

## International Land & Water Management M1 at Wageningen University

In the study track at Wageningen University of the MSc programme international land and water management (MIL) you will have to follow 4 courses compulsory for all MIL students and 1 specialisation course. In addition you need to choose at least one more optional specialisation course. More information about these courses can be found below.

### Compulsory courses

#### **Sustainable Watershed Management (LDD 30306) period 1 afternoon**

6 credits (ECTS)

	Contact hours
Classroom Lectures	24
Practical Training Extensive	34
Practical Training Intensive	23
Excursion (one day)	5

#### **Contact person(s)** dr S Visser

	dr ir MJPM Riksen
Lecturer(s)	dr ir GJA Veldwisch
	ir B Bruins
	dr S Visser
	dr ir MJPM Riksen
	dr ir EJJ van Slobbe
Examiner(s)	ir B Bruins
	dr S Visser
	prof. dr WP Cofino

#### **Contents:**

This course deals with problems related to watersheds from temperate and tropical zones as the spatial units for land and water management. Typically the upstream part of a watershed is used for rainfed agriculture, while in the downstream part both rainfed and irrigated agriculture is found. Erosion in the upstream part will influence the water quality and quantity, which may have a negative impact on crop production in the up- and the downstream parts. Well known problems are sedimentation in reservoirs for power generation, reduction of soil fertility, flooding in urban areas, reduced water quality for irrigation, and degradation of ecosystems. In river basins these watersheds are combined and integrated with multiple-use of land and water resources by agriculture, industry and urban activities.

Land use planning and water management at the watershed and river basin level require a thorough understanding of the relations between upstream and downstream parts. During the lectures of this course the following topics will be dealt with: river basin and watershed hydrology, sectoral and/or competing water uses, land use planning, stakeholder participation, and integrated policy making processes. Three watersheds/river basins are selected in which these topics are applied by students in order to prepare a management plan, in which different policy options are presented. Finally the management plan is tested with different context scenarios and the plan is presented for debate.

**Learning outcomes:**

After this course the student is expected to be able to:

- comprehend the physical, biological and environmental aspects and their interrelations within a watershed; - choose and apply available system tools for system intervention;
- comprehend the participatory decision making processes;
- comprehend the interdependencies between natural resources and management at different locations in land and water management;
- formulate a vision and design a sustainable watershed management plan that shows an integrated approach towards multiple use of land- and water resources and social equity and economic viability;
- work in multidisciplinary and multicultural groups (with respect for different views, expertise and culture);
- reflect on own contribution to group work and on group processes;
- prepare and deliver an oral presentation with the use of power point.

**Activities:**

- to attend lectures and study lecture notes;
- to participate in a case study during which an integrated watershed management plan is developed;
- to prepare interim and final presentations of the developed management plan;
- to participate in group reflection sessions;
- to write a group report on the management plan.

**Examination:**

- written examination (40% but > 5.5)
- group report (will be approved through specified requirements) (40% but > 5.5);
- individual reflection report (20% but > 5.5).

**Literature:**

A course reader will be available at the WUR shop

## Research Approaches in Land and Water Management (IWE 32306) period 4 afternoon

### Contact hours

Classroom Lectures	24
Problem Oriented Education	5
Tutorials/Instruction	17
Individual Paper	1

### Contact person(s) dr ir JA Bolding

Lecturer(s)	dr ir JA Bolding dr SD Keesstra dr ir M Zwartveen dr ir EJJ van Slobbe
Examiner(s)	prof. dr LF Vincent prof. dr ir L Stroosnijder

### Contents:

The course Research Approaches in International Land and Water Management prepares students to do their own thesis research by helping them appreciate that all knowledge is 'theory-laden' and that 'a problem' can be approached from different perspectives. In particular, the course explores the role and importance of theory in international land and water management research, and helps students develop their own thesis research proposal. A central premise of the course is that all land and water management knowledge is sociotechnical (or socionatural), which is why the question of how to integrate natural science with social science approaches and the different ways of doing this (multi/inter/trans-disciplinarity) receives much attention.

The course is complementary to courses that focus on research methodologies and designing a research project. It is based on the important insight that one's choice of data collection plans and research methodologies is intrinsically interwoven with (1) the objectives and goals of the research and (2) the way in which one makes sense of, and indeed conceptualizes, land and water management realities.

The course is broadly divided in three blocks:

- 1) Science, knowledge and (inter)disciplinarity in ILWM research;
- 2) Overview of different conceptual approaches used by chair groups in the MIL programme; and
- 3) Performing a research: the link between conceptual framework and research methodology. During the course, students are expected to develop the outline of their own thesis research. It is therefore highly recommended that students have already defined (even if only in general terms) their research topic at the start of the course. In weeks 2, 4 and 6 each student will submit an individual assignment covering his/her science perception, conceptual framework, and methodological approach, respectively. In the final week of the course students will give each other feed-back on the thesis proposal outline developed.

### Learning outcomes:

On completion of the course the student is expected to:

- have gained an understanding of the relationship between theory and research in international land and water management;
- appreciate the differences between positivist and constructivist research paradigms and the difficulties of designing and implementing multi/inter/trans-disciplinary research in international land and water management;
- have further developed the academic skill to translate land and water development, design and management issues into research topics that are conceptually grounded
- understand the linkages between research object, purpose and method.

### Activities:

The course consists of lectures, self-study, plenary and group discussions. During the

lectures academic staff and guest speakers clarify the various topics and literature is discussed. Each block is concluded with an individual essay (i.e. in weeks 2, 4 & 6 of the course). The last week is devoted to individual presentations of draft research proposals.

**Examination:**

Students will be assessed on the basis of:

- 3 assignments to be handed-in in weeks 2, 4 and 6 (20% each);
- 1 presentation, in week 6 (20%);
- their participation in class (20%).

**Literature:**

The course reader will be made available at the beginning of the course.

## **Sustainable Land and Water Management (IWE 33306 (Spain)), Period 5, second half**

### **Contact hours**

Tutorials/Instruction	17
Practical Training Outside	126
Self Study	

### **Contact person(s)** ing. H Boesveld

Lecturer(s)	dr ir RA Boelens dr ir J de Graaff ing. H Boesveld PD Peters dr KM Seeger dr ir A Kessler
Examiner(s)	prof. dr ir L Stroosnijder prof. dr LF Vincent

### **Contents:**

This course consists of two parts: One week lectures and workgroups in Wageningen and a three weeks practical in Spain.

