark was made about paying more attention to knowledge and skills in programming or geo-database management. In the opinion of the committee, this is an important part of Geo-Information Science, but it is a bit scattered over the programme. The

suggestion was made to introduce a coherent path in programming or geo-database management for those students who are interested in it.

Different teaching methods are used in the programme, but there is an emphasis on practical work. This is a typical requirement of the domain of Geo-Information Science. Students appreciate the close interaction with lectures. The favourable student staff ratio makes this possible. Students experience a reasonable study load. The programme has good staff, and it has a broad diversity of backgrounds in several disciplines. The committee appreciates the attention paid to the pedagogical and didactic skills of the lecturers.

All Wageningen programmes provide a lot of freedom for the individual student, making the programmes student-centred. The chair groups and their research strongly influence the courses offered, making the programmes also course-oriented. This makes the position of the study adviser crucial and demands certain qualities of him/her. The committee thinks that the study adviser should be a member of the academic staff to be able to support students in their choice for certain courses. The student support is well organized.

Wageningen University has an international reputation, in terms of both high-quality research and the number of international master students. The committee especially considered the latter point since there are also potential drawbacks as well as advantages to having many international students.

2.3 Conclusion

Master programme Geo-Information Science: the committee assesses Standard 2 as **good**.

Standard 3: Assessment and achieved learning outcomes

The programme has an adequate assessment system in place and demonstrates that the intended learning outcomes are achieved.

Explanation:
The level achieved is demonstrated by interim and final tests, final projects and the performance of graduates in actual practice or in post-graduate programmes. The tests and assessments are valid, reliable and transparent to the students.

3.1 Findings

Assessment system

For each course the lecturers have to formulate five to eight intended learning outcomes, which are published in the Study Handbook and course guides. The course guide is obligatory for each course and explains what a course is about, how it is organized, and how students are expected to participate. Part of the course guide covers the assessment strategy, for which requirements have recently been introduced. The assessment strategy clarifies how and when a learning outcome is assessed, who is involved in assessing students, and how the final mark will be determined. It also shows the transparency and validity of the assessment. To enhance the reliability of the assessment, examiners need to explain which elements in the student's answers lead to a certain mark. For multiple choice questions this is embodied in the answer key, and for open answer questions this is shown by model answers, assessment criteria or rubrics (for an example, see Appendix 9). The previous practice was similar to the new theory, but had a less formalized manner. Currently, all Wageningen programmes are in the transition phase from the previous practice to the new situation.

According to the critical reflection, the assessment strategy depends strongly on the intended learning outcomes of the course. In general, the basic courses include closed book written assessments to test the simpler learning objectives, as defined in the *Taxonomy for Learning, Teaching and Assessing*. Options to train for these assessments are included in the course material. Complex learning objectives are evaluated by open book assessments, practical assignments, projects and/or reviews. The more advanced learning outcomes require students to write reviews, papers and scientific reports. The committee was very impressed to find not only an overview showing in what courses the different intended learning outcomes are addressed, but also an overview of the assessment methods used. The matrix showed that a balanced mix of assessment methods is employed, and all intended learning outcomes are assessed properly. The matrix was designated by the committee as a best practice, as it reveals the balance between the assessments methods on both the course and programme level.

With the changes in the Higher Education and Research Act, the position of the Examining Boards has changed. They are currently in the process of strengthening their role in assuring the quality assessment, both via interim course exams and the evaluation of internships and theses. The new role of the Examining Boards has two elements. The first is that each examiner will be made explicitly responsible for ensuring that an assessment of a course is valid, reliable and transparent. This was made a regular part of the University Teaching Qualification. Wageningen University produced documents to help examiners and lecturers achieve this, and meetings between the Examining Boards and examiners were held in the spring of 2011. The second element is that the Examining Boards will visit chair groups on a regular basis to verify the quality of assessment of courses provided by the groups. Additional visits will take place when required, for example when indicated by the results of course evaluations.

The committee learned during the site visit that students can do many resits for each course if they don't pass the first time. Each year three exam possibilities are offered for each course and students can retake the exam as often as needed to pass.

Quality and assessment of the thesis work
For master programmes, the thesis, internship and the (domain specific) Academic Consultancy Training (ACT) form important parts of the programme. There is an extensive assessment format for the ACT to evaluate each student's individual contribution to the final product and collaborative process. It aims at securing grading reliability across the large number of teams participating each year. For the internship an assessment form is used which is common to all programmes. An external and an internal supervisor are appointed for the internship: the external supervisor advises on the quality of the student's performance, the internal supervisor grades the internship. For the thesis a university-wide assessment form has been designed, with which research competences, quality of the thesis report, the colloquium and the final oral examination are assessed. The final mark weights are 45%, 45%, 5% and 5%, respectively. These criteria are communicated to students at the start of their thesis project and agreed in the thesis contract. Recently, a rubric was developed for each component of the assessment form to describe the relation between the level of performance and the grades. The rubric can be found in Appendix 9.

Prior to the site visit, the committee members received a total of 15 recent theses, selected from a list in the critical reflection of all theses completed during the last two years. The selection was done by the secretary on behalf of the chairman of the committee. When selecting the theses, the grading and the graduation date were considered. The student numbers of the selected theses are provided in Appendix 7. For all theses the committee read the thesis report.

The thesis is assessed in three stages:

- a Go/No-Go advice on the thesis proposal 3-4 weeks after the start of the thesis;
- a mid-term presentation halfway through the scheduled period;
- the overall thesis assessment at the end.

