GHENT UNIVERSITY

Course Specifications

Valid as from the academic year 2026-2027

Soil Water Management (I002708)

Course size *(nominal values; actual values may depend on programme)*

Credits 5.0 **Study time 150 h**

Course offerings and teaching methods in academic year 2027-2028

A (semester 2)	English	Gent	seminar
			lecture

Lecturers in academic year 2027-2028

Cornelis, Wim	LA20	lecturer-in-charge

Offered in the following programmes in 2027-2028	**crdts**	**offering**
Master of Science in Sustainable Land Management(main subject Land and Groundwater Management)	5	A
International Master of Science in Soils and Global Change (main subject Soil Ecosystem Services and Global Change)	5	A
Master of Science in Sustainable Land Management(main subject Urban Land Engineering)	5	A
Master of Science in Bioscience Engineering: Forest and Nature Management	5	A
Master of Science in Bioscience Engineering: Land, Water and Climate	5	A
Master of Science in Geology	5	A
Exchange Programme in Bioscience Engineering: Agricultural Sciences (master's level)	5	A
Exchange Programme in Bioscience Engineering: Environmental Technology (master's level)	5	A
Exchange Programme in Bioscience Engineering: Land and Forest management (master's level)	5	A

Teaching languages

English

Keywords

Soil-hydrological processes, soil hydraulic properties, water conservation, water harvesting, water balance, sustainability, water productivity, rainfed

Position of the course

Soil-water management is essential for sustainable crop production while minizing environmental risks, and to build resilience to droughts and floods, particularly under a changing climate. The course provides deeper insight in soil hydrological processes and presents a wide range of practices to improve the partitioning of rainwater hence optimizing the water regime. Such practices contribute to address several Sustainable Development Goals directly and indirectly, to deliver several Ecosystem Services, and to formulate evidence-based sustainable solutions to climate change (i.e. adaptation). They are an essential part of climate-smart agriculture.

Contents

1. Building resilience against drought: the soil-water management perspective
Part 1. Rainwater partitioning
2. Infiltration - entry of water into soil
3. Redistribution of water in soil
4. Evaporation from bare soil
5. Surface runoff
Part 2. Soil-water management practices to increase crop productivity
6. Improving restricted rainfall infiltration

7. Physical structures across slope or along contour
8. Reducing water losses from evaporation and excessive transpiration
9. Reducing rainwater drainage beyond the rooting zone
10. Improving soils with restricted rooting
11. Maximizing usefulness of low and erratic rainfall

Part 3. Methods to evaluate and model rootzone water balance

12. Assessing components of rootzone water balance
13. Crop response to water using the crop-water model AquaCrop

Initial competences

'Soil-water Management' primarily builts on the learning outcomes of the course 'Soil Physics'. The learning outcomes may also have been achieved in a different way.

Final competences

1 Explain how to use water sustainably and advice policy makers accordingly.
2 Explain the components of the field water cycle.
3 Select and evaluate techniques to conserve and harvest rainwater, in order to increase water productivity while minimising the environmental risks.
4 Use the Hydrus computer model to simulate changes in water content and matric potential during infiltration, redistribution and evaporation processes.
5 Use the AquaCrop model to predict crop-response to water under various conditions.

Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

Conditions for exam contract

This course unit cannot be taken via an exam contract

Teaching methods

Seminar, Excursion, Lecture

Extra information on the teaching methods

Lecture: on campus lectures; all lectures are given in PC rooms which enables a mix between theory and practical work
Seminar: a few excercises in Excel, Python or R, and with the computer simulation models Hydrus and AquaCrop are made. Information on future precipitation, soil moisture, frequency of droughts, blue and green water shortage, and soil-water management practices needs to be collected for each student's home country/region and shared document (SharePoint).
Excursion: a visit to greenhouse and rainout shelter facilities, and field plots is organized (at ILVO, the Flanders Research Institute for Agriculture, Fisheries and Food).