Preparation week Wageningen: In the introductory week in Wageningen, attention will be paid to the specific land and water management problems in different watersheds in Valencia, Spain. Lectures and literature will focus on the technical and socio-organizational dimensions of land and water management, and place problems in the framework of the institutional and policy environment. In small groups, students will select a case study and elaborate a proposal for practical and research activities. A range of case studies will be offered in the field of Water management, Land management and Integrated Land and Water management.

**Practical in Spain:** Next, students will participate in a three weeks practical in Spain. During the first week, excursions and field visits will clarify the specific land and water problems in the area, students get an overview of the different land and water management systems in the area, and exercises will be done related to a number of important field research methods. In small groups, students will continue to work on their research plan. During the following two weeks, the students will focus on their specialization and work on the analysis and design of irrigation systems, soil and water conservation measures or water and land management policies. In the last week, the workgroups will elaborate their research findings in the form of research report and discuss their conclusions with the staff and other workgroups.

Students have to pay a contribution to the travel, boarding and lodging costs.

### **Learning outcomes:**

This course is an integrating element in the MSc study International Land and Water Management, in which the theoretical concepts learned in earlier courses are further elaborated, integrated and applied in practice. After concluding this course, students are able to:

- integrate and use knowledge from different disciplines to analyze a land and water management problem and set up, present and execute a research plan on the issue;
- understand the relations between soil, water, land use and land management within the agro-ecological, socio-economic and political environment;
- understand and describe the physical and socio-economic effects of land and water management interventions within a watershed, at various management levels;
- design land and water measures or design management and organizational concepts and assess the performance of existing land and water infrastructure and management forms;
- present their field research conclusions in a coherent manner.

### **Activities:**

- to attend lectures;

- to prepare a short research plan about land and water management and policies in Spain;
- to participate in excursions;
- to realize several important land and water management field research methods;
- to carry out research concerning the effects of different land and water use systems;
- to present conclusions coherently.

**Examination:**

Examination will be based on the quality of the practical reporting, participation during the practical and the presentations.

**Literature:**

- practical manual;
- additional articles and papers.

## **Modular skills training (YMC 60303 (MOS)) all periods**

3 credits (ECTS) (YMC – 60306 6 credits variant optional)

Contact person(s): see the various contact persons for each module.

Lecturer(s): Staff of various chairgroups

Examiner: Prof dr M Mulder

### **Mandatory knowledge:**

Competences acquired during Bachelor programme.

### **General description:**

The modular skills training teaches skills that are necessary for graduates to function in jobs at MSc level. In consultation with the MSc study advisor an assessment is made on which skills (competences) are already mastered and which are necessary to develop (more). Based on this, the student selects a number of modules to a total of 3 or 6 credit points.

It is important for students in the programmes mentioned above to reach an agreement with their study adviser about which modules to follow, at a very early stage of your MSc study. Once you both agreed on which modules to take, you should register as soon as possible at CSA online. More information can also be found on the website: [www.mos.wur.nl](http://www.mos.wur.nl)

In the MOS set up we make a distinction between three categories of modules  
1) the first category consists of refresher modules to meet the competences, required at WU – BSc graduation and 2) academic skills at master level. A third category is added that includes modules offering additional skills training, useful for your professional careers.

More information on each of the modules can be found below. (Between brackets is the abbreviation of the responsible chair group and course-code)

### **The first category modules:**

Skills Assessment (ECS-65000) (meeting, presentation, argumentation, reflection and writing skills)	1,5 erts
Computer Literacy (INF-65000)	1,5 erts
Information Literacy (ECS-65100)	1,5 erts
Basic presentation skills (ECS-65200)	1,5 erts

These modules should be followed as early in the academic year as possible.

### **The second category modules:**

Advanced Presentation Skills (ECS-65700)	1,5 erts
Negotiation Skills (ECS-65300)	1,5 erts
Intercultural Communication Skills (ECS-65400)	1,5 erts
Argumentation Skills (ECS-65500)	1,5 erts
Observation Techniques (YRM-65000)	1,5 erts
Professional Ethics (APP-65000)	1,5 erts
Introduction Philosophy of Science (APP-65100)	1,5 erts
Scientific Writing Skills (ECS-65600)	1,5 erts
Project Planning and Organising (INF-65100)	1,5 erts
Interviewing Techniques (YRM-65100)	1,5 erts
Questionnaire Construction (YRM-65300)	1,5 erts

### **The third category modules:**

Intuitive Intelligence (ECS-65800)	1,5 erts
Career Development & Planning (ECS-65900)	1,5 erts
Train the trainer (ECS-66000)	1,5 erts
Entrepreneurial skills (ECS-66100)	1,5 erts
Consultancy skills (ECS-66200)	1,5 erts
Management skills (ECS-66300)	1,5 erts

As a general rule, as MSc student you should at MSc-graduation master 100% of the category 1 skills. From the category 2 skills, relevant modules are selected in consultation with the study advisers and for instance depending on thesis and or internship requirements.

Skills modules from category 3 can be chosen in line with your personal wishes and professional development plans.

**Registration:**

You have to register for the individual modules (thus not for YMC 60303) through SSC online, similarly as you register for other courses. Given the number of students that will enrol, it is advised to register well ahead as soon as you reach an agreement with your study adviser.

**Scheduling:**

For the scheduling and timetables of the modules please check the scheduling page on this MOS website [www.mos.wur.nl](http://www.mos.wur.nl)

**Grades:**

Your results of the modules you followed will be available through CSA online. If you take the 3 ects Modular skills course, you need to have finalized successfully two modules from the list above. For individual modules you can receive marks but no credits are shown at csa.wur.nl. However, for the whole MOS course you will receive a definite pass, once you have passed the examination of each of the two modules.

## Specialisation A : Land Degradation and Development

Courses in the specialisation Land Degradation and Development, next to the courses from the common part:

Compulsory course:

**- Physical aspects of Land Management**

Choose at least 1 course from the list below (Restricted Optional):

**- Remote sensing**

**- Impact Assessment of Land and Water Management**

**- Erosion Processes and Modelling**

### **Physical aspects of Land Management (LDD 30806), period 1 morning**

#### **Contact hours**

Classroom Lectures	20
Tutorials/Instruction	55

**Contact person(s)** dr KM Seeger

Lecturer(s) PD Peters  
dr S Visser  
dr KM Seeger

Examiner(s) prof. dr ir L Stroosnijder

#### **Contents:**

Approximately 30 % of the earth surface is covered by land, varying from hot deserts to snow-capped mountains and poles. Land combines the natural resources of soil, water and vegetation, which are of crucial importance for food production. The properties of land may be negatively affected by bad land management, often leading to land degradation problems (salinization, erosion, and nutrient depletion) and a reduction in the production potential. To make sure that land remains productive now and in the future, adequate land management is needed.