The Go/No-Go advice is given by the examiners or their representatives. A thesis examination committee assesses the overall thesis work quality. This committee consists of at least three people: an assessor, the supervisor and the examiner. The assessor is an invited third person who is well acquainted with the topic of the thesis. The committee appreciates the fact that a third assessor is invited to assess the theses.

The committee is of the opinion that the master theses are of very good quality; they are well-written and have a good structure; it was impressed by them. The three stages lead to well written theses and scientific papers. Since 2008, 33 scientific papers have been co-authored by students, two students have won scientific prizes (URISA 2010 best student research paper; nominated AGILE 2010 best paper), and five students have graduated with distinction. This shows that the quality of the theses is beyond any doubt. The committee also agreed with the grades awarded.

Success rates and performance of graduates
The critical reflection provides an overview of the success rates (see Appendix 5). The programme's target is that approximately 90% of the students complete their programme

within three years. Since 2004 the programme has on average realized this target, which is in line with the success rates of other master programmes at Wageningen University. According to the critical reflection, students are generally extremely motivated and have carefully thought about starting their programme, which could explain the reasonably high success rate.

According to the critical reflection, the professional field states that there is a high demand for Geo-Information Science graduates. At the end of their study, most students easily find a job. Since 2008, 20% of the graduates continued with a PhD project. Of the students who finished the programme in the 2005-2010 period, 138 are registered in the KLV Alumni Society data archive. Of this group, three graduates have already finished a PhD project. Graduates whose employer is known work mainly for organizations related to research and commercial activities. Some 35% of the graduates do research-oriented work at universities and research institutes, while 60% perform research and development-oriented work for consultancy firms, governmental and non-governmental organizations. The committee established that the programme prepares students well for both research and the professional field.

3.2 Considerations

The committee is very positive with regard to the initiatives Wageningen University is currently implementing in the bachelor and master programmes. The Examining Boards are in the process of strengthening their role in ensuring the quality of assessment and are committed to formalizing the assessment system. The committee agrees that having only four Examining Boards is stimulating the consistency and equality of the procedures. However, these four Examining Boards are responsible for a total of 49 programmes. The committee was worried that the limited number of Examining Boards could lead to a certain distance from the programmes, making it difficult for them to really be in control at the programme level. During the two meetings with representatives of the Examining Boards and their secretaries it became clear to the committee that they are in control. The secretaries of the four committees have a key role in the communication between programme management and Examining Board. Each programme at Wageningen University standardized the filling in of free choice credits.

The programme is on schedule to implement the new initiatives. The use of course guides makes the assessment procedures very clear and transparent, and they are very useful to the students. The committee especially values the use of the rubric for the master thesis.

The committee was very enthusiastic about the matrix in the critical reflection, which showed the balance between the assessment methods on both the course and programme level. Therefore, it was designated by the committee as a best practice. The assessment strategies of the different courses are good, and all intended learning outcomes are assessed properly.

The committee enjoyed reading the theses and believes their quality is beyond any doubt, and it agreed with the grades awarded. It appreciates the fact that a third assessor is invited to assess the theses. The success rates are reasonably high. It is also clear to the committee that graduates of the master programme are well-prepared for jobs in both research and the professional field.

The committee is of the opinion that with the current pressure on graduating in time in the Netherlands, the large number of possible resits at Wageningen University is outdated. If

students don't feel the need to pass an exam, they might not take it seriously. This is likely to lead to study delays.

Conclusion
Master programme Geo-Information Science: the committee assesses Standard 3 as **good**.

General conclusion

Based on the assessments given for the three standards, the committee is of the opinion that this programme more than fulfils the requirements for a master programme. Especially the second and third standards are of high quality. Although Standard 1 is 'satisfactory', the committee would recommend writing down the profile and objective more clearly in order to brand the programme.

Conclusion
The committee assesses the *master programme Geo-Information Science* as **good**.

APPENDICES

Appendix 1: Curricula Vitae of the members of the assessment committee

Prof. Frans Zwarts was Rector Magnificus of the University of Groningen between 2002 and 2011. He studied linguistics at the University of Amsterdam (1967-1973) and at the Massachusetts Institute of Technology (1974), and wrote a doctoral dissertation on Categorial Grammar and Algebraic Semantics (cum laude). He was appointed lecturer at the University of Groningen in 1975 and became Professor of Linguistics in 1987. He was the initiator of the European Summer School in Logic, Language and Information (ESSLLI) in 1989. In 1992, Zwarts was a visiting scholar at UCLA (University of California, Los Angeles). Between 1995 and 2002, he was chair of the Netherlands Steering Committee for Research on Developmental Dyslexia, initiated by the NWO as part of a multidisciplinary national research programme. In 1999, he became academic director of the Graduate School of Behavioural and Cognitive Neurosciences of the University of Groningen. In 2003, he and the Rector Magnificus of Uppsala University established a close partnership between Groningen and Uppsala. This was extended in 2006, when the Universities of Ghent, Göttingen, Groningen, and Uppsala decided to form the U4. In 2011 he was appointed professor and manager to realise the University Campus Fryslân. Zwarts was a member on several NQA assessment committees. He has been a Fellow of the Royal Netherlands Academy of Arts and Sciences (KNAW) since 1999.

