MEE thesis research vacancies 2021
Soil Physics & Land Management

This booklet provides an overview of current thesis research vacancies at SLM for the master study Earth and Environment. If you follow another master study, the contact person of the particular topic will decide whether your background is suitable. The topics are divided in 5 categories:

1. Water - Soil
2. Solute - pollutants
3. Groundwater
4. Vegetation
5. Regional studies

The list is not exhaustive. If you have a topic in mind which relates to soil physics and land management and which is not listed here, don't hesitate to contact us.

For general questions or an intake to get better guidance please contact:
Loes.vanschaik@wur.nl (tel. 0317 489408)

MEE thesis supervisors at the SLM group

	Ing. George Bier Gaia room B.017 Phone: 0317 482830 George.bier@wur.nl	– Hydrology – Groundwater – Numerical modeling
	Dr.ir. Jos van Dam Gaia room B.015 Phone: 0317 484825 Jos.vandam@wur.nl	– Hydrology – Soil Physics – Modeling ecohydrology
	Dr.ir. Violette Geissen Gaia room B.013 Phone: 0317 484825 Violette.geissen@wur.nl	– Environmental Management – Land Degradation – Soil Biology – Soil Chemistry – Soil Fertility – Soil Management – Soil Physics – Soil Sciences
	Dr.ir. Loes van Schaik Gaia room B.015 Phone: 0317 489408 Loes.vanschaik@wur.nl	- Ecohydrology - Soil Physics - Water Management
	dr.ir. Klaas Metselaar Gaia room B.017 Phone: 0317 485322 Klaas.Metselaar@wur.nl	- Ecohydrology - Soil Physics - Water Management
	Prof. Dr. Sjoerd van der Zee Gaia room B.014 Phone: 0317 482103 Sjoerd.vanderZee@wur.nl	– Water flow & solute transport – Pollutant behaviour in soil & groundwater – Contaminant bioavailability

MEE thesis supervisors at the SLM group

SLM Staff member	Expertise
 Dr.ir. Michel Riksen Gaia room B.012 Phone: 0317 482833 Michel.Riksen@wur.nl	– Wind erosion – Coastal dune management – Soil and water conservation – Landscape restoration
 Dr.ir. Jantiene Baartman Gaia room B.018 Phone: 0317 486131 jantiene.baartman@wur.nl	– Soil erosion modelling – Physical land degradation processes – Soil and water conservation
 Dr. ir. Luuk Fleskens Gaia room B.012 Phone: 0317 485467 Luuk.Fleskens@wur.nl	– Ecosystem services – Multi-scale impact assessments SLM – Farmer decision-making – Water harvesting
 Prof.dr. Coen Ritsema Gaia room B.013 Phone: 0317 486517 Coen.ritsema@wur.nl	– Land Degradation – Soil Management – Soil Physics
 Dr. Esperanza Huerta Lwanga Gaia room B.020 Phone: 0317 486602 Esperanza.huertalwanga@wur.nl	- Soil quality - Tropical agriculture - Soil protection - Ecology - Plastic in soil

Overview of master thesis topics for MEE 2021

#	Water - soil	Supervisor
1	Coupling atmospheric, root zone, and groundwater drought	Jos van Dam
2	Analysis of near future demands for sprinkling irrigation in Brabant	Jos van Dam
3	Soil heath in Norway	Loes van Schaik
4	Soil texture determination: comparison of different methods	Loes van Schaik
5	Do prescribed burns promote erosion and alter plant diversity?	Jantiene Baartman
6	Effects of slope stabilization treatments after wildfires	Jantiene Baartman
7	Wildfire Ash Mobilization by wind and water erosion	Jantiene Baartman
8	Investigating Carbon fluxes with time-since-wildfire	Jantiene Baartman

#	Solutes – pollutants	
1	Evaluating risks of sub-surface irrigation with treated wastewater	Darrell Tang/ Sjoerd v.d. Zee
2	Isolation of enzymes that can decay oil-based plastics	Violette Geissen / Esperanza
3	Modelling overland transport of water and pharmaceuticals	Sjoerd v.d. Zee /Peter Schaap
4	Microplastic detection in soils using spectroscopy and chemometrics	Violette Geissen / Esperanza
5	Effects of microplastics in the terrestrial food web	Violette Geissen / Esperanza
6	Sludge microplastics decay through earthworms	Violette Geissen / Esperanza
7	Biogeochemical glyphosate and AMPA degradation in soils	Violette Geissen / Esperanza
8	Effect of glyphosate and boscalid on soil organisms	Violette Geissen / Esperanza
9	Innovation in microplastic measurements	Nicolas Beriot / Esperanza
10	Spatial variability in microplastics urban green areas	Loes van Schaik

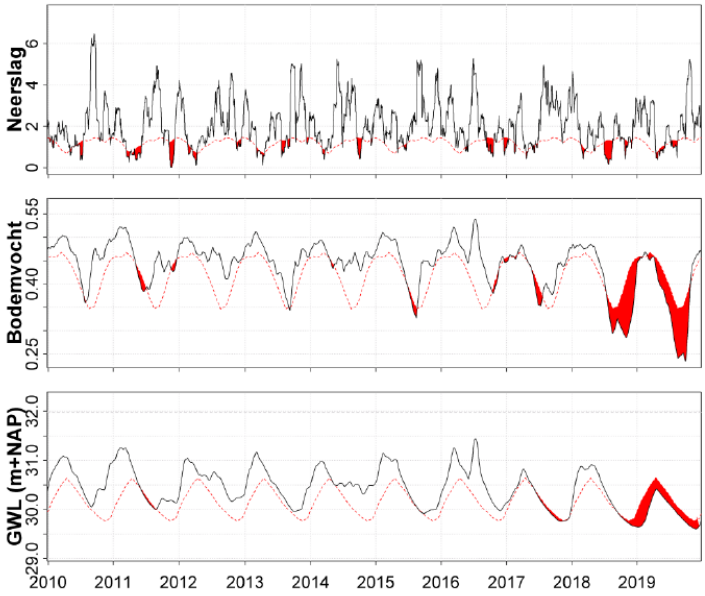
#	Groundwater	
1	Development hydrological model Doorwerth Estates	George Bier
2	Alternative water sources for the fosse of Hoekelum Estate	George Bier
3	Measures to improve the fen-meadow in Kraaigraaf	George Bier
4	Measures to improve water management Panovenpas	George Bier
5	Modeling of density driven flow in the coastal region	George Bier / Sjoerd vd Zee
6	Fresh water lenses of islands	George Bier

#	Vegetation	
1	Flevoland: water, rotation, longterm sustainable soil management	Klaas Metselaar/Loes v Schaik
2	Water balance of paludiculture: sustainable peatsoil management	Klaas Metselaar
3	Climate change adaptation options for mediterranean croplands	João Pedro Nunes
4	Modeling drought and oxygen stress in clay soils	Jos van Dam
5	Unravelling fuel management effectiveness in mitigating wildfire	João Pedro Nunes
6	Salt, freshwater and mangrove forest growth in Bonaire	Klaas Metselaar
7	Irrigation and land use management to ensure resilience	João Pedro Nunes

#	Regional analysis	
1	Land use, groundwater and flooding issues in Argentina	Joop Kroes/ Ab Veldhuizen
2	Water management modeling for Argentina	Jos van Dam / Ab Veldhuizen
3	Modelling a coupled socio-ecological system under global change	Jantiene Baartman
4	Modelling hydrological responses in burned and unburned forests	Jantiene Baartman
5	Assessing soil and water conservation practices in Uganda	Jantiene Baartman
6	Impact of climate and land use change on land degradation	Jantiene Baartman
7	Impact of climate change adaptation strategies on soil erosion	Jantiene Baartman
8	Cover crop biodiversity, soil structure and ecosystem services	Jantiene Baartman
9	Effect of UV radiation on plant litter decomposition	Jantiene Baartman
10	Sustainable agricultural practices for climate change mitigation	Jantiene Baartman
11	Snow melt, frozen soils and soil erosion in Norway	Jantiene Baartman
12	Sediment yield modeling of the Meuse river	Jantiene Baartman

MSc thesis research
Water and soil – topic 1

Coupling atmospheric, root zone, and groundwater drought



Project Description

The weather years 2018 – 2020 were very dry for large pats of The Netherlands, especially the higher sandy regions in the East and South. Due to the large rainfall shortage in the summer season, soil moisture declined, groundwater levels dropped, brooks ran dry, seepage declined, agriculture crops wilted, and natural vegetation died. Climate change will probably increase the occurrence of these dry summer periods.

The root zone forms an important buffer between the atmospheric drought and groundwater drought. Proper knowledge of soil moisture redistribution, root water uptake, and percolation to groundwater is therefore crucial to improve water management. Recently at different locations in the higher sandy regions soil moisture probes were installed near piezometers with long term records.

The purpose of this thesis is to analyse the weather, soil moisture and groundwater data, model the link between these data, and use this knowledge to evaluate water management scenarios.

Host institute: KWR Watercycle and Wageningen University

Country: Netherlands

Starting date: any time

Contact persons: Jos van Dam (jos.vandam@wur.nl); Ruud Bartholomeus (KWR Watercycle)

WAGENINGEN UNIVERSITY
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SLM
Soil Physics and Land Management

MSc thesis research SLM
Water and soil – topic 2

Analysis of near future demands for sprinkling irrigation in Brabant

Project Description

Groundwater levels in parts of Brabant are declining, which affects brooks and nature reserves. In this research satellite data and soil moisture measurements are combined to analyse the regional groundwater systems. An important issue is the effect of groundwater extraction for sprinkling irrigation in agriculture: how does this affect brook discharges and natural seepage areas in dry years.

The central research question is how satellite images, soil moisture data and hydrological modeling can be combined to assess the effect of drought periods on agricultural yields, groundwater recharge and seepage fluxes.

Proposed methods are:

- Literature research on techniques to measure soil moisture and their performance (reliability, accuracy)
- Analyses of available field measurements of soil moisture at various locations in Brabant and comparison with satellite data and observed groundwater levels.
- Simulation of soil moisture content and groundwater levels with SWAP.