This course deals with the bio-physical aspects of land and the tools available to analyze land use and management. In the lectures, the following topics related to land management are presented: the concept of 'land management'; physical, chemical and biological aspects of land; soil physics; hydrology; soil fertility; cropping systems; good practices of land management; bad practices of land management; techniques for land management analysis; improving land management.

During practical work land use and management of an area in East Africa is analyzed using GIS and modelling. Solutions to overcome the main problems will be developed and a plan for improved land management will be made.

#### **Learning outcomes:**

After completion of this course the student will:

- have basic knowledge of the physical, chemical and biological aspects of land;
- understand good and bad land management practices;
- be able to work with tools for land management analysis and improvement.

#### **Activities:**

- attendance of lectures;
- studying lecture notes and journal articles;
- practical work with remote sensing, GIS and modelling.

**Examination:**

Written examination.

**Literature:**

Reader based on several book chapters and journal articles.

## **Remote Sensing, (GRS 20306), Period 2, morning**

### **Contact hours**

Classroom Lectures 12  
Practical Training Extensive 76

### **Contact person(s)** dr ir JGPW Clevers

Lecturer(s) dr ir JGPW Clevers  
drs H Bartholomeus  
dr ir L Kooistra  
Examiner(s) dr ir JGPW Clevers

### **Contents:**

This course offers a deepening into the field of remote sensing, starting from the information needs of various land applications. It is directed at providing a basic knowledge of remote sensing concepts and methods (recording techniques in the optical and microwave region, image construction, digital image analysis and pattern recognition, geometric and cartographic aspects and the relationship with GIS) and of the possibilities and limitations of remote sensing from aeroplanes and satellites as a source of information for the inventory, monitoring and policy making in the fields of agriculture, forestry, land use, agrohydrology, nature conservation and environmental control. New developments will be dealt with. Handling remote sensing data yourself is central in this practical course.

### **Learning outcomes:**

At the end of the course, the student is expected to be able to:

- demonstrate understanding of the possibilities of the various remote sensing processing techniques, particularly functionality, advantages and disadvantages
- apply the various digital image processing techniques to remote sensing data
- understand the application possibilities of remote sensing for the inventory, monitoring and policy making in the fields of agriculture, forestry, land use, agrohydrology, nature conservation and environmental control.

### **Activities:**

- acquiring basic knowledge of the main remote sensing concepts and methods in a practical way;
- performing exercises on theoretical aspects of remote sensing, after introductory lectures;
- working with real remote sensing image data;
- working with digital image processing techniques;
- working with a common image processing software tool.

### **Examination:**

The student's final mark will be based on:

- a closed book examination (75%);
- results of a practical exercises (25%).

### **Literature:**

Information guide available.

Lillesand, T.M., R.W. Kiefer & J.W. Chipman, Remote Sensing and Image Interpretation, Wiley, 5th edition (2004) or 6th edition (2008).

## **Impact Assessment of Land and Water Management (LDD 31306), Period 2 afternoon**

### **Contact hours**

Classroom Lectures	24
Practical Training Extensive	51

### **Contact person(s)** dr ir J de Graaff

Lecturer(s)	dr ir J de Graaff dr ir A Kessler
Examiner(s)	dr ir J de Graaff

### **Contents:**

Lectures: A main challenge for land and water management (LWM) interventions in developing countries is how to achieve sustainable impact. This challenge is central in this course. Emphasis is given on the role of stakeholders in LWM and how this affects adoption of conservation practices and final impact. The lectures deal with social, economic and institutional aspects that play a role in project planning, monitoring and evaluation. Methods are discussed to assess physical impact of LWM (e.g. water and nutrient balances), the economic impact (e.g. cost-benefit analysis) and the impact on people. Policies and strategies to enhance the impact of LWM interventions (e.g. participation, incentives, scaling-up) are dealt with in the lectures. Both theoretical insights and practical examples are given.

**Practical sessions:** During eight half-days, attention is paid to planning for and assessing impact from a socio-economic and technical perspective. This concerns a.o. understanding factors affecting adoption, project planning, formal and informal survey methods, the effects of conservation measures on water- and nutrient balances, cost-benefit analysis and multi-criteria analysis for assessment of benefits of land and water management interventions.

### **Learning outcomes:**

At the end of this course, the student will have the knowledge and skills to:

- analyse both the physical effects (soil, water and nutrients) and socio-economic effects of LWM interventions;
- identify and understand the main factors that affect the impact of LWM interventions, both during project planning, implementation and monitoring evaluation;
- understand and explain which strategies and policies are crucial in enhancing the involvement of farmers in LWM and in achieving sustainable final impact;
- apply impact assessment techniques, socio-economic analysis and evaluation methods for the planning, implementation, monitoring and evaluation of LWM interventions;
- prepare budgets, to calculate costs and to estimate the benefits of LWM interventions.

### **Activities:**

- lectures and studying lecture notes and reader;
- practical sessions.

### **Examination:**

Practical reports and written examination.

### **Literature:**

Lecture note / reader available at WUR-Shop, Forum.

## **Erosion Processes and Modelling, (LDD 31806), period 4, morning**

### **Contact hours**

Classroom Lectures	24
Practical Training Extensive	12
Tutorials/Instruction	1

### **Contact person(s)** dr KM Seeger

Lecturer(s)	PD Peters prof. dr C Ritsema dr KM Seeger
Examiner(s)	prof. dr C Ritsema

### **Contents:**

Water and wind erosion are globally the most important soil degradation processes, which may threaten food security for many people. Water erosion is particularly important on sloping lands in semi-arid, humid tropical and temperate areas, while wind erosion is mainly a problem in arid and semi-arid regions. Controlling wind and water erosion requires a thorough understanding of the processes involved and an ability to quantify sediment transport rates. For the latter, more and more use is made of detailed erosion models.

This specialized course deals with several topics relevant to experimental studies of erosion processes, as well as modelling of erosion and sedimentation dynamics. During the lectures the following topics related to wind and water erosion processes are presented: properties of sediment particles and fluids, fluid mechanics, fluid particle interactions, soil crusting, infiltration into crusted soils, overland flow hydrology, soil detachment, sediment transport, and wind erosion processes. Much emphasis is placed on modeling concepts in water erosion. Two types of water erosion models will be presented, and students will make an exercise with the Water Erosion Prediction Project (WEPP) model. Finally, students will work with a rainfall simulator in the laboratory to quantify the water balance and surface erosion from a sandy soil.