Mrs. Renate Prenen, MSc, is educational advisor and independent entrepreneur in educational advice. She studied Applied Educational Sciences at Twente University. She worked at Randstad employment agency as advisor and programme manager. Later, she worked at the Academic Medical Centre (AMC) of the University of Amsterdam, where she was educational advisor for the Board of the AMC. In September 2009 she started as an independent educational advisor. She has been a committee member on other QANU assessment committees.

Prof. Jochen Schiewe is full professor Geoinformatics and Geovisualization at HafenCity University Hamburg, Germany. He studied Surveying Engineering at universities in Hannover (Germany) and Fredericton (Canada). He obtained his PhD ("Dr.-Ing.") at University of Hannover (Germany) with a topic related to photogrammetry/remote sensing, furthermore his habilitation ("venia legend") at University of Vechta (Germany) with a topic related to remote sensing in combination with e-learning. He held temporal professorships ("Vertretungsprofessuren") at universities in Vechta (Germany, 2003) for "GIS and Remote Sensing" and in Bonn (Germany, 2004-2005) for "Cartography". Presently, he is co-ordinator of the annual, German speaking "GIS-Ausbildungstagung", Vice-President of the Society for Geoinformatics (GfGI), and Chair of the Commission "Cartography and Research" of German Cartographic Society (DGfK).

Prof. Pierre Defourny is full professor at Université catholique de Louvain (Belgium) and currently the President of the Earth and Life Institute. At the master level, he is responsible since 1993 for all remote sensing and GIS courses for the curricula of bioengineers, biologists, civil engineers and urban planners. Since 6 years, he also coordinates a continuing education program for professionals. From a research point of view, he leads the Environmetrics and Geomatics research lab (20 researchers) with a special focus on optical and microwave remote sensing methods development for agriculture and forestry monitoring. He also supervised the development in GIS modeling for land use planning applications. More recently, his research activities include land cover mapping at global scale and land cover change detection from local to continental scale. He obtained his Bioengineering degree in 1987 and received a Ph.D. degree in agricultural engineering in 1992, both from the

Université catholique de Louvain. He spent several years in remote sensing research in Africa and South-East Asia, worked at the Asian Institute of Technology for 2 years (1991-1993) and was visiting scientist at the NASA Goddard Space Flight Center in 2005.

Mrs. K. Bak Nielsen, BSc is master student in Geography and Mathematics of Roskilde University, Denmark. Bak Nielsen was involved in a number of study programme reviews in Denmark at four different universities. She furhtermore has international experience with quality assurance from several occasions. As a Geography and Mathematics student she is familiar with the general interdisciplinary approach at Wageningen University.

Appendix 2: Domain-specific framework of reference

Geo-Information Systems and Remote Sensing
Longley et al. (Longley, 2011) state in their textbook "Almost everything that happens, happens somewhere. Knowing where something happens can be critically important". This specific location awareness is the main driver of geo-information systems and remote sensing. Major events that support this driver are technology and society based. Some historic examples may illustrate this: Tournachon's photography of Paris from a balloon (1866), first photographs of the Earth from space by explorer-6 (1959) and the Canadian Geographic Information System developed by Roger Tomlinson (1963).

Geo-information systems and remote sensing deal with capturing, storing, analysing, presenting and exchanging geo-data by the use of computer technology. Geo-data are based on representations of real world phenomena and the basis of geo-information. For that reason geo-data mostly describe the phenomena by geometric attributes (location, direction, size, shape, topology of the phenomena), by thematic attributes (contextual meaning of the phenomena) and by temporal attributes (for example moment in time and duration). For that reason both fields rely on and integrate knowledge from domains like cartography, geodesy, geography and informatics. Remote sensing refers to obtaining information about phenomena at the Earth's surface by using electromagnetic radiation without being in direct contact with the object or area. Generally, remote sensing refers to observing from quite some distance, mainly from airborne or space borne platforms. Electromagnetic (EM) radiation coming from the Earth's surface is being measured and translated into information about the Earth or information on processes related to the Earth.

Geo-Information Science
After a few decades of experiments and applications with these new technologies more fundamental questions in relation to the creation, handling, storage and use of geoinformation have arisen. This shift is very well described in the landmark article of Goodchild (Goodchild, 1992). This article outlines the scope and foundation of a scientific domain that studies these fundamental issues taking into consideration the spatial and temporal scale in relation to the purpose. Since this publication the field of geographical information *systems* has evolved into geographical information *science*: robust scientific disciplines with dedicated international conferences, scientific journals, research agendas and Chair Groups at universities world-wide.

Themes of the research agendas show, considering the nature of geo-information science, a wide range. The 2006 agenda of the US university consortium for geographic information science (UCGIS) mentions 10 different main themes, which can be considered as central in the field of geo-information science in relation to higher education. These themes are:

1. Analytical methods
2. Conceptual foundations
3. Cartography and visualization
4. Design aspects
5. Data modelling
6. Data manipulation
7. Geo-computation
8. Geospatial data
9. GIS and society
10. Organizational and institutional aspects

Each of the themes consists of different sub themes. Some of these themes (2, 3, 4, 6, 9 and 10) have to be related to other scientific fields, the so-called application domains, like agricultural and environmental sciences, social sciences and business sciences.

Trends

Developments in technology, science and society influence the content of themes and specific applications. The following major research trends, which are observed by the Dutch NCG sub commission on Geographical Information Infrastructure (GII, 2010), are considered important:

From practice to theory

The early Geographical Information (GI) research questions were mainly derived from application domains and rather technical in nature, but over the years an own GI body of knowledge starts to develop. Current GI theoretical questions deal with spatial scaling, the spacetime description of spatial phenomena and processes, spatial perception of humans, spatial ontology's, etc.

