# Book of abstracts



## ELI-Day - 25 May 2023









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# **General information**



## Organising committee: the ACELI team

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Welcome to this third edition of the ELI-Day, organised by the Researchers Association of the Earth and Life Institute (ACELI) with the support of the ELI institute.

If you do not know us yet...The ACELI has the primary objective of promoting the status and interests of the researchers affiliated to the Earth and Life Institute. It represents the ELI scientific body in various institutional structures at the level of the Institute, the Sector, and the University. Moreover, the ACELI also aims to provide recreational and scientific activities within the institute to build relationships between researchers from different backgrounds.

As you all well know, the Earth and Life Institute is divided into five Poles: Agronomy (ELIA), Ecology and Biodiversity (ELIV), Earth & Climate Sciences (ELIC), Environmental Sciences (ELIE) and Applied Microbiology (ELIM). Each Pole is further separated into various working groups that represent the functional day-to-day structure, managed by academics.

ELI is a huge institute, counting over 400 members and the research themes are various. Moreover, due to the repartition of our offices in different buildings (Mercator, Mendel, De Serres, and Carnoy, among others), we only get in touch in our everyday life with our working group.

Therefore, the ELI members do not know each other, nor their research thematic, very well. Over the years, the ACELI has organised several activities to help researchers to get to know each other. For instance, once a year we organised a welcome meeting for the newcomers in ELI; we ride a bike at the 24h ride bike in favour of a charity; and we offer you a fun recreational day during the second quarter. However, these are mainly social events and we wanted to create a new event that mainly focused on science and research.

The organisation of the ELI-day has required an important investment from all the ACELI members. However, it would not have been possible without the support of the ELI-bureau and some other persons that we would like to thank here:

The ELI's president Marnik VANCLOOSTER, and the Poles' representatives: Xavier DRAYE (ELIA), Emmanuel HANERT and Sophie OPFERGELT (ELIE), Nicolas SCHTICKZELLE (ELIV), Bas VAN WESEMAEL (ELIC), Patrick GERIN (ELIM) for their support. Bruna GAINO and the poles' secretaries, for facilitating the implementation of the project at several levels and the communication with the different Poles. The chairpersons Sophie Opfergelt, Marie Cavitte, Jacques Mahillon and Valentin Couvreur for their availability. And finally, all the scientific contributors to the ELI-Day!



### **Practical information**

#### Poster sessions

Three poster sessions will take place during the ELI-Day. They are scheduled during the morning coffee break (10:45-11:30 am) and during lunch time (12:45-2:00 pm). We invite you to the Cafeteria of the De Serres building (B0). Posters will be displayed according to the order given in the programme.

#### Selection of your favourite posters and presentations

You will have the opportunity to vote for your favourite oral presentation, graphical abstract and poster. The vote will take place at the end of the day, during the drink, via the Wooclap platform. The winners will receive a gift coupon for the Altérez-vous citizen café (<u>https://www.alterezvous.be/</u>) in Louvain-la-Neuve; another good reason to stay until the end of the conference!

**How to vote?** The votes will take place from 5:00PM to 6:00PM and the winners will be announced immediately after. Use one of the three following options:

#### **Best Talk Award**





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### Programme for oral presentations

- 9:00-9:30 am: Welcome & Opening -

Words from the president of ELI Marnik VANCLOOSTER

Presentation of the ACELI

#### - 9:30-10:45 am: Session 1 -

Are poorer children schooled in worse quality environments in Fédération Wallonie-Bruxelles? Group presentation: Harmony Brulein, Madeleine Guyot - ELIC

Cryogenic preservation of root samples without disturbing the cellular osmotic potential

Adrien Heymans – ELIA

Transparency, traceability and deforestation in the Ivorian cocoa supply chain

Cecile Renier – ELIC

#### The potential of wheat-associated bacteria in the development of crop protection strategies

Group presentation: Louis Morandini, Mathieu Delitte - ELIM

#### - 10:45-11:30 am: Posters & Coffee & Tea -

#### - 11:30-12:45 am: Session 2 -

The research group in plant physiology: minor crops, abiotic stress tolerance and plant reproductive biology

Group presentation: Adrien Luyckx, Nolan Regnier, Pauline Moreels, Muriel Quinet - ELIA

Does structural habitat management provide functional breeding habitat? A test with the Redbacked shrike