### **Learning outcomes:**

After completion of this course the student will:

- have a good understanding of erosion and sedimentation processes;
- have a better insight in erosion modelling concepts and model applications;
- be familiar with scientific journal articles on erosion processes and modelling;
- be able to carry out experimental research on soil erosion processes.

### **Activities:**

- attendance of lectures;
- studying lecture notes and journal articles;
- application of the WEPP erosion model;
- erosion experiment with a rainfall simulator.

### **Examination:**

Written examination and exercises.

Literature:

Reader from book 'Sediment transport and depositional processes' by K. Pye (1994) and additional journal articles on selected topics.

## **Specialisation B : Irrigation and Water Management**

Courses in the specialisation Irrigation and Water Management, next to the courses from the common part:

Compulsory course:

- **Irrigation and Development**

Choose at least 1 course from the list below (Restricted Optional):

- **Irrigation System Design and Operation**
- **Water Systems Design at Catchment Level**
- **Water Institutions, Reform & Equity(WIRE)**
- **Gender & Land and Water Management**
- **Water Delivery**

### **Irrigation and Development (IWE 20806), Period 2, Morning**

#### **Contact hours**

Classroom Lectures 36

Tutorials/Instruction 36

Contact person(s) dr K Wegerich

Lecturer(s) Academic Staff

Examiner(s) prof. dr LF Vincent

#### **Contents:**

The course Irrigation and Development is intended for students planning to do research on the role of irrigation in development. The course serves as an analytical introduction to contemporary irrigation issues and debates, and aims to train students in translating irrigation design and management issues into research topics. An interdisciplinary approach for analysing irrigation water management practices is presented, in which the technical, organizational and political dimensions of irrigation situations are dealt with simultaneously. An important aim of the course is that the participants develop their own vision on the debates pertaining to irrigation and development, by understanding and engaging with the paradigms underlying these debates. To achieve these aims, special attention is given to developing a crucial academic skill, namely analysing scientific texts.

#### **Learning outcomes:**

At the end of the course, the students should be:

- able to explain their position (both verbally and in writing) in different debates on irrigation, development, and water management;
- able to apply the analytical frameworks presented in the course on concrete cases; and
- capable of analyzing and reproducing scientific arguments from scientific texts.

#### **Activities:**

The course consists of lectures, and group discussions and assignments. During the lectures academic staff clarify the various topics. Case studies are presented and discussed. The study materials consist of a reader and lecture handouts. Assignments are discussed in groups of 5 people. The lecturer will give feedback to the discussion group and mark the assignment.

#### **Examination:**

Based on marked assignment.

#### **Literature:**

The course reader is available with the IWE secretariat.

## Irrigation System Design and Operation, (IWE 30206), period 1, morning

### Contact hours

Classroom Lectures	24
Practical Training Extensive	51

**Contact person(s)** ir GH van Vuren

Lecturer(s) ir GH van Vuren

Examiner(s) ir GH van Vuren

### Contents:

#### **Block 1:** General

This course starts with an overview of the different types of irrigation systems and an analysis will be made about why certain types are region specific (colonial history, water availability, climate etc.). A summary will be given of the required knowledge of hydraulic engineering in irrigation design.

#### **Block 2:** Lay-out of irrigation systems

First a logical design procedure will be presented with attention to top-down and bottom-up approaches. Based on topography and water source the lay-out of the system will be developed. Exercises will be carried out to find the features that will determine the lay-out of main and secondary canals and the tertiary units. Water distribution systems like proportional, rotation and on-demand systems will be explained and concepts of 'modern irrigation systems' will be discussed.

#### **Block 3:** Tertiary unit design

The tertiary unit is the level where farmers are receiving water in bulk and will have to distribute it among the farms. The water requirements at field level will determine the required flow. Advantages and disadvantages of water schedules will be analysed. Finally a method will be presented to design an optimal size of the tertiary unit from a farmers perspective (high transparency and logic of distribution).

#### **Block 4:** Operation of systems and special topics

An irrigation system design is based on the period of maximum water requirements. The question is what the behaviour of the system is during periods of reduced flows and how these problems can be tackled. Important in this context is the theory on sensitivity of canal structures and hydraulic flexibility.

The requirements in terms of quantity and level of education of personnel to operate systems depends strongly on the irrigation concept of a particular system; this will be analysed for the most common types of systems.

#### **Block 5:** Design practical

A guided design practical in which the theory will be applied to realise a system design on the base of pre-set operational criteria.

### Learning outcomes:

- understand and recognise the different flow regimes in canal systems;
- know the theory of canal design and operation;
- understand implications of canal infrastructures on operational modalities;
- to apply the theory in a water user perspective;
- design an irrigation system.

### Activities:

Attending the lectures, studying the theory in lecture notes and readers. Design of an irrigation system in a guided practical.

**Examination:**

Design report and written exam.

**Literature:**

Lecture notes.

## Water Systems Design at Catchment Level, (IWE 30306) period 2, afternoon

### Contact hours

Classroom Lectures	24
Literature study	
Tutorials/Instruction	34

### Contact person(s) dr ir P Wester

Lecturer(s)	dr ir FP Huibers dr ir P Wester prof. dr LF Vincent
Examiner(s)	prof. dr LF Vincent

### Contents:

This course focuses on the needs and repercussions of irrigation activities in the context of river basins. Based on a water systems perspective, the course deals with water regulation and allocation at the interface of irrigation and river basin management. The contents can vary from year to year depending on developments in the profession and interests of students. In the coming academic year the following issues will be studied:

- water allocation and river basins: concepts and approaches;
- groundwater assessment and management in a basin context;
- wastewater irrigation: design and governance.

Based on the analysis of these issues, students will reflect and write reports on the design and management of water systems with due attention for the repercussions on wider water management at river basin level.

### Learning outcomes:

After the course the participants are expected to be able to:

- indicate current challenges to irrigation in the context of river basin management;
- analyse the relationship between irrigation activities and river basin management in conditions of water scarcity;
- compare different surface water rights doctrines and water allocation mechanisms;
- describe basic terms and analytical methods relating to aquifer water yields and water quality, and groundwater management and development;
- assess basic design features of wells and pumps, and the operation of groundwater-based irrigation systems;
- understand contemporary frameworks to study change processes and management of groundwater resources;
- understand and participate in the debate on wastewater management; knowing the pros and cons of large scale versus decentralized treatment plants and effects of wastewater return flows on basin efficiencies;
- argue the role of wastewater irrigation as a livelihood approach and the potential of safe and productive wastewater irrigation;
- understand the urban watershed approach, linked to growing cities and the importance of a reverse wastewater design approach;
- argue the importance of wastewater governance and multi-stakeholder platforms; and
- present and defend own ideas and working methods, in writing and in front of audiences.