Host institute: Waterboard Brabantse Delta

Country: Netherlands

Starting date: as soon as possible

Contact persons: Jos van Dam (jos.vandam@wur.nl); Kees Vink (k.vink@brabantsedelta.nl)

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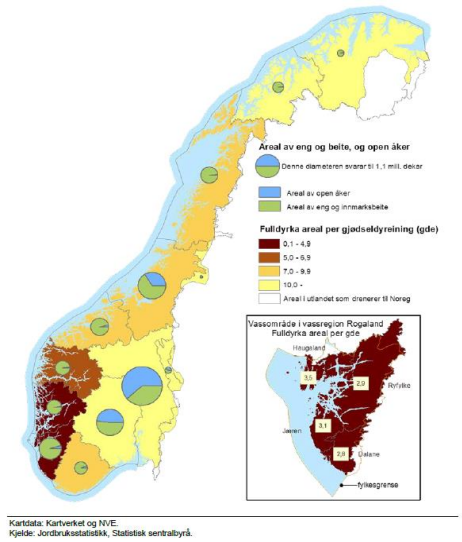
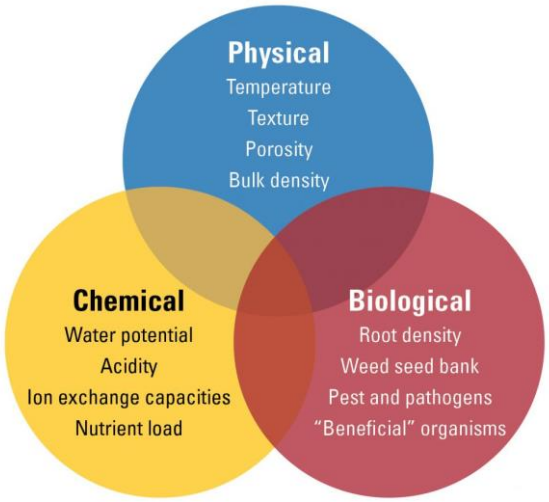
SLM
Soil Physics and Land Management

MSc thesis research
Water and soil - topic 3

Soil health in Norway



Spatial distribution of land use in Norway



Indicators of soil health

Project description

Soil degradation negatively impacts soil ecosystem services (ES), which is defined as the benefits people obtain from ecosystems. In Norway, the most prominent soil degradation processes are erosion by water, soil compaction, decline of soil organic matter and soil biodiversity loss. Methodologies and tools for assessing soils are necessary to monitor soil degradation, to evaluate land management strategies, whilst also considering soil ES that are beneficial to human beings. The concept of soil health has recently gained attention in this regard. The food and Agriculture Organization of the United Nations (FAO, 2008) defines soil health as:

"the capacity of soil to function as a living system, with ecosystem and land-use boundaries, to sustain plant and animal productivity, maintain or enhance water and air quality, and promote plant and animal health. [...]". Soil health cannot be measured directly, but is evaluated through measurements of physical, chemical and biological soil indicators. In this thesis, you are invited to come to Norway to assess soil health through soil sampling, lab and data analysis. Your approach can of course be adapted according to your interests and will depend also on the travel restrictions / possibilities related to the development of the COVID Pandemic.

Location: NIBIO Norway or Wageningen University

Country: Norway or Netherlands

Starting date: any time

SLM contact person: Loes van Schaik (Loes.vanschaik@wur.nl) / Frederik Boe, Jannes Stolte (NIBIO)

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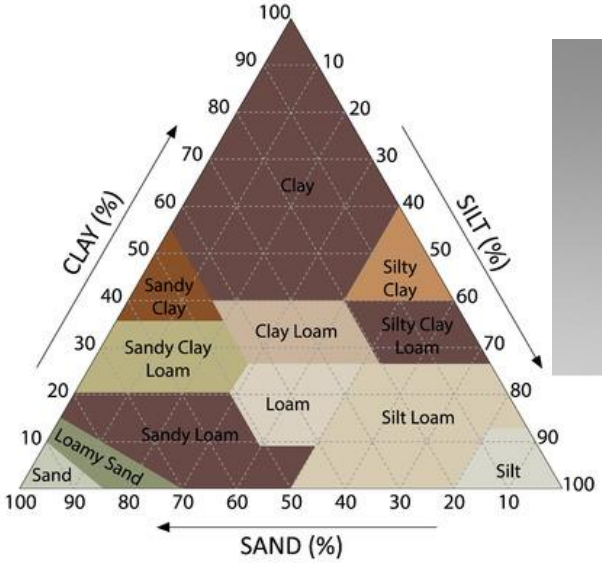
SLM
Soil Physics and Land Management

MSc thesis research
Water and soil – topic 4

Soil texture determination: comparison of different methods



Project Description

The classical soil texture determination is done by sieving and sedimentation analysis. As a large part of the scientific literature in which soil texture is related to soil functioning is based on soil texture as measured with this method, it is known as the reference method for soil texture determination. This is a very labour intensive method. The classification of soil particles in size groups (clay, silt, sand) with this method is based on am equivalent particle diameter which is derived from the theoretical rate of sedimentation of particles with a spherical shape in the water column. Laser spectroscopy has been used as a quicker method for texture measurements. However due to the shape of clay particles, their influence on the diffraction of the laser beams is very different than that of spherical particles, leading to a strong underestimation of clay. The QICPIC is a relatively new method for particle size analysis, based on dynamic image analysis, which is still under development. The method seems to have the advantage that the form and size of all the particles can be analysed. The question however is how these measurements relate to the classical method of sieving and sedimentation and whether the additional information on form and size has aids our understanding of the inflluence of clay particles in soil functioning.

Host institute: Soil physics laboratory Wageningen University

Country: Netherlands

Starting date: any time

Contact persons: Loes van Schaik Loes.vanschaik@wur.nl / Harm Gooren

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SLM
Soil Physics and Land Management

MSc thesis research
Water and soil – topic 5

Do prescribed burns promote soil erosion and alter plant diversity?

Problem context

Prescribed fire removes or reduces the plant material that is prone to forest fires by creating fuel discontinuity and minimising fire intensity. This forest management measure potentially impacts Mediterranean ecosystems' hydrological response and plant biodiversity by influencing water infiltration into soil and directly burning vegetation. As direct measurements (e.g. soil erosion, absence/presence of plant, etc) this study has evaluated changes in soil erosion and plant composition after prescribed fires in representative plots of forests in the Iberian Peninsula under Mediterranean semi-arid conditions.

Research Objective/Question

The present study aims to evaluate the effects of prescribed fires severity on soil erosion and plant diversity under semiarid conditions. The fieldwork experiment should confirm or reject the working hypothesis of this study. Initially, we hypothesize that prescribed fires decrease infiltration rate thereby increasing surface runoff rates and soil erosion and plant mortality in forest soil. This trend may be modulate by fire severity.

What is expected from the student (type of research)

It is expected that the student work actively on:

- A literature review on the topic
- Fieldwork including soil and plant biodiversity surveys
- Lab analyses including soil bulk density and other physicochemical soil properties will be calculated in the laboratory (soil texture, OM, …)
- Statistical analyses work

Host institute: Castilla la Mancha University, Albacete campus

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

MSc thesis research
Water and soil – topic 6

Effects of soil slope stabilization treatments on soil erosion and plant recovery after wildfires

Problem context

Postfire restoration practices encompass those which aim to reduce negative wildfire impacts and to improve burned area rehabilitation. Mulching, Contour-felled log debris (CFD) and log erosion barriers (LEB) are techniques used worldwide on hillslopes after wildfires in order to avoid soil erosion. In this context, it is essential to evaluate how these restoration techniques can affect soil and plant ecosystems by increasing or decreasing wildfire impacts.

Research Objective/Question

The objective of this study is to evaluate the effects of postfire hillslope stabilisation techniques on soil quality, nutrient content and plant biodiversity, using different biomarkers of the soil microbial community's functional ability, such as soil enzyme activities, microbiological soil parameters and soil nutrient content. Unburned and burned areas with no postfire restoration techniques will be used as the control. We hypothesised that hillslope stabilisation techniques may enhance plant recovery and soil quality compared to unburned and burned areas because these techniques increase the detention and infiltration of overland flow and, therefore, reduce runoff and sediment transport capacity, which directly affect soil organic matter (OM) content and nutrient storage.

What is expected from the student (type of research):

It is expected that the student work actively on:

A literature review on the topic

Fieldwork including soil and plant biodiversity surveys

Lab analyses of physiochemical soil properties, such as soil bulk density, soil texture, OM,...

Statistical analyses work

Host institute: Castilla la Mancha University, Albacete campus

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

WAGENINGEN UNIVERSITY
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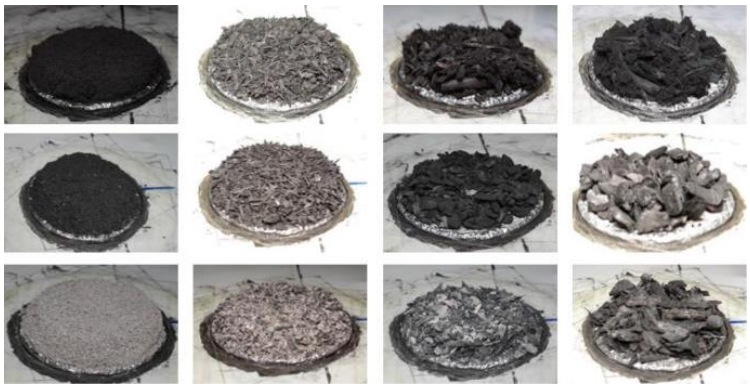
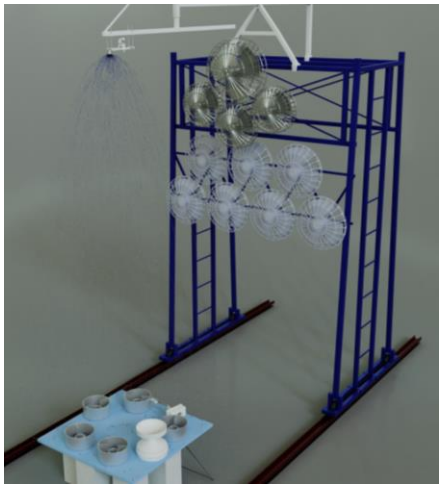
SLM
Soil Physics and Land Management

MSc thesis research
Water and soil – topic 7

Wildfire Ash Mobilization by wind and water erosion: measuring and modelling





ASHMOB project

In Portugal, wildfires have affected 100.000 ha per year and >300.000 ha in extreme years. A key concern regarding wildfires is their impacts on forest ecosystem services, with erosion control being an important focus of post-fire land management in Portugal, starting with emergency stabilization reports by ICNF. This project addresses the lack of knowledge that currently exists regarding the ash layer deposited by wildfire and, in particular, its subsequent mobilization by wind and water erosion. Currently, no model explicitly simulates mobilization of the ash layer deposited by wildfire, while wildfire ash is not only highly erodible but also contains a significant part of a forest's nutrient capital and has high contaminant loads (with marked ecotoxicological effects). This omission in the existing models must be understood against the generalized lack of information on ash deposition by wildfires and, even more so, its subsequent mobilization by wind and water erosion.

Research Objective/Question

Within this context, the ESP team can offer you the following MSc research topics:
Quantifying ash mobilization by splash under a simulated rainfall (lab work)
Experimental measurement of ash mobilization by run-on on a flume (lab work)
Assessment of mitigation measures of ash transport by water considering rainfall and runoff (lab)
Incorporation of experimentally obtained splash, run-on, and runoff erosion data in hydrological models (numerical modelling)

What is expected from the student (type of research)

Depending on the research topic, the research involves laboratory and/or modelling work.