Suzon Rondeaux - ELIV

Indirect land use change theory under quasi-experimental verification. The case of biofuel mandates and pan-tropical cropland

Valentin Guye – ELIC

A method to account diversity in Conservation Agriculture

Manon Ferdinand - ELIA



#### - 12:45-2:00 pm: Lunch break & Posters -

#### - 2:00-3:15 pm: Session 3 -

10 years of the PROBA-V/Energetic Particle Telescope mission for Space Weather Services Group presentation: Stanislav Borisov, Sylvie Benck - ELIC

Mixed microbial chain elongation pathways depend on the availability of organic substrate, H2 and CO2

Grégoire Henry – ELIM

The social costs of pesticide use in France

Diana Borniotto – ELIA

Diagnosing the AMOC slowdown in a coupled model: a cautionary tale

Justin Gérard - ELIC

#### - 3:15-3:30 pm: Coffee and tea break -

#### - 3:30-4:45 pm: Session 4 -

Are the enemies of our enemies our best friends? Phages leading the way to control and detect pathogenic bacteria

Group presentation: Elise July, Manon Nuytten, Annika Gillis - ELIM

Pace of life and movement patterns in a freshwater ciliate: the influence of oxygen availability

Florent Manzi – ELIV

Detection of soil erosion hotspots in the black soil region Northeast China Sentinel-2 multispectral remote sensing

Lulu Qi – ELIC

MultiSpecies Canopy Segmentation: Interactive1 Machine-Learning and Pseudo-Labelling are key Charles Rongione - ELIA



- 4:45-7:00 pm: Posters & Drink -



# Programme for posters

Poster number	Title	Names
1	Hydrogeophysical characterization of a peatland hillslope in the Belgian High Fens	Maud HENRION
2	Interactions between xylem-specialized phytopathogenic bacteria and the xylem-endophytes: case-study	Lena PESENTI
3	Disentangling the effects of tree characteristics on litter decomposition processes in forests of the northern hemisphere	Joachim LOPEZ
4	Towards a better understanding of host-Polymyxa-virus interactions with the first sequencing of Polymyxa graminis genome	Margaux GENARD
5	Characterizing the drivers of organic matter fluctuations in surface water lakes: the case of the Gileppe water reservoir	Elise VERSTRAETEN
6	Integrating UAV-borne remote sensing with Traditional Field Surveys to Study Soil Respiration in a Peatland of Belgian High Fens Soil	Yanfei LI
7	How effective are conservation farming practices in mitigating runoff and soil erosion in Western Europe: a meta-analysis	Timothée CLEMENT
8	Identification of winter biogeochemical connectivity in permafrost soils with silicon isotopes (Stordalen, Sweden)	Maëlle VILLANI
9	Half-precession cycles in ENSO induced by maximum equatorial insolation	Zhipeng WU
10	A threshold in the collapse and recovery of Atlantic Meridional Overturning Circulation under different interglacial conditions	Wei LIU
11	Insolation triggered abrupt cooling at the end of interglacials and implication for the future	Giuzhen YIN
12	How to estimate Soil Extractable Water Capacity of forest soils in Wallonia: challenges related to their specificities	Anne DOAT
13	Dendroecology: tree growth response to climate	Guisset, Camille
14	Asynchronous Holocene Optimum in East Asia monsoon region recorded by stalagmites and its underlying climate dynamics	Ming-Qiang LIANG



