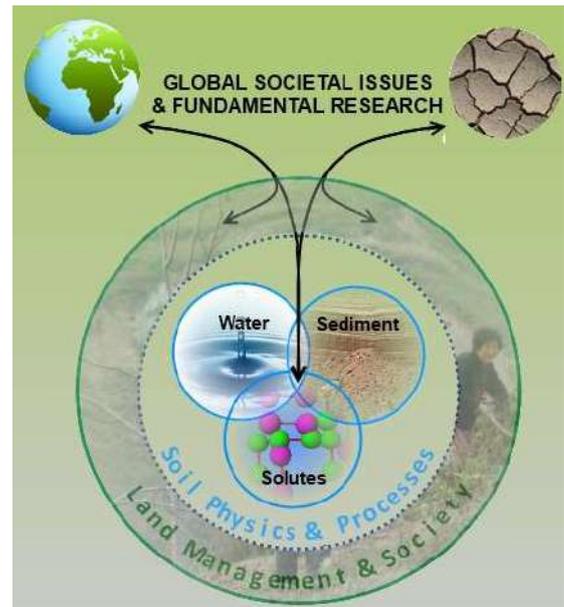# Thesis opportunities within the Soil Physics and Land Management (SLM) group

Version January 2026

Dear students,

While you are on the search for thesis opportunities, you may use this booklet to get inspiration and ideas for your own MSc thesis research.

In the SLM chair group our research focuses on three domains, including **(1) soil physics** (flow and transport of water, heat, sediment and solutes), **(2) ecohydrology** (soil-water-plant interactions) and **(3) land use and management** (factors affecting soil degradation, conservation and restoration).

In this booklet you can find thesis opportunities which are currently available with our staff members and where you as a student can contribute to exciting projects! To make it easier to search for a topic, there is an overview in which all the topics are divided into the following classes: Water, Soil, Groundwater, Pollutants, Vegetation, Socioeconomic aspects. Also, feel free to approach us with your own research ideas!

When you would like to do your thesis within the SLM group, first contact one of our thesis coordinators to discuss your ideas and plans. MEE students should contact Reynold Chow (reynold.chow@wur.nl), for MIL students the contact person is Xiaomei Yang (Xiaomei.yang@wur.nl). And to join the SLM thesis rings, contact Loes van Schaik once you start with your thesis.

We are looking forward to collaborate with you!

WAGENINGEN
UNIVERSITY & RESEARCH

SLM staff involved in MSc thesis supervision

dr. ir. L (Luuk) Fleskens luuk.fleskens@wur.nl **[Interim Chairholder]**	▪ Ecosystem services ▪ Multi-scale impact assessments SLM ▪ Scenario analysis ▪ Farmer decision-making
dr. Reynold Chow reynold.chow@wur.nl **[MEE Thesis/Internship Coordinator]**	▪ Hydro(geo)logical processes ▪ Groundwater flow and transport modelling ▪ Water contamination
dr. X (Xiaomei) Yang xiaomei.yang@wur.nl **[MIL Thesis/Internship Coordinator]**	▪ Soil chemistry ▪ Environmental analysis ▪ Soil pollution ▪ Soil quality
Dr. ir. (Jantiene) Baartman jantiene.baartman@wur.nl	▪ Soil erosion modelling ▪ Physical land degradation processes ▪ Soil and water conservation
JP (Joao) Carvalho Nunes PhD joao.carvalhonunes@wur.nl	▪ Hydrological process ▪ Soil erosion ▪ Water contamination ▪ Socio-hydrological systems
Dr. ir. JC (Jos) van Dam jos.vandam@wur.nl	▪ Ecohydrology ▪ Physical soil transport processes ▪ Modelling
Dr. C. Stoof cathelijne.stoof@wur.nl	▪ Land degradation ▪ Pyrogeography ▪ Soil management

WAGENINGEN
UNIVERSITY & RESEARCH

SLM staff involved in MSc thesis supervision

	ing. G (George)Bier george.bier@wur.nl	▪ Hydrology ▪ Groundwater ▪ Modelling ▪ Solute transport
	dr. ir. K (Klaas) Metselaar klaas.metselaar@wur.nl	▪ Ecohydrology ▪ Green roofs
	P (Paula) Harkes PhD paula.harkes@wur.nl	▪ Soil microbiology ▪ Soil biology ▪ Nematology
	dr. ir. MJPM (Michel) Riksen michel.riksen@wur.nl	▪ Wind erosion ▪ Coastal dune management ▪ Soil and water conservation ▪ Rainwater harvesting
	dr. E (Esperanza) Huerta Lwanga Esperanza.huertalwanga@wur.nl	▪ Hydrological process ▪ Soil erosion ▪ Water contamination ▪ Socio-hydrological systems
	Dr. NLMB (Loes) van Schaik loes.vanschaik@wur.nl	▪ Ecohydrology ▪ Soil physics
	Dr. Yan Liu yan1.liu@wur.nl	▪ Streamflow modelling ▪ Climate change impacts

WAGENINGEN
UNIVERSITY & RESEARCH

SLM staff involved in MSc thesis supervision

	dr. ir. CA (Aad) Kessler aad.kessler@wur.nl	• Farmer decision-making & adoption • Intervention strategies • Integrated Farm Management
	dr. S (Saskia) van der Kooij saskia.vanderkooij@wur.nl	• Water management • Resource efficiency • Circular economy
	TA (Teun) Vogel MSc teun.vogel@wur.nl	• Land restoration • GIS , drones
	dr. K. (Karrar) Mahdi Karrar.mahdi@wur.nl	• Soil-landscape degradation • Climate smart agriculture
	dr. V (Vera) Felix da Graca Silva Vera.felixdagracasilva@wur.nl	• Soil pollution • Pesticide transport • Risk assessment
	dr. M. (Mahrooz) Rezaei Mahrooz.Rezaei@wur.nl	• Soil erosion • Wind erosion
	dr. NG. (Nicolas) Beriot nicolas.beriot@wur.nl	• Soil microplastics • Environmental sustainability of plastics

Master Thesis & Internship Topics SLM 2026 — Overview

Water Resources, Hydrology & Climate Resilience

Topic	Supervisor(s)
Evaluating groundwater resilience and quality in fire-impacted landscapes (AquaFire)	Reynold Chow, Joao Nunes
Evaluating Managed Aquifer Recharge schemes in the Cape Flats Aquifer, South Africa	Reynold Chow
Uncovering hidden wells: using groundwater models to detect unregistered wells	Reynold Chow
Pump or Sink: Modelling Controlled Groundwater Recharge in Urban Rotterdam	Reynold Chow
Desiccation of Hatertse & Overasseltse Fens (NL)	G. Bier, K. Metselaar
Groundwater–surface water exchange: the hyporheic zone	Reynold Chow, Yan Liu, George Bier
Evaluating landscape measures to mitigate floods & droughts — LandEX	Jantiene Baartman, Joao Nunes
Ecohydrology of natural peatland ecosystems (NL, Canada, Finland)	Jelmer Nijp, Klaas Metselaar
Peatland time-travel: evolution of ecohydrological processes (Sweden)	Jelmer Nijp, Klaas Metselaar
Assessing vulnerability to drought in the Upper Godavari watershed (India)	Joao Nunes, Haris Ali
Monitoring soil hydrology & erosion after wildfires (Spain)	Joao Nunes
Assessing vulnerability to drought in a Dutch–Belgian transboundary catchment	Joao Nunes, Reynold Chow, Saskia van der Kooij, Haris Ali
Linking surface & groundwater quality under hydrological extremes (Ireland)	Joao Nunes, Reynold Chow, Golnaz Ezzati
Integrated sustainable management of the water–soil–plant system in Mediterranean agroforestry	Joao Nunes
Agricultural transition in Waterwijzer Landbouw	Martin Mulder, Geerten van der Zalm
Landscape rehydration in Australia	Willem Vervoort, Jos van Dam
Optimizing rainwater harvesting for MAR (Erbil, Iraq)	Reynold Chow, Karrar Mahdi
Rainwater harvesting for supplemental irrigation in wheat systems (Iraq)	Karrar Mahdi

Linking soil physical properties with crop production (NL arable farms)	Klaas Metselaar, Paul Ravensbergen, Jop van der Wel

Pollutants, Contaminant Fate & Environmental Risk

Topic	Supervisor(s)
Environmental quality: nitrate leaching (RIVM)	Jos van Dam, Piet Groenendijk, Timo Brussee
Evaluating the hydrological fate and environmental risks of GMOs (HydroGMO)	Reynold Chow, Joao Nunes
Evaluating urban sources of aquatic pesticide pollution & mixture risks (Western Cape, South Africa)	Reynold Chow
Developing risk maps of aquatic pesticide pollution in rivers of the Czech Republic	Reynold Chow
Developing a soil & water quality risk map from crop residue burning in India	Reynold Chow, Joao Nunes, Idhaya Ilampooranan
Transport of microplastics across the soil–atmosphere interface	Mahrooz Rezaei, Agatha Zamuner
Quantify microplastics transport via natural rainfall events	Qi Liu, Loes van Schaik, Jantiene Baartman
Quantify microplastics transport with runoff & erosion via soil flumes	Qi Liu, Loes van Schaik, Jantiene Baartman
Pyraclostrobin degradation by *Lumbricus terrestris*	Esperanza Huerta Lwanga, Kasia Kujawa
Starch-based microplastic degradation by earthworms	Esperanza Huerta Lwanga, Kasia Kujawa
Fate and transport modelling of PFAS (PFOA) in peat meadow systems nearby Dordrecht	Reynold Chow
Plastic contamination in agriculture: a European snapshot	Nicolas Beriot
Plastic contamination & invasive cane in southeast Spain	Nicolas Beriot
Effects of microplastic contamination on maize	Nicolas Beriot
Mixture of pesticides in soil from Spanish remote & urban areas	Vera Silva
Post-fire contaminant fate & mobilisation in water supply reservoirs (Portugal)	Vera Silva
Source-to-sink gradient of macro- & microplastics in Mediterranean valleys	Xiaomei Yang, Mistral van Oudenhove, Carolina Boix-Fayos
Earthworms Mediated Fate of Plastic Carbon in Soil	Xiaomei Yang, Ke Meng

Soil Processes, Degradation & Restoration

Topic	Supervisor(s)
Organic amendments & earthworm activity to improve soil hydrology	Loes van Schaik, Ellis Hoffland
Assessing the value of soil moisture data for preferential flow detection	Loes van Schaik
Soil compaction research in the Netherlands	Loes van Schaik, Jos van Dam, Guido Bakema
Land degradation & desertification in Sicily	Giorgia Giudice, Luuk Fleskens
Identification of best management practices solving soil compaction	Karin Pepers, Guido Bakema

Socio-economic / Cross-cutting / Remote Sensing

Topic	Supervisor(s)
AI-powered detection of landscape restoration interventions (Justdiggit)	Sander de Haas, Thijs van der Zaan
Evidence-based impact communication internship (Justdiggit)	Sander de Haas, Thijs van der Zaan

Coastal & Geomorphological Dynamics

Topic	Supervisor(s)
Storm impacts & long-term change in SE Australia's beach–dune systems	NSW Government (SLM examiner t.b.d.)
Linking beach topography & macrofauna community assembly (Sweden)	Michel Riksen, Janne Nauta

Plastic contamination in Agriculture: An Europeaan snapshot

Country: France and other EU Possibilities

Online possible : No

## Project description

Problem context :

Plastic use in agriculture has tremendously increased in the past decades resulting in plastic contamination in soils. The goal is to provide a snapshot of the plastic contamination in Europe in 2026 and compare it with a similar field campaign done in 2022. The topic can be extended with exploring different sources, transport in different soil depths and/ or natural areas.

Research Objective/Question

- How much plastic is found in the soil?
- What are the different sources of plastic contamination?

What is expected from the student (type of research)

- Field sampling and interviews
- Lab work
- Analysis (R)
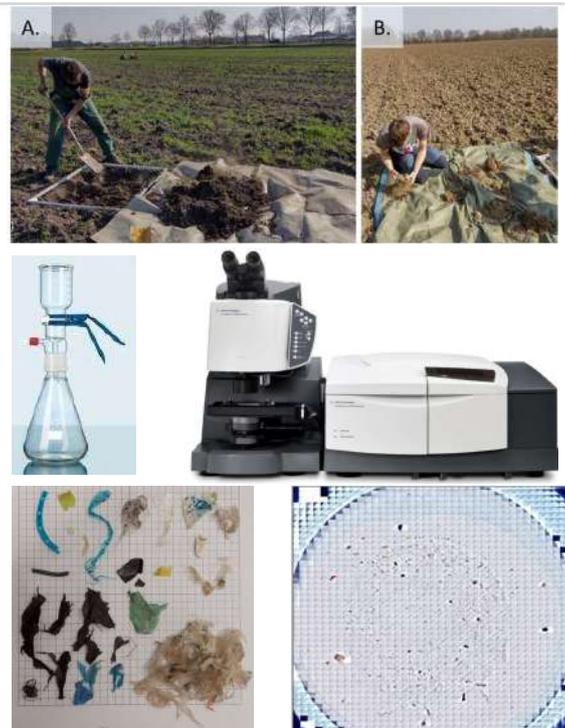
Project details

<u>Group:</u> Soil Physics and Land Management group
<u>Project type:</u> Thesis / Internship / Research practice
<u>Study programme:</u> MIL / MEE / MIL & MEE

<u>Begin date:</u> Flexible
<u>End date:</u>

<u>Used skills:</u> Lab skills, R
<u>Requirements:</u>

Contact

<u>Supervisor(s):</u> Nicolas Beriot (nicolas.beriot@wur.nl)
<u>Examiner:</u>
<u>Contact details:</u>

WAGENINGEN
UNIVERSITY & RESEARCH

Plastic contamination and invasive Cane in south east Spain

Country: Spain

Host institute: To be defined, potentially University of Valencia

Online possible : No

Project description

Problem context :

Arundo donax, is an invasive cane species in the east coast of Spain. It grows on river banks, suffocating local species and blocking flows. In the past years a solution has been tested fight it: milions of euros have been spent to cover the river banks with polypropylene mulch for few years with the hope of revegetalizing after.

Research Objective/Question

• How much plastic has been used?

• What is the resulting plastic contamination?

• Is the method successful?

What is expected from the student (type of research)

• Literature research

• Field sampling and Lab work

• Possibilities for stakeholder interviews and GIS

Project details

<u>Group:</u> Soil Physics and Land Management group
<u>Project type:</u> Thesis / Internship / Research practice
<u>Study programme:</u> MIL / MEE / MIL & MEE

<u>Begin date:</u> Flexible
<u>End date:</u>

<u>Used skills:</u> Lab skills
<u>Requirements:</u> Autonomy

Contact

<u>Supervisor(s):</u> Nicolas Beriot (nicolas.beriot@wur.nl)
<u>Examiner:</u>
<u>Contact details:</u>

WAGENINGEN
UNIVERSITY & RESEARCH

MINAGRIS

Effects of microplastic contamination on maize

Country: Netherlands, possibly Switzerlands

Host institute: WUR, possibly with FIBL-CH

Project description

Problem context :

Microplastics are detected everywhere in the environment, in air, in water and in soils but the resulting effects are not known. In 2024 we applied known amounts of plastic in a field of the Unifarm in order to measure the impact of this contamination on the soil-plant system.