Host institute: CESAM, university of Aveiro, ESP team

Country: Portugal

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

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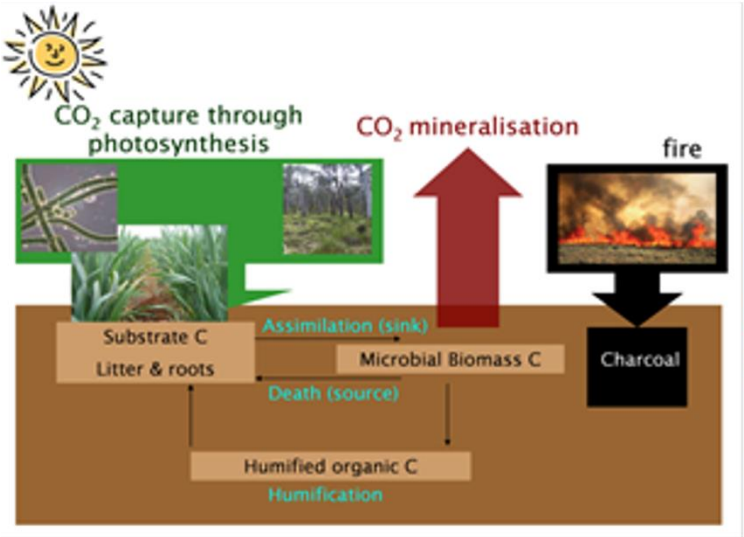
SLM
Soil Physics and Land Management

MSc thesis research
Water and soil – topic 8

Investigating Carbon fluxes with time-since-wildfire



Problem context

Wildfires affect forest carbon pools directly, through combustion/heating processes, and indirectly, by changing abiotic (e.g. soil temperature) and biotic (e.g. leaf area index) conditions. The indirect impacts appear to be important, as model results suggest that post-fire carbon losses are roughly equivalent to emissions during the fire.

The pulse of carbon dioxide (CO2) resulting from the first rainfall after the wildfire and subsequent dry periods is well documented at the landscape scale but the underpinning processes are not well explored.

In this research, a combination of soil respiration, ecosystem respiration and laboratory methods will be used to understand these CO2 pulses.

Research Objective/Question

Some research questions are:

How does rainfall affect CO2 pulses?

How long does it take after the rainfall to observe the CO2 pulse?

How does the CO2 pulse depend on soil physical, chemical and biological properties?

Is the CO2 pulse observable at the ecosystem scale?

What is expected from the student (type of research)

This research requires participation both in field work in burnt areas in Portugal and laboratory work for a minimum period of 6 months.

Host institute: CESAM, university of Aveiro, ESP team

Country: Portugal

Starting date: to be determined

SLM contact person: Jantiene Baartman, João Pedro Nunes

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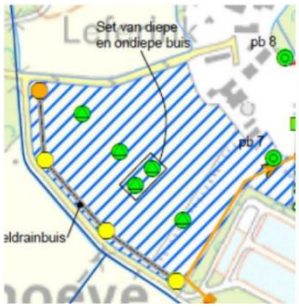
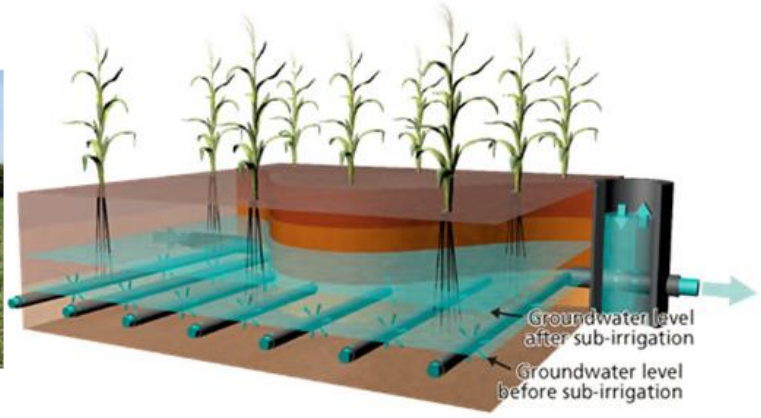
SLM
Soil Physics and Land Management

MSc thesis research
Solutes /pollutants- topic 1

Evaluating environmental and crop contamination risks of sub-surface irrigation with treated wastewater.





Project Description

Sub-surface irrigation (SSI) of crops may be done with water of marginal quality, such as the effluent of wastewater treatment plants (WWTP), in order to conserve freshwater. Such water contains contaminants that WWTPs are unable to fully treat. However, much of the contaminants are organic contaminants (e.g. sewage, pharmaceuticals) that biodegrade in the soil. The idea of SSI is thus to inject effluent beneath the water table to increase the hydraulic head and maintain shallower groundwater levels during dryer periods, so that crops have access to water without being exposed to effluent, while contaminants in the effluent layer biodegrade over time. The pipes used for SSI function as drains during wetter periods, which prevents waterlogging of crops and allows some contaminants to be removed. Nevertheless, there is a risk that some contaminants will spread and be taken up by plants, or be discharged into adjacent rivers and canals. We will evaluate this risk using simulations with models such as MODFLOW, and relate the findings to data obtained from our experimental maize farm. Factors that we may consider include regional groundwater flow, rainfall, adsorption, and biodegradation.

Host institute: SLM/Wageningen University

Country: Netherlands

Starting date: any time

SLM contact person: Darrell Tang (darrell.tang@WUR.NL), George Bier, Sjoerd van der Zee

WAGENINGEN UNIVERSITY
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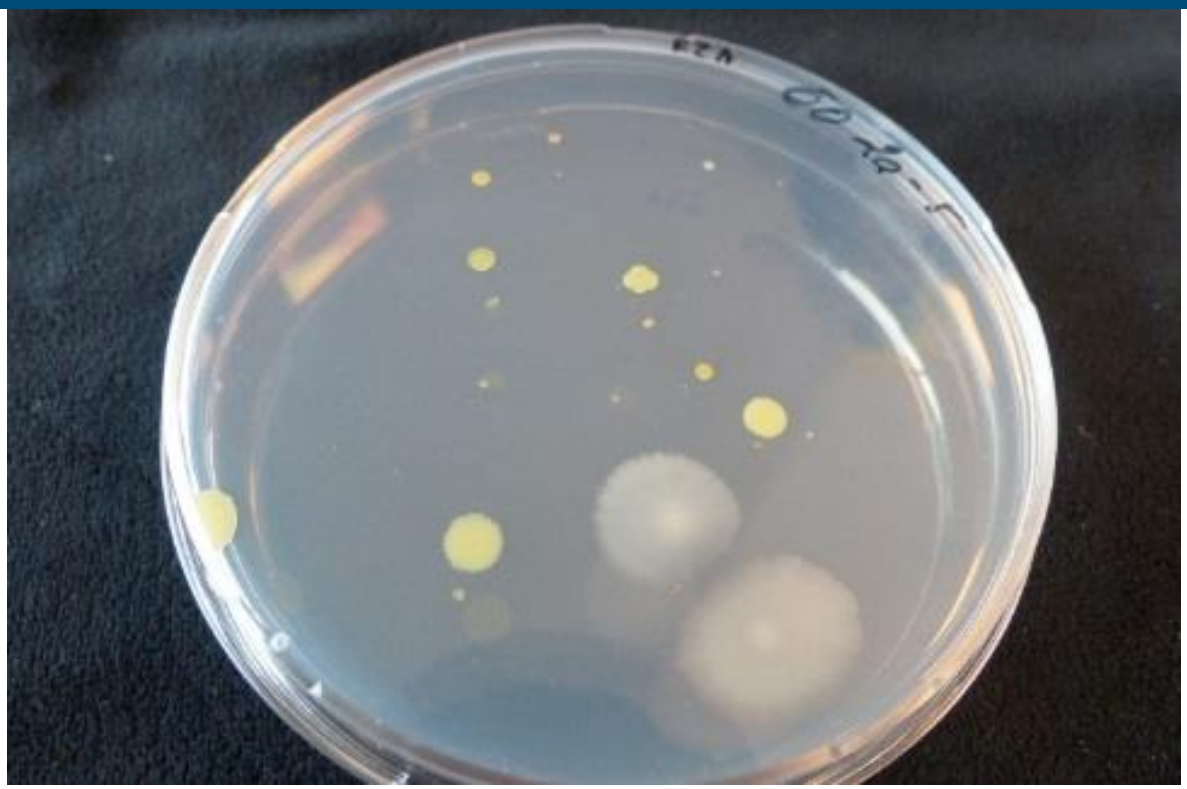
SLM
Soil Physics and Land Management

MSc thesis research
Solutes / pollutants – topic 2

Isolation of plastic-lasas or enzymes that can decay oil-based plastics.



Project Description

Light density Polyethylene is one of the oil-based plastics widely distributed. And due to the mismanagement of the residues of this plastic. It is possible to find light density polyethylene microplastics in agricultural and non-agricultural soils. Previous studies have shown how this plastic can be decayed with the use of bacteria.

The aim of this Master research is to isolate enzymes that can degrade light density polyethylene. It is recommended that the student also has background on microbiology.

Host institute: SLM Group Wageningen University and NIOO

Country: Netherlands

Starting date: as soon as possible

SLM contact person: Violette Geissen (violette.geissen@wur.nl), Esperanza Huerta Lwanga (esperanza.huertalwanga@wur.nl)

WAGENINGEN UNIVERSITY
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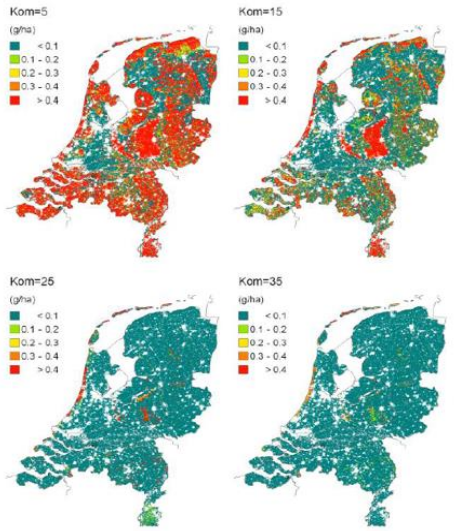
SLM
Soil Physics and Land Management

MSc thesis research
Solutes/ pollutants – topic 3

Modeling of overland transport of water and veterinary pharmaceuticals into surface water



Problem context
Veterinary pharmaceuticals (VPs) in manure end up in agricultural fields and threaten surface water quality. The most important and fastest route by which VPs could reach the surface water is probably the overland flow. In this case, the VPs present in soil-applied manure have limited time to degrade, thus significant VPs portions could end up in surface water. But overland flow/runoff in flat areas has received little attention so far. Currently, we combine GIS, data, and a simple leaching model for VPs in GeoVPmodel, so we can calculate VP-leaching for each field in the Netherlands. This yields maps of VP leaching that depend on e.g. adsorption coefficient (similar as for pesticides in maps on the right). Now we intend to pre-process data and develop a simple overland flow model, so that we can calculate the major transport route of VPs into surface water for all of the Netherlands.

What is expected from the student (type of research)
You will study literature, work with GIS and combine data bases (AHN-soil surface elevation; land use; etc) and develop a model for overland flow and transport of VPs. Work with GIS and flow/transport models will be main activities.