15	Crop successions as a tool to think pesticide use reduction	Noé VANDEVOORDE
16	Belowground hydraulic resistance generates stomatal closure of grapevine in soil water-limited conditions	Louis DELVAL
17	Role of common mycelial networks of AMF on mobilizing free-living or symbiotic N-fixing bacteria and stimulating N acquisition	Jiadong HE
18	Are vertically transmitted endophytic bacteria involved in increasing plant drought tolerance provided by humic and fulvic acids	Salomé LENGRAND
19	The impact of tephra on agriculture: systemic analysis of farms' structure and functioning reveals contrasting vulnerability	Sophie MALHERBE
20	Crop vulnerability to tephra fall in volcanic regions: field, experimental and modelling approaches	Noa LIGOT
21	Dynamics of bacterial populations in soils and in organic amendments of animal origin exposed to antibiotics	Marie VERHAEGEN
22	What distribution channels use market gardeners in Cœur de Condroz (Belgium)	Nicolas BIOT
23	From the delta to the sea: Challenges in modelling the Danube-Black Sea continuum	Lauranne ALAERTS
24	Understanding the biogeochemical interactions of the Scheldt-North Sea river-ocean-continuum through multiscale modelling	Riana RANDRESIHAJA
25	Automated counting of spores in arbuscular mycorrhizal fungi in vitro cultures	Bérengère BASTOGNE
26	Short- and long-term changes in soil physical properties following biochar addition to soils in Wallonia	Martin ZANUTEL
27	Resistance and resilience of mixed tree species communities associated to ectomycorrhizal fungi under drought stress	Paola MUSELLA
28	Diversity of hydraulic responses to water deficit in major crops and trees in controlled conditions and natural habitats	Moustapha Arèmou KOLAWOLE
29	Characterization and causes of North Atlantic cold bias in climate models	Xia LIN
30	Impacts of soil aggregation on the mobility of silicon in model variable charge soils	Zimin LI
31	Cropland mapping in southern Africa over the last 30 years	Xiaojing OU



32	Can agricultural practices among small-scale cassava farmers influence root crop yield?	Fidèle BARHEBWA BALANGALIZA
33	A new framework for mapping conservation agricultural fields using time-series imagery	Yue ZHOU
34	Solution pH, weathering degree and organic matter content control fluoride adsorption in volcanic soils	Arnaud DENIS
35	Impact of streetlights on moth communities under low and high light pollution at night: a citizen science approach in Belgian gardens	Evert VAN DE SCHOOT
36	Another record low for Antarctic sea ice in 2023	Jinfei WANG
37	Combined influences of floral resources, soil environment, and land use on plant-bee interactions at the landscape scale	Maxime BURON
38	Fast characterizations of pavement layered Media using deep learning-based GPR full-wave inversion	Li ZENG
39	Hydrological controls on soil processes controlling carbon- and nutrient-efflux in the Critical Zone at the landscape scale	M. Henrion, Y. Li, A. Thami, E. du Bois d'Aische, F. Jonard, S. Lambot, S. Opfergelt, V. Vanacker, K. Van Oost
40	Comprendre les systèmes agricoles et alimentaires, analyser les dynamiques de transition écologique	Diana Borniotto, Océane Duluins, Raïssa Montois, Anton Riera, Céline Chevalier, Caroline Amrom, Noé Vandevoorde
41	<i>Bacillus mycoides</i> as a candidate for controlling potato late blight	Vivien Le Vourch ; Louis Morandini
42	Herbaria, a scientific heritage to protect and promote!	Morgane Dendoncker, Caroline Vincke
43	Who refills my tank? Coelenterazine as fuel for Amphiura filiformis luminescence	Constance Coubris, Laurent Duchatelet, Jérôme Mallefet
44	Is silicon useful for cassava?	Barhebwa Fidèle, Bruno Delvaux, Li Zimin,Vanlauwe Bernard
45	How to improve an AMF assist phytoremediation system?	Fernando Serrano, Monica Garces, Stéphane Declerck
46	Presentation of the MOCA platform	Hélène DAILLY



47	Presentation of the SEFY platform	Marc MIGON
48	Une nouvelle filière wallonne de moutarde en agriculture biologique de conservation	Hugues Falys, Rémi Desmet (FERM)



# **Oral presentations**



## First session 9:30 -10h45 am

Chairperson: Sophie Opfergelt



1 - Are poorer children schooled in worse quality environments in Fédération Wallonie-Bruxelles?
Madeleine Guyot (<u>madeleine.guyot@uclouvain.be</u>), Harmony Brulein - ELIC
Supervisor(s): Sophie Vanwambeke

Keywords: Socio-economic status, schools, Fédération Wallonie-Bruxelles, greenness, air pollution

This study explores the association between socio-economic status (SES) of the pupils and the school environment in the Fédération Wallonie-Bruxelles (FW-B), with a particular focus on greenness and air pollution levels. The main hypothesis is that children from lower socio-economic backgrounds may attend schools located in environments with lower levels of greenness and higher levels of air pollution. The study further examines differences in this relationship between urban and rural areas, specialized education, and different educational networks (private and public). SES is measured using the synthetic index based on variables including parents' income, education level, professional activities and unemployment rates. It describes the mean socio-economic level of each school's population. The school environment is described in different buffer sizes using land cover from LifeWatch, air pollution levels, including NO2, PM2.5, PM10, and black carbon from IRCELINE. The study reveals a significant association between mean SES and school greenness as well as pollution. We found that schools with lower SES indexes are associated with fewer green spaces and higher levels of pollution. These results can inform and support policies and interventions promoting more equitable access to healthy school environments for all children in the Fédération Wallonie-Bruxelles.