Research Objective/Question

How do different plastic contamination (time, concentration, polymer) affect :

- The maize growth?
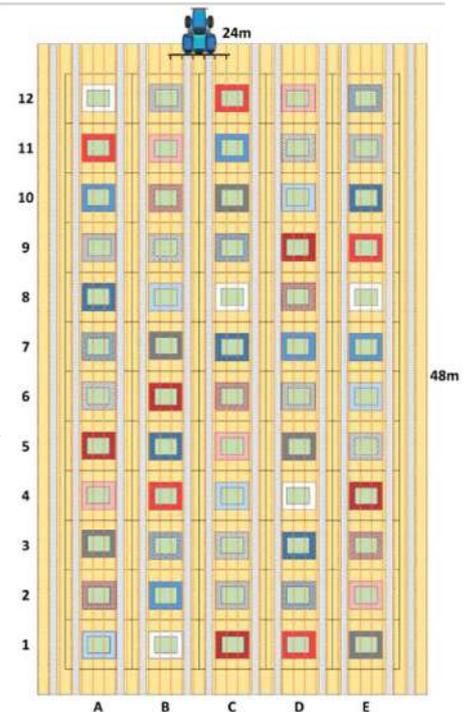- The soil chemistry?
- The soil Macrofauna?

You are welcome to bring other questions, for example, how these results impact farmers choice?

Plastic contamination:

MP1	LDPE	0.01%
MP1	LDPE	0.10%
MP3	Starch	0.01%
MP3	Starch	0.10%
MP2	PBAT	0.01%
MP2	PBAT	0.1%
Control soil		
Albendazole		

Type of research

Field work, Lab work and Analysis (R)

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE /

Begin date: Mars-Mai 2026
End date: Flexible

Used skills: Field Work
Requirements: Lab skills

Contact

Supervisor(s): Nicolas Beriot
Examiner:
Contact details: nicolas.beriot@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Mixture of pesticides in soil coming from Spanish remote and urban areas

Country: Spain

Host institute: CIEMAT (Research Centre for Energy Environment and Technology)

Project description

The main objective of this project is to **evaluate the distribution of pesticides in soil** , from 10 different locations across Spain, classified as remote/rural and urban areas.

Practical tasks:
- Literature review on pesticides in soils and environmental samples.
- Pre-treatment of soil samples for the analysis of pesticides.
- Extraction and purification of samples by QuEChERS and other analytical techniques. Use of several equipment to sample preparation. <- training and lab guidance always available!!
- Identification and quantitative determination of contaminants using liquid/gas chromatography coupled with mass spectrometry with a triple quadrupole analyzer (UHPLC/HRGC-MS/MS).
- Evaluation and interpretation of the results.
- Synthesize and present the results obtained from a scientific perspective.

Specific skills:
- To perform a quantitative analysis to determine the concentration of pesticides in soil samples.
- To acquire the necessary skills to properly process data and evaluate the results obtained.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL & MEE

Begin date: August 2026

Requirements: No pesticide or analytical background needed! GIS skills would be nice!

Contact

Supervisor(s): Vera Silva, SLM
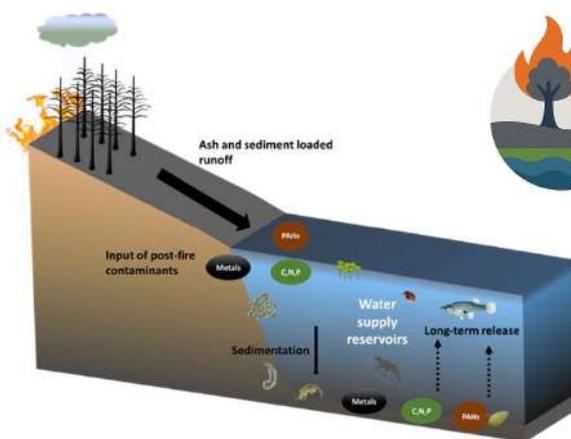Contact details: Vera.felixdagracasilva@wur.nl

Assessment of Post-Fire Contaminant Fate and Mobilisation in Water Supply Reservoirs

Country: Portugal

Host institute: University of Aveiro, Departments of Biology and Environment and CESAM

Online possible ? : No

Project description

Wildfires release large quantities of nutrients, metals, and polycyclic aromatic hydrocarbons (PAHs), which are subsequently transported into water supply reservoirs. These contaminants may compromise water quality, alter biogeochemical processes, and accumulate in sediments, posing long-term risks to ecosystems and human health.

This MSc project focuses on two interconnected components of the Project AQUAIGNIS: **T2.1 Water Quality Assessment** and **T2.2 Sediment Quality Assessment**.

•

- **Aims**
- The student will investigate the mobilisation, distribution, and fate of post-fire contaminants in reservoir water and sediments, with emphasis on:
- **Nutrients, metals, and PAHs in water and suspended particulate matter.**
- **Characterising sediments as both historical records and potential secondary sources of contamination.**
- **Evaluating the remobilisation potential of contaminants stored in sediments.**

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: to be determined
End date: to be determined

Used skills: litterature review, labwork, data analysis
Requirements:

Contact

Supervisor(s): Vera Silva
Examiner:
Contact details: vera.felixdagracasilva@wur.nl

Earthworms Mediated Fate of Plastic Carbon in Soil

Country: People's Republic of China

Host institute: School of Environment, Nanjing University (NJU)

Project description

Plastic contamination has become a global challenge, and the input of both conventional and biodegradable plastics into soils has been observed worldwide. Plastics and their debris potentially disrupt soil nutrient and element cycles via different mechanisms, but little is known about how soil macrofauna might alter the impacts brought by plastics. Existing studies have shown that earthworms, an important soil engineer, could effectively ingest and break up plastics in soils, potentially leading to the acceleration of plastic degradation. However, it is unclear how the carbon emission and organic carbon composition of soil could be affected if earthworms and plastics co-exist in the ecosystem.

Research Objective

In this project, we would like to utilize isotope tracers (natural stable isotopic abundance, 13C or 14C) to systematically investigate: (1) the influence of earthworms and plastics on the carbon emission of soil; (2) the fate of plastic carbon in the soil carbon cycle with and without the presence of earthworms.

The findings of the project might unveil the overlooked role of soil macrofauna on altering the fate of plastic carbon in the soil ecosystem.

References

1. Meng, K., Paula H., Huerta Lwanga, E., Geissen, V. (2024) Soil Biology and Biochemistry, 195, 109480.

2. Munhoz, D., Meng, K., Wang, L., … Harkes, P. (2024) Science of The Total Environment, 927, 172175.

3. Meng, K., Huerta Lwanga, E., … Geissen, V. (2023) Journal of Hazardous Materials, 447, 130765.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: 2026 or 2027
End date: 2026 or 2027

Used skills: Lab experiments under controlled conditions
Requirements: (experience on basic soil experiments)

Contact

Supervisor(s): Xiaomei Yang (WUR) & Ke Meng (NJU)
Examiner:
Contact details: xiaomei.yang@wur.nl (X Yang)
ke.meng@nju.edu.cn (K Meng)

WAGENINGEN
UNIVERSITY & RESEARCH

Quantifying the Source-to-Sink Gradient of Macro- and Microplastics from Intensive Horticulture into a Semi-Natural Mediterranean Valley

Country: Spain

Host institute: Centro de Edafología y Biología Aplicada del Segura (CEBAS-CSIC)

Project description

Intensive horticulture and plastic mulching are expanding into fragile semi-arid ecosystems. However, the fate of plastic residues remains poorly understood, particularly as recent evidence suggests vertical migration in soil is limited. A new research question arises regarding how lateral erosion processes (wind/water) drive the source-to-sink transport of macro- and micro-plastics, and how their accumulation alters soil health (Carbon/Nitrogen cycling) in threatened Mediterranean valleys.

Research Objective

In this thesis, we would like to (i) detect the occurrence and spatial gradient of macro/micro-plastics from an intensive agricultural source into a semi-natural sink; (ii) compare the abundance of plastics in hydrological (riverbed) versus aeolian (hillside) deposition zones to identify dominant transport mechanisms; and (iii) explore the potential effects of plastic accumulation on soil properties. The findings from this thesis will elaborate on the lateral connectivity of plastic contamination in semi-arid catchments, which may contribute to further studies related to environmental baseline assessments for agricultural expansion.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: 2026 or 2027

End date: 2026 or 2027
Used skills: lab work
Requirements: no

Contact

Supervisor(s): Xiaomei Yang, Mistral van Oudenhove, Carolina Boix-Fayos
Examiner: t.b.d.
Contact details: xiaomei.yang@wur.nl

Transport of microplastics across the soil-atmosphere interface

Country: Netherlands

Host institute: WUR

Online possible ? : No

Project description

Agricultural soils are known to be heavily polluted with a wide range of contaminants. Among these, microplastics have increasingly been detected in European soils, primarily originating from compost and paper mulches applied on the fields. Due to their low density, microplastics are highly mobile and can move easily in the soil, but also through other environmental matrices. Within the European-funded project **SOILPROM**, a field campaign in a wind erosion prone agricultural area of the northeastern Netherlands investigated the wind-driven transport of microplastics with soil particles, with airborne soil samples from and air filters collected for micro- and nanoplastics analysis.

Research Questions

1. Are micro- and nanoplastics present in the air above an agricultural field in the Netherlands?
2. How does the concentration of micro- and nanoplastics vary with height?
3. What types of microplastics are detected in the samples, and are they consistent with plastics applied in local agricultural practices?

Research Methods

The proposed thesis is based on laboratory work. The student will analyse samples collected during the SOILPROM field campaign and interpret the results. Some samples may be analysed in Utrecht, where the laboratory has the technology to quantitatively detect nanoplastics.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL / MEE / MIL & MEE

Begin date: March 2026 (but flexible)
End date: December 2026

Requirements: No

Contact

Supervisor(s): Mahrooz Rezaei (SLM & MAQ), Agatha Zamuner (SLM & MAQ)
Examiner: Mahrooz Rezaei
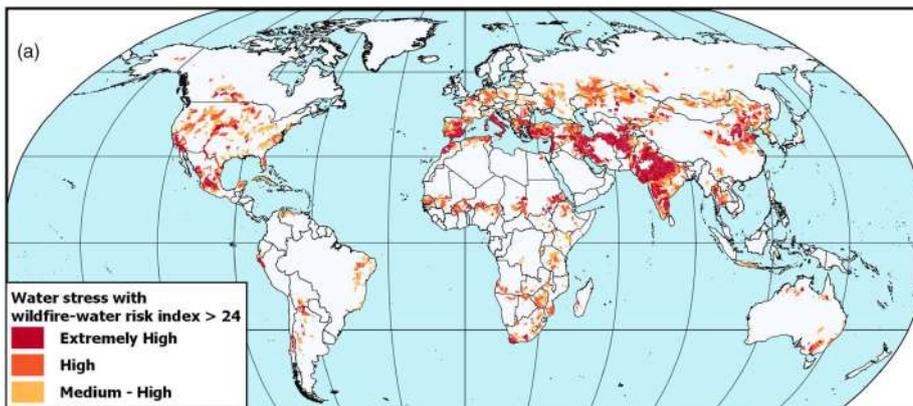Contact details: agatha.zamuner@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Evaluating Groundwater Resilience and Quality in Fire-Impacted Landscapes (AquaFire)

Country: N/A

Host institute: Soil Physics and Land Management (WUR)

Online possible: Yes

Emerging wildfire-watershed risk hotspots. Water-stressed waterhseds with a median wildfre-watershed risk index >24. (Robinne et al., 2021)

Project description

Wildfires are increasing in frequency and intensity worldwide, posing serious risks to water resources. The AquaFire project investigates how wildfires impact groundwater quality and explores innovative strategies to mitigate these effects.

AquaFire focuses on understanding the fate and transport of pollutants released during and after wildfires. We aim to identify how contaminants travel from fire-affected landscapes into groundwater systems. The project also investigates nature-based solutions, such as Managed Aquifer Recharge (MAR), to improve water quality and develop effective mitigation strategies.

You will contribute to experimental design, data collection, and model development while learning to integrate field/lab observations with process-based simulations. You'll gain interdisciplinary experience in hydrogeology, water quality assessment, and wildfire ecology.

AquaFire provides an exciting opportunity to engage in applied environmental science, developing skills that bridge research and real-world challenges. Join us in tackling the impacts of wildfires on groundwater and help shape innovative solutions for protecting water resources in a changing climate.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills: Environmental modelling
Requirements: GIS skills, hydrogeology

Contact

Supervisor(s): Reynold Chow, Joao Nunes
Examiner: t.b.d
Contact details: reynold.chow@wur.nl

Evaluating Managed Aquifer Recharge Schemes in the Cape Flats Aquifer, South Africa
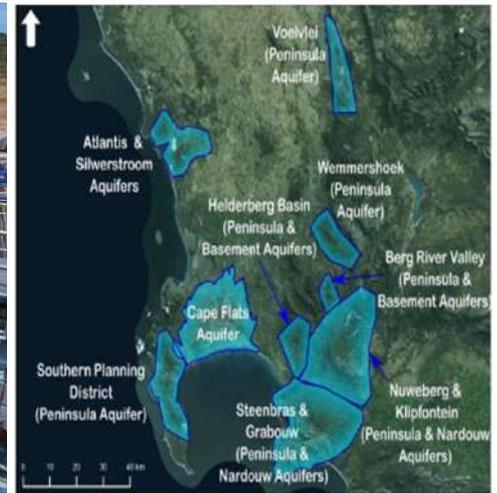
Country: South Africa

Host institute: Soil Physics and Land Management (WUR) and Earth Sciences (Stellenbosch University)

Online possible: Yes

(IOL, 2023)

(Water Outlook, 2018)

Project description

The Cape Flats Aquifer, located in the Western Cape, South Africa, has the potential of supplying considerable quantities of groundwater to the city of Cape Town and the surrounding municipalities. This groundwater resource will become increasingly important during droughts, such as the prolonged drought from 2015-2018 in the Western Cape.

South Africa's Department of Water and Sanitation (DWS) is planning to operate a managed aquifer recharge (MAR) scheme within the Cape Flats Aquifer to enhance its replenishment and to maintain a sustainable supply of groundwater.