Location: Wageningen University

Country: Netherlands

Starting date: any time

SLM contact person: Peter Schaap, Nikola Rakonjac, Sjoerd van der Zee

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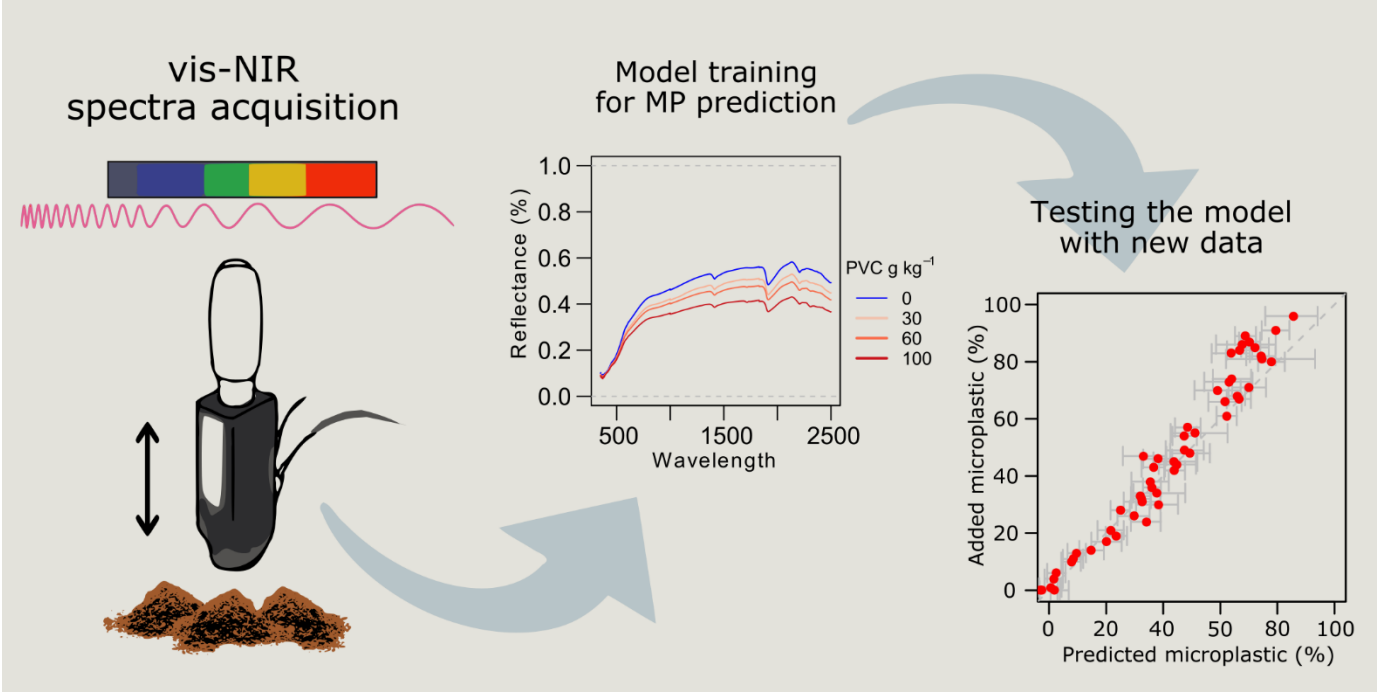
SLM
Soil Physics and Land Management

MSc thesis research
Solutes / pollutants - topic 4

Microplastic detection in soils using spectroscopy and chemometrics



Project Description

Microplastics are emerging pollutants that pose an environmental threat. New questions are arising about their impact in aquatic and continental environments. However, research has been jeopardized by the lack of efficient methods to quantify microplastics in complex matrices such as soil or sludge. Current methods are slow, and usually expensive. To fill the gap, new methods that bind spectroscopy and chemometrics are proposed. Wageningen University is looking for a student that can develop and evaluate a new methodology to screen microplastics in soils. The proposed thesis/internship may focus on using near infrared detectors to predict the probability of finding plastic particles within soil samples.

Host institute: Wageningen University

Country: Netherlands

Starting date: any time

SLM contact person: Nicolas Beriot (nicolas.beriot@wur.nl), Esperanza Huerta Lwanga, Violette Geissen

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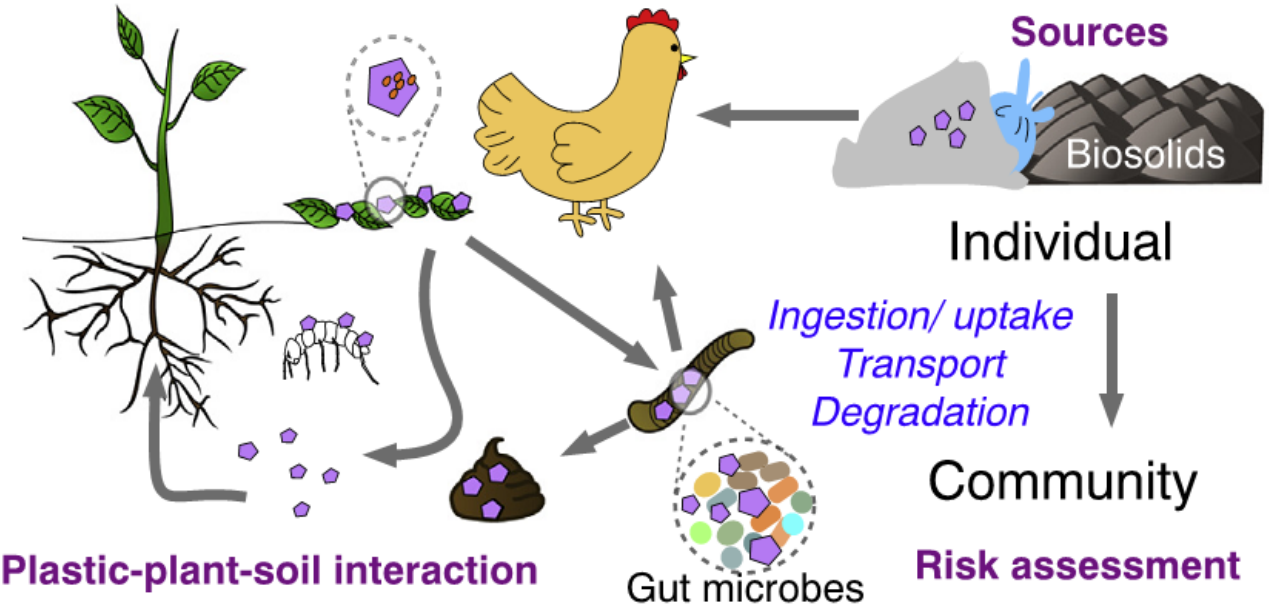
SLM
Soil Physics and Land Management

MSc thesis research
Solutes / pollutants – topic 5

Microplastics along the terrestrial food web. The case of cities and natural reserves in the Netherlands.



From Ng Ling et al. 2018.

Project Description

Nevertheless microplastics characteristics and distribution are well-known in the aquatic systems. In the terrestrial environments it is not the case. Previous studies have shown that the microplastics can be carriers of pesticides. And microplastics can be transferred a long the food chain. In the Netherlands no information about this matter is present.Therefore studies are required for monitoring and determing the concentrations of microplastics in soil, soil invertebrates and vertebrates. The aim of the study is to determine the concentrations of microplastics in the terrestrial environment and a long the terrestrial food web in cities and nature reserves in the Netherlands.

Host institute: SLM GROUP

Country: Netherlands

Starting date: as soon as possible

SLM contact person: Violette Geissen (violette.geissen@wur.nl) and Esperanza Huerta Lwanga (esperanza.huertalwanga@wur.nl)

MSc thesis research
Solutes / pollutants – topic 6

Sludge microplastics decay through earthworms

Project description.
Microplastics on terrestrial environments have become a big concern in the last years due to the effects that they produce to the soil invertebrates.
Previous studies have shown that plastic residues are present in sludge's. And sludge's are used commonly as soil amendment. Action that promotes the dispersion of the microplastics on the soil. Some microplastics can decay with the help of some earthworms gut bacteria.
The aim of this master thesis is to explore and enhance sludge microplastics decay with the help of earthworms.

Host institute: SLM GROUP, NIOO and Grupo Aguas (Spain)

Country: Netherlands

Starting date: as soon as possible

SLM contact person: Violtte Geissen (violette.geissen@wur.nl) and Esperanza Huerta Lwanga (esperanza.huertalwanga@wur.nl)

MSc thesis research
Solutes / pollutants – topic 7

Physical, chemical and biological glyphosate and AMPA degradation from soils

Project Description

Wide spectrum herbicides as glyphosate are widely used in the Netherlands. In soils, pesticides are accumulated even after several years of application. After monitoring, we found middle to high concentrations of this herbicide even in soils where it is not applied. Once the first decay of glyphosate occurs, and the AMPA (its first metabolite) it is attached to the clay particles. Glyphosate and AMPA remains for years in the soil. The aim of this Master research is to study the decay of glyphosate and AMPA through several physical, chemical and biological techniques of degradation. It is recommended that the student also has background on microbiology.

Host institute: SLM Group Wageningen University and NIOO

Country: Netherlands

Starting date: as soon as possible

SLM contact person: Violette Geissen (violette.geissen@wur.nl) and Esperanza Huerta Lwanga (esperanza.huertalwanga@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Solutes / pollutants – topic 8

Effect of Glyphosate and Boscalid(Pesticides) on soil organisms

Project Description

Wide spectrum pesticides as glyphosate and boscalid are widely used in the Netherlands. In soils, pesticides are accumulated even after several years of application. After monitoring, we found middle to high concentrations of those pesticides in soils from the North of the Netherlands. The aim of this Master research is to study the effect of these pesticides on the biodiversity of soil organisms, from microorganisms until macrofauna. Therfore, it is adviced that the student has knowledge on microbiology.

Host institute: SLM Group Wageningen University and NIOO

Country: Netherlands

Starting date: as soon as possible

SLM contact person: Violette Geissen (violette.geissen@wur.nl) and Esperanza Huerta Lwanga (esperanza.huertalwanga@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Solutes / pollutants - topic 9

Innovation in microplastic measurement: Method improvement and validation

Introduction

Microplastic particles are found in all environments. The detection of microplastics in a diversity of substrates is needed to understand the transport processes from one environment to another. Quantification and identification methods exist but there recovery is often presented for a specific substrate or a specific plastic type while there is a big diversity of substrate and plastic types that are analysed. Moreover, most quantification and identification methods require the plastic particles to be extracted from the substrate. However plastic particles share many properties with organic matter particles so current extraction methods are limited by the organic matter content in the sample.

Research questions

- What is the recovery of the microplastics extraction and analysis method?
- Is this recovery different for different plastic particles and different soil types?
- How to improve the method to analyse substrates with higher organic matter contents?