#### 2 - Cryogenic preservation of root samples without disturbing the cellular osmotic potential

Adrien Heymans (adrien.heymans@uclouvain.be) - ELIA

Supervisor(s): Valentin Couvreur

Keywords: Root, Microscopy, Hydraulics, Anatomy

The uptake and transport of water and nutrients is a key plant root function. However, the exact transport pathways and behavior of some of the main nutrients are still poorly understood. Modern microanalytical methods, such as bioimaging by Laser ablation inductively coupled plasma mass spectroscopy (LA-ICP-MS), are increasingly used to elucidate these plant root functions. Nevertheless, the technical challenges involved in cryo-manipulation and cryotransfer pose significant obstacles to sample preparation. Here, we developed a protocol for preserving the structural and osmotic integrity of root samples, using paraffin encapsulation to prevent cryopreservant infiltration while ensuring proper sample sealing. The effectiveness of this approach was validated by staining the cryopreservant with a fluorescent compound and using fluorescence microscopy to monitor if samples were contaminated.



**3** - Transparency, traceability and deforestation In The Ivorian cocoa supply chain Cecile Renier (<u>c.renier@uclouvain.be</u>) - ELIC

Supervisor(s): Patrick Meyfroidt

**Keywords:** International commodity trade, Agriculture, Sustainability standards, Environmental governance

Cocoa production is known as a major global driver of deforestation, but its precise contribution to deforestation in West Africa remains unclear. It is also unknown to what degree companies and international markets are able to trace their cocoa imports, and satisfy their sustainable sourcing commitments. Here, we use publicly-available remote-sensing and supply chain data for Côte d'Ivoire, the world's largest cocoa producer, to quantify cocoa-driven deforestation and trace 2019 cocoa exports and the associated deforestation from their department of origin, via trading companies, to international markets. We find 2.4 Mha of cocoa deforestation and degradation over 2000-2019, representing 45% of the total deforestation and forest degradation over that period. Only 43.6% (95% CI: 42.6 - 44.7%) of exports can be traced back to a specific cooperative and department. The majority of cocoa (over 55%) thus remains untraced, either indirectly sourced from local intermediaries by major traders (23.9%, 95% CI: 22.9 - 24.9%), or exported by untransparent traders (32.4%). Traceability to farm lags further behind, and is insufficient to meet the EU due-diligence legislation's requirement for geolocation of product origins. We estimate that trading companies in the Cocoa and Forests Initiative have mapped 40% of the total farms supplying them, representing only 22% of all Ivorian cocoa exports in 2019. We discuss issues of company- and state-led traceability systems, often presented as solutions to deforestation, and stress the need for transparency and for the sector to work at landscape-level to preserve the remaining stretches of forests in West Africa.



# 4 - The potential of wheat-associated bacteria in the development of crop protection strategies Louis Morandini (<u>louis.morandini@uclouvain.be</u>), Delitte Mathieu - ELIM Supervisor(s): Mahillon Jacques, Bragard Claude

Keywords: biological control, Bacillus spp., Pantoea spp., Pseudomonas spp., wheat

In Walloon region, two to three foliar treatments of chemical fungicides are usually used to ensure an adequate wheat production. The emergence of fungal populations resistant to these chemical pesticides and the demand by the European Authorities for a better integrated pest management has now encouraged the development of new environment-friendly approaches, including the use of biological control agents. The Antagonist project aims at developing alternative control strategies, compatible with organic agriculture, to valorise the whole potential of bacteria present in the Walloon region. Three bacterial genera known for their biocontrol properties have been investigated in the course of this project: *Bacillus, Pseudomonas* and *Pantoea*. More than 1.500 bacterial strains were isolated from wheat fields and the active strains were selected by in vitro confrontation against four major wheat pathogens. The most promising bacteria were analysed by genome sequencing and mining, and their potential for producing antifungal compounds was evaluated in planta. Additionally, a new methodological approach aimed at typing the microbial populations of wheat leaves and based on third generation sequencing was also developed. This method should allow not only the monitoring of the applied biological control agent, but also its impacts on the wheat microbiome.