From GI application to geo-information infrastructure

A few decades ago a GI-application was a combination of data and a software system for the support of a specific question. Since the beginning of this century a world-wide paradigm shift took place. Spatial data are increasingly organized in the form of local, national en international infrastructures (GII) that support many actual and potential applications. This has resulted in GII research which focuses on spatial data and technical interoperability, standards, policy, organization issues, assessment frameworks, etc.

From spatial data structuring to meaningful spatial data integration

Data structures and the efficient algorithms for storing and retrieving data were key research activities in the eighties and the nineties of the previous century. Now the emphasis has shifted towards meaningful exchange and integration of spatial data. The concept of spatial data ontology as a potential solution to this challenge is an emerging research topic world-wide.

From mapping to dynamic real-time spatial data collection and visualization

The 2D static map was and probably still is the dominant way of obtaining and presenting geo-information. Fast developments in sensor technology and visualization techniques induce a shift to dynamic real-time spatial data collection and the direct use of these data in process models and in visualizations. Research on how these new approaches can be used to obtain reliable information on spatial phenomena and how these data can be used by public, governments and business is still in its infancy.

From technological to socio-technical

Originally GI research was quite technical in nature, however with the strong diffusion of the GI technology in society it is also becoming a research area for policy-, organization- and law researchers. Also the functioning of the GI setting within a society has become a research topic. From a mainly technical research field it has developed into a socio-technical research field. Appropriate scientific methods still need to be developed and tested.

From a few application areas to many disciplines in society

One of the major developments the last 20 years is probably the strong increase in disciplines where GI is used. The classical domains for GI are agriculture, spatial planning, environment, land registration and transportation. Now, GI has found its way into almost all disciplines in

our society, ranging from history to medicine and banking and tourism. This has resulted is a strong demand for "with GI" research. A key question is how GI concepts and technologies can be beneficial to the discipline.

Remote Sensing

Developments in remote sensing are partly parallel to those mentioned by the Dutch NCG sub-commission on Geographical Information Infrastructure. Additionally the following trends are considered of great interest (Battrick, 2006).

From multispectral to spectro-directional research

A clear trend can be seen from multispectral to spectrodirectional research for land applications (Schaepman, 2004). The latter is defined as the simultaneous acquisition of spatially co-registered images in many, spectrally contiguous bands at various observation angles from a remotely operated platform. Focus is not only on fundamental, quantitative research (for example related to the carbon cycle and agricultural production), but also on products, applications, observation systems and their technology (e.g. so-called sensor webs).

Towards global context and societal benefits

The remote sensing field has been evolving towards stimulating societal interactions (Herold, 2011). An example is the monitoring of deforestation. The negotiations of the post-Kyoto climate agreement emphasize on the increasing role of developing countries in reducing carbon emissions from deforestation and forest degradation (REDD). While international and national REDD policies and ways to compensate developing countries for their efforts are taking shape, the need for robust and transparent monitoring, reporting and verification is essential. Developing countries, international donors supporting REDD activities, local implementers and NGO's, and the interested public in general are putting high expectations to satellite monitoring.

Including ground-based observations in a remote sensing systems approach

Traditionally land remote sensing has been involved in deriving information on soil and vegetation, whereby scaling issues from the leaf to the global level play a crucial role. The information derived from remote sensing observations becomes really useful once it has been enhanced with observations from the ground (Herold, 2011). As an example, the use of a terrestrial LIDAR has proven to be a comprehensive ground data reference source for remote sensing analysis.

References

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Wageningen University, 2004. *UCGIS* http://www.ucgis.org/Default.asp

Appendix 3: Intended learning outcomes

		After successful completion of the programme the students are expected to be able to:	Dublin Descriptors				
			Have knowledge and understanding	Apply knowledge and understanding	Making judgements	Communication	Learning skills
Domain specific knowledge and understanding and applying that knowledge and understanding	1	Explain the basic theories, concepts and methods in the field of geo-information science and remote sensing	X				
	2	Apply geo-information science and remote sensing tools for the acquisition, storage, analysis, visualisation and dissemination of spatial data		X			
	3	Investigate the usability of geo-information in spatial problems		X			
	4	Create geo-information solutions for spatial problems in an application domain		X	X		
Scientific learning outcomes (research)	5	Analyse concepts, approaches and methods and reflect upon scientific literature, with special reference to the field of geo-information science and remote sensing		X	X		
	6	Design a research plan in the field of geo-information science and remote sensing and critically reflect (under supervision) on the phases of a scientific research process		X	X		
	7	Carry out a research in the field of geo-information science and remote sensing by using adequate methods and techniques to collect and interpret data		X	X		
General academic learning	8	Communicate clearly – both orally and in writing – to present the outcomes of their research and design projects and discuss these results with specialists and non-specialists				X	
	9	Function effectively in international multidisciplinary teams		X			
	10	Respond to social, organizational, scientific and ethical issues that are encountered in the field of geo-information science and remote sensing			X		
	11	Reflect critically on their performance and results, as well as on those of colleagues			X		
	12	Design and plan their own learning processes in the domain of geo-information science and remote sensing based on experiences from working in this domain					X