To gain a better understanding of how managed aquifer recharge should be implemented, a 3D regional scale numerical groundwater model was developed in MODFLOW. This project aims to utilize the Cape Flats groundwater model to develop an optimal MAR scheme under different land use and climate change scenarios. The ideal MAR scheme will be able to sustainably supply groundwater to the region under a wide variety of conditions. The optimal MAR scheme will then be presented to the DWS to aid them in their MAR designs.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: Hydrogeology, Groundwater Modelling

Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
Contact details: reynold.chow@wur.nl
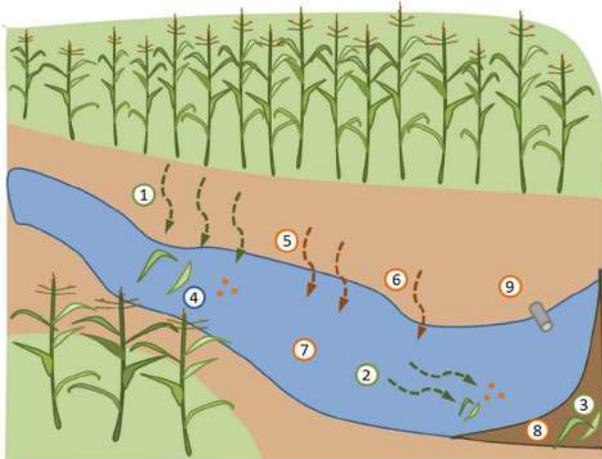
WAGENINGEN
UNIVERSITY & RESEARCH

Evaluating the Hydrological Fate and Environmental Risks of Genetically Modified Organisms (HydroGMO)

Country: N/A

Host institute: Soil Physics and Land Management (WUR)

Online possible: Yes

Plant material	Ref.	Free toxin	Ref.
① Wind drift: 0.1-7.9 g AFDM/m²	d	⑤ Run-off water: up to 130 ng/L	e
Harvest drift: 26 g dw/m² (edge of the field)	c	Run-off sediment: up to 143 ng/g dw	e
Pollen drift: 0.1-1.0 g/m²	d	⑥ Groundwater, soil pore water: 17.2 ng/L, 21.7 ng/L (single observations)	e
② Transport of plant material in flowing water: 0.38-180 m	d	⑦ Toxin in water: 0.014 ng/ml (mean), 0.2 ppb (single observation), up to 60 ng/L	a,b, f
Transport of pollen in flowing water: 20-60 m	d	⑧ Toxin in sediment: 0.5-0.9 ppb	a
③ Plant material in sediment: up to 6.4 AFDM/m²	d	⑨ Drainage: up to 60 ng/L	b,f
		Toxin in plant material	**Ref.**
		④ Toxin in plant material in water: 95 ± 73 ng/g dw	e

Exposure pathways of the aquatic environment to GMOs (Pott et al., 2018)

Project description

The increasing use of genetically modified organisms (GMOs) in agriculture offers many benefits but raises concerns about their potential impacts on the environment. The HydroGMO project investigates how GMOs and their genetic material move, persist, and transform in aquatic systems, including surface water and groundwater. This research addresses critical questions about the environmental risks of GMOs, their interactions with native species, and their influence on water quality and ecosystem health.

A key focus of HydroGMO is understanding the risks of horizontal gene transfer—the movement of genetic material from GMOs to non-target organisms—which could have unforeseen ecological consequences. The project evaluates how GMOs affect nutrient cycles, biodiversity, and aquatic ecosystem stability. This work is essential for informing regulatory policies and protecting vital water resources.

You will develop skills in hydrogeology, environmental chemistry, and ecosystem modelling. HydroGMO offers a unique opportunity to contribute to cutting-edge research with real-world applications. Join us to help safeguard water resources and biodiversity while addressing one of today's most pressing environmental challenges!

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills: Environmental modelling
Requirements: GIS skills, hydrogeology

Contact

Supervisor(s): Reynold Chow, Joao Nunes
Examiner: t.b.d
Contact details: reynold.chow@wur.nl
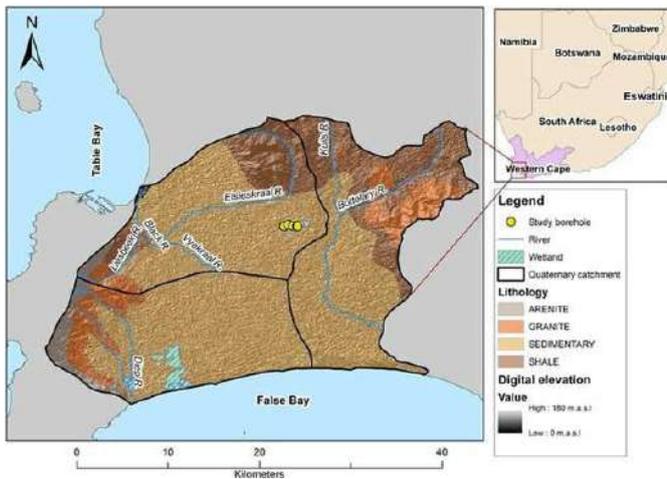
WAGENINGEN
UNIVERSITY & RESEARCH

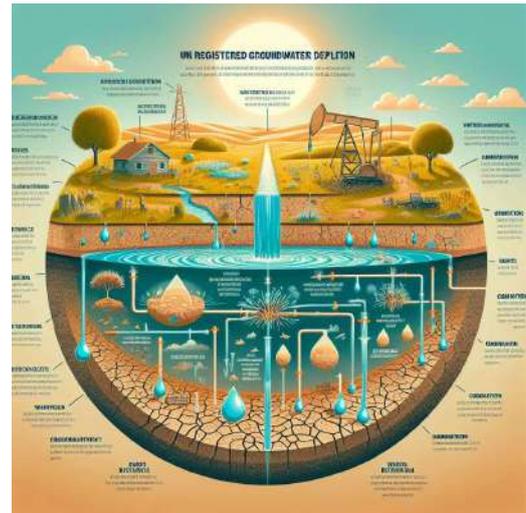## Uncovering Hidden Wells: Using Groundwater Models to Detect Unregistered Wells/Boreholes

Country: South Africa

Host institute: Soil Physics and Land Management (WUR)

Online possible: Yes

Cape Flats Aquifer in Western Cape, South Africa (Gxokwe et al., 2020)

Project description

Illegal wells and boreholes pose significant challenges to sustainable groundwater management, often leading to over-extraction and contamination of vital water resources. This MSc project aims to investigate the application of groundwater modelling techniques to identify and locate unregistered wells. By integrating hydrological data, remote sensing, and machine learning algorithms, the project will develop a robust methodology capable of detecting anomalies in groundwater flow patterns that may indicate the presence of illegal boreholes. The study will focus on a case study area with known issues of unregistered wells, providing a practical context for model validation. The outcomes of this research will not only enhance our ability to manage groundwater resources more effectively but also support regulatory agencies in enforcing water extraction laws. This project offers a unique opportunity to contribute to the field of hydrogeology by addressing a critical environmental issue through innovative modeling approaches. Students will gain hands-on experience with state-of-the-art groundwater modeling tools and techniques, preparing them for careers in environmental consultancy, water resource management, and regulatory agencies.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills: Environmental modelling
Requirements: GIS skills, hydrogeology

Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
Contact details: reynold.chow@wur.nl
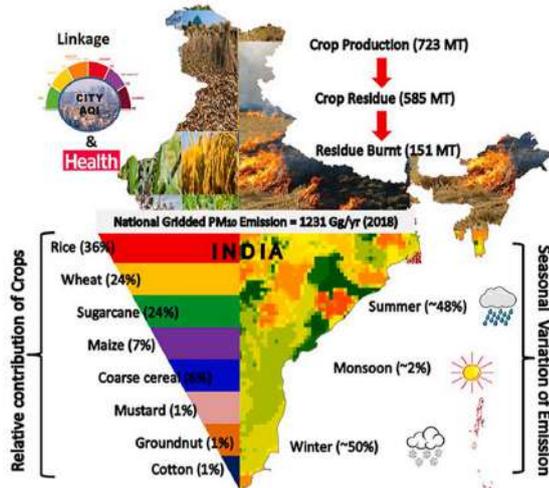
WAGENINGEN
UNIVERSITY & RESEARCH

Developing a soil and water quality risk map from crop residue burning in India

Country: India

Host institute: Soil Physics and Land Management (WUR) and Indian Institute of Technology Roorkee

Online possible: Yes

(Sahu et al., 2021)

Project description

Crop residue burning is a prevalent practice in India, particularly in the northwestern regions, where it significantly impacts soil and water quality. This MSc thesis project aims to develop a comprehensive risk map that highlights the areas most affected by crop residue burning and its subsequent effects on soil and water quality.

Subproject 1: Remote Sensing and Geospatial Analysis
•*Objective:* Identify areas affected by crop residue burning.
•*Methods:* Use remote sensing data and geospatial techniques to monitor soil moisture and detect burnt areas.
•*Outcome:* Develop an initial risk map highlighting affected regions.

Subproject 2: Field Surveys and Laboratory Analyses
•*Objective:* Assess soil and water quality in burnt areas.
•*Methods:* Conduct field surveys and laboratory analyses to measure soil health (organic matter, nutrients) and water quality (pH, turbidity, contaminants). Use GIS to correlate these findings with remote sensing data.
•*Outcome:* Create a detailed risk map identifying hotspots of soil and water degradation.

Subproject 3: Controlled Experiments and Socio-Economic Assessment
•*Objective:* Simulate residue burning impacts and evaluate farmers' perspectives on alternatives.
•*Methods:* Perform controlled experiments to collect leachate as a surrogate for groundwater contamination. Conduct surveys and interviews with farmers to understand their views on alternative practices.
•*Outcome:* Provide insights into potential groundwater contamination and develop recommendations for sustainable agricultural practices.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills: Environmental modelling
Requirements: GIS skills, hydrogeology

Contact

Supervisor(s): Reynold Chow, Joao Nunes, Idhaya Ilampooranan
Examiner: t.b.d
Contact details: reynold.chow@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Developing risk maps of aquatic pesticide pollution in rivers of the Czech Republic based on agricultural application patterns
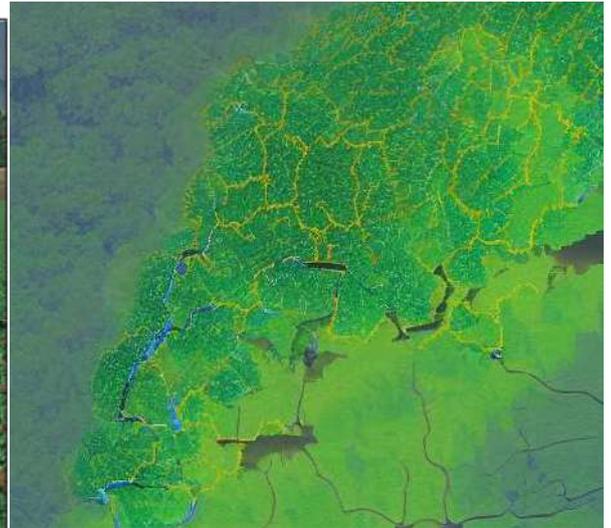
Country: Czech Republic

Host institute: Soil Physics and Land Management (WUR)
Online possible: Yes

(USGS, 2023)

(Artificial Art, 2023)

Project description

Pesticide pollution in European rivers is a significant environmental concern with far-reaching implications for ecosystems, human health, and biodiversity. The primary goal of this project is to develop a comprehensive risk map depicting the potential for aquatic pesticide pollution in rivers across the Czech Republic. The focus will be on understanding and visualizing the impact of agricultural pesticide application patterns on water quality.

This project will include the analysis of general pesticide application patterns. The pesticide application patterns will then be linked to spatially distributed land use/crop types. Different crops have unique characteristics, pest pressures, and agricultural practices, which in turn impact the choice and intensity of pesticide use. GIS and modelling tools (e.g., ArcGIS, QGIS, R) that incorporate the relationships between pesticide application, land use, and hydrology will then be utilized to map potential pesticide concentrations in the rivers of the Czech Republic. Risk to the aquatic environmental can then be assessed by comparing the mapped concentrations with environmental quality standards.

This project aims to produce accurate and actionable risk maps that can guide environmental policies, support sustainable agriculture practices, and contribute to the preservation of water quality in rivers of the Czech Republic. The methodology developed in this project will then be applied across all of Europe.

Project details
Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: Data Analysis Skills, GIS skills, Hydrochemistry, Hydrology

Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
Contact details: reynold.chow@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Evaluating Urban Sources of Aquatic Pesticide Pollution and the Risk of Pesticide Pollution Mixtures in Western Cape rivers, South Africa

Country: South Africa

Host institute: Soil Physics and Land Management (WUR) and Earth Sciences (Stellenbosch University)

Online possible: Yes

(Flickr, 2017)

(Engineering News, 2021)

Project description

The Western Cape of South Africa has a Mediterranean climate, and an abundance of agriculturally productive land to support the wheat, fruit, wine, and citrus industries of the country. South Africa is also the leading pesticide user in Sub-Saharan Africa. Active ingredients within pesticide compounds can enter non-target environments such as surface and groundwater where they can persist and be a risk to the environment and human health.

Sixty pesticides and transformation productions were detected in the rivers of three agricultural catchments in the Western Cape. Most samples contained five or more pesticides. Aquatic pesticide pollution can potentially harm aquatic organisms, but there is still a limited understanding of the nature of the pesticide pollution sources (urban vs. agricultural) and how pesticide mixtures could increase the exposure risk (and toxicity) to aquatic organisms.

This project aims at analysing over 3 years of aquatic pesticide pollution monitoring data to evaluate the sources and potential risks pesticide mixtures have on the aquatic environment. Statistical and time-series analysis will be performed in R or other scripting languages (e.g., Matlab). Findings will help in the design of mitigation measures to effectively tackle pesticide pollution issues in the region.

Project details
Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: Data Analysis Skills, Hydrogeology, Hydrochemistry, Hydrology

Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
Contact details: reynold.chow@wur.nl
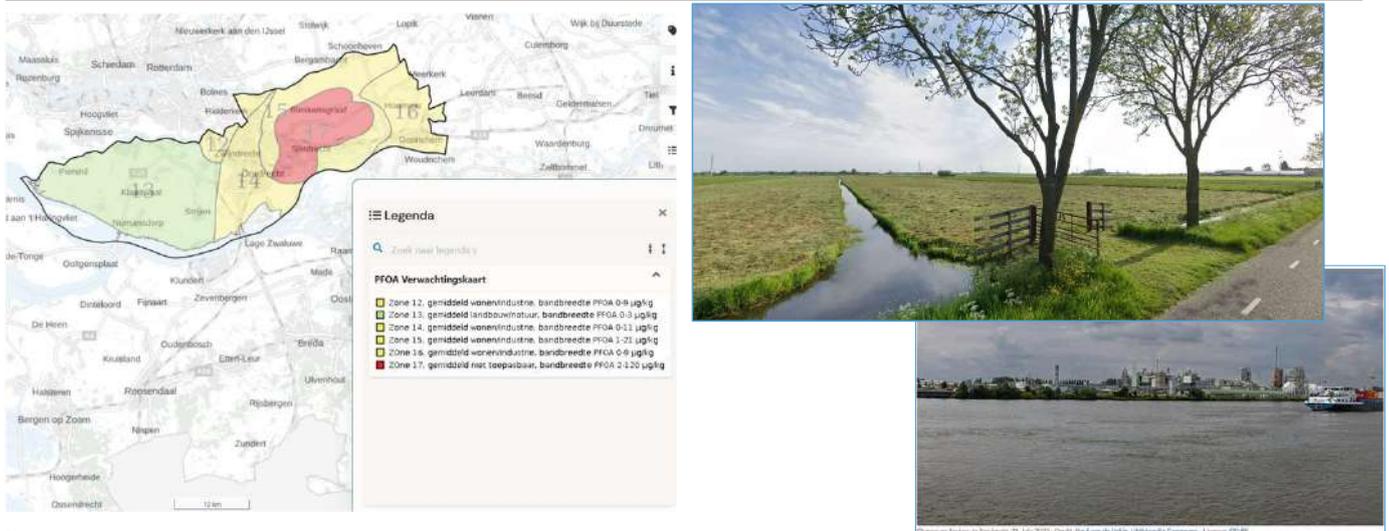
WAGENINGEN
UNIVERSITY & RESEARCH

Fate and transport modelling of PFAS (PFOA) in peat meadow systems nearby Dordrecht

Country: Netherlands

Host institute: Soil Physics and Land Management (WUR)

Online possible: Yes

Project description

Per- and polyfluoroalkyl substances (PFAS) are a class of persistent organic pollutants widely used in industrial and consumer products for their water- and grease-resistant properties. Among them, perfluorooctanoic acid (PFOA) is particularly concerning due to its high mobility, environmental persistence, and potential health impacts. One of the most notable PFAS contamination hotspots in Europe is the agricultural area around Dordrecht, the Netherlands, where historical emissions from a fluoropolymer manufacturing facility have led to significant soil, subsurface, and surface water contamination, affecting both the vadose and saturated groundwater zones.