## Second session 11:30 –12:45 am

Chairperson: Marie Cavitte



### 5 - The research group in plant physiology: minor crops, abiotic stress tolerance and plant reproductive biology

Adrien Luyckx (adrien.luyckx@uclouvain.be), Nolan Regnier, Pauline Moreels, Muriel Quinet, Stanley Lutts - ELIA

Supervisor(s): Muriel Quinet, Stanley Lutts

**Keywords:** Plant physiology ; phytoremediation ; reproductive biology ; abiotic stress ; self-incompatibility

The Research Group in Plant Physiology (ELIA/GRPV) is a dynamic team of three academics, three technicians, five PhD students and nine master thesis students. We work in the broad field of plant biology, mainly at the level of the plant (e.g. physiology, reproductive biology), but also with field and molecular biology approaches. Three main research areas are currently investigated. First, we work on the abiotic stress tolerance of crop species, with a particular interest in minor/orphan crops and wild relatives of major crops: (1) salinity tolerance of amaranth (*Amaranthus cruentus*) and cultivated tomato (*Solanum lycopersicum*), one of its wild relative (*S. chilense*) and their hybrids; (2) tolerance to cold or heat stress and drought on common and tartary buckwheat (*Fagopyrum esculentum* and *F. tataricum*, respectively). Secondly, we are interested in the tolerance mechanisms of several plant species to heavy metal toxicity with a perspective of phytoremediation. The current main project is on hemp (*Cannabis sativa*). Thirdly, our lab aims to investigate the floral biology and its sensitivity to various abiotic stresses, with tomato as a model species. In particular, we investigate the molecular mechanisms in the self-incompatibility and unilateral incompatibility of cultivated tomato, a wild relative (*S. chilense*) and their hybrids.



#### 6 - Does structural habitat management provide functional breeding habitat? A test with the Redbacked shrike

Suzon Rondeaux (<u>suzon.rondeaux@uclouvain.be</u>) - ELIV Supervisor(s): Hans Van Dyck, Nicolas Titeux

**Keywords:** Habitat selection, functional habitat, grassland management, Red-backed shrike, reproductive success

Human land-use is a fundamental element to consider for understanding habitat selection in birds, as it may affect the correlation between the cues they use to select their habitat and the quality of that habitat. Planning species conservation management is usually based upon restoring structural habitat (e.g. vegetation types). However, structural habitat may deviate from the functional habitat encompassing all ecological resources (i.e. consumables and utilities) needed by the target organism. This is key to the resource-based habitat concept, which defines habitat in a functional, bottom-up way from the perspective of a particular organism. Here, we address a structural vs. functional habitat approach in the case of the Red-backed Shrike (Lanius collurio L., 1758), a migratory grassland bird in Europe. In this integrated field study, we focus on semi-natural grassland habitats created by different management regimes and their consequences for shrike habitat selection and reproductive success. Over three breeding seasons (2020-2022), we assessed attractivity and quality of different grassland habitats, tracking c. 200 shrike territories yearly. We investigated structural habitat variation through regular monitoring of management practices, hedge network and nest substrate, as well as nest-site microclimate. As all three years had extreme and contrasting weather conditions, our study is able to account for the influence of meso-climatic variation. We also assessed the link between structural and functional habitat based on field surveys assessing predation rate, insect prey offer and prey use, through a behavioural lens looking at shrike hunting behaviour and nest provisioning.



### 7 - Indirect land use change theory under quasi-experimental verification The case of biofuel mandates and pan-tropical cropland

Valentin Guye (valentin.guye@uclouvain.be) - ELIC

Supervisor(s): Patrick Meyfroidt

Keywords: ILUC, biofuel, RFS, deforestation

Agricultural supply and demand shocks can cause unintended environmental damages as they propagate across space, time and commodity markets according to mechanisms that have been vastly simulated but barely verified empirically. In this paper, I propose a unified framework to corroborate such mechanisms of indirect land use change (ILUC). In a quasi-experimental application provided by the pre-determined nature of biofuel mandates, I identify how crop-specific exposures moderate spatially explicit land use change responses to the mandate shocks. This detects signals of ILUC for eight different crops across the global tropics, yielding three main results: it corroborates the land use displacement mechanism specifically; it indicates the general prevalence of the mechanisms that propagate the incentives to expand cropland – including in the case of the main drivers of deforestation; but it also reveals the existence of mechanisms that attenuate the propagation of incentive shocks. These results warn about the reality of ILUC, and partially identify how it occurs.