Appendix 4: Overview of the curriculum

Course	Name	Credits
	Compulsory (CS)	
GRS-60312	Remote Sensing and GIS integration	12
YMC-60303	Modular Skills Training	3
GRS-80436	Thesis	36
	Restricted optionals 3 (RO3)	
GRS-70424	Academic Internship	24
GRS-80424	Thesis	24
	Basics (RO0)	
YRM-20306	Research methods in Environmental Science	6
GRS-10306	Introduction Geo-Information Science	6
GRS-20306	Remote Sensing	6
GRS-20806	Geo-Information Tools	6
	Restricted optionals 1 (RO1)	
GRS-30306	Spatial modelling and statistics	6
GRS-32306	Advanced Earth observation	6
GRS-32806	Spatial data infrastructure	6
GRS-33306	Advanced GIS for Earth and Environment	6
	Free choice options (RO2)	
INF-22306	Programming in Python	6
INF-21306	Data management	6
INF-31806	Models for Ecological systems	6
LAD-30306	Inventory techniques for geosciences	6
ESA-20806	Principles of Environmental Sciences	6
ESS-21306	Principles of Earth and Ecosystems Science	6
ENR-21306	Environmental Economics for Environmental Sciences	6
MST-21306	Advanced Management and Marketing	6
COM-20306	Communication and policy making	6

Appendix 5: Quantitative data regarding the programme

Data on intake, transfers and graduation

Success rates for the master programme

Cohort	2003	2004	2005	2006	2007	2008	2009	2010
Size at the outset	11	33	29	23	13	22	15	21
Diploma after 2 years (%)	64	76	66	57	69	82		
Diploma after 3 years (%)	82	94	86	87	92			
Diploma after 4 years (%)	82	94	90	94				
Drop-outs 1 October 2011 (%)	*18*	*6*	*10*	*9*	*0*	*5*	*7*	

Teacher-student ratio achieved

For Wageningen University the average student/staff ratio lies between 5.5 and 12.5 for bachelor programmes, and between 5.5 and 10 for master programmes.

For the master programme in Geo-Information Science the student/staff ratio is 6.55.

Average amount of face-to-face instruction per stage of the study programme

Number of programmed contact hours

Year	Contact hours	Contact hours (% of 1680)
M1	886	53%
M2	48	2.4%

Appendix 6: Programme of the site visit

Site visit Geo-Information Science (MGI), 21 June 2012

10.30 – 11.15 **Management (responsible for content of the programme)**
Prof. dr. ir. A.K. (Arnold) Bregt (Chairman Programme Committee MGI)
A. (Anne-Ruth) Sneep (Student Member Programme Committee)
Dr. G.F. (Gerrit) Epema (Programme Director MGI)

11.15 – 11.30 **Break**

11.30 – 12.15 **Students MGI**
A.R. (Anton) Bakker
E.A. (Eskender) Beza
A.P.A. (Arthur) Drost
E. (Eliakim) Hamunyela
G.J.P. (Gijs) van Lith
P.A. (Paula) Nieto
K.M.C. (Kevin) Raaphorst
C. (Cristina) Rosales Sanchez

12.15 – 13.00 **Lecturers MGI**
Prof.dr. M. (Martin) Herold (Chairholder Remote Sensing)
Dr.ir. R.J.A. (Ron) van Lammeren (Lecturer Geo-Information Science and Remote Sensing)
Dr.ir. A. (Arend) Ligtenberg (Lecturer Geo-Information Science and Remote Sensing)
Dr.ir. G.B.M. (Gerard) Heuvelink (Lecturer Land Dynamics)
Dr. H.M. (Harm) Bartholomeus (Lecturer Geo-Information Science and Remote Sensing)
Dr.ir. S. (Sytze) de Bruin (Lecturer Geo-Information Science and Remote Sensing)
Dr.ir. L. (Lammert) Kooistra (Lecturer Geo-Information Science and Remote Sensing)

13.00 – 14.00 **Lunch (Grand Café Forum)**

14.00 – 14.30 **Programme Committee**
Ing. W.T. (Willy) ten Haaf (Member Programme Committee and Study Adviser)
Dr.ir. J.G.P.W. (Jan) Clevers (Member Programme Committee)
T.J. (Tsoefiet) van Beuningen (Student Member Programme Committee)
W.J. (Wiecher) Olthof (Student Member Programme Committee)
C.L. (Charlaine) Vaseur (Student Member Programme Committee)

15.15 – 16.00 **Final meeting with management (final responsibility for programme)**
Prof. dr. ir. A.K. (Arnold) Bregt (Chairman Programme Committee MGI)
A. (Anne-Ruth) Sneep (Student Member Programme Committee)
Dr. G.F. (Gerrit) Epema (Programme Director MGI)

16.00 – 16.45 **Drafting of preliminary findings by the committee**

16.45 – 17.00 **Presentation of the preliminary findings by committee chair** (open for everybody)