Study material

Type: Syllabus

Name: Soil-Water Management. Lecture notes
Indicative price: Free or paid by faculty
Optional: no
Language : English
Number of Pages : 290
Oldest Usable Edition : 2024-2025
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No

Type: Slides

Name: Slide shows Soil-Water Management
Indicative price: Free or paid by faculty
Optional: no
Language : English
Number of Slides : 712
Oldest Usable Edition : 2025-2026
Available on Ufora : Yes

Online Available : Yes
Available in the Library : No
Available through Student Association : No

Type: Handouts

Name: Crop response to water using the crop-water model AquaCrop - PC Exercises
Indicative price: Free or paid by faculty
Optional: no
Language : English
Number of Pages : 21
Oldest Usable Edition : 2024-2025
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Usability and Lifetime within the Course Unit : regularly
Usability and Lifetime within the Study Programme : regularly
Usability and Lifetime after the Study Programme : regularly

Type: Handouts

Name: Assignments Soil-Water Management
Indicative price: Free or paid by faculty
Optional: no
Language : English
Number of Pages : 20
Oldest Usable Edition : 2024-2025
Available on Ufora : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Usability and Lifetime within the Course Unit : one-time
Usability and Lifetime within the Study Programme : one-time
Usability and Lifetime after the Study Programme : not

Type: Software

Name: AquaCrop
Indicative price: Free or paid by faculty
Optional: no
Available on Athena : No
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Usability and Lifetime within the Course Unit : regularly
Usability and Lifetime within the Study Programme : regularly
Usability and Lifetime after the Study Programme : regularly

Type: Software

Name: Hydrus-1D v4.17
Indicative price: Free or paid by faculty
Optional: no
Available on Athena : Yes
Online Available : Yes
Available in the Library : No
Available through Student Association : No
Usability and Lifetime within the Course Unit : regularly
Usability and Lifetime within the Study Programme : regularly
Usability and Lifetime after the Study Programme : regularly

Type: Audiovisual Material

Name: Video lectures Soil-Water Management
Indicative price: Free or paid by faculty
Optional: yes
Language : English
Available on Ufora : Yes
Online Available : Yes

Available in the Library : No
Available through Student Association : No
Usability and Lifetime within the Course Unit : regularly
Usability and Lifetime within the Study Programme : regularly
Usability and Lifetime after the Study Programme : regularly

References

Hillel, D. (1998). Environmental soil physics. Academic Press, San Diego Hudson, N.W. (1987). Soil and water conservation in semi-arid areas FAO Soils Bulletins 57, Rome
Shaxson, F. and Barber, R. (2003). Optimizing soil moisture for plant production. The significance of soil porosity. FAO Soils Bulletin 79, Rome
Oweis, T. Y. , Prinz, D. and Hachum, A.Y. (2012). Rainwater harvesting for agriculture in the dry areas. CRC press

Course content-related study coaching

The lectures enable intensive interaction between instructors and students, during which ample opportunity is provided for questioning and discussion. Instructors (professor/assistants) are available for questions and further explanations on appointment.

Assessment moments

end-of-term and continuous assessment

Examination methods in case of periodic assessment during the first examination period

Written assessment with open-ended questions

Examination methods in case of periodic assessment during the second examination period

Written assessment with open-ended questions

Examination methods in case of permanent assessment

Participation, Assignment

Possibilities of retake in case of permanent assessment

examination during the second examination period is possible in modified form

Extra information on the examination methods

Written exam with open-ended questions (end-of-term assessment): short answer, essay questions and exercise
Participation (continuous assessment): three assignments must be uploaded before the specified deadlines
Assignment (continuous assessment): scenario analysis of different options to strengthen drought resilience using the AquaCrop model

Calculation of the examination mark

End-of-term assessment: 70%, continuous assessment: 30%
Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner. This means that if, in that case, a grade of 10 or more out of 20 is obtained, the grade may be brought down to 7/20.