#### 8 - A method to account diversity in Conservation Agriculture

Manon Ferdinand (<u>manon.ferdinand@uclouvain.be</u>) - ELIA Supervisor(s): Philippe Baret

Keywords: Farming models ; Typology ; Multivariate cluster analysis ; Archetypal analysis

Conservation Agriculture (CA) is actively promoted as an alternative farming system. CA is defined by three pillars: (i) minimising mechanical soil disturbance, (ii) maximising soil cover, and (iii) diversifying crop species. The vagueness of the terms used to define CA, coupled with the local and individual constraints of farmers, influence the translation of the CA pillars into practice. Classifying the diversity of CA practices helps to assess impacts, guide policy decisions and improve communication between stakeholders. We propose a new classification method grounded on the intersection of an archetype analysis and a hierarchical clustering analysis. We used this method to study the CA practices of 48 farmers in Wallonia, Belgium. Through cross-referencing the archetype and hierarchical clustering analysis, we identified five CA models, differentiated into three archetypal and two intermediate models. While the archetypal models represent farmers with a particularly original combination of pillar practices, the intermediate models represent farmers with practices that straddle the archetypal models. No model maximises all three pillars simultaneously. Archetypal model practices are influenced by: (i) the proportion of soil preparation-intensive crops and (ii) temporary grasslands in the rotation, as well as (iii) the organic certification. Studying the evolution of these intermediate models will help to determine whether they are stable over time or whether they will evolve into other models. This classification method could be replicated in other geographical contexts and farming systems. Our results underline the importance of understanding the diversity of CA practices for the improvement of stakeholder collaboration and impact assessment.



# Third session 2:00 - 3:15 pm

Chairperson: Jacques Mahillon



**9 - 10 years of the PROBA-V/Energetic Particle Telescope mission for Space Weather Services** Stanislav Borisov (<u>stanislav.borisov@uclouvain.be</u>), Sylvie Benck - ELIC

Supervisor(s): Véronique Dehant

Keywords: Space Weather, Space Radiation, Space Technologies

The Sun plays an important role in defining the near-Earth environment. It is a source of life, but in some occasions may represent a danger as well. In this presentation the concept of Space Weather and Space climate will be explained. The Center for Space Radiation (CSR) team within ELI-C did develop the Energetic Particle Telescope (EPT) for studies of the radiation component of space environment. The instrument was constructed within a consortium including the UCLouvain/CSR, Belgian Institute for Space Aeronomy and industry "Qinetiq Space". The EPT was launched on board PROBA-V into low-Earth orbit of altitude 820 km on 7 May 2013, therefore the mission lasts already for 10 years. The achievements of EPT as well as its contribution to Space Weather Services will be presented.


10 - Mixed microbial chain elongation pathways depend on the availability of organic substrate, H2 and CO2

Grégoire Henry (gregoire.henry@uclouvain.be) - ELIM

Supervisor(s): Patrick Gerin

**Keywords:** Biomass valorization - Brewer's spent grain - Fermentations - Medium Chain Carboxylates - H2 and CO2 conversion