Programme for Kick-off meeting, 21 February: Common part of critical reflections

09.00 – 09.15 **Welcome by the Rector and the Director of the EI**[1]
09.15 – 11.00 **Preparatory meeting of assessment panel**
11.00 – 12.15 **General management programmes**:
P. (Paulien) Poelarends (member, Board of the EI)
R.A. (Rosella) Koning (member, Board of the EI)
Prof. T.W.M. (Thom) Kuyper (member, Board of the EI)
Prof. L.E. (Leontine) Visser (member, Board of the EI)
Prof. E.W. (Pim)Brascamp (Director of the EI)
J.J. (Jan) Steen (Quality assurance and enhancement officer)
12.15 – 12.45 Lunch
12.45 – 13.30 **Study Advisers:**
Dr. A.E.M. (Anja) Janssen (BSc and MSc Food Technology, Food Safety, Food Quality Management)
C.M. (Neeltje) van Hulten (BSc and MSc Agriculture and Bioresource Engineering)
C.Q.J.M. (Stijn) Heukels (BSc and MSc Landscape Architecture and Planning)
W.T. (Willy) ten Haaf (MSc Geo-Information Science)
Dr. W. (Wouter) Hazeleger (MSc Animal Sciences) [not present]
R.N.M. (Gineke) Boven (BSc Management and Consumer Studies)
13.30 – 14.30 **Examining Boards**:
Dr. P.B.M. (Paul) Berentsen (secretary, EB[2] Social Sciences)
Dr. M.C.R. (Maurice) Franssen (secretary, EB Technology and Nutrition)
C.P.G.M. (Lisette) de Groot (chair, EB Technology and Nutrition)
Dr. D. (Dick) van der Hoek (secretary, EB Environment and Landscape)
Dr. K. (Klaas) Swart (secretary, EB Life Sciences)
Prof. W (Willem) Takken (chair, EB Life Sciences)
14.30 – 14.45 Break
14.45 – 15.45 **Lecturers of Programme Committees:**
Dr. A.J.B. (Ton) van Boxtel (Biotechnology and Bioinformatics)
Dr. J. (Jan) den Ouden (Forest and Nature Conservation)
Dr. K.B.M. (Karin) Peters (Leisure, Tourism and Environment)
Dr. W.A.H. (Walter) Rossing (Organic Agriculture)
Dr. R. (Rico) Lie (International Development Studies)
Dr. W.T. (Wilma) Steegenga (Nutrition and Health)
15.45 – 17.15 **Meeting of assessment panel**: evaluation and first findings
17.15 – 18.00 **Graduates**:
Francesco Cecchi, MSc (MSc International Development Studies)
Prof. Charlotte de Fraiture (MSc International Land and Water Management)
Dr. Dinand Ekkel (MSc Animal Sciences)
Loes Mertens (MSc Organic Agriculture)
M. Visser (MSc Forest and Nature Conservation)

[1] EI = Education Institute
[2] EB = Examining Board

Appendix 7: Theses and documents studied by the committee

Prior to the site visit, the committee studied the theses of the students with the following student numbers:

840802435070
870127650080
810911824060
790605724090
850409777100
850629725010
830324352130
851026884110
860327677040
830809576090
800430703020
840604701040
860512280030
850311759050
821124987020

During the site visit, the committee studied the following documents (partly as hard copies, partly via the institute's electronic learning environment):

- Reports of consultations with relevant committees / organs (Programme Committee and examinations committee, relevant ad-hoc committees);
- Examination tasks with associated evaluation criteria and standard (answer keys) and a representative selection of completed examinations (presentations, internship and/or research reports, portfolios, etc.) and their evaluations;
- List of required literature;
- Summary and analysis of recent evaluation results and relevant management information;
- Thesis regulations and guidelines for preparing projects;
- Internship regulations/handbooks;
- Course, staff and curriculum evaluations, student satisfaction survey(s), etc.;
- Alumni/exit questionnaires;
- Material about the student associations;
- Documentation on teaching staff satisfaction.

Appendix 8: Declarations of independence

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DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: FRANS ZWARTS

HOME ADDRESS: PETRUS CAMPERSINGEL 253
9713 AP GRONINGEN

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / ~~SECRETARY~~:

LIFE SCIENCES, SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

WAGENINGEN UNIVERSITY

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

1

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nederlands - vlaamse accreditatieorganisatie

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS;

CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO;

HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Nageningen DATE: March 30, 2012

SIGNATURE:

2

Bijlage bij onafhankelijkheidsverklaring

Visitatiebezoek	Opleiding (CROHO-nummer):	Variant:
A. Food Technology	B Levensmiddelentechnologie (BLT; 56973)	Voltijd
	M Food Safety (MFS; 60112)	Voltijd
	M Food Technology (MLT; 66973)	Voltijd
	M Food Quality Management (MQ; 60109)	Voltijd
B. Biotechnology en Bio-Informatics	B Biotechnologie (BBT; 56841)	Voltijd
	M Biotechnology (MBT; 66841)	Voltijd
	M Bioinformatics (MBF; 60106)	Voltijd
C. Agricultural and Bioresource Engineering	B Agrotechnologie (BAT; 56831)	Voltijd
	M Agricultural and Bioresource Engineering (MAB; 66831)	Voltijd
D. Forest and Nature conservation	B Bos- en Natuurbeheer (BBN; 56219)	Voltijd
	M Forest and Nature Conservation (MFN; 66219)	Voltijd
E. International Land and Water Management	B Internationaal Land- en Waterbeheer (BIL; 50100)	Voltijd
	M International Land and Water Management (MIL; 60104)	Voltijd
F. Landscape, Architecture and Planning	B Landschapsarchitectuur en ruim. Planning (BLP; 56848)	Voltijd
	M Landscape, Architecture and Planning (MLP; 66848)	Voltijd
G. Leisure, Tourism and Environment	M Leisure, Tourism and Environment (MLE; 60111)	Voltijd
H. Geo-Information Science	M Geo-Information Science (MGI; 60108)	Voltijd
I. Plant Sciences	B Planterwetenschappen (BPW; 56835)	Voltijd
	M Plant Sciences (MPS; 66835)	Voltijd
	M Organic Agriculture (MOA; 69300)	Voltijd
	M Plant Biotechnology (MPB; 60105)	Voltijd
J. Animal Sciences	B Dierwetenschappen (BDW; 56849)	Voltijd
	M Animal Sciences (MAS; 66849)	Voltijd
K. Climate Studies	M Climate Studies (MCL; 60107)	Voltijd
L. International Development Studies	B Internationale Ontwikkelingsstudies (BIN; 56837)	Voltijd
	M International Development Studies (MID; 66837)	Voltijd
	M Development and Rural Innovation (MDR; 60103)	Voltijd
M. Management, Economics and Consumer Studies	B Bedrijfs- en Consumentenwetenschappen (BBC; 56836)	Voltijd
	M Management, Economics and Consumer Studies (MME; 66836)	Voltijd
N. Nutrition and Health	B Voeding en Gezondheid (BVG; 56868)	Voltijd
	M Nutrition and Health (MNH; 66868)	Voltijd