This MSc project will focus on developing a fate and transport model to understand the behaviour of PFAS (primarily PFOA) in the unsaturated and saturated zones nearby the Dordrecht site. The project will start with a review of site-specific data, PFAS physico-chemical properties, and contaminant transport processes, followed by the development of a conceptual model of the peat meadows, which is the dominant landscape down wind of the Chemours plant. The peat meadow systems consist of narrow meadow plots surrounded by drainage ditches. The system's shallow depth, upward groundwater seepage, narrow plots, and strong soil–groundwater–surface water connectivity create a complex setting for PFAS fate and transport modelling.

Based on this, a numerical model will be constructed using HYDRUS (for vadose zone processes) or MODFLOW and MT3DMS (for groundwater flow and solute transport), or a coupled modelling approach. Key processes to be considered include advection, dispersion, sorption, and potential transformation or retention mechanisms relevant to PFAS. The model will be used to simulate the spatial and temporal evolution of PFAS plumes under current conditions, with the long-term aim of informing risk assessments and supporting the evaluation of possible mitigation or remediation strategies (e.g., pump-and-treat, in-situ barriers, or soil flushing). This project offers hands-on experience in contaminant hydrology modelling with direct application to one of the most pressing soil quality challenges in Europe, with important implications for groundwater quality and agricultural land use.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MEE

Begin date: any time
End date:

Used skills:
Requirements: GIS skills, hydrogeology, modelling

Contact

Supervisor(s): Reynold Chow, Vera da Silva
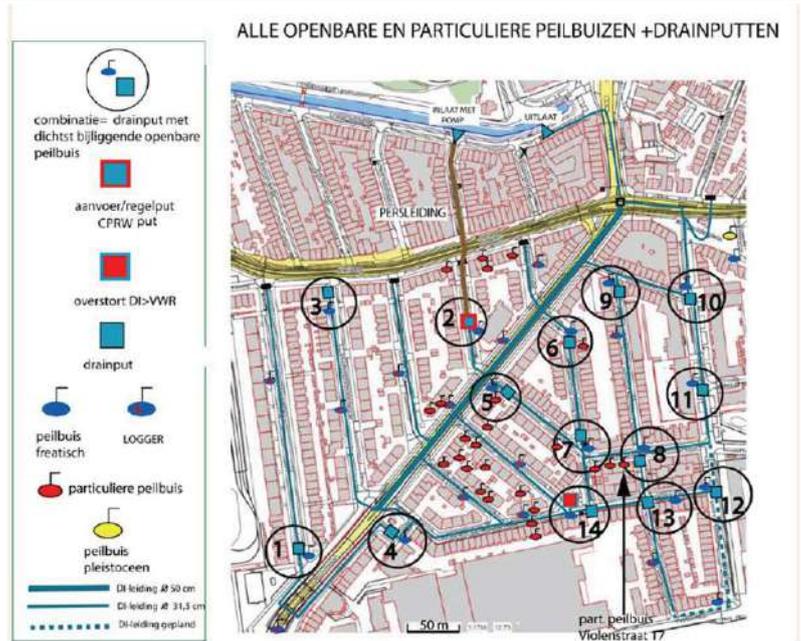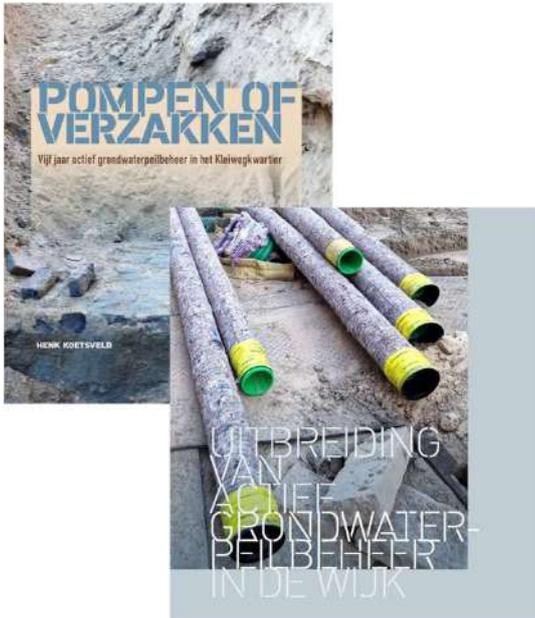Examiner: t.b.d
Contact details: reynold.chow@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Pump or Sink: Modelling Controlled Groundwater Recharge in Urban Rotterdam

Country: Netherlands

Host institute: Soil Physics and Land Management (WUR)

Online possible: Yes

Project description

This project challenges students to design and implement a numerical hydrogeological model of the Kleiwegkwartier neighbourhood near Rotterdam, where controlled groundwater management (active management with a pump) has been applied to combat subsidence and damage on wooden foundation piles.

The model will simulate the infiltration of water used to maintain stable groundwater levels and test the hypothesis that this intervention effectively prevents pile rot and structural issues in houses while sustaining local ecosystem services. Students will integrate site-specific data on soil stratigraphy, hydraulic conductivity, precipitation, and infiltration rates to calibrate and validate the model.

Scenario analysis will explore the long-term impacts of managed infiltration under varying climate and urban development conditions. The project combines technical modelling skills with applied hydrogeology, encouraging students to critically assess the balance between engineering solutions and ecological outcomes. By the end, students will deliver a robust evaluation of whether controlled groundwater recharge can serve as a sustainable strategy for protecting urban infrastructure and enhancing environmental resilience in low-lying Dutch neighbourhoods. An alternative topic can be reduction of heat stress by controlled groundwater management.

Project details

Group: Soil Physics and Land Management Group
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:
Requirements: Groundwater modelling, GIS, hydrogeology
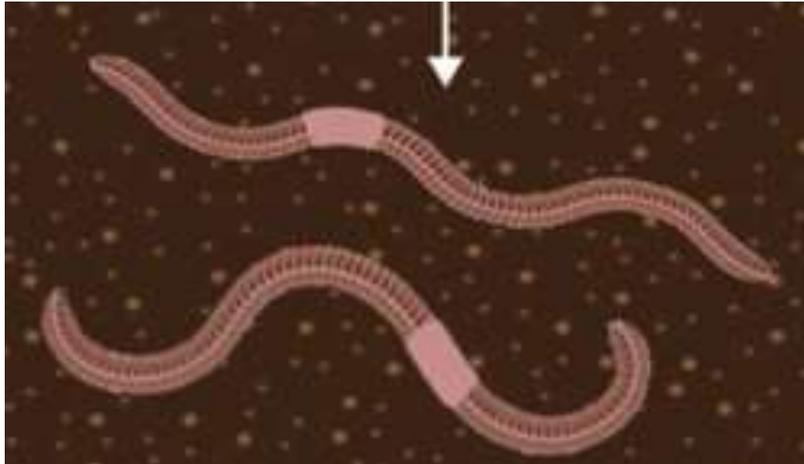
Contact

Supervisor(s): Reynold Chow
Examiner: t.b.d
Contact details: reynold.chow@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Pyraclostrobin degradation by *Lumbricus terrestris*

Country: Netherlands.
Host institute: SLM & ETE Wageningen University

Project description

- In conventional agriculture, the application of Plant protection products (PPP) is a common practice. Among the most used PPP is the fungicide pyraclostrobin.
- *Lumbricus terrestris*, is an anecic earthworm common in agricultural sites with low use of PPP, this earthworm contributes to different soil ecosystem services, such as infiltration, and water retention.
- In the EU-MINAGRIS project, we observed that *L. terrestris* can degrade pyraclostrobin, if this PPP is present in low concentration and without plastics.
- In this thesis or internship, we want to explore the mechanisms behind the degradation of pyraclostrobin by *L. terrestris*. As well we want to identify if climate change scenarios might affect this degradation.

Activities and objectives

- Your main task will be to assess the concentration of pyraclostrobin, in bulk soil and in burrows or casts done by *L. terrestris* at laboratory conditions.
- Dependent on your own interest, you can also dive into:
  - measuring the leaching of pyraclostrobin in groundwater

Project details

Group: Soil Physics and Land Management group
Project type: Thesis /Research practice
Study programme: MEE, MIL,

Begin date: February-March 2026
End date: open

Used skills: laboratory work and data analysis,
Requirements: to be discussed

Contact

Supervisor(s): Esperanza Huerta Lwanga & Kasia Kujawa
Examiner: to be discussed

Contact details: Esperanza Huerta Lwanga
(esperanza.huertalwanga@wur.nl)

Starch-based microplastic degradation by earthworms

Country: Netherlands.
Host institute: SLM & ETE Wageningen University
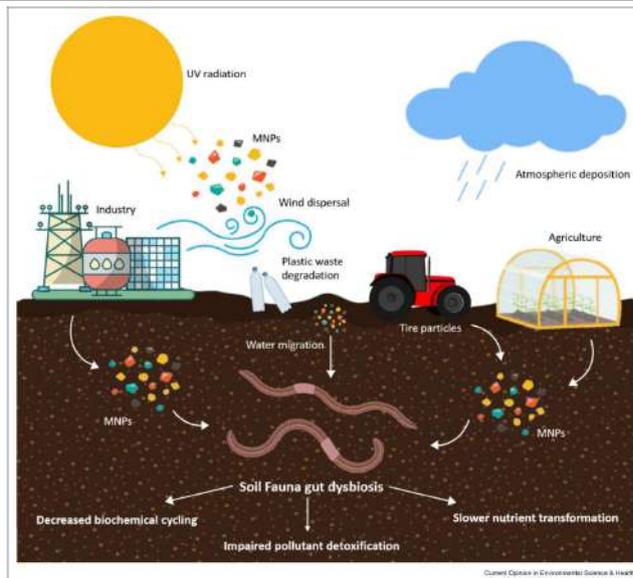
Project description

- In the last years, new types of plastics have been developed, in response to microplastic pollution. Among them the bio-based microplastics seem very promising.
- Earthworms known as soil ecosystem engineers, are impacted if microplastic pollution occurs in soils.
- In the EU-MINAGRIS project, we observed that *Aporrectodea calaginosa* (an endogeic earthworm) can gain weight with low doses of starch-based microplastics.
- In this thesis or internship, we want to explore the mechanisms behind the gain of weight of *A. calaginosa* with the presence of starch-based microplastics.

Activities and objectives

- Your main task will be to assess the concentration of starch-based microplastics or/and its derivatives in the body and casts of *A. calaginosa* at laboratory conditions.
- Dependent on your own interest, you can also dive into:
  - measuring the leaching of starch-based microplastics in groundwater

*Figure extracted from Vaccari et al. 2022.doi.org/10.1016/j.coesh.2022.100402

Project details

Group: Soil Physics and Land Management group
Project type: Thesis /Research practice
Study programme: MEE, MIL,

Begin date: February-March 2026
End date: open

Used skills: laboratory work and data analysis,
Requirements: to be discussed

Contact

Supervisor(s): Esperanza Huerta Lwanga & Kasia Kujawa
Examiner: to be discussed

Contact details: Esperanza Huerta Lwanga
(esperanza.huertalwanga@wur.nl)

Desiccation of Hatertse and Overasseltse Fens, Netherlands, Province of Gelderland

Host institute: Vereniging Natuur en Milieu Wijchen i.c.w. Staatsbosbeheer

Project description

The nature reserve "Hatertse en Overasseltse Fens" suffers from drought due to climate change and the drainage of agricultural land in the surrounding area. Although several internal restoration measures have been carried out, their effects on the local hydraulic heads are limited.

Research questions

• Quantify the effect of regional water management (rivers, agriculatural area, Berendonck ponds) on the head distribution of Hatertse and Overasseltse Fens, through modeling.
• Evaluate several applicable measures to mitigate desiccation

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MEE

Begin date: t.b.d.
End date:

Used skills: (Groundwater) modeling
Requirements: HWM33806 (WANT), SLM21306 (CoHy) or
SLM33306 (AHSA)
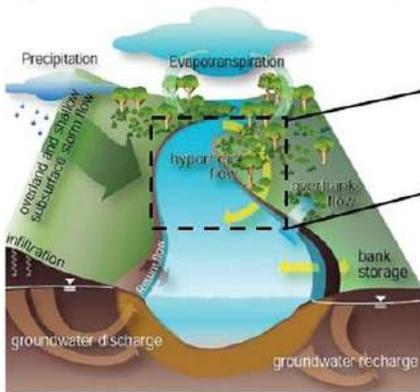
Contact

Supervisor(s): G. Bier, K. Metselaar
Examiner: t.b.d.
Contact details: G. Bier (george.bier@wur.nl), K. Metselaar (klaas.metselaar@wur.nl)
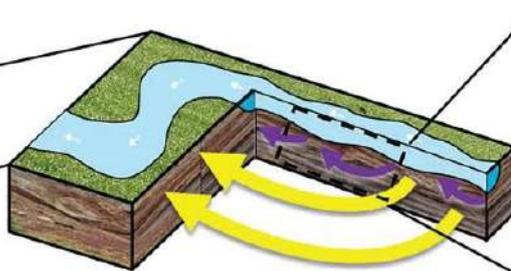
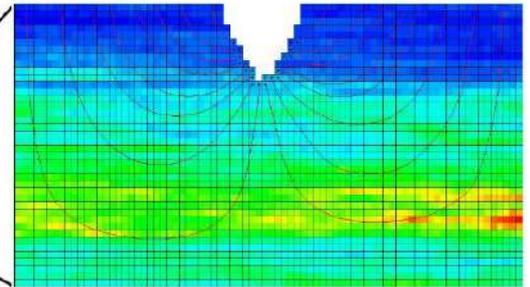# Groundwater-Surface-water exchange, the Hyporheic zone

(a) River-Corridor-Scale (1 km – 10 m)   (b) Meander-Scale (10 m - 1 m)   (c) Local-Scale (0.5 - 0.1 m)

Project description

The hyporheic zone, defined by shallow subsurface pathways through river beds and banks beginning and ending at the river, is an integral and unique component of fluvial systems. It hosts myriad hydrologically controlled processes that are potentially coupled in complex ways. Understanding these processes and the connections between them is critical since these processes are not only important locally but integrate to impact increasingly larger scale biogeochemical functioning of the river corridor up to the river network scale (M. Bayani Cardenas).