What is expected from the student (type of research)

- Inventory of methods to reduce the organic matter content in samples and extract microplastics
- Plastic particles recovery tests for different plastic types, soil types and extraction procedures

Host institute: Wageningen University

Country: Netherlands

Starting date: any time

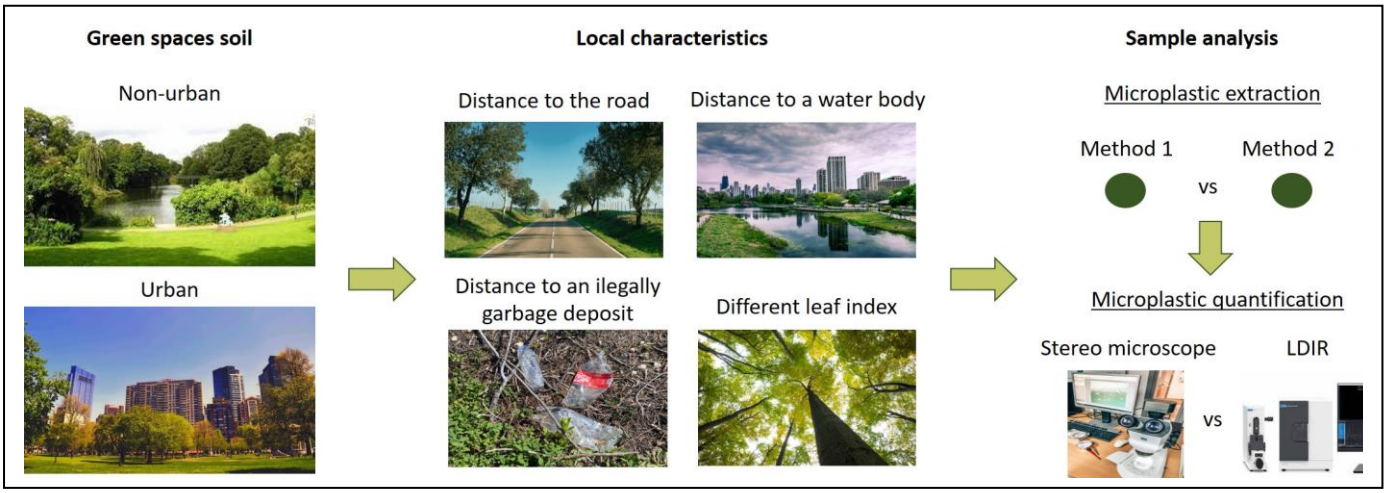
SLM contact person: Nicolas Beriot (nicolas.beriot@wur.nl), Esperanza Huerta Lwanga, Violette Geissen

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Solutes / pollutants - topic 10

Microplastics in green spaces: local spatial distribution



Introduction

Microplastics are causing a high degree of concern worldwide, since they are poorly controlled. This pollutant has been studied in aquatic environments, especially marine. However, there are few studies involving microplastics in terrestrial environments, especially in urban spaces. In this context, we are looking for a student to assess the occurrence of microplastics in urban and non-urban green spaces, as well as the local distribution of microplastics according to different characteristics. To extract and quantify microplastics, the student would use different methods, in order to find possible differences in the results.

Research questions

- Is there a considerable difference between the occurrence of microplastics in urban and non-urban green spaces?
- Do local characteristics of green spaces influence the local distribution of microplastics in soil?
- Do different methods of extraction and visualization of microplastics lead to different results of occurrence of microplastics?

Host institute: Wageningen University

Country: Netherlands

Starting date: August 2021

SLM contact person: Loes van Schaik (loes.vanschaik@wur.nl); Inês Amorim Leitão (ines.amorimdovaleleitao@wur.nl)

WAGENINGEN UNIVERSITY
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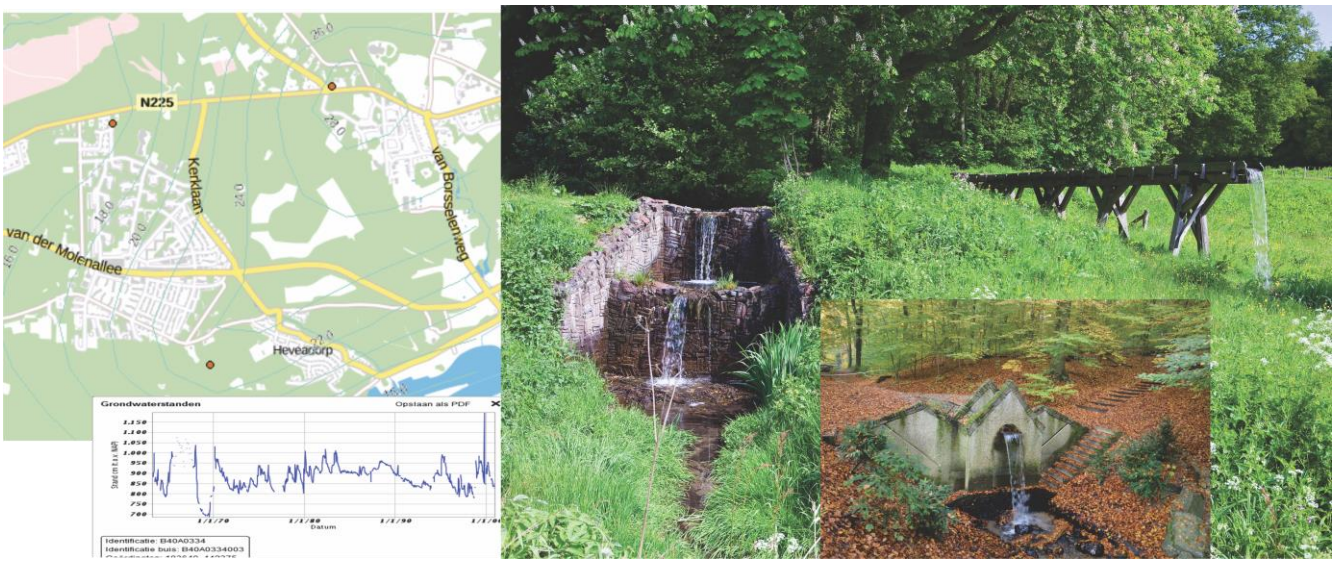
SLM
Soil Physics and Land Management

MSc thesis research
Groundwater– topic 1

Development hydrological model Doorwerth Estates



Introduction

The Geldersch Landschap & Kastelen (GLK) manages a large number of (natural) sites, including Natura 2000 areas. Eco-hydrological conditions are of great importance for the preservation of the natural values for many sites. These conditions are under pressure for a number of these sites. GLK requests a hydrological model research carried out for these sites in order to gain insight into the current eco-hydrological conditions, to identify possible causes of deterioration of the natural values and how potential measures can be carried to restore these conditions.

Several estates within the cluster *Doorwerth* (Castle Doorwerth, Duno, Oorsprong and Zilverberg) contain a large diversity in hydrological conditions and flora. At the transition from ice pushed ridges and the floodplains of the Rhine different ecosystems can be distinguished; rain water fed higher areas, springs at the lower parts of the ridges and upward seepage in the floodplains next to the ridges.

Objective

An analysis of the regional hydrological system through modeling to capture the main hydrological aspects of the area at Doorwerth.

Location: Wageningen University

Country: Netherlands

Starting date: any time

SLM contact person: George Bier (george.bier@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Groundwater– topic 2

Investigate alternative water sources for the fosse of Hoekelum Estate

Introduction

The Geldersch Landschap & Kastelen (GLK) manages a large number of (natural) sites, including Natura 2000 areas. Eco-hydrological conditions are of great importance for the preservation of the natural values for many sites. These conditions are under pressure for a number of these sites. GLK requests a hydrological model research carried out for these sites in order to gain insight into the current eco-hydrological conditions, to identify possible causes of deterioration of the natural values and how potential measures can be carried to restore these conditions.

The estate *Hoekelum*, located between Ede and Bennekom, suffers from the changed hydrological conditions over past decades. The water level of the fosse (NL: gracht) can now only be maintained with pumping from the subsoil which is far from optimal. Originally the fosse was fed from the ice pushed ridge. Later on a spring was dug for this purpose but due to water management measures in the surrounding area the spring fell dry.

Objective

An analysis of the hydrological system, through modeling, to obtain insight in the current hydrological conditions and investigate measures to retain the water capacity of the dug spring.

Location: Wageningen University

Country: Netherlands

Starting date: any time

SLM contact person: George Bier (george.bier@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Groundwater– topic 3

Measures to improve eco-hydrological conditions fen-meadow in Kraaigraaf

Introduction
The Geldersch Landschap & Kastelen (GLK) manages a large number of (natural) sites, including Natura 2000 areas. Eco-hydrological conditions are of great importance for the preservation of the natural values for many sites. These conditions are under pressure for a number of these sites. GLK requests a hydrological model research carried out for these sites in order to gain insight into the current eco-hydrological conditions, to identify possible causes of deterioration of the natural values and how potential measures can be carried to restore these conditions.

Kraaigraaf is a nature area north west of Twello which contains fen-meadows (NL:blauwgrasladen) which depend heavily on wet conditions (upward seepage) of good quality. Although the terrain is small (19 hectares) the fen-meadows have good potential in further development and expansion.

Objective
An analysis of the hydrological system, through modeling, to obtain insight in the current hydrological conditions and investigate measures to improve the conditions to extend the area with fen-meadows.

Location: Wageningen University

Country: Netherlands

Starting date: any time

SLM contact person: George Bier (george.bier@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Groundwater– topic 4

Measures to improve water management Panovenpas

Introduction
The Geldersch Landschap & Kastelen (GLK) manages a large number of (natural) sites, including Natura 2000 areas. Eco-hydrological conditions are of great importance for the preservation of the natural values for many sites. These conditions are under pressure for a number of these sites. GLK requests a hydrological model research carried out for these sites in order to gain insight into the current eco-hydrological conditions, to identify possible causes of deterioration of the natural values and how potential measures can be carried to restore these conditions.

Panovenpas a small forest in the floodplains of the Waal near Dodewaard and contains an abundance of Rough Horsetail (NL:Schaafstro). Due to poor hydrological conditions the nature area is hardly passable making maintenance of the site laborious.

Objective
An analysis of the hydrological system, through modeling, to obtain insight in the current hydrological conditions and investigate measures to improve the water management in and around the area of the site.

Location: Wageningen University

Country: Netherlands

Starting date: any time

SLM contact person: George Bier (george.bier@wur.nl)

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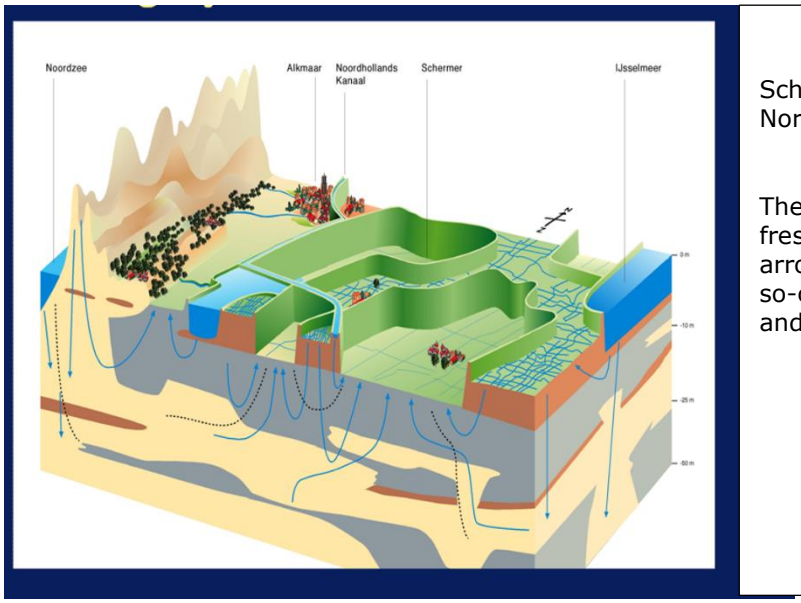
SLM
Soil Physics and Land Management

MSc thesis research
Groundwater – topic 5

Modeling of groundwater flow in case of density driven flow: coastal region research



Schematized representation of the Dutch North Sea coastal area.