### Activities:

The course consists of an introduction (3 contact hours) and three blocks of 52 hours each. Each block will consist of a mixture of teaching methods, consisting of lectures (7 contact hours) and guided coursework (17 contact hours). The remaining 29 hours are for reading, assignments and self-study.

**Examination:**

In each block, students will work individually and/or in groups on an assignment / exam that will be graded. Each assignment has to be graded mark 5 or above. The average grade of the three assignments will make up the final grade.

**Literature:**

The course reader will be made available at the beginning of the course.

## **Water Institutions, Reform & Equity (WIRE), (IWE 31306) period 3, afternoon**

### **Contact hours**

Classroom Lectures	24
Project	14
Tutorials/Instruction	17

### **Contact person(s)** dr ir P Wester

Lecturer(s)	dr ir RA Boelens dr ir P Wester dr K Wegerich
Examiner(s)	prof. dr LF Vincent

### **Contents:**

The course focuses on water reforms in the context of Integrated Water Resources Management (IWRM), by addressing the following main topics: 1. water agencies and institutional change, 2. local water management organizations, and 3. the interactive design process in project implementation. Over the past ten years a growing body of experience and knowledge has developed on the institutional and organizational aspects of irrigation, such as the development of water users organization and participatory irrigation management, participatory design of irrigation infrastructure, strengthening and reform of water bureaucracies, irrigation management transfer, irrigation financing and cost-recovery, and wider water sector reform and policy development. This course covers these topics by presenting concepts and methodologies for analysis and interventions in the organisation of 'government agencies' for irrigation as well as 'local level water management organisations'. This is placed in the context of wider developments in the water sector. Attention is also paid to the management of design processes in view of developing organisational capacity of users and agency staff.

### **Learning outcomes:**

After the course the participants are expected to be able to:

- analyse current concepts and methodologies used for reforming water agencies and the water sector;
- apply a method for analysing organizations to water agencies;
- appraise current concepts and methodologies for the improvement of local water management organisations;
- argue the importance of the integration of the irrigation design process in project implementation, and ways to improve the participation of the water users in this process;
- know current concepts and methodologies for integrating gender concerns in the reform of water bureaucracies, institutional design of WUAs and irrigation design processes.

### **Activities:**

Study activities are threefold:

- participants follow in total 13 classes of 4 hours. The first session of the course introduces the themes of the course and the course programme. The three main subjects will each be dealt with in blocks of two weeks, in which four sessions will be dedicated to lectures and presentations. (52 hours);
- as introduction to the classes literature is studied (44 hours);
- small groups of students will work on assignments covering the 3 main subjects. The group assignments are complementary in order to broaden and deepen the collective learning process. Each group will present their work, followed by discussion. (64 hours).

### **Examination:**

A mark is given based on the (group) assignments and participation in discussions.

### **Literature:**

The course reader will be made available at the beginning of the course.

## **Gender in Natural Resources, (IWE 33806), period 3, morning**

### **Contact hours**

Classroom Lectures	24
Tutorials/Instruction	24
Self Study	

### **Contact person(s)** dr ir M Zwarteven

Lecturer(s) dr ir M Zwarteven

Examiner(s) dr ir M Zwarteven

### **Contents:**

How is the use, management and knowledge of natural resources and the environment gendered? International and national policy statements on the environment frequently make explicit reference to the crucial importance of women as users, guardians and managers of natural resources. Development policies tend to refer to women as the 'local experts' on water, soils, forests and seeds. Yet, most rights to land, water and trees continue to be vested in men, while men also predominate as managers of and experts in natural resources. In this course students learn how the use, management and knowledge of natural resources are gendered.

The course starts with proposing and discussing tools and concepts to identify, understand and explain this 'genderedness', and to understand its implications for equity, sustainability and efficiency. It continues with presenting different frameworks (gender and environment, feminist political ecology, eco-feminism) for analyzing gender and environment linkages. These frameworks are discussed based on cases of different countries. The course also critically examines gendered assumptions of current policy approaches to the management of natural resources. In addition, the course provides an introduction to gender sensitive planning methods in watershed, forestry and irrigation management projects.

### **Learning outcomes:**

In the course, students learn to understand how feminist questions interact with environmental and natural resource management questions. After having followed this course, students:

- appreciate how the use, management and knowledge of natural resources and the environment are deeply gendered;
- are able to unravel gendered assumptions implicit in current approaches to natural resource development, conservation and management;
- can demonstrate knowledge of concepts and methods for analyzing gendered implications of natural resource and environmental development interventions;
- can name and discuss the trade-offs and synergies between sustainability, efficiency and gender equity in natural resources management;
- display knowledge of approaches for gender sensitive natural resources management and environmental planning processes.

### **Activities:**

The course consists of:

- plenary sessions and (guest) lectures;
- literature study;
- group discussions;
- presentations and written assignments, including an essay

### **Examination:**

Students are examined on the basis of the written assignments and presentations (1/3), and an examination (2/3).

### **Literature:**

A course reader is provided before the course.

## Water Delivery, (IWE 30806), period 4, morning

### Contact hours

Classroom Lectures	24
Practical Training Extensive	12
Practical Training Intensive	21
Problem Oriented Education	10

### Contact person(s) dr ir GE van Halsema

Lecturer(s)	ing. H Boesveld dr ir GE van Halsema dr ir JC van Dam guest lecturers
Examiner(s)	prof. dr LF Vincent

### Contents:

#### Block 1. Field irrigation methods

The course commences with an introduction to the course and memory refresh of agro-irrigation.

Surface irrigation issues (furrow, border and basin irrigation) will be freshened. The advance functions and infiltration relationships will be deepened followed by the discussion of the volume-balance method which will be used in the first - 8 mornings lasting - practical.

Next Sprinkler- and Drip irrigation will be dealt with during 4 lectures. Advantages and disadvantages of different pressurized irrigation systems will be discussed. You will be introduced to the properties of these systems and to calculation procedures in order to be able to design sprinkler and drip systems.