Research Questions

• How is the local flow towards an open water course distributed ?
• What is the effect of the heterogeneity in the subsoil on flow in the hyporheic region?
• Can this local distribution be incorporated in simple Cauchy top boundary systems like the River package in MODFLOW?

Approach

• Use of several modeling environments (e.g. GMS-MODFLOW, IGroW) and programming tools (e.g. R, Python)
• Develop a strategy to determine the flux distribution entering the open water course
• Consider scaling strategies to capture the flux rate
• Evaluate the impact of the different spatial scales

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MEE

Begin date: t.b.d.
End date:
Used skills: Groundwater modeling
Requirements: HWM33806(WANT),SLM21306 (CoHy)or SLM33306 (AHSA)

Contact

Supervisor(s):Reynold Chow,Yan Liu, George Bier
Examiner: George Bier
Contact details:George Bier (george.bier@wur.nl), R. Chow (reynold.chow@wur.nl)
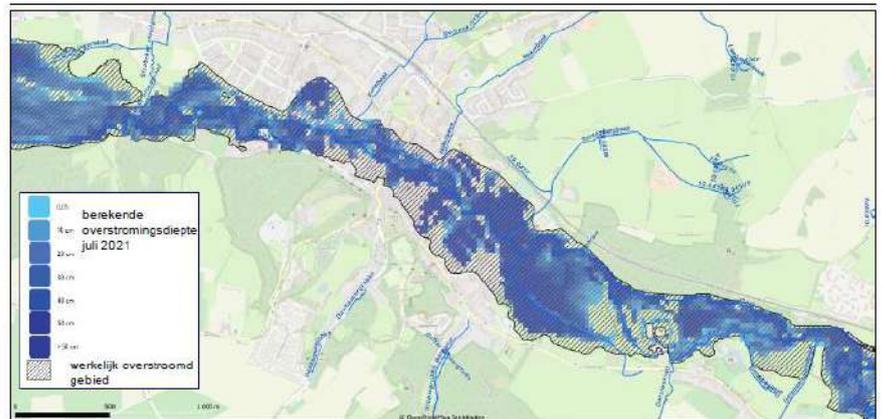
WAGENINGEN
UNIVERSITY & RESEARCH

Evaluating landscape measures to mitigate floods and droughts – LandEX project

Country: potential: NL, Portugal, Spain, Norway, Sweden
Host institute: t.b.d.
Online possible: N.A.

Calculated flood areas of the Geul river near Valkenburg. The striped areas are the really flooded areas based on aerial imagery, blue colours indicate water depths based on model calculations.

Source: Deltares, 2022. Analyse overstroming Valkenburg. Watersysteemevaluatie Waterschap Limburg

Project description

Floods and droughts have become an increasing societal concern. The LandEX project aims to improve landscape resilience to floods and droughts by spatially optimising a suite of adaptation measures in the landscape. Questions addressed include: (i) how can various (Nature-Based) measures increase water retention in the landscape; (ii) how do their spatial location determine their effectiveness at the landscape level, and (iii) what are the potential synergies in a network of measures distributed throughout the landscape? LandEX will design spatially-explicit adaptation scenarios in close collaboration with local stakeholders and quantify their effectiveness using connectivity-based spatially distributed hydrological modelling in 5 study areas in northern and southern Europe.

Research Objectives/Questions
Depending on the student's interested and stage of the project, potential topics are:
- Synergy of flood and drought measures and their functioning in the landscape
- Connectivity-based modelling of flood and drought risks
- Co-design of spatial (Nature Based Solutions) effective measures in collaboration with local stakeholders
- Process-based modelling of the effectiveness of the designed measures

What is expected from the student (type of research)

Depending on the exact research topic, various activities will be carried out. Spatial modelling (e.g. using OpenLISEM and connectivity analysis), field measurements, mapping and analysing of existing measures and interviews and stakeholder analysis regarding their preferred measures.

Project details
Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MIL & MEE

Begin date: tbd, likely from September 2024 onwards
End date: tbd

Used skills: modelling, interviewing, fieldwork, mapping, measuring
Requirements: depending on topic (e.g.: modelling)

Contact
Supervisor(s): Jantiene Baartman, Joao Nunes & project partners
Examiner: tbd
Contact details: jantiene.baartman@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Ecohydrology of natural peatland ecosystems – several topics

Country: The Netherlands, Canada, Finland

Host institute: WUR, University of Nipissing (Canada), University of Oulu (Finland)

Project description

• Several thesis topics on ecohydrology of peatlands are available in The Netherlands, Finland and Canada.
• The exact thesis content can be adapted to the interest of the student.
• Get in touch with Klaas.Metselaar@wur.nl or Jelmer.Nijp@kwrwater.nl for more information

Peatland ecohydrology topics

1. **Effect of nature restoration measures on hydrological properties of the topsoil in peatland ecosystems**
   You will execute fieldwork in the peatland Fochteloerveen in The Netherlands, execute soil hydrological laboratory methods and/or use the results in model simulations. You will be based at WUR and KWR Water Research Institute. Field work period: summer or autumn 2026.
2. **Effects of rewetting of northern peatlands on properties of natural peat soils**
   If the hydrology of peatlands changes, also peat formation and decomposition processes will change. This has consequences for peat hydrological properties and processes. In collaboration with University of Nipissing (CA) you will carry out fieldwork in Canada and execute model simulations to understand how temporal changes in peat structure affect the peatland water balance. Begin date: any time.
3. **Impact of hydrological processes in northern peatlands on streamflow and water storage dynamics**
   Catchment scale peatland models exist to predict how the water cycle of natural peatlands will change under climate change. In this thesis you will compare the strengths of simulation models of different complexity in collaboration with Oulu University (FI). Begin date: any time

Project details

Group: Soil Physics and Land Management group
Project type: Thesis /Research practice
Study programme: MEE

Begin and end date: see topics above

Used skills: depends on topic, ranging from fieldwork to modelling
Requirements: to be discussed

Contact

Supervisor(s): Jelmer Nijp and Klaas Metselaar and external local supervisors
Examiner: to be discussed

Contact details:
Jelmer Nijp (Jelmer.nijp@kwrwater.nl)
Klaas Metselaar (Klaas.Metselaar@wur.nl).

WAGENINGEN
UNIVERSITY & RESEARCH

Peatland Time Travel: Exploring the evolution of ecohydrological processes in natural northern Swedish peatlands

Country: Sweden or The Netherlands

Host institute: Swedish Agricultural University (SLU) Umeå or WUR

Project description

• Peatlands act as natural water sponges, store large amounts of carbon, and shape the regional water cycle. In northern Sweden, the land is slowly rising after the last Ice Age (isostatic rebound), exposing new land area where peatlands can form. Over the last ~7000 years, this has created a time-since-initiation gradient (chronosequence) of peatlands.

• Along this chronosequence we monitor groundwater levels and other ecosystem properties. This allows to explore how water storage and ecohydrological functioning of peatlands evolves over millennia.

• In this thesis (or internship) you'll gain practical and scientific skills and work with environmental data in one of Europe's most natural ecosystems.

Activities and objectives

• Your main task will be to process and analyze groundwater timeseries and quantify hydrological characteristics of peatlands. If your thesis will be executed between May - September, you can also join fieldwork in natural northern peatlands, before the sites disappear under a thick snowpack.

• Dependent on your own interest, you can also dive into for example:
  • Process-based ecohydrological modelling
  • GIS-based landscape analysis
  • In case of internship you can be involved in other research topics, e.g. carbon and mercury accumulation

Project details

Group: Soil Physics and Land Management group
Project type: Thesis /Research practice
Study programme: MEE

Begin date: any time after March 2026
End date: open

Used skills: data analysis, basic programming, hydrology
Requirements: to be discussed

Contact

Supervisor(s): Jelmer Nijp and Klaas Metselaar
Examiner: to be discussed

Contact details:
Jelmer Nijp (Jelmer.nijp@kwrwater.nl)
Klaas Metselaar (Klaas.Metselaar@wur.nl)

WAGENINGEN
UNIVERSITY & RESEARCH

Assessing vulnerability to drought in the Upper Godavari watershed, India

Country: India
Host institute: Indian Institute of Technology Roorkee
Online possible : no

RESTARTᴵᴺ

Upper Godavari (Marathwada Region)

Drought conditions force Marathwada farmers to migrate for work as sugarcane cutters

RAINFALL
Figures in mm

2014 — **399** — 42% below normal level
2015 — **334** — 44% below normal level
2016* — **687**
*Between June & September

Maharashtra

Marathwada

India — The average June-September rainfall for Marathwada region is 687mm

- Only 2% water left in 11 major dams in May; 8 of them recorded zero live water storage*
- All big dams have live water storage of 5,142 million cubic metres
- Unlike 1972, last year more than 1,000 farmers committed suicide due to water scarcity

*Live water storage is when water in the dam is high enough to flow out of the sluice gates

Reservoir levels dip as drought looms large in Maharashtra's Marathwada region
According to IMD, out of the total 36 districts of Maharashtra, 13 received less than average rainfall

Vanishing wells of Marathwada: Farmers report water table dropped to 300 metres in 30 years
As trips to fetch water from tankers get longer, expert says dire situation result of poor water management

Only 17% rainfall in the entire region in 2012

Project description

Context: The Upper Godavari watershed, located in the rain-shadow region of the Western Ghats, experiences frequent meteorological and agricultural droughts despite its strategic importance for irrigation, drinking water supply, and regional food security. In the Marathwada region, drought disproportionately affects small and marginal farmers, as well as rain-fed agricultural communities that are dependent on groundwater. Recurrent crop failures, declining reservoir storage, and falling water tables have led to income instability, food insecurity, seasonal migration, and increased farmer distress. Despite this situation, existing water management interventions in the region have delivered limited long-term resilience due to poor site selection, inadequate maintenance, and weak hydrological planning. Understanding drought vulnerability in this region is therefore essential for designing targeted adaptation strategies, improving water governance, and enhancing resilience under climate change.

The work is part of **RESTARTin: "Restructuring and Enhancing Strategies with a Transformative AppRoach for InTegrated Water Disaster Management in India and the Netherlands"**. The student will work at IIT Roorkee (https://www.iitr.ac.in/), one of India's top technological institutes.

Objectives: the student can choose between the following:
1) Understand the hydrological functioning of the Upper Godavari watershed using process-based hydrological modeling (SWAT/SWAT+) and available hydro-meteorological datasets.
2) Assess the potential of water retention structures (nature-based solutions) to mitigate drought impacts.
3) Assess drought vulnerability using integrated conceptual frameworks.

Expected Research Methods: depending on the objectives: (i) Process-based hydrological modeling of the Upper Godavari watershed using SWAT/SWAT+. (ii) Characterization and parameterization of water retention structures (Area-Volume-Depth relationships) using remote sensing data and available hydrological information. (iii) Spatial mapping and quantification of drought vulnerability and risk zones.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL & MEE

Begin date: tbd
End date: tbd

Used skills: GIS, modelling, data analysis
Requirements: good computer skills

Contact

Supervisor(s): Joao Nunes or Haris Ali
Host Supervisor(s): Idhaya Chandhiran, Swetasree Nag
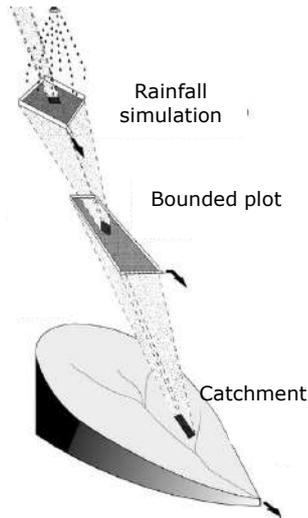Examiner: t.b.d
Contact details: joao.carvalhonunes@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Monitoring soil hydrology and erosion after wildfires: effect of fire recurrence and severity.

Country: Spain

Host institute: Biological Mission of Galicia (MBG-CSIC), Pontevedra

Online possible: No

Rainfall simulation

Bounded plot

Catchment

Project description

Context: The study of the hydrologic and erosion processes after wildfires poses many challenges, since they are highly dependent on the fire severity and frequency, the spatial and temporal scales, as well as a broad number of topographic, climate, soil and biological field variables. While soil burn severity indexes are commonly used to assess fire impact, few studies have directly linked these measures to subsequent hydrologic and erosion responses. To obtain clear results, researchers must conduct complex, intensive field assessments with sufficient replication, avoiding mixed or coupled data. Rainfall simulations offer a reliable alternative to compare scenarios under controlled conditions. At MBG-CSIC, we address this knowledge gap through multiple projects that use laboratory, field, and modeling approaches to understand how wildfire frequency and severity influence water- and wind-driven erosion.

Research Objective: The specific objective can be one of the following:

1. Calculate the hydrologic (peak flows, runoff/rainfall rates) and erosion responses (rainsplash, interrill, rill) from different fire severities and/or frequencies after the 2026 wildfire season, in the framework of the MULCHAR project;

2. Predict the effects of fire frequency/severity on surface hydrology and erosion at broad temporal and spatial scales through hydrologic modelling (LISEM, SWAT, etc) and remote sensing.

Expected research methods: The workplan can involve a mixed laboratory, field and modelling approach, to be discussed with the student. While focusing on a specific topic, the student will integrate the MBG-CSIC research team and work on one or more of the following tasks: i) calibration of hydrologic monitoring devices (pressure & dielectric sensors installed in V-notchs, parshalls and small flumes); ii) assessment of water discharge or erosion in small catchments; iii) hydrological modelling iv) remote sensing analysis.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis/Internship
Study programme: MIL & MEE

Begin date: from September 2026
End date: until June 2027

Used skills: fieldwork, data analysis, numerical modelling
Requirements: knowledge of soil sciences

Contact

WUR Supervisor: Joao Nunes
Host Supervisor: Sergio A. Prats / Cristina Fernandez
Examiner: t.b.d.
Contact details: joao.carvalhonunes@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Assessing vulnerability to drought in a transboundary Dutch-Belgian catchment

Country: Netherlands
Host institute: WUR
Online possible : no

RESTARTin

Project description

Dutch landscapes are traditionally designed to drain excess water. However, the 2018 drought exposed a phenomena that is recent in the Netherlands, but increasing in frequency and intensity. This highlighted both the need for better drought management, and the lack of information on local drought processes. Project **RESTARTin: "Restructuring and Enhancing Strategies with a Transformative AppRoach for InTegrated Water Disaster Management in India and the Netherlands"** is addressing this issue in the Aa of Weerijs, a transboundary catchment between the Netherlands and Belgium. Recent droughts – including in 2025 – have increasingly affected agricultural and tree-growing activities, putting pressure on available groundwater resources and on the regional water authority's management.

This MSc project aims to assess the vulnerability of the Aa of Weerijs to droughts: meteorological (lack of rainfall), vegetation (lack of soil moisture), and/or hydrological (low streamflow and groundwater levels). The work will include analyzing spatially distributed data, including meteorology (rainfall radar), vegetation (satellite imagery for vegetation and evapotranspiration), and water bodies (streamflow, groundwater levels). Scenario analysis with hydrological modelling (MODFLOW-MetaSWAP) is also possible. The work will be integrated in RESTARTin, in coordination with the regional water authority Brabantse Delta.