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DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: RENATE PRENEN

HOME ADDRESS: Simon Stevinweg 21
1401 TB Bussum

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / ~~SECRETARY~~:

LIFE SCIENCES - SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

WAGENINGEN UNIVERSITY

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

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CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO;

HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Wageningen DATE: 29-03-'12

SIGNATURE:

Bijlage bij onafhankelijkheidsverklaring

Visitatiebezoek	Opleiding (CROHO-nummer):	Variant:
A. Food Technology	B Levensmiddelentechnologie (BLT; 56973)	Voltijd
	M Food Safety (MFS; 60112)	Voltijd
	M Food Technology (MLT; 66973)	Voltijd
	M Food Quality Management (MQ; 60109)	Voltijd
B. Biotechnology en Bio-Informatics	B Biotechnologie (BBT; 56841)	Voltijd
	M Biotechnology (MBT; 66841)	Voltijd
	M Bioinformatics (MBF; 60106)	Voltijd
C. Agricultural and Bioresource Engineering	B Agrotechnologie (BAT; 56831)	Voltijd
	M Agricultural and Bioresource Engineering (MAB; 66831)	Voltijd
D. Forest and Nature conservation	B Bos- en Natuurbeheer (BBN; 56219)	Voltijd
	M Forest and Nature Conservation (MFN; 66219)	Voltijd
E. International Land and Water Management	B Internationaal Land- en Waterbeheer (BIL; 50100)	Voltijd
	M International Land and Water Management (MIL; 60104)	Voltijd
F. Landscape, Architecture and Planning	B Landschapsarchitectuur en ruim. Planning (BLP; 56848)	Voltijd
	M Landscape, Architecture and Planning (MLP; 66848)	Voltijd
G. Leisure, Tourism and Environment	M Leisure, Tourism and Environment (MLE; 60111)	Voltijd
H. Geo-Information Science	M Geo-Information Science (MGI; 60108)	Voltijd
I. Plant Sciences	B Plantenwetenschappen (BPW; 56835)	Voltijd
	M Plant Sciences (MPS; 66835)	Voltijd
	M Organic Agriculture (MOA; 69300)	Voltijd
	M Plant Biotechnology (MPB; 60106)	Voltijd
J. Animal Sciences	B Dierwetenschappen (BDW: 56849)	Voltijd
	M Animal Sciences (MAS; 66849)	Voltijd
K. Climate Studies	M Climate Studies (MCL; 60107)	Voltijd
L. International Development Studies	B Internationale Ontwikkelingsstudies (BIN; 56837)	Voltijd
	M International Development Studies (MID; 66837)	Voltijd
	M Development and Rural Innovation (MDR; 60103)	Voltijd
M. Management, Economics and Consumer Studies	B Bedrijfs- en Consumentenwetenschappen (BBC; 56836)	Voltijd
	M Management, Economics and Consumer Studies (MME; 66836)	Voltijd
N. Nutrition and Health	B Voeding en Gezondheid (BVG; 56868)	Voltijd
	M Nutrition and Health (MNH; 66868)	Voltijd

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DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: Prof.Dr. Jochen Schiewe

HOME ADDRESS:

Fuhlentwiete 40
21423 Winsen
Germany

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / SECRETARY:

M.Sc. GI Science

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

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HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS;

CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO;

HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Winsen DATE: 09.11.11

SIGNATURE: Jochen Schiewe

nvao

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: Pierre Defourny

HOME ADDRESS:
COUAS D'ORVAL 18
1348 LOUVAIN-LA-NEUVE
BELGIUM

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / ~~SECRETARY~~

Life Sciences - Geo-Information science

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

Wageningen University

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

1

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HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS;

CERTIFIES TO OBSERVING STRICT CONFIDENTIALITY WITH REGARD TO ALL THAT HAS COME AND WILL COME TO HIS/HER NOTICE IN CONNECTION WITH THE ASSESSMENT, INSOFAR AS SUCH CONFIDENTIALITY CAN REASONABLY BE CLAIMED BY THE PROGRAMME, THE INSTITUTION OR NVAO;

HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Louvain-le-Neuve DATE: 20 June 2012

SIGNATURE:

2

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DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: Kristine Bak Nielsen