The last two lectures deal with the transition process of surface irrigation to pressurized irrigation in traditional small holder irrigation systems. Case studies from the Andes will be presented. Within the search for more efficient irrigation methods, more and more farmers and irrigation systems are switching to pressurized irrigation systems. However, the changeover from surface irrigation to pressurized irrigation systems requires high investments for farmer's. Farmer's investment possibilities depend on socio-economic context and the type of farming systems. Most irrigation projects investing in infrastructure do not include investments of equipment at farm level. These and other aspects dealing with the introduction of sprinkler and drip irrigation will be presented on the basis of some experiences in Peru.

#### Block 2. Environmental and quality aspects of irrigation water use on the field:

The second block deals with an overview of quality aspects of irrigation water. Especially water containing soluble salts have to be treated very carefully when used for irrigation. A clear understanding of the effects of salts on crops and salt accumulation in soils is necessary to be able to calculate leaching and drainage requirements, in order to avoid salinization of soils and drainage water. But also the irrigation water may contain nutrients, especially when waste water is reused in agriculture. Quantitative knowledge of these nutrient contents is required, in order to avoid over fertilization of crops. Two lectures will be dedicated to wastewater issues and four lectures with exercises to salinity problems.

Specific issues dealt with are:

Waste water (re)- use in agriculture; Nutrients content of irrigation water; Multiple water use issues. Salinity in relation to irrigation and drainage; Soil salinity and Sodicty; Salt Balance of the rootzone; Salinization due to capillary rise; Leaching process in the rootzone; Simulation of water flow and solute transport; Reclamation of salt affected soils;

#### Block 3. Water Productivity, Performance and economic aspects of irrigated agriculture

The last lecture block deals with some complementary issues on farm water

management. The following subjects will be discussed:

The need to be more efficient with water use in irrigation applies to all levels of irrigation systems and holds an increasing pressure on the economics of irrigated agriculture. Performance assessment is an important issue to visualize real water use and to advise on improvement of water use efficiency. An overview of different performance indicators will be presented, as well as different assessment methods from agency- as well as farmers perspective. New techniques and research topics such as the use of remote sensing in establishing water balances and crop water use will be presented. Finally the productivity and efficiency analysis of (irrigated) agriculture will be scaled up to the system and basin level through the application of the economic water valuation tool - where productivity analysis is converted into economic analyses. The aim of economic valuation is to provide a quantitative assessment tool with which potential trade-offs between water use, productivity and economic value can be identified, in specific with regard to IWRM management scenarios.

### **Learning outcomes:**

After the course, participants are able to:

- understand conceptual approaches of on-farm water management and irrigated agriculture;
- evaluate the performance of surface irrigation and the impact of different irrigation technologies on water use efficiency and productivity;
- analyze the optimal use of water for different methods of irrigation water supply, in respect to water availability and quality and land degradation;
- establish environmentally safe water delivery schedules, when dealing with low quality water and soil degradation hazard;
- design a sprinkler or micro irrigation system at field level;
- understand and analyze the problems farmers are dealing with in the transformation process from surface to pressurized irrigation;
- conduct water use efficiency and water productivity analysis of irrigation systems;
- conduct field and experimental trials to determine the advance and infiltration functions for surface irrigation for different soils;
- optimize the layout of furrows and water application to minimize water losses.

### **Activities:**

The course consists of lectures, including guest lectures about specific subjects; Selfstudy; assignments; Active participation in working groups and practicals:

- field practical on performance of furrow irrigation;
- practical on design of a sprinkler or drip irrigation system.

### **Examination:**

The end mark is based on a written exam and the practical reports.

### **Literature:**

The course reader will be made available at the beginning of the course

## Specialisation C : Integrated Water Management

Courses in the specialisation Integrated Water Management, next to the courses from the common part:

Compulsory course:

- **Integrated Water Management**

Choose at least 1 course from the list below (Restricted Optional):

- **Impact Assessment of Land and Water Management**
- **Water Institutions, Reform & Equity (WIRE)**
- **Natural Hazards and Disasters**
- **Environmental policy: Analysis and Evaluation**

### **Integrated Water Management, (ESS 20806), period 3 morning**

	<b>Contact hours</b>
Classroom Lectures	36
Practical Training Extensive	25

**Contact person(s)** dr RMM Roijackers

Lecturer(s) prof. dr WP Cofino  
dr RMM Roijackers  
dr ir EJJ van Slobbe

Examiner(s) prof. dr WP Cofino

#### **Contents:**

The course aims at teaching concepts and principles of sustainable development and integrated management of water-land systems. Due to ongoing human population growth, welfare and the unequal global distribution of water resources, human water demands frequently exceed the carrying capacity of (aquatic) ecosystems. As a result, over-exploitation of groundwater and surface water resources occurs as well as pollution problems, loss of biodiversity, droughts and floods (as related to processes of (human induced) climate change), etcetera.

The course highlights global, European, regional and local projects including examples of recent European and Dutch experiences with integrated land and water management. European water policy, with the Framework Water Directive as a central element, is an important element of the course as well. Water is everybody's business, starting from international river basin committees to individual citizens. Water management takes place at a global scale, as well as in every household. Decision-making processes, public participation and communication and information transfer systems are important elements of water management in the 21st century. In the course actual and urgent water management problems will be presented and discussed regarding available and desired technical-scientific knowledge, goods and services of (aquatic) ecosystems, socio-economic, political and institutional aspects.

#### **Learning outcomes:**

After this course the student will be able to:

- comprehend concepts of sustainable and integrated water management at different temporal and spatial scales including knowledge on decision making styles, goods and services of water systems, institutional organization, public participation and communication strategies;
- explain relations and (inter) dependencies between upstream and downstream parts of (transboundary) river basins and to identify and to argue assessment indicators for success and failure of river basin management;

- apply knowledge on water management approaches in European countries, starting from the EU-Water Framework Directive;
- understand experiences in integrated water management in the Netherlands and can discuss the applicability in different situations;
- write a short essay which shows comprehension of the concepts of IWM and application to a water management issue;
- compile with a group a poster showing a concept or research findings regarding IWM.

**Activities:**

- to attend (interactive) lectures and study lectures notes;
- to write a short essay; - to compile a poster in a small group.

**Examination:**

A written exam counts for 50% (minimum 5,5) the poster and the essay counts for 25% each, with minimum 5,5.

**Literature:**

Slides and literature are provided in EDU Class Blackboard . A reader of the literature is available in the class.