Several activities are possible:
• Explore how drought propagates from meteorological to vegetation and hydrological droughts.
• Explore remote sensing tools to map and quantify irrigation water use.
• Map drought vulnerability according to land use (e.g. agriculture, tree nurseries) or stream characteristics.
• Assess if drought vulnerability differs between the Dutch and Belgium sides, and why.
• Use modelling to explore the effectiveness of land management measures aimed at reducing vulnerability, e.g. crop rotations or adjustments in sowing and harvesting periods.
• Explore the adoption by farmers of tools to monitor drought and increase irrigation efficiency.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MEE & (for transboundary topics) MIL

Begin date: tbd
End date: tbd

Used skills: GIS, remote sensing, coding (R/Python)
Requirements: good computer skills

Contact

Supervisor(s): depending on the topic, Joao Nunes, Reynold Chow, Saskia van der Kooij or Haris Ali
Examiner: t.b.d
Contact details: joao.carvalhonunes@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Linking Surface and Groundwater quality under different land management practices with more frequent hydrological extremes

Country: Republic of Ireland
Host institute: Teagasc Johnstown Castle
Online possible ? : No

AGRICULTURAL CATCHMENTS PROGRAMME

Project description

The Agricultural Catchments Programme (ACP) started in 2008 to investigate the connection between anthropogenic activities, climatic drivers, and water quality within six hydrologically diverse Irish agricultural catchments covering a range of landscape/soil/farming combinations. Since the start, the catchments have been under very high temporal resolution monitoring (10-min basis) and the programme has amassed a unique environmental, agronomic and socio-economic data set unrivalled around the world. ACP is coordinated and managed from the Teagasc Environmental Research Centre in Johnstown Castle, Ireland, and funded by Department of Agriculture, Food, and the Marine of Ireland. The current phase [Phase 5] runs from 2024–2027. Within this programme, different research topics can be pursued as a master's thesis topic or internship.

Students are currently being sought to examine the impact of land management practices and climate change on the interface between groundwater and surface water quality, using simulation or optimization models. More specifically, the impact of cascading extreme hydrological events on catchment hydrologic functioning and water quality in two groundwater fed catchments are going to be explored.

This will mostly be a desk work, including big data analysis on high resolution data, GIS, and statistical assessments. The results would contribute to the ongoing catchment scale modelling works of ACP for development of climate-smart catchment-specific adaptation/mitigation measures.

Students are also invited to propose their own research topic which suits their interests.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE

Begin and end date: to be decided with the students

Used skills: Big data analysis, Hydro(geo)logy

Contact

Supervisor(s): Joao Nunes or Reynold Chow (WUR) & Golnaz Ezzati (ACP)
Examiner: Luuk Fleskens
Contact details: joao.carvalhonunes@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Integrated Sustainable Management of the Water-Soil-Plant system in Mediterranean Agroforestry

Country: Portugal
Host institute: University of Évora & MED, Évora
Online possible : no

Project description

This thesis topics will focus on one of the traditional agroforestry systems of the Iberian Peninsula: the **Montado** agrosilvopastoral system, and **Olive groves**.

The **montado** is characterized by the combination of pasture with cork and holm oaks. Its long-term sustainability and resilience is at risk due to the ageing oak populations and insufficient natural regeneration. Balancing forest regeneration with livestock grazing is critical, as grazing intensity directly influences seedling survival, soil properties, stand structure, and ecosystem function. Understanding how different grazing regimes affect the montado regeneration and sustainability is central to the project. Topsoil plays a critical role in water infiltration, nutrient availability, organic matter dynamics, and root development, and is therefore a key component linking grazing management and forest regeneration.

Objective: Analyze interactions between grazing pressure, forest stand structure, litter layer, topsoil condition, and identifying thresholds that promote or limit oak regeneration.

Olive groves are highly susceptible to runoff generation and soil erosion, especially under Mediterranean climate conditions, characterized by irregular rainfall patterns and intense precipitation events. The application of organic material on the soil surface (mulching) is widely recognized as effective for soil and water conservation. However, understanding hydrological and erosive processes remains challenging, as they are strongly dependent on spatial and temporal scales and are influenced by multiple topographic, climatic, soil, and biological factors. Consequently, intensive field assessments, robust methodologies, and adequate experimental replication are required to obtain consistent and reliable results.

Objective: To evaluate the effects of soil conservation practices—particularly mulching—on hydrological and erosive processes in olive groves under Mediterranean climate conditions.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL & MEE

Begin date: first half of 2026
End date: tbd

Used skills: fieldwork, laboratory work, data analysis
Requirements: experience in fieldwork

Contact

WUR Supervisor: Joao Nunes
Host supervisor(s): montado – Eva Barrocas & Maria Isabel Ferraz; olive groves – Joao Canedo & Sergio Prats
Examiner: t.b.d
Contact details: joao.carvalhonunes@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Agricultural transition in Waterwijzer Landbouw

Country: Netherlands

Host institute: Witteveen+Bos

Online possible ? : No

Project description

Do you contribute to better evaluation of extensive forms of agriculture in the transition of our rural area? And would you enjoy to work at the interface between research and application in collaboration with consultancy firm Witteveen+Bos and Wageningen Environmental Research? Maybe this MSc internship is something for you!

Waterwijzer Landbouw (WWL, see waterwijzerlandbouw.wur.nl) is a scientific agrohydrological model/methodology which is used in The Netherlands to determine how crops develop, depending on weather, cultivation, soil type and drainage conditions. Consultancy firm Witteveen+Bos uses WWL to analyse the effect of different water management options on agricultural crop yields. Examples of projects are new extractions for drinking water, adaptations of surface water levels and brook restoration projects.

WWL has not been used yet to analyse the effects of the transition from traditional agriculture to more extensive agriculture, such as wet cultivation in peat areas and agriculture around nature areas. These are often projects in which we investigate with a multi-disciplinary team the options for biodiversity restoration, measures to alleviate drought- and oxygen stress, transition of agriculture and sometimes other functions of rural areas such as housing. In these projects, we notice that currently WWL is unable to analyse well extensive agriculture.

In this internship, we want to investigate how more extensive forms of agriculture can be incorporated in WWL and apply this in ongoing projects. The precise contents of the internship we determine in consultation with you, Wageningen Environmental Research (Mirjam Hack and Martin Mulder) and Witteveen+Bos (Geerten van der Zalm en Berto Meeuwissen).

Project details

Group: Soil Physics and Land Management group
Project type: Internship

Study programme: MEE

Begin date: Any time

Used skills: Agrohydrological modeling

Contact

Supervisor(s): Martin Mulder (WENR) and Geerten van der Zalm (Witteveen+Bos)

Examiner: Jos van Dam

Contact details: jos.vandam@wur.nl; martin2.mulder@wulder.nl; Geerten.van.der.zalm@witteveenbos.com

WAGENINGEN
UNIVERSITY & RESEARCH

Landscape Rehydration in Australia

Country: Australia

Host institute: University of Sydney

Online possible ? : No

Project description

The Landscape Rehydration Project (LRP) of Sydney University specifically aims at testing typical regenerative agriculture practices for Australia. This can be seen in the larger context of Nature Based Solutions for drought and flooding.

The LRP at Llara farm, which is funded until mid-2027, intends to increase infiltration and water retention due to the reduction of overland flow velocity. Due to increased water availability, soil quality and soil carbon increases. The landscape rehydration treatments include grazing treatments.

The major objective of the LRP is to test whether landscape rehydration can provide drought resilience for pasture production. The evidence to support this objective focuses on three main areas:
- Changes in the overall water balance
- Changes in pasture production and animal production
- Changes in soil quality and health

Your task during this thesis or internship is to:

1. Analyse soil moisture regime of control and treatment sites, using measurements by 32 capacitance soil moisture probes and 16 neutron probes.
2. Derive the water balance for the different fields, using remote sensing satellite data, soil moisture observations, and creek discharges.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE

Begin date: Any date

Used skills: data analysis with R, use of agrohydrological model SWAP, analysis remote sensing data

Contact

Supervisor(s): Willem Vervoort (University of Sydney)

Examiner: Jos van Dam

Contact details: jos.vandam@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Environmental quality: nitrate leaching

Country: The Netherlands

Host institute: RIVM

Online possible ?: No

Project description

The National Institute for Public Health and the Environment (RIVM) is responsible for national measurements of environmental quality. One part (Landelijk Meetnet effecten Mestbeleid = LMM) focuses on the effect of manure policy on the nitrate concentrations in soil water, groundwater and surface water. The measured concentrations are highly dependent on weather circumstances. To eliminate the effect of weather and derive year-average concentrations, RIVM uses the so-called "vormingstijd". The vormingstijd simulates the residence time of non-reactive solutes in the top 1 meter of a soil profile. Currently, the vormingstijd is calculated with a special for RIVM adapted version of SWAP (Soil, Water, Atmosphere and Plant model). The current procedure simulates the entire country as a sand profile with grass on top.

We want to investigate whether the most recent SWAP version is more suitable for determining the vormingstijd. In addition, we want to extend the vormingstijd from grassland-sand to other land use-soil combinations in our LMM.

We are searching for a hydrology student interested in:
• Water quality in agricultural areas
• Agro-hydrology and water quality simulations with SWAP

Next to knowledge of agro-hydrologic simulation, experience with the programming language R is desirable.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MEE

Period: Any time

Used skills: programming language R is desirable

Contact

Supervisor(s): Jos van Dam, Piet Groenendijk (WENR), Timo Brussée (RIVM)

Examiner: Jos van Dam

Contact details: jos.vandam@wur.nl; piet.groenendijk@wur.nl; timo.brussee@rivm.nl

Map MAR suitability zones using GIS/remote sensing and multi-criteria decision analysis (MCDA/AHP) integrating hydrogeological, topographic, and land use parameters
Identify optimal MAR techniques by location (infiltration basins/ponds, check dams/gabions, recharge trenches/pits) and evaluate recharge performance: infiltration capacity, seasonal recharge volume, and groundwater response
Identify optimal MAR techniques by location (infiltration basins/ponds, check dams/gabions, recharge trenches/pits) and evaluate recharge performance: infiltration capacity, seasonal recharge volume, and groundwater response
Assess implementation risks (clogging/sedimentation, contamination vulnerability, water quality impacts) and deliver implementation-ready outputs: suitability maps, candidate site portfolio, preliminary designs, and monitoring plans
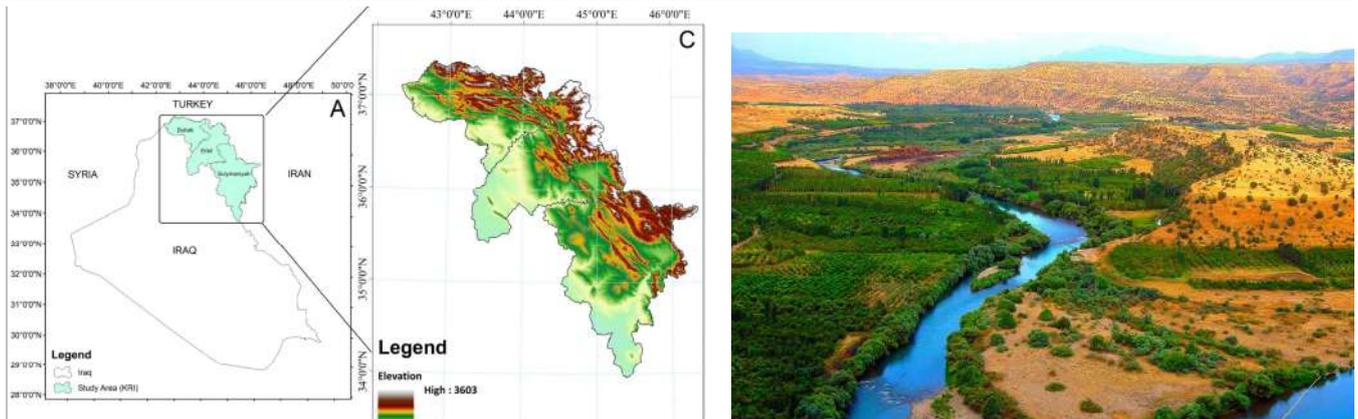
WAGENINGEN
UNIVERSITY & RESEARCH

Optimizing Rainwater Harvesting for Managed Aquifer Recharge (Erbil)

Country: Iraq

Host institute: Salahaddin University in Erbil- Iraq

Online only

Project description

Declining groundwater levels and water quality degradation in Erbil require sustainable solutions. Managed Aquifer Recharge (MAR) using rainwater harvesting (RWH) offers potential to enhance groundwater storage, mitigate flood risks, and improve drought resilience. This project integrates GIS/remote sensing and performance modeling to identify optimal MAR locations and designs. Semi-arid rainfall patterns generate short, high-intensity events with rapid runoff, making strategic MAR implementation critical. Success depends on proper site selection considering soil permeability, aquifer characteristics, water quality, and contamination risk.

Research objectives:-

1. Quantify runoff potential at sub-catchment scale for storm events and seasonal totals using hydrological modeling
2. Map MAR suitability zones using GIS/remote sensing and multi-criteria decision analysis (MCDA/AHP) integrating hydrogeological, topographic, and land use parameters
3. Identify optimal MAR techniques by location (infiltration basins/ponds, check dams/gabions, recharge trenches/pits) and evaluate recharge performance: infiltration capacity, seasonal recharge volume, and groundwater response
4. Assess implementation risks (clogging/sedimentation, contamination vulnerability, water quality impacts) and deliver implementation-ready outputs: suitability maps, candidate site portfolio, preliminary designs, and monitoring plans

Expected knowledge

Interested student(s) should have foundational knowledge in hydrogeology and watershed management, GIS software (ArcGIS/QGIS) and remote sensing , and familiarity with multi-criteria decision analysis (MCDA/AHP) and hydrological/groundwater modeling tools such as SWAT/MODFLOW.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship /
Study programme: MEE/MIL

Begin date: felxible
End date:

Used skills:
Requirements: (e.g. GIS skills)

Contact

Supervisor(WUR): Rynold Chow and Karrar Mahdi
Supervisor (SUE): Heman Ahmed

Examiner: t.b.d
Contact details: karrar.mahdi@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Rainwater Harvesting for Supplemental Irrigation in Rain-Fed Wheat Systems (Kirkuk Plains)

Country: Iraq

Host institute: Salahaddin University -Iraq

Online only

Project description

Rainwater harvesting (RWH) can provide targeted supplemental irrigation (SI) to stabilize yields and improve water productivity in rain-fed wheat systems. However, SI may increase soil salinity risk where drainage is limited or water quality is marginal. This topic integrates GIS/remote sensing and hydrological modeling to assess yield stability, monitor soil salinity dynamics, and evaluate critical growth stages for optimal irrigation timing. Rain-fed wheat systems in semi-arid environments are highly sensitive to rainfall timing and water stress. Poor timing or excessive amounts may mobilize salts or concentrate salinity in the root zone, requiring careful monitoring of crop stress and salinity patterns.