The dotted lines signify the interface between fresh and (deeper) saline water, and the blue arrows show the complex flow pattern in the so-called hinterland (polders, surface water, and flat sandy regions, behind the dunes).

Project Description: Coastal regions are commonly characterized by dense populations, many cities, and intensive agriculture. Groundwater is an important resource in such regions for drinking, irrigation, and industrial process water. Groundwater hydrology is often affected by density driven flow due to e.g. sea water intrusion. Protection and management of this resource therefore requires us to take account of density differences, e.g. in the Mega Sand Suppletions at the Dutch coast fresh water reserves are building up now.

Methodology: In the context of a project, a region (in NL or abroad) is selected or a hypothetical situation is defined. The hydrological system is implemented in GMS and groundwater flow modeling is done with SEAWAT, which is able to take different densities of fresh and saline water into account. Modeling is done in steps with increasing complexity.

Research objective/question: Objective is usually to use modeling, to obtain more understanding of the water flow patterns in regions with significant water density gradients. Such understanding may be needed to estimate maximum pumping rates and sustainability of fresh water consumption (drinking or irrigation water), temporary storage of fresh water (e.g. Dutch "Freshmaker" program), or theory development.

Host institute: SLM and possibly Deltares

Country: Netherlands

Starting date: unrestricted

Prior knowledge: Subsurface Solute Transport (SLM21306)

Adv. Hydrological System Analysis (SLM-33306)

SLM contact person: George Bier (George.Bier@WUR.NL), Sjoerd van der Zee (Sjoerd.vanderZee@WUR.NL)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Groundwater – topic 6

Fresh groundwater lenses (FGL) below atoll islands in the Pacific Ocean

Project Description

The small island developing states (SIDS) are the first to be hit seriously by sea level rise and climate change. Besides increased flooding and coastal erosion, freshwater lenses below islands will shrink and fresh groundwater reserves will be reduced significantly. The migration of climate refugees from SIDS to the continents is inevitable when we are not able to find a solution to protect the precious fresh groundwater reserves below these islands.

Research question

Which hydrogeological conditions control the size of fresh groundwater lens on atoll islands in the Pacific Ocean and how can these lenses be protected against sea level rise and climate change?

Method

A sensitivity analyses will be carried out by numerical modelling of different kinds of islands showing the variation of the above-mentioned characteristics. The models will be constructed with SEAWAT

Host institute: Deltares

Country: Netherlands

Starting date: as soon as possible

SLM contact person: George Bier (george.bier@wur.nl), Perry de Louw (perry.delouw@deltares.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Vegetation – topic 1

Flevoland: Water, rotation, longterm sustainable soil management

Methodology:

Experimental analysis, and if you are fast: fieldwork this summer in Lelystad.

Research question:

Different soil management systems were compared in a longterm field experiment. In addition to crop yields, organic matter and soil physical characteristics were determined for a soil quality (biology and physics) based analysis. The results need to be checked against current model concepts and literature, notably in terms of their effect on the water balance. You will learn about soil organic matter dynamics, soil physics, and soil biology.

Host institute: together Plant science group (Bert Rijk), soil biology (Gabriel Moinet)
Country: Netherlands

Starting date: Summer 2021

SLM contact person: Klaas.metselaar@wur.nl; Loes.vanschaik@wur.nl

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Vegetation – topic 2

Water balance of paludiculture: sustainable management of peatsoils

Methodology:

Literature, modelling and discussing current experiments

Research objective/question:

Paludiculture is the productive land use of wet and rewetted peatlands that preserves the peat soil and thereby minimizes CO2 emissions and subsidence. The question to a hydrologist is how this changes the waterbalance. Mitigating soil subsidence is another important aspect. There are many types and examples of paludiculture - do they differ in their effects on the waterbalance and on subsidence?

Host institute: WUR
Country: Netherlands

Starting date: September/october 2021

SLM contact person: Klaas Metselaar (Klaas.metselaar@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Vegetation– topic 3

Climate change adaptation options for Mediterranean irrigated croplands

Introduction

In the Mediterranean region, intensive agriculture is usually associated with irrigation due to the mismatch between the rain season and the growing season, and the strong inter-annual variability of rainfall. Climate change is expected to bring pressure on existing irrigation networks by decreasing both available water supplies and their regularity, thus increasing the risk of hydrological and socioeconomic drought. Moreover, the prospect of low water volume in reservoirs increases the chance for water supply contamination from upstream croplands.

The University of Lisbon is designing a climate change adaptation roadmap for Portugal, and water resources is a primary concern, especially for well-developed irrigation networks such as that of the Sorraia valley in southern Portugal.

Objective

A complete analysis of the hydrological and irrigation system of the Sorraia valley using the Soil and Water Assessment Tool eco-hydrological model, to assess the vulnerability of the system to water quantity and quality droughts, and test potential climate change adaptation measures.

Location: University of Lisbon or Wageningen University (student's choice)

Country: Portugal or Netherlands

Starting date: any time

SLM contact person: João Pedro Nunes (joao.carvalhonunes@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Vegetation – topic 4

Modeling drought and oxygen stress in clay soils

Project Description

Potentially clay soils are very fertile. Nevertheless proper cultivation of clay soils is hard as they may change rapidly with respect to too wet and too dry conditions. Also proper simulation of drought- and oxygen stress in clay soils is still a challenge.

Recently the model instrument 'WaterVision Agriculture' became available (see site waterwijzerlandbouw.wur.nl). WaterVision Agriculture simulates the effects of soils, water, farm management and climate change on agricultural production. It uses the hydrological model SWAP and the generic crop growth model WOFOST, and simulates in detail the effects of dry, wet or saline conditions in the root zone.

Although WaterVision Agriculture shows good results for sandy and loamy soils, the results for clay soils are less reliable. In this master thesis research you investigate the reliability of current and alternative modeling concepts.

Affinity with agrohydrological modeling and data analysis is important.

Host institute: Wageningen Environmental Research (WENR)

Country: Netherlands

Starting date: any time

Contact persons: Jos van Dam (jos.vandam@wur.nl); Marius Heinen (WENR)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Vegetation– topic 5

Unraveling fuel management effectiveness in mitigating wildfire hazard

Left: A large wildfire burning and jeopardizing the village of Vieira de Leiria in 2017
Right: Firefighters creating a fuelbreak line to reduce fire spread
Source: Portuguese Civil Protection Special Force (FEPC)

Introduction
The Mediterranean region is strongly affected by recurring wildfires, and on average almost half a million hectares burn per year, with devastating environmental and socioeconomic impacts. Fuel reduction (through prescribed burning or landscape segmentation) has long been shown to decrease fire size and severity. However, current fire management focuses mainly on suppression; the few existing fuel treatments are conducted without any assessment of wildfire impacts at the landscape level. Hence, it is crucial to deepen the current understanding of preventive fuel management and to support land managers in creating less flammable landscapes.

Objective
This study aims to understand the full effectiveness different fuel management strategies in reducing wildfire hazard in the Monchique mountains, southern Portugal. The student will calibrate and validate a wildfire behaviour model implemented at the University of Lisbon, and use it to evaluate the magnitude of the impacts that could have been avoided if specific fuel management strategies would have been implemented before the fire season.

Location: University of Lisbon or Wageningen University (student's choice)

Country: Portugal or Netherlands

Starting date: any time

SLM contact person: João Pedro Nunes (joao.carvalhonunes@wur.nl)

WAGENINGEN UNIVERSITY
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SLM
Soil Physics and Land Management

MSc thesis research
Vegetation – topic 6

Salt, freshwater and mangrove forest growth in Bonaire: analyzing a restoration project.

Methodology:

Data analysis, modelling and measuring

Research objective/question:

In a Ramsar site on Bonaire (Lac) Stinapa is executing a mangrove restoration project. They would like to understand the hydrology of the mangrove area after restoration. They have gathered longterm diver data of tidal levels before and after restoration which can be used for analysis and modelling. Based on previous research there is understanding of the ins- and outs of the system – we would like the student to assess the effect of the restoration measures.

Host institute: WUR in cooperation with Stinapa, Bonaire
Country: Bonaire

Starting date: any time

SLM contact person: Klaas Metselaar (Klaas.metselaar@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Vegetation – topic 7

Irrigation and land use management to ensure resilience under drought and scarcity risks

Introduction

In southern Europe, the economic and environmental sustainability of agriculture is highly dependent on adequate land and water management. Hydrological conditions of the soil and irrigation processes are thus key issues for agro-systems, and reservoirs also play an essential role in this necessary equilibrium. Increasing water uses and risks associated with climate change impacts represent added challenges and require adaptation measures on land use and irrigation strategies to ensure the resilience of agricultural systems.

For this purpose, new field monitoring technologies associated with eco-hydrological modelling represent an effective way to identify risks and optimize solutions to support agricultural management in drylands. This is the case in the southern region of Alentejo, in Portugal, where agro-systems are already under pressure of elevated scarcity and drought risk, thus enhancing the need for testing these new methodologies in field conditions.

Objective

Combine technological monitoring solutions with hydrological modelling to support improving land management and irrigation optimization in agro-systems under the risk of drought and scarcity.

Location: Wageningen University /Nova School of Science and Technology (Lisbon)

Country: Netherlands / Portugal

Starting date: any time

SLM contact person: Joao Pedro Nunes (joao.carvalhonunes@wur.nl)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research SLM
Regional studies - topic 1

The Argentina case: land use drives groundwater and flooding issues

Project Description

During the latest years Argentina is hit by floods which cannot be explained by climate change alone. Analyses at a national scale indicate land use changes as a main contributor to increasing groundwater levels. Research has a focus on catchments where modeling tools are being tested which should support evaluation of several measure to influence groundwater recharge, salinity issues and prevent flooding. Core of these tools are the hydrological model SWAP and the generic crop growth model WOFOST. Argentinian groups are setting up analyses for one such catchment (Laboulaye) and this brings up many research questions, like:

- To which extent can these modeling tools be used to evaluate measures?
- How can we make the simulation of these catchments more efficient?
- What measures are relevant and can be implemented in the catchment?

Requirements

Spanish speaking is a pre
Knowledge of QGIS and R
Stay in Argentina is optional

Host institute: Wageningen Environmental Research (WENR)

Country: Argentina

Starting date: any time

Contact persons: Joop Kroes (joop.kroes@wur.nl); Ab Veldhuizen (WENR)

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Regional studies – topic 2

SWAP-WOFOST models for water management scenarios in Argentina

Introduction
Water is a very important production factor in agriculture. Due to the changing climate in Argentina, drought and flooding will occur more often. This can have far-reaching consequences for farmers, the food processing industry and water managers.

In the Dutch-Argentine project Alta de la Picasa, we will apply the SWAP-WOFOST model to assess various water and climate issues in the catchment area of Alta de la Picasa. The calculation results will be used in guiding decision-making processes by the provincial government, soy producers and other stakeholders.