HOME ADDRESS: Bregnerødgade 21, 3. tv.
DK-2200 Copenhagen N.
Denmark

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN EXPERT / ~~SECRETARY:~~

Life Sciences - Geo Information Science

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

Wageningen University

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

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nederlands - vlaamse accreditatieorganisatie

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HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: Wageningen DATE: 20/6 - 2012

SIGNATURE: [signature]

2

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nederlands - vlaamse accreditatieorganisatie

DECLARATION OF INDEPENDENCE AND CONFIDENTIALITY

TO BE SUBMITTED PRIOR TO THE ASSESSMENT OF THE PROGRAMME

THE UNDERSIGNED

NAME: MARIOUS MAARLEVELD

HOME ADDRESS: BMC
Smalle pad 34
3811 MG AMERSFOORT

HAS BEEN ASKED TO ASSESS THE FOLLOWING PROGRAMME AS AN ~~EXPERT~~ / SECRETARY:

SEE ATTACHMENT

APPLICATION SUBMITTED BY THE FOLLOWING INSTITUTION:

WAGENINGEN UNIVERSITY

HEREBY CERTIFIES TO NOT MAINTAINING ANY (FAMILY) CONNECTIONS OR TIES OF A PERSONAL NATURE OR AS A RESEARCHER / TEACHER, PROFESSIONAL OR CONSULTANT WITH THE ABOVE INSTITUTION, WHICH COULD AFFECT A FULLY INDEPENDENT JUDGEMENT REGARDING THE QUALITY OF THE PROGRAMME IN EITHER A POSITIVE OR A NEGATIVE SENSE;

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nederlands - vlaamse accreditatieorganisatie

HEREBY CERTIFIES TO NOT HAVING MAINTAINED SUCH CONNECTIONS OR TIES WITH THE INSTITUTION DURING THE PAST FIVE YEARS;

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HEREBY CERTIFIES TO BEING ACQUAINTED WITH THE NVAO CODE OF CONDUCT.

PLACE: WAGENINGEN DATE: 29 - 03 - 2012

SIGNATURE: [signature]

2

Bijlage bij onafhankelijkheidsverklaring

Visitatiebezoek	Opleiding (CROHO-nummer):	Variant:
A. Food Technology	B Levensmiddelentechnologie (BLT; 56973)	Voltijd
	M Food Safety (MFS; 60112)	Voltijd
	M Food Technology (MLT; 66973)	Voltijd
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	M Biotechnology (MBT; 66841)	Voltijd
	M Bioinformatics (MBF; 60106)	Voltijd
C. Agricultural and Bioresource Engineering	B Agrotechnologie (BAT; 56831)	Voltijd
	M Agricultural and Bioresource Engineering (MAB; 66831)	Voltijd
D. Forest and Nature conservation	B Bos- en Natuurbeheer (BBN; 56219)	Voltijd
	M Forest and Nature Conservation (MFN; 66219)	Voltijd
E. International Land and Water Management	B Internationaal Land- en Waterbeheer (BIL; 50100)	Voltijd
	M International Land and Water Management (MIL; 60104)	Voltijd
F. Landscape, Architecture and Planning	B Landschapsarchitectuur en ruim. Planning (BLP; 56848)	Voltijd
	M Landscape, Architecture and Planning (MLP; 66848)	Voltijd
G. Leisure, Tourism and Environment	M Leisure, Tourism and Environment (MLE; 60111)	Voltijd
H. Geo-Information Science	M Geo-Information Science (MGI; 60108)	Voltijd
I. Plant Sciences	B Plantenwetenschappen (BPW; 56835)	Voltijd
	M Plant Sciences (MPS; 66835)	Voltijd
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J. Animal Sciences	B Dierwetenschappen (BDW; 56849)	Voltijd
	M Animal Sciences (MAS; 66849)	Voltijd
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	M International Development Studies (MID; 66837)	Voltijd
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M. Management, Economics and Consumer Studies	B Bedrijfs- en Consumentenwetenschappen (BBC; 56836)	Voltijd
	M Management, Economics and Consumer Studies (MME; 66836)	Voltijd
N. Nutrition and Health	B Voeding en Gezondheid (BVG; 56868)	Voltijd
	M Nutrition and Health (MNH; 66868)	Voltijd

Appendix 9: Rubric for the assessment of a MSc-thesis

Author: Arnold F. Moene, Meteorology and Air Quality Group, Wageningen University
Version: 1.1 (December 15, 2010)
This document is released under the Creative Commons Attribution-Noncommercial-Share Alike 3.0 Netherlands License

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
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 is motivated and/or overcomes an occasional setback on his own and considers the work as his "own" project.	The student is very motivated, goes at length to get the most out of the project. Takes complete control of his own project. Considers setbacks as an extra motivation.
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 his own creative ideas on hypothesis formulation, design or data processing.	Innovative research methods and/or data-analysis methods developed. Possibly the scientific problem has been formulated by the student.
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 plans and performs tasks mostly independently, asks for help from the supervisor when needed.	Student plans and performs tasks independently and organizes his sources of help independently.
	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 actively performs critical self-reflection on some aspects of his functioning	Student actively performs critical self-reflection on various aspects of his own functioning and performance.
1.4. Efficiency in working with data Note: depending on the characteristics of the thesis work, not all three aspects	**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.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
(experimental work, data analysis and model development) may be relevant and some may be omitted	**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.
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.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
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.
	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.
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.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
	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.
	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.

Item	Mark for item					
	2-3	**4-5**	**6**	**7**	**8**	**9-10**
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.
	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 verse.	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.

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).