## **Impact Assessment of Land and Water Management (LDD 31306), Period 2 afternoon**

### **Contact hours**

Classroom Lectures	24
Practical Training Extensive	51

### **Contact person(s)** dr ir J de Graaff

Lecturer(s)	dr ir J de Graaff
	dr ir A Kessler
Examiner(s)	dr ir J de Graaff

### **Contents:**

Lectures: A main challenge for land and water management (LWM) interventions in developing countries is how to achieve sustainable impact. This challenge is central in this course. Emphasis is given on the role of stakeholders in LWM and how this affects adoption of conservation practices and final impact. The lectures deal with social, economic and institutional aspects that play a role in project planning, monitoring and evaluation. Methods are discussed to assess physical impact of LWM (e.g. water and nutrient balances), the economic impact (e.g. cost-benefit analysis) and the impact on people. Policies and strategies to enhance the impact of LWM interventions (e.g. participation, incentives, scaling-up) are dealt with in the lectures. Both theoretical insights and practical examples are given.

Practical sessions: During eight half-days, attention is paid to planning for and assessing impact from a socio-economic and technical perspective. This concerns a.o. understanding factors affecting adoption, project planning, formal and informal survey methods, the effects of conservation measures on water- and nutrient balances, cost-benefit analysis and multi-criteria analysis for assessment of benefits of land and water management interventions.

### **Learning outcomes:**

At the end of this course, the student will have the knowledge and skills to:

- analyse both the physical effects (soil, water and nutrients) and socio-economic effects of LWM interventions;
- identify and understand the main factors that affect the impact of LWM interventions, both during project planning, implementation and monitoring evaluation;
- understand and explain which strategies and policies are crucial in enhancing the involvement of farmers in LWM and in achieving sustainable final impact;
- apply impact assessment techniques, socio-economic analysis and evaluation methods for the planning, implementation, monitoring and evaluation of LWM interventions;
- prepare budgets, to calculate costs and to estimate the benefits of LWM interventions.

### **Activities:**

- lectures and studying lecture notes and reader;
- practical sessions.

### **Examination:**

Practical reports and written examination.

### **Literature:**

Lecture note / reader available at WUR-Shop, Forum.

## Water Institutions, Reform & Equity (WIRE), (IWE 31306) period 3, afternoon

### Contact hours

Classroom Lectures	24
Project	14
Tutorials/Instruction	17

### Contact person(s) dr ir P Wester

Lecturer(s)	dr ir RA Boelens dr ir P Wester dr K Wegerich
Examiner(s)	prof. dr LF Vincent

### Contents:

The course focuses on water reforms in the context of Integrated Water Resources Management (IWRM), by addressing the following main topics: 1. water agencies and institutional change, 2. local water management organizations, and 3. the interactive design process in project implementation. Over the past ten years a growing body of experience and knowledge has developed on the institutional and organizational aspects of irrigation, such as the development of water users organization and participatory irrigation management, participatory design of irrigation infrastructure, strengthening and reform of water bureaucracies, irrigation management transfer, irrigation financing and cost-recovery, and wider water sector reform and policy development. This course covers these topics by presenting concepts and methodologies for analysis and interventions in the organisation of 'government agencies' for irrigation as well as 'local level water management organisations'. This is placed in the context of wider developments in the water sector. Attention is also paid to the management of design processes in view of developing organisational capacity of users and agency staff.

### Learning outcomes:

After the course the participants are expected to be able to:

- analyse current concepts and methodologies used for reforming water agencies and the water sector;
- apply a method for analysing organizations to water agencies;
- appraise current concepts and methodologies for the improvement of local water management organisations;
- argue the importance of the integration of the irrigation design process in project implementation, and ways to improve the participation of the water users in this process;
- know current concepts and methodologies for integrating gender concerns in the reform of water bureaucracies, institutional design of WUAs and irrigation design processes.

### Activities:

Study activities are threefold:

- participants follow in total 13 classes of 4 hours. The first session of the course introduces the themes of the course and the course programme. The three main subjects will each be dealt with in blocks of two weeks, in which four sessions will be dedicated to lectures and presentations. (52 hours);
- as introduction to the classes literature is studied (44 hours);
- small groups of students will work on assignments covering the 3 main subjects. The group assignments are complementary in order to broaden and deepen the collective learning process. Each group will present their work, followed by discussion. (64 hours).

### Examination:

A mark is given based on the (group) assignments and participation in discussions.

### Literature:

The course reader will be made available at the beginning of the course.

## **Environmental Policy: Analysis and Evaluation (ENP 34306) period 2, morning**

<b>Contact hours</b>	
Classroom Lectures	20
Project	14
Tutorials/Instruction	4
Self Study	

**Contact person(s)** dr A Gupta

Lecturer(s) dr A Gupta

Examiner(s) dr A Gupta

### **Contents:**

This course focuses on the analysis, evaluation and design of environmental policy at different levels of aggregation (local, national and international). It provides the students with up to date information on policy theories and models; on developments in environmental governance and the role of state, market and civil society actors there in; and on the tools and methods to analyse and evaluate environmental instruments and policy programmes. It builds upon basic knowledge in policy sciences and research methods and extends this to environmental governance at different levels. Carrying out policy evaluation via a group case study is an important part of the course.

### **Learning outcomes:**

By the end of this course, students are able to demonstrate knowledge and understanding of:

- current theories and models of (environmental) policy formulation, implementation and evaluation;
- key actors and multiple levels involved in environmental policy making as well as the interactions between them;
- methods and techniques for analyzing and evaluating environmental policy.

### **Activities:**

The course consist of the following activities:

1. Plenary lectures on recent policy theories, with a strong focus on the environment: key developments in environmental governance, new state-market relations, environmental subpolitics, relations between national and international levels of environmental policy-making;
2. One major policy evaluation study, carried out in small groups of 3-5 students. The study will entail an evaluation of a specific environmental policy. Students will have the opportunity to present/discuss their group work in class.

### **Examination:**

Written exam and a group assignment.

### **Literature:**

Made available through EDUweb.

A course outline can be obtained upon request from the course coordinator.

## Natural Hazards and Disasters ( RDS-35306), period 4 morning

### Contact hours

Classroom Lectures	30
Literature study	
Problem Oriented Education	5

### Contact person(s) drs JF Warner

Lecturer(s)	prof. dr ir JWM van Dijk drs JF Warner
Examiner(s)	prof. dr ir JWM van Dijk drs JF Warner

### Contents:

Disasters caused by natural hazards such as volcanic eruptions, earthquakes, tsunamis, floods and famines seriously affect human societies. The course introduces different analytical perspectives on the causes and consequences of disaster, including the question where disaster begins and where normality resumes, and on the interconnections between natural hazards, the vulnerability of populations exposed to them, and the realtion with climate change. It also discusses the responses to disaster as developed in different social domains, including local communities, governance structures and science. Guest lectures by experts address technical issues such as the impact of climate change and the use of remote sensing in disaster management.