Objective
The aim of the project is to create and calibrate SWAP-WOFOST models for the relevant crops in the region. The resulting models will be used to evaluate the outcomes of several scenarios, including land use changes, management changes and climate change.

Location: Wageningen Environmental Research

Country: Netherlands/Argentina

Starting date: any time

Contact person: Ab Veldhuizen (ab.veldhuizen@wur.nl) / Jos van Dam

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 3

Modelling the impacts of global change on the sustainable development of a coupled socio-ecological system

Problem context

The Mar Menor coastal lagoon is a singular socio-ecosystem that hosts several endemic species and provides various recreational services to the local population and tourists. In 2016 the lagoon underwent an ecological crash after 40 years of continuous nutrient inputs, mainly coming from irrigated agricultural areas that started flourishing in the catchment area of the lagoon in the early 80's. The negative environmental status of the lagoon strongly affects other sectors like tourism, fisheries and local populations. Restoration of the socio-ecosystem to provide environmental, social, and economic benefits is one of the main current environmental and socio-political challenges.

Research Objective/Question

The European H2020 COASTAL project aims to identify novel synergies between coastal and rural areas that promote a more sustainable social and economical development and the restoration of the lagoon. For this purpose, a system dynamic (SD) model has been developed in a participatory setting, which include the main drivers, pressures and impacts coming from and affecting different sectors, such as local populations, tourism, agriculture, etc. The main objective of the proposed MSc thesis topic is to assess how external drivers based on Shared Socioeconomic Pathways might affect model input variables and model outputs. Besides, model sensitivity analyses will be performed using the set of affected input variables in order to quantify uncertainty in model outputs.

The student should be willing to learn about environmental, economic, and social development indicators, apply an existing System Dynamics model using Vensim software, be able to summarize quantitative information and perform data analysis. Reading skills in Spanish are an advantage.

Host institute: CEBAS-CSIC

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 4

Modelling hydrological responses in burned and unburned forests

Problem context

Wildfires have become a persistent threat in the Mediterranean, especially in the Iberian Peninsula where, on average, more than 100 000 ha y-1 of land burned in the past decade. From the commonly reported environmental disturbances associated to wildfires, soil erosion by water is probably the one raising most concern. Depending on its severity, it even could result in catastrophic damage by destructive floods and debris flows to populated areas downstream, and damage aquatic habitats by contamination. Several effective mitigation techniques to tackle post-fire impacts are already available, and many have been tested in Portugal. Now, there is a need for a post-fire modelling tool that allows to identify areas with the highest erosion risk and to evaluate the effectiveness of erosion control measures, optimizing the use of resources in post-fire management.

Research Objective/Question

The aim of this study is to test which model performs better estimating post-fire hydrological and erosive response at slope scale, and also to assess if is possible to use such models as a post-fire management tool.

What is expected from the student (type of research)

The student should participate in fieldwork campaigns taking place in recently burned areas, for model input collection. Additionally the student is expected to learn and apply a hydrological and soil erosion model to post-fire environments (e.g. RUSLE, MMF, PESERA, OpenLISEM), including calibration and validation with field data

Host institute: CESAM, University of Aveiro, ESP team

Country: Spain

Starting date: to be determined

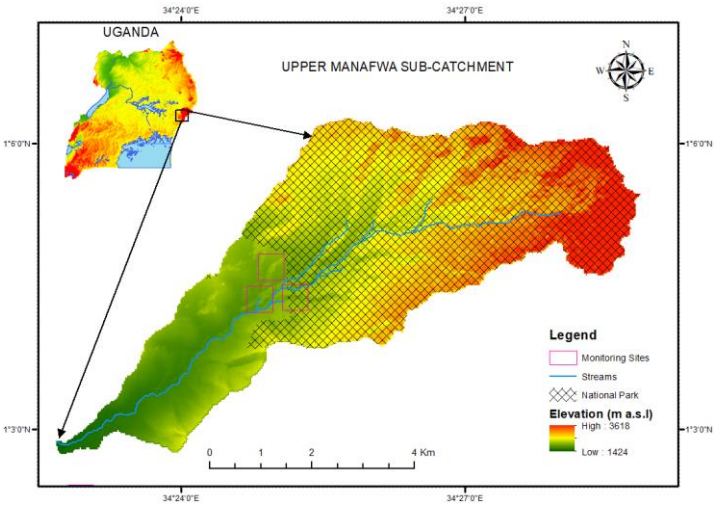
SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

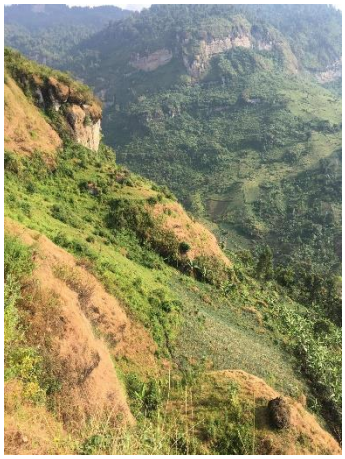
WAGENINGEN UNIVERSITY
WAGENINGEN UR

SLM
Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 5

Assessing the effect of soil and water conservation (SWC) practices on hydrological responses and soil erosion processes in Manafwa sub-watershed using the event-based OpenLISEM Model.





Problem description

For the last five decades, Mount Elgon region has experienced rapid population growth and expansion of arable land by increasing park encroachment. This has accelerated reoccurrence of soil erosion & landslides in the Manafwa watershed. Besides loss of lives & affecting farmer's livelihoods, these disasters have also altered soil properties, hydrology, increased runoff and sedimentation of reservoirs downstream. The situation is worse during the onset of rainy seasons when the vegetation cover is very scanty. The rainfall amounts & intensity combined with steep slopes with scanty surface cover makes the watershed susceptible to soil erosion and landslides, affecting communities and their livelihoods. In search of solutions, government and other stakeholders have jointly worked with farmers to put in place several soil & water conservation (SWC) practices to reduce occurrence of disasters and restore degraded farmlands.

This study seeks to better understand the effect of SWC practices on the hydrological response and processes on a sub-catchment in Manafwa watershed, by applying the physical event-based soil erosion model (OpenLISEM).

The student is expected to participate in fieldwork campaigns (if possible), for the collection of input data as also to understand which SWC practices have an impact on the hydrological and erosive response. The student is also expected to be able to work with GIS data, long-term data analysis and learn to implement OpenLISEM model.

Host institute: Makerere university, Kampala, Uganda

Country: Spain, W

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

WAGENINGEN UNIVERSITY
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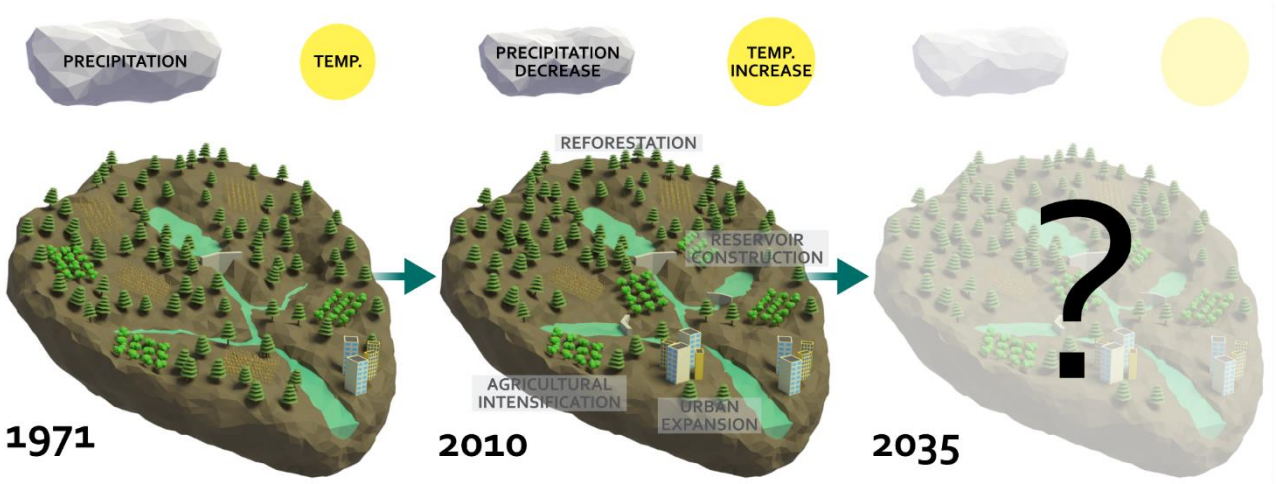
SLM
Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 6

The impact of climate and land use change on land degradation in a semi-arid catchment



Problem context

Climate change is expected to have a negative impact on land degradation, mainly due to the projected increase in extreme precipitation. Land use change may amplify (e.g. due to agricultural intensification) or decrease (e.g. due to reforestation) the impact of climate change on land degradation. Because of this uncertainty, it is essential to consider land use change in climate change assessments, to assess the combined impact on land degradation.

Research Objective/Question

This MSc thesis project aims to assess how land use change can be considered in climate change impact assessments in a semi-arid catchment in Southeast Spain, where climate change is expected to cause a significant increase in soil erosion and sediment yield.

What is expected from the student (type of research)

Through a literature review, the student will evaluate the techniques used to assess land use change in climate change impact assessments. This may include historical land use trend analysis, models (e.g. CLUE, Land Change Modeler) or other (statistical) techniques. The most promising technique will be selected, based on data and other requirements. The land use change technique will be applied in the study area, with the aim to obtain detailed land use maps under future climate conditions. The impact of climate and land use change on land degradation may be evaluated through the application of the SPHY model, a hydrological model coupled with a soil erosion and sediment transport module. The student will evaluate if land use change significantly decreases the impact on land degradation under climate change.

Host institute: CEBAS-CSIC, Soil and water conservation group

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

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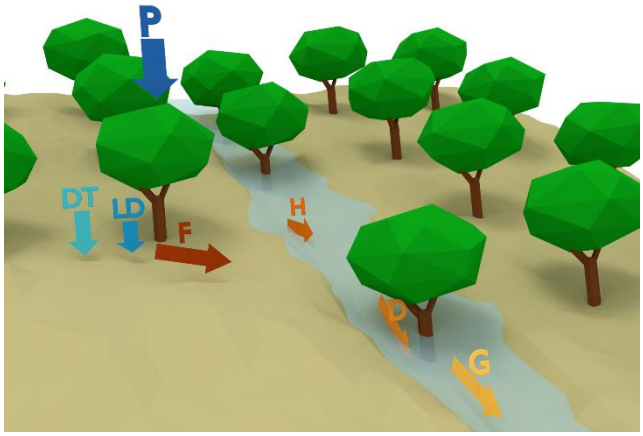
SLM
Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 7

Assessing the effectiveness of climate change adaptation strategies on soil erosion



Problem context

Many studies show that soil erosion will increase under climate change, because of the expected increase in extreme precipitation. Adaptation strategies are needed to prevent wide-scale land degradation of agricultural fields, but also to prevent the negative off-site impacts, such as reservoir sedimentation. Nature-based Solutions (NbS) are increasingly promoted as a climate change adaptation strategy, which have the ability of counteracting the on-site and off-site impact of climate change on soil erosion and sediment yield. NbS include measures taken at the source, such as reduced tillage and cover crops in agricultural fields, but also measures taken in the channel network, such as buffer strips and stream restoration.