Research objectives:-

1. Assess RWH potential and identify priority zones for implementation using GIS/remote sensing and terrain hydrology
2. Quantify the impact of SI (from harvested rainwater) on wheat yield, yield stability, evapotranspiration, and water productivity
3. Characterize and map soil salinity dynamics (temporal and spatial) under different SI strategies
4. Evaluate scheduling guidance (timing and amount) that minimizes salinity build-up, maximizes water productivity, and supports yield gains
5. Produce decision outputs: RWH suitability and salinity risk maps, plus farmer/practitioner recommendations

Expected knowledge

Interested student(s) should have foundational knowledge in GIS (ArcGIS/QGIS) and remote sensing , and familiarity with multi-criteria decision analysis (MCDA/AHP)

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MEE/MIL

Begin date: Flexible
End date:

Used skills:
Requirements: (e.g. GIS skills, followed a specific course)

Contact

Supervisor(WUR): Karrar Mahdi & t.b.d from WRM
Supervisor (SUE): Dr Heman Ahmed

Examiner: t.b.d
Contact details: karrar.mahdi@wur.nl and heman.ahmed@su.edu.krd

Linking soil physical properties with crop production in a Dutch arable farming context

Project description

Currently data are collected within a network of approximately 40 arable farmers with 131 plots in two areas in the Netherlands: around the Hoeksche Waard and around the south of Drenthe. This data collection is part of a PhD project that is being executed at Plant Production Systems group, with the main aim to quantify and explain variations in resource use efficiency among arable farmers in the Netherlands. Yield data, nutrient uptake by crops and nutrients in soil samples are analyzed, and cultivation records from growers are also collected to gain the best possible insight into the input-output relationships of the various plots. However, there are many other factors that can contribute to explaining differences. These include weed pressure, diseases and pests, as well as soil physical properties.

The link between soil physical properties and what that means for production, for example, but also for nitrogen use efficiency, is particularly relevant. The question is, among other things, how one can gain better insight at plot level without it becoming too complicated in terms of measurements. Determining retention curves and unsaturated permeability for all plots is not realistic, but perhaps measurements for compaction, bulk density, aggregate stability or infiltration rates are feasible? A selection of areas could also be made, for example only on clay soils where structural problems play a greater role than on sandy soils.

A possible thesis could focus on executing simple field measurements in the farmers' fields to quantify certain soil physical parameters, and to use this then as input in ecohydrological models. The modelling part could focus on quantifying the effect of soil physical properties on crop yields, with the particular aim to relate this to the observed differences between fields.

Period, required skills

Starting period is flexible. Field work might be involved, but the exact period of field work is also depending on type of measurements (doing measurements in winter can be tough (and also less relevant))

Willingness to conduct some field work is a requirement, for which having a driver license is also an advantage.

Supervision:
Klaas Metselaar (SLM)
Paul Ravensbergen (PPS)
Jop van der Wel (PPS)

Interested in this topic? Contact:

Klaas Metselaar , klaas.metselaar@wur.nl

Jop van der Wel (PhD candidate at PPS), jop.vanderwel@wur.nl
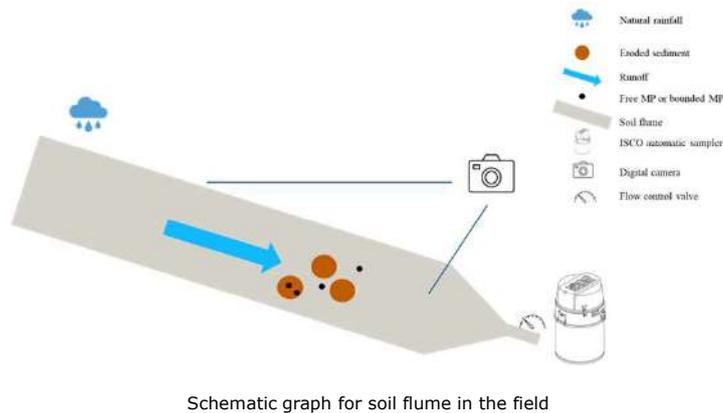
Quantify MicroPlastics Transport via Natural Rainfall Events

Country: NL / laboratory experiment
Host institute: Soil Physics and Land Management Group
Online possible: No/Yes

Schematic graph for soil flume in the field

Field with potatoes ridges

Example soil flume
(https://www.kwaad.net/Erosieproefvelden.html)

Project description:

Microplastics (MPs, diameter < 5mm) are pervasive, persistent environmental contaminants. There is increasing research interest in MPs in terrestrial systems, particularly in agricultural soil. MPs enter agricultural soil via direct sources, such as plastic mulches and irrigation pipes, as well as indirect sources, including compost and sewage sludge. Once in soil, MPs can incorporate into soil aggregates and alter soil structure and hydro-physical properties (e.g., bulk density, aggregate stability, water retention curve). These changes can affect runoff generation and erosion processes. Despite their importance, research on MPs transport in soil via runoff and erosion remains limited, and detailed empirical data are missing.

Research Aims and Objectives

This project aims to investigate the lateral transport and distribution patterns of MPs in agricultural slopes during natural rainfall events and use this dataset to incorporate MPs as a pollutant in erosion models. Research objectives include:
- Quantify the lateral transport of MPs with runoff and erosion during natural rainfall events on agricultural slopes.
- Assess whether there is enrichment or depletion of MPs in eroded sediment compared to their original concentration in soil.
- Investigate the preferential flow patterns of MPs (whether free or sediment-bound).
- Compare the preferential flow patterns of different types of MPs under natural rainfall conditions.
- Integrate MP transport as a pollutant into an existing soil erosion model by coupling small-scale, event-based dataset.
- Calibrate and validate the updated model using data from natural rainfall events.

What is expected from the student:

We expect to experience several rainfall events and to collect and transport runoff samples back to Wageningen University & Research (WUR) before September 2026. Students will focus on the extraction and analysis of MPs from runoff samples. The experiment is anticipated to last two to three months, excluding the subsequent modeling, data analysis and writing process. The modeling part can be online.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MIL & MEE

Begin date: September 2026
End date: tbd

Used skills: laboratory experiments, data analysis
Requirements: t.b.d.

Contact

Supervisor(s): Qi Liu, Loes van Schaik, Jantiene Baartman
Examiner:
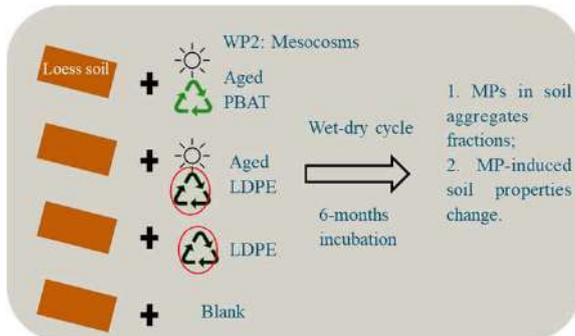Contact details: loes.vanschaik@wur.nl or jantiene.baartman@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Quantify MicroPlastics Transport with Runoff and Erosion via Soil Flumes
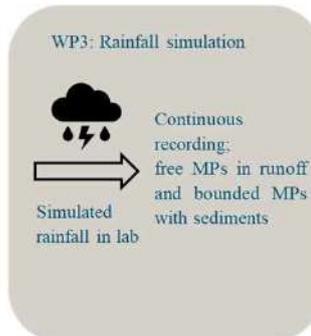
Country: NL / laboratory experiment
Host institute: Soil Physics and Land Management Group
Online possible: No

Schematic graph for project

Soil aggregates

Project description:

Microplastics (MPs, diameter < 5mm) are pervasive, persistent environmental contaminants. There is increasing research interest in MPs in terrestrial systems, particularly in agricultural soil. MPs enter agricultural soil via direct sources, such as plastic mulches and irrigation pipes, as well as indirect sources, including compost and sewage sludge. Once in soil, MPs can incorporate into soil aggregates and alter soil structure and hydro-physical properties (e.g., bulk density, aggregate stability, water retention curve). These changes can affect runoff generation and erosion processes. Despite their importance, research on MPs transport in soil via runoff and erosion remains limited, and detailed empirical data are missing.

Research Aims and Objectives

This project aims to investigate how common types of microplastics (MPs) with different weathering statues (aged PBAT, aged LDPE and pristine LDPE) affect runoff generation and erosion processes by altering soil structure and hydro-physical properties via soil flumes and indoor rainfall simulation. Research objectives include:

For MPs in soil aggregates:
- Investigate the reliability of different methods for assessing aggregate stability.
- Examine the incorporation of different types of microplastics (MPs) into soil aggregate fractions (<53 µm, 53–250 µm, and 250 µm–2 mm) after incubation under constant soil moisture conditions.
- Evaluate whether the distribution of MPs across different aggregate fractions influences MP transport during rainfall events.

For erosion and transport:
- Assess whether the lateral transport patterns of various MPs differ, focusing on the onset of runoff, amount of sediment erosion, and duration of runoff via simulated rainfall.
- Investigate whether different MPs exhibit similar transport patterns, specifically distinguishing between free versus sediment-bound MPs.
- Determine the enrichment or depletion of MPs in eroded sediment relative to their original concentrations in the soil.

What is expected from the student:

Depending on the research focus, students will work either on MP analysis in soil aggregates or on MP analysis in runoff samples. The experimental phase is expected to last three months, excluding the subsequent data analysis and writing.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MIL & MEE

Begin date: September 2026
End date: tbd

Used skills: laboratory experiments, data analysis
Requirements: t.b.d.

Contact

Supervisor(s): Qi Liu, Loes van Schaik, Jantiene Baartman
Examiner:
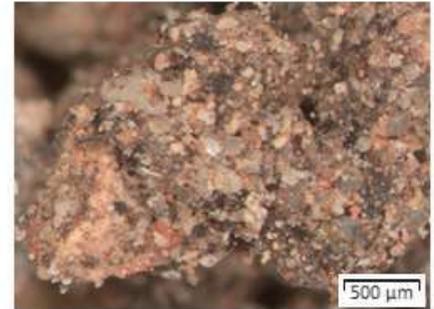Contact details: loes.vanschaik@wur.nl or jantiene.baartman@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Organic amendments and earthworm activity to improve soil hydrology

Country:

Host institute: WUR, Soil physics and land management and Soil Biology

Project description

Climate change leads to more frequent drought and high intensity rainfall events. In recent years, arable production suffered from both, with droughts being particularly impactful on sandy soils. Innovations are needed to prevent freshwater reserves from being depleted and crop production from being water-limited. Against this background we wish to design measures to improve infiltration and soil water retention through selective amendment of organic matter that promotes soil water retention. However, we do not know which quality of organic matter is particularly effective in promoting soil water retention. In addition, the affinity of earthworms for a certain organic amendment might increase / decrease the influence of the amendment on soil structure and thereby infiltration and water retention.

In this thesis study, you will design an experimental set-up to test several types of organic matter on their capacity to improve soil water retention. On the long run, we would like to link this capacity to chemical characteristics of organic amendments and/ or activity of earthworms, such that we are better able to advise farmers on organic matter management with the purpose to mitigate the impact of droughts and heavy showers.

Project details

Group: Soil Physics and Land Management & Soil Biology
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:

Contact

Supervisor(s): Loes van Schaik, Ellis Hoffland
Examiner: t.b.d.
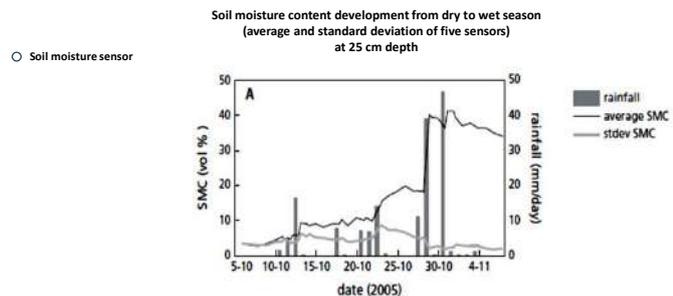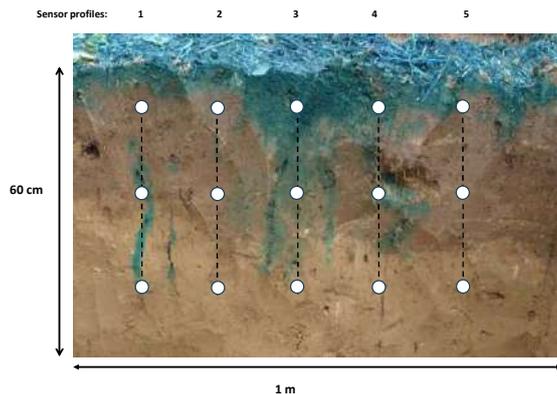Contact details: loes.vanschaik@wur.nl, Ellis.hoffland@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Assessing the value of typical soil moisture data for the determination of preferential flow

Country: Netherlands

Host institute: WUR, Soil physics and land management

Project description

Based on field experiments and observations it is clear that preferential flow can play a big role in the distribution of rainfall into infiltration and surface runoff as well as in the way the infiltrating water is distributed in the soil profile. With the expected higher frequency of extreme events, both higher intensity rainfall events as well as longer periods of drought, the influence of preferential flow on the infiltration and depth distribution of water in the soil profiles is expected to increase in future. At the same time, measurements and modelling of preferential flow remain a challenging. As is shown in the figure above, with a standard setup of just three soil moisture sensors in one vertical profile, the resulting conclusions on depth distribution of the infiltrating water in this soil profile will be very different and dependent on the location of the vertical sensor profile.

In many research projects the soil moisture data gathered is based on just single vertical profiles, in few cases there is more than one vertical profile. In this thesis the idea is to make an assessment of the value of single or multiple profiles of soil moisture data for determination of depth distribution of preferential flow. In order to do this a virtual simulation of the infiltration into a 2 D soil profile with preferential flow will be done. In this modelled virtual soil profile, the time series of soil moisture content for different configurations of vertical and horizontal distribution of the sensors will be used to assess what the analysis of such soil moisture time series can tell us about the actual "known" infiltration processes.

Project details

Group: Soil Physics and Land Management & Soil Biology
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: any time
End date:

Used skills:

Contact

Supervisor(s): Loes van Schaik
Examiner: t.b.d.
Contact details: loes.vanschaik@wur.nl
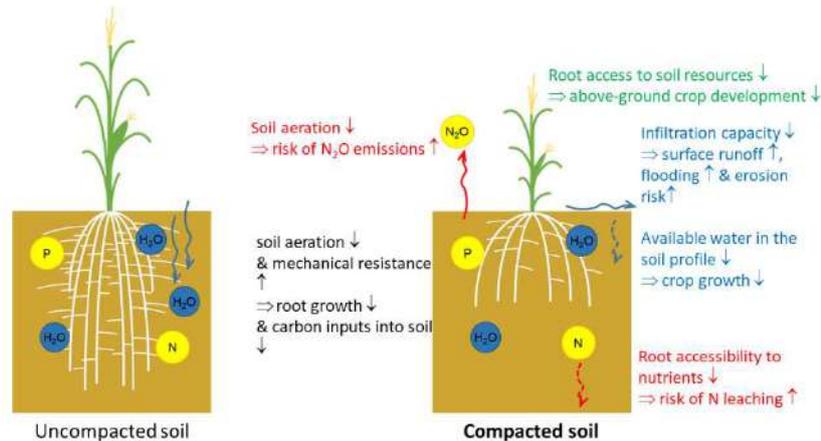
WAGENINGEN
UNIVERSITY & RESEARCH

Soil compaction research in the Netherlands

Country: Netherlands

Host institute: Wageningen environmental research

Online possible: No

Project description

Soil compaction affects crop growth. This can be hampered by limitations of water and air management and rootability. It is only known to a limited extent which of these three factors is the most decisive and how they differ for the various soil types and crops. Boone (1988) and Håkansson & Lipiec (2000) have already given indications in their studies how the various factors depend on the pore pressure and density/porosity. If it is not sufficiently known which factors inhibit plant growth, it is also impossible to properly assess whether a soil can be regarded as compacted and whether this applies to all crops. Soil compaction in the field is now often determined on the basis of dry bulk density and resistance to penetration. However, it appears that these two values cannot properly explain the reduction in plant growth. Also because, if provided with sufficient water and nutrients, plants can grow well even in highly compacted soils.