### Learning outcomes:

At the end of the course, the students are expected to be able:

- to identify and discuss the prevailing theories, basic concepts, typology and epidemiology of natural hazards and disasters;
- to explain the concept of vulnerability and use it as an analytical tool;
- to identify and discuss disaster management practices and policies at local, national and international levels;
- to relate social and technical aspects of disasters and disaster management.

Comprehension and capacity to critically discuss are assessed during discussions in class and in the written exam. In addition, students are expected to be able to synthesise information and formulate new questions on the above issues by designing and presenting a poster to their fellow-students.

### Activities:

Classroom lectures with room for active participation of students. At the end of the course, students prepare a poster for presentation on a topic of their interest.

### Examination:

A written exam concludes the course. The final mark comprises the results of the examination, the group essay and the poster presentation.

### Literature:

Literature will be made available in the form of a reader obtainable at the commencement of the course.

## Overview Curriculum MSc International Land and Water Management 2009 – 2010

### Common Part

It is not allowed to choose subjects that already were part of one's BSc programme at WU

( CS = Compulsory – RO = Restricted Optional – M1 = Master year 1 – M2 = Master year 2 – AM = morning – AM = afternoon)

### This common part is compulsory for all MIL students

Course code	Course title	credits	study phase	period	day	part	
LDD-30306 PM	Sustainable Watershed Management	6.00	CS	M1			1
IWE-32306 M1	Research Approaches to Land and Water Management	6.00	CS				
IWE-33306	Sustainable Land and Water Management (Spain)	6.00	CS	M1	5	week 39-42	
YMC-60303	Modular Skills Training MOS	3.00	CS	M1/M2			1,2,3,4,5

### Specialization A - Erosion, Soil and Water Conservation

LDD-30806 AM	Physical Aspects of Land Management	6.00	CS	M1	1
Choose 1 from RO1 LDD-31306	Impact Assessment of Land and Water Management	6.00	RO1	M1	2 PM
GRS -20306	Remote sensing	6.00	RO1	M1	2 AM
LDD-31806 AM	Erosion Processes and modelling	6.00	RO1	M1	4
LDD-80436	Thesis Erosion and Soil & Water Conservation	36.00	CS	M1/2	

		Period 1 September - October	Period 2 November - December	Period 3 January – February	Period 4 March – April	Period 5 May - June/July (not AM-PM but 1 <sup>st</sup> & 2 <sup>nd</sup> half)
MIL1	AM	LDD 30806 Physical Aspects of Land Management	GRS 20306 Remote sensing	Free choice	LDD 31806 Erosion Processes & modelling	LDD-80436 thesis Preparation Thesis work & proposal presentation
	PM	LDD 30306 Sustainable Watershed management	LDD 31306 Impact Assessment of Land and Water Management	Free choice	IWE 32306 Research Approaches to Land and Water Management	IWE-33306 Sustainable Land and Water Management (Spain)
M2						

Preparation for the M2 thesis starts in period 5 of the first year and is concluded by a research proposal that is presented and discussed for a mixed audience of fellow master and bachelor students and supervising staff during the Research Methodology week.

## Specialization B - Irrigation and Water Management

IWE-20806	Irrigation and development	6.00	CS	M1	2	AM	
Choose 1 course from RO3							
IWE-20306	Irrigation System Design & operation	6.00	RO3		M1		1
	AM						
IWE 30306	Water Systems Design at Catchment Level	6.00	RO3	M1	2	PM	
IWE-31306	Water Institutions, Reform & Equity (WIRE)	6.00	RO3	M1			
	PM						
IWE-31806	Gender and Land & Water Management	6.00	RO3	M1			
	AM						
IWE-30806	Water Delivery	6.00	RO3	M1	4	AM	
IWE-80436	Thesis Irrigation and Water Engineering	36.00	CS			M1/2	

		Period 1 September - October	Period 2 November - December	Period 3 January – February	Period 4 March – April	Period 5 May - June/July (not AM-PM but 1 <sup>st</sup> & 2 <sup>nd</sup> half)
MIL1	AM	IWE-20306 Irrigation System Design & operation	IWE 20806 Irrigation & Development	IWE-33806 Gender and Land & Water Management	IWE 30806 Water Delivery	IWE-80436 Thesis Irrigation & Water Management Preparation Thesis work & proposal presentation
	PM	LDD 30306 Sustainable Watershed management	IWE 30306 Water Systems Design at Catchment Level	IWE-31306 Water Institutions, Reform & Equity (WIRE)	IWE 32306 Research Approaches to Land and Water Management	IWE-33306 Sustainable Land and Water Management (Spain)

M2					
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Preparation for the M2 thesis starts in period 5 of the first year and is concluded by a research proposal that is presented and discussed for a mixed audience of fellow master and bachelor students and supervising staff during the Research Methodology week.

### Specialisation C - Integrated Water Management

ESS 20806 Integrated Water Resource Management	6.00	CS	M1	3	AM	
Choose 1 course from RO5						
ENP 34306 Environmental Policy: Analysis and evaluation	6.00	RO5	M1	2	AM	
LDD-31306 Impact assessment of land and water management	6.00	RO5	M1	2	PM	
IWE-31306 Water Institutions, Reform & Equity (WIRE)	6.00	RO5	M1	3	PM	
RDS 90406 Natural hazards and disasters	6.00	RO5	M1	4	AM	
ESS-80436			Thesis Integrated Water Management	36.00	CS	M2

		Period 1 September - October	Period 2 November - December	Period 3 January – February	Period 4 March – April	Period 5 May - June/July (not AM-PM but 1 <sup>st</sup> & 2 <sup>nd</sup> half)
MIL1	AM	Free choice	ENP 34306 Environmental Policy: Analysis and evaluation	ESS 20806 Integrated Water Resource Management	RDS 35306 Natural hazards and disasters	ESS-90836 Thesis Integrated Water Management Preparation Thesis work & proposal presentation

	PM	LDD 30306 Sustainable Watershed Management	LDD 31306 Impact Assessment of Land and Water Management	IWE-31306 Water Institutions, Reform & Equity (WIRE)	IWE 32306 Research Approaches to Land and Water Management	IWE-33306 Sustainable Land and Water Management (Spain)
MIL2						

Preparation for the M2 thesis starts in period 5 of the first year and is concluded by a research proposal that is presented and discussed for a mixed audience of fellow master and bachelor students and supervising staff during the research methodology week.