Research Objective/Question

This MSc thesis project aims to assess the effectiveness of Nature-based Solutions as a climate change adaptation strategy in a semi-arid catchment in Southeast Spain, where climate change is expected to cause a significant increase in soil erosion and sediment yield.

What is expected from the student (type of research)

The student will apply the SPHY model, which is a hydrological model coupled with a soil erosion and sediment transport module, in a reference scenario, with climate data (precipitation and temperature) obtained from the period 1971-2000. The impact of climate change on land degradation will be assessed with climate data obtained from a number of climate models. A representative and realistic NbS will be selected and implemented in the model, which most likely involves a sensitivity analysis of related model parameters. This might also involve some modifications to the model code (Python) to be able to simulate NbS in the SPHY model. By comparing the different scenarios, it will be assessed how effective the NbS are to mitigate the impact of climate change on soil erosion and sediment yield.

Host institute: CEBAS-CSIC, Soil and water conservation group

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

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MSc thesis research
Regional analysis – topic 8

Assessing the role of cover crop biodiversity in improving soil structure and related ecosystem services in semiarid agro-ecosystems

The adoption of sustainable agricultural practices, in particular the implementation of cover crops can substantially reduce emissions and sequester some of the CO2 removed from the atmosphere by plants, contributing to climate change mitigation. In addition, cover crops offer a range of ecosystem services, such as: i) enhancing soil fertility, biodiversity and crop productivity; ii) preventing soil erosion and water contamination; iii) increasing soil water infiltration and storage capacity; iv) supporting agroecosystems to be more resilient against the impacts of climate change; and v) reducing floods and decreasing sediment export downstream. However, many of these ecosystem services offered by agricultural soils need to be optimized to reach societies that mitigate and adapt to climate change.
The objective of this topic is to assess the role of cover crop biodiversity in improving soil structure and related ecosystem services in semiarid Mediterranean agroecosystems. To do so, plant cover biodiversity and root traits from different natural cover crops as well as soil properties such as aggregate stability, porosity and carbon sequestration will be characterized in rain-fed woody cropping systems (almonds and olives) in South Spain where cover crops have been implemented for over ten years.

Research Objective/Question

Determine and identify the different species growing under different cover crops at different locations.
Determine soil properties related to soil structure and carbon sequestration under different cover crops.
Identify the most appropriate species to be used as cover crops depending on the local conditions (e.g., climate, soil type, slope, soil degradation status) to maximize the capacity of semiarid agricultural ecosystems to provide essential services.

What is expected from the student (type of research)

Interest in conducting field and laboratory work, particularly with soils and sediments
Interest in learning methodological approaches for measuring soil CO_2 emissions, erosion rates, soil carbon stocks, and carbon balance assessments.
Experience in data management and statistical analyses
Basic Spanish skills and driving licence are desirable but not essential

Host institute: CEBAS-CSIC, Soil and water conservation group

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

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MSc thesis research
Regional analysis – topic 9

Modeling the effect of UV radiation on plant litter decomposition in semiarid agro-ecosystems

Project description

The objective of this topic is to assess the role of UV-photodegradation in the decomposition of plant residues of different quality and its implications for soil carbon and nutrient balances in agricultural systems under different local climatic conditions. The ultimate goal of this project is to identify the most efficient management strategy for plant residues derived from different cover crops and ground covers (mulching or incorporation) depending on the local conditions (e.g., climate, soil type, and orientation) to maximize the capacity of semiarid agricultural ecosystems to provide essential services (e.g., soil formation, carbon sequestration, and fertility enhancement). To do so, a mechanistic dynamic model is being developed that accounts for the most important factors that control the decomposition of plant residues in semi-arid environments (temperature, air humidity, solar UV radiation and plant litter chemical composition) as well as their interactions over time. The student should be acquainted with R and should be able to help developing and testing the model.

What is expected from the student (type of research)

Experience in using R
Interest in helping to develop and test the model
Independence, responsibility and autonomy
Experience in data management and statistical analyses
Basic Spanish skills are desirable but not essential
Driving licence is desirable but not essential

Host institute: CEBAS-CSIC, Soil and water conservation group

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

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Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 10

Sustainable agricultural practices for climate change mitigation/adaptation and provision of ecosystem services

Problem context

Agriculture and associated land-use changes contribute ~25% of total global anthropogenic greenhouse gas (GHG) emissions, being CO2 responsible for 50% of average annual GHG emissions for the 2000-2009 period. Isolated studies reveal how soil can be very relevant carbon sinks, capable of changing annual carbon balances in terrestrial ecosystems. Specifically, more local studies suggest that agricultural soils may have a key role in carbon capture and storage and, especially, when they have low organic carbon contents, far from saturation, such as dryland agricultural soils, traditionally unproductive and marginalized. In this sense, the adoption of sustainable agricultural practices (reducing tillage, growing cover crops, and implementing crop residue retention measures besides others) can substantially reduce these emissions and sequester some of the CO2 removed from the atmosphere by plants, which is further incorporated as carbon (C) in soil organic matter (SOM). The aim of this MSc thesis is to identify the most efficient combinations of sustainable agricultural practices to enhance the potential of semiarid cropping systems for optimizing ecosystem services related to climate regulation through soil carbon sequestration. It is expected to advance the knowledge of soil organic carbon (SOC) stabilization mechanisms under different combinations of sustainable agricultural practices and edapho-climatic conditions.

Research Objective/Question

Estimate SOC stocks and sequestration rates under different combinations of agricultural practices. Assess changes in soil aggregate size distribution and associated OC pools in agroecosystems, identify soil carbon pools as indicators of SOC stabilization mechanisms under different soil managements.

What is expected from the student (type of research)

Interest in conducting field and laboratory work, particularly with soils and sediments. Interest in learning methodological approaches for measuring soil CO_2 emissions, erosion rates, soil carbon stocks, and carbon balance assessments. Experience in data management and statistical analyses

Basic Spanish skills and driving licence are desirable but not essential

Host institute: CEBAS-CSIC, Soil and water conservation group

Country: Spain

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

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Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 11

Snowmelt, frozen soils and soil erosion in Norway

Problem context
One of the research themes of the Nibio institute in Southern Norway (As) is the understanding of water pathway processes in small catchments and to define small, local measures for reducing peak flow and soil loss.

Research Objective/Question
Depending on the interests of the student, and the time of the year, several research topics can be formulated, e.g.:
Gully erosion: modelling and measuring
Soil erosion after spring snowmelt periods
Effectiveness of local soil conservation measures for erosion control and peak flow reduction
Modelling soil erosion, with focus on cold climate processes

What is expected from the student (type of research)
Mix of fieldwork, laboratory and data analysis. Fieldwork could consist, depending on the research focus, of sampling and measurement of soil and vegetation characteristics, measurement of runoff and soil loss from small catchments and snow dynamics measurements, acquisition and processing of aerial photography (drone) and/or satellite imagery.

Host institute: NIBIO, As

Country: Norway

Starting date: to be determined

SLM contact person: Jantiene Baartman, jantiene.baartman@wur.nl

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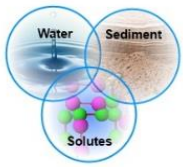
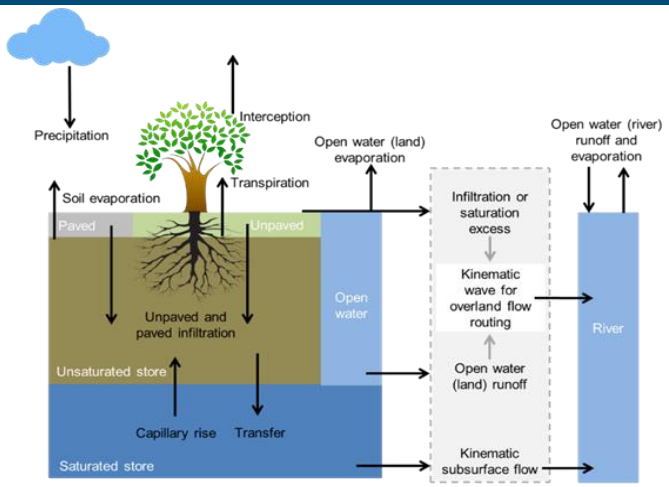
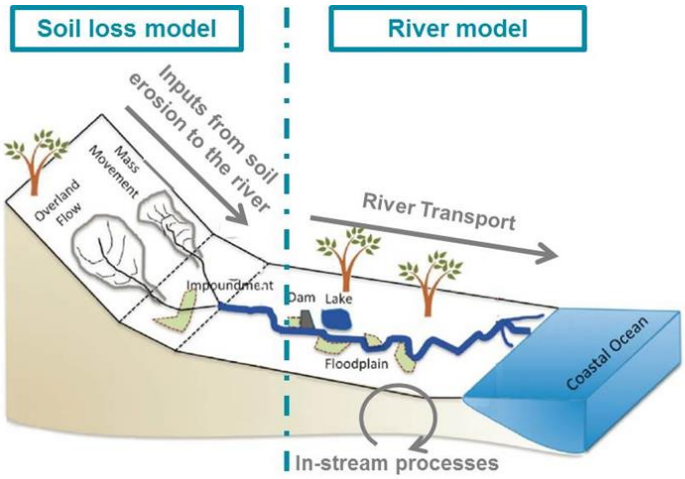
Soil Physics and Land Management

MSc thesis research
Regional analysis – topic 12



Sediment Yield Modelling of the Meuse River





Problem context

The sediment balance for the Meuse River is not well known. The annual loads of gravel, sand and silt in the river are important to explain morphological processes in the river and response to measures. Assessment and analysis of the sediment yield of the Meuse catchment is an important step towards an improved sediment balance.

WFLOW-SBM (picture left) is a distributed hydrology model developed by Deltares (open source python). A new development is WFLOW-SEDIMENT (picture right), which calculates soil loss and sediment transport in the river system using the results of the WFLOW-SBM. For the Meuse River a WFLOW-SBM model has been built recently and successfully calibrated. A WFLOW-SEDIMENT model is not yet available.

Research Objective/Question

Construction of a WFLOW-SEDIMENT model for the Meuse River based on the existing WFLOW-SBM model, calibration of the model and apply it in a sensitivity and uncertainty analysis. The results will provide improved knowledge on the sediment balance in the Meuse River, including the most important (model) parameters and uncertainty interval. The study will further give recommendations for use of and new developments in WFLOW-SEDIMENT.

What is expected from the student (type of research)

Construction of the WFLOW-SEDIMENT model using open source model building scripts and based on the existing WFLOW-SBM model and open source data on vegetation and soil texture.

Collection and analysis of calibration data: several papers available on tributaries Ardennes + contacts Uni Liege. Calibration of the model for one or two sub-catchments + application on other sub-catchments. Sensitivity analysis: selection of parameters and selection of most relevant parameters for uncertainty analysis. Uncertainty analysis for complete Meuse River with focus on Dutch part of the Meuse River.

Host institute: Wageningen University and Research

Country: Netherlands/ Belgium

Starting date: to be determined

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