The aim of the research is to determine the consequences of soil compaction on plant growth and water management, as a result of which:
• It is easier to predict which drought and wetness damage crops will incur with further soil compaction.
• It can be better determined and measured to what extent which soils are compacted or are sensitive to compaction.
• Targeted measures can be indicated to prevent further soil compaction and the negative consequences for plant growth caused by agricultural vehicles.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship
Study programme: MIL & MEE

Begin and end date: to be decided with the student

Used skills: vary with the sub-topic but can include fieldwork or modelling
Requirements: varies with the sub-topic selected

Contact

Supervisor(s): Loes van Schaik / Jos van Dam, Guido Bakema
Examiner: tbd
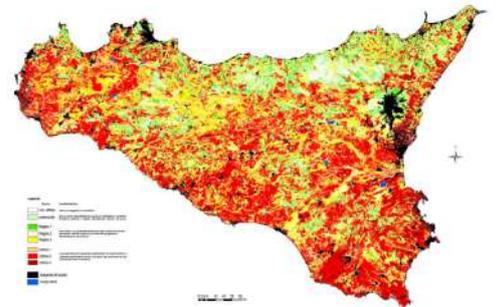Contact details: loes.vanschaik@wur.nl, guido.bakema@wur.nl

Land Degradation and Desertification in Sicily

Country: Italy

Host institute: University of Catania

Online possible: No

Project description

Sicily is one of Europe's hotspots for land degradation and desertification risk. A semi-arid climate, increasingly variable rainfall, recurring droughts and heatwaves, and long-term pressures from agricultural intensification (e.g., soil disturbance, low organic inputs, erosion-prone cropping systems) interact to reduce soil functions and resilience. In this context, soils are not just biophysical substrates: they are also lived and interpreted landscapes, where farmers develop "emic" indicators (local signs of soil health/degradation) and practical soil literacy that shape management decisions. This MSc thesis sits within a broader PhD project that aims to explore desertification in both quantitative and qualitative terms, identifying a robust parameter framework to investigate desertification in Sicily.

Activities and thesis goal

The student will conduct soil sampling, soil analysis and help generating a comparable dataset of soil degradation indicators. Fieldwork will take place in multiple locations across Sicily, selected to represent different pedological areas and agricultural regimes. The design will include paired or matched comparisons where possible (similar soil-landscape units under different management).

- Use existing soil/landscape information (soil maps, geology, land use, topography) to define sampling strata
- Establish sampling plots/transects per field; record GPS, slope, land cover, visible erosion features
- Collect composite soil samples by depth
- Simple field tests where feasible such infiltration assessment
- Record surface indicators: such as rills/gullies, stoniness, residue cover, signs of runoff concentration
- Laboratory analysis such as soil organic carbon/organic matter, texture, pH, EC/salinity proxy
- Compare indicators across pedological strata and management regimes
- Produce a short methods protocol + a dataset suitable for integration with the PhD's social/anthropological components

Project details

Group: SLM / KTI
Project type: Thesis / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date: August/September 2026

Requirements: Italian is strongly preferred (for field logistics and informal exchanges), but not mandatory if the student is comfortable working in a mixed-language environment.

Contact

Supervisor(s): Giorgia Giudice
Examiner: Luuk Fleskens
Contact details:
luuk.fleskens@wur.nl; giorgia.giudice@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Identification of best management practices solving soil compaction

Country : the Netherlands

Host institute : Wageningen University / Aeres University of Applied Sciences

Online possible : yes

Project description

Compaction is a global problem in agricultural lands. In the Netherlands, approximately 50% of agricultural fields experience some degree of subsoil compaction due to the use of heavy machinery for tillage, fertilization and/ or harvesting. This can impede soil functions, such as production capacity, water retention capacity, water quality (leaching and runoff of nutrients and pesticides into groundwater and surface water), carbon storage, and soil biodiversity. The effect of agricultural activities on bulk density is highly dependent on the conditions and the time of the growing season; texture, moisture content and organic matter content have a major influence on the impact and/or effectiveness of cultivation measures. To assess impacts of management measures on soil bulk density in view of optimum values needed for related soil functions, a desk study will be done. Effects will be quantified where possible in relation to local characteristics such as land use, weather conditions, and cultivation intensity.

This **thesis aims** to assess the role of management practices to avoid or repair the soil damage related to compaction. This includes various soil, crop, water and fertilizer management practices being derived from literature. Their impact is strongly dependent on site properties like soil texture, crop rotation, precipitation and applied machinery. An analysis of their applicability and impact will be done by a meta-analysis of the literature, thereby expanding and deepening the evidence library of the effects of Farming Practices into spatial explicit regression models. The **final product** will be a mitigation measure catalogue (a database) with relevant indicators regarding applicability and potential impacts.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis
Study programme: MIL / MEE / MIL & MEE

Begin date:
End date:

Used skills:
Requirements: (e.g. GIS skills, followed a specific course)

Contact

Supervisor(s): Karin Pepers, Aeres, Guido Bakema WENR
Examiner:
Contact details: k.pepers@aeres.nl Guido.bakema@wur.nl
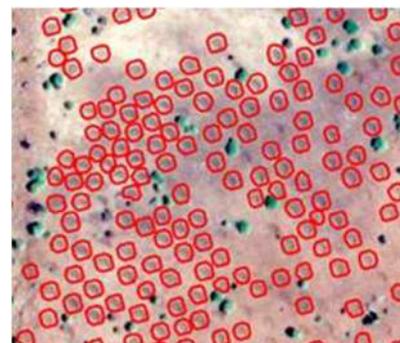
AI-Powered Detection of Landscape Restoration Interventions

Do you enjoy working with remote sensing & machine learning to support landscape restoration?
Join Justdiggit in this exciting MSc thesis or internship position!

Location: Amsterdam (hybrid possible)
Host institute: Justdiggit

ABOUT JUSTDIGGIT

Justdiggit is an international non-profit restoring degraded ecosystems in Africa by regreening drylands, with positive impacts on climate, ecosystems, and people. Justdiggit is exploring how high-resolution satellite imagery and AI can track landscape restoration at scale.

This thesis / internship examines whether restoration activities by Kijani app users—such as water bunds, fanya juu trenches, and zai pits—can be detected using object-detection methods. The project will include data preparation, model development, validation, and assessment of operational feasibility.

WHAT WILL YOU DO?
• Preprocess high-resolution satellite imagery.
• Develop and test object-detection models for restoration features.
• Evaluate performance under real-world conditions.
• Deliver practical results in an MSc thesis or internship report.

WHAT ARE WE LOOKING FOR?
• Experience with GIS and remote sensing (e.g. Google Earth Engine, QGIS).
• Can program in Python or similar.
• Have interest in machine learning and object detection.
• Have an affinity with landscape restoration or related fields.

WHAT WE OFFER
• Contribute to the mission of regreening our planet.
• Hands-on experience with advanced GIS and AI tools.
• Work in an international non-profit environment.
• Internship allowance, travel reimbursement, and hybrid working (Amsterdam).

Project details

Group: Soil Physics and Land Management group
Project type: ~~Thesis~~ / Internship / ~~Research practice~~
Study programme: MIL / MEE / MIL & MEE

Begin date: flexible
End date: flexible

Contact

Supervisor(s): Sander de Haas & Thijs van der Zaan
Examiner:
Contact details:
If you are interested, send an email with your CV to sander@justdiggit.org. Please use 'AI-Powered Detection of Landscape Restoration' as your email subject line.

Evidence based Impact Communication Internship

Do you enjoy translating science into clear stories about impact?
Join Justdiggit in this exciting internship position!

Location: Amsterdam (hybrid possible)
Host institute: Justdiggit

ABOUT JUSTDIGGIT

Justdiggit is an international non-profit restoring degraded ecosystems in Africa by regreening drylands, with positive impacts on climate, ecosystems, and people.

We are developing Impact Factsheets: web pages that clearly explain how we measure impact, what results we achieve, and the scientific evidence behind our work.

WHAT WILL YOU DO?

- Learn how Justdiggit measures impact (e.g. water, biodiversity, soil, livelihoods) and write clear, accessible summaries.
- Gather and structure existing internal knowledge, such as reports, pilots, and research projects.
- Review scientific literature on the impacts of landscape restoration.
- Work with Business Development and Communications teams to turn this into accurate and inspiring impact stories.

WHAT ARE WE LOOKING FOR?

- Communicate complex information clearly and engagingly for a broad audience.
- Work carefully and accurately with diverse information sources.
- Can distinguish scientific evidence from anecdotal information.
- Have a background in landscape restoration or related fields (e.g. earth sciences, ecology, environmental sciences).

WHAT WE OFFER

- The chance to contribute to a meaningful mission: regreening our planet.
- Hands-on experience in impact measurement and science-based communication.
- Experience in an international non-profit working across Africa and Europe.
- Internship allowance, commuting reimbursement, and a hybrid working setup

Project details

Group: Soil Physics and Land Management group
Project type: ~~Thesis~~ / Internship / ~~Research practice~~
Study programme: MIL / MEE / MIL & MEE

Begin date: flexible
End date: flexible

Contact

Supervisor(s): Sander de Haas & Thijs van der Zaan
Examiner:
Contact details:
If you are interested, send an email with your CV to sander@justdiggit.org. Please use 'Evidence based Impact Communication Internship' as your email subject line.

WAGENINGEN
UNIVERSITY & RESEARCH

Storm Impacts and Long-Term Change in Southeast Australia's Beach-Dune Systems

Country: Australia

Host institute: NSW Government – Department of Climate Change, Energy, the Environment and Water – Sciecne Division

Online possible ? : Can be online – but will get more out of it if in-person.

Project description

This project investigates the dynamics of sandy coastal systems across southeast Australia, focusing on how beaches, dunes, and associated vegetation respond to extreme weather events and longer-term climatic change. Leveraging high-resolution LiDAR datasets—captured via both airborne platforms and remotely piloted aircraft (RPA)—we are quantifying spatial and temporal changes in shoreline morphology, dune volume, and vegetation structure across hundreds of kilometres of coastline.

These elevation datasets are integrated with in-situ and modelled wave, wind, and water level data to assess the drivers of erosion, recovery, and sediment transport across a range of embayed and open coast settings. The project includes storm-impact case studies (e.g., severe Tropical Cyclone or East Coast Low storm systems) and also addresses broader questions of system resilience under future sea-level rise and changing storm regimes.

Field campaigns involve extensive use of drone-based surveys, RTK-GNSS mapping, and shallow-water data collection from research vessels. These efforts support both baseline mapping and post-storm response assessments. The research provides critical insight for coastal managers and policymakers and offers opportunities for hands-on training in advanced remote sensing, field instrumentation, and coastal hazard assessment..

This project can be tailored to being a thesis/internship project if it is selected.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Internship / Research practice
Study programme: MIL / MEE / MIL & MEE

Begin date:
End date:

Used skills:
Requirements: (e.g. GIS skills, followed a specific course)

Contact

Supervisor(s): Michel Risken
Examiner: t.b.d.
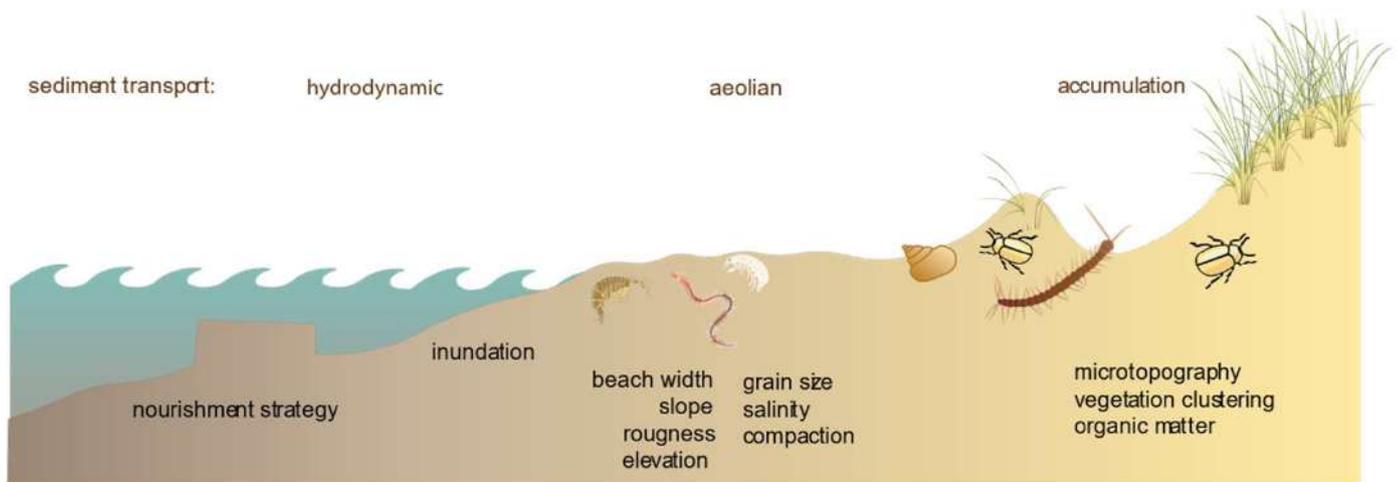Contact details: michel.riksen@wur.nl

WAGENINGEN
UNIVERSITY & RESEARCH

Linking beach topography and macrofauna community assembly on Swedish beaches

Country: Sweden

Host institute: Lund University

Online possible ? : no

Project description

How do changing beach and dune landscapes shape the communities that live there? Join our research team to explore how variations in beach topography, sediment dynamics, and dune development influence macrofauna community assembly.

As part of an interdisciplinary coastal research program, you will contribute to understanding how natural and human-driven changes (e.g. sand nourishments) affect ecological functioning of sandy shores. In this project, you will study the grain size effects on trait-based community assembly on Swedish beaches with varying sediment properties.

Your tasks may include:
• Conducting field surveys on selected coastal sites
• Analyzing datasets on beach morphology, sediment characteristics, and macrofauna communities across the Swedish coast
• Exploring relationships between beach topography and species or functional group composition.

What you'll gain:
• Experience in coastal ecology, fieldwork, data analysis, and geomorphological interpretation.
• Insights into interdisciplinary research connecting physical and biological processes.

Project details

Group: Soil Physics and Land Management group
Project type: Thesis / Research practice
Study programme: MIL & MEE

Begin date: spring 2027

Used skills: fieldwork, data analysis, and geomorphological interpretation

Contact

Supervisor(s): Michel Riksen (SLM); Janne Nauta (PEN)
Examiner: T.B.D.
Contact details: Janne.nauta@wur.nl