Brewer spent grain is a complex organic feedstock under-valorized with an estimated global production of 34.6 million tons in 2021. It is composed of fermentable macromolecules such as proteins, starch and residual soluble carbohydrates but also contains at least 50%DM of lignocellulose. Methane arrested anaerobic digestion is a microbial conversion process able to degrade such type of organic feedstock and produces intermediates molecules such as ethanol, small chain carboxylates, H2 and CO2. Under specific physicochemical conditions of fermentation, these intermediates can be microbially transformed into medium chain carboxylates through chain elongation pathways. Medium chain carboxylates are of great interest because they can be used as pesticides, food additive, include in medicine or easily transformed by classical organic chemistry into fuels and chemicals. In this study, the potential of brewer spent grain to produce medium chain carboxylates thanks to a mixed microbial culture is determined. As the lack in electron donor is known as a limiting factor for the conversion of complex organic feedstock to medium chain carboxylates, we investigated the supplementation of H2 and CO2 gases in the headspace in order to trigger the chain elongation pathways and increase the production of medium chain carboxylates. The exogenous addition of H2 alone (as second source of electron donor), CO2 alone (as second source of carbon) and both H2&CO2 were investigated. Exogenous supply of H2 alone allowed the CO2 produced during acidogenesis to be consumed and nearly doubled the medium chain carboxylates production. Exogenous supply of CO2 inhibited the whole fermentation. The supplementation of both H2&CO2 allowed a second elongation phase when the organic feedstock was exhausted, which increased the medium chain carboxylate production by 276% compared to the reference condition. Analysis of the stoichiometric carbon and electron balance suggests a H2&CO2 driven second elongation phase, converting small chain carboxylates to medium chain carboxylates from only H2 and CO2.



11 - The social costs of pesticide use in France
Diana Borniotto (<u>diana.borniotto@uclouvain.be</u>) - ELIA
Supervisor(s): Philippe Baret

Keywords: pesticides use, social costs, France, externalities, public budget accounting

The modern agricultural production system relies heavily on the use of synthetic pesticides, but over the course of recent decades various concerns have been raised on the associated negative externalities touching a variety of dimensions, such as human health and the environment. Yet, the magnitude of those effects is still unclear and data availability is scattered and heterogenous across dimensions, regions, and time. The public sector is called upon to develop and implement strategies to face those externalities and their associated social costs. This study aims to provide an assessment of social costs of pesticides in France in the prospect of an integration to the public budget spending, helping public authorities to identify financial flows of public funding with an impact perspective, within a methodological framework based on the social norms at the core of the public system. The results show that the social costs attributable to synthetic pesticide use in France amounted to 372 million euros, of which environmental costs are estimated at least at 291.5 million euros, health costs at least at 48.5 million euros, regulation at least at 31.9 million euros and public financial support to the sector at least at 0.4 million euros. For comparison, this total value of social costs represents more than 10% of the annual budget in 2017 of the French Ministry of Agriculture and Food. The analysis can be used as a monitoring indicator for the implementation of public policies in the context of the growing social and environmental issues they face.



#### 12 - Diagnosing the AMOC slowdown in a coupled model: a cautionary tale

Justin Gérard (justin.gerard@uclouvain.be) - ELIC

Supervisor(s): Michel Crucifix

Keywords: AMOC cGENIE diagnostic

It is now established that the increase in atmospheric CO2 is likely to cause a weakening, or perhaps a collapse of the Atlantic Meridional Overturning Circulation (AMOC). To investigate the mechanisms of this response in CMIP5 models, Levang and Schmitt (2020) have estimated offline the geostrophic streamfunction in these models and decomposed the simulated changes into a contribution caused by the variations in temperature and salinity. They concluded that under a warming scenario, and for most models, the weakening of the AMOC is fundamentally driven by temperature anomalies while freshwater flux changes actually act to stabilize it. However, given that both 3-D fields of ocean temperature and salinity are expected to respond to a forcing at the ocean surface, it is unclear to what extent the diagnostic is informative about the nature of the forcing. To clarify this question, we used the Earth system Model of Intermediate Complexity (EMIC) cGENIE (Marsh et al., 2011). First, we reproduced the experiments simulating the RCP8.5 warming scenario and observed that cGENIE behaves similarly to the majority of the CMIP5 models considered by Levang and Schmitt (2020), with the response dominated by the changes in the thermal structure of the ocean. Next, we considered hysteresis experiments associated with (1) water hosing and (2) CO2 increase and decrease. In all experiments, changes in the ocean streamfunction appear to be primarily caused by the changes in the temperature distribution, with variations in the 3-D distribution of salinity compensating only partly for the temperature contribution. These experiments also reveal limited sensitivity to changes in the ocean's salinity inventory. That the diagnostics behave similarly in CO2 and freshwater forcing scenarios suggests that the output of the diagnostic proposed by Levang and Schmitt (2020) is mainly determined by the internal structure of the ocean circulation, rather than by the forcing applied to it.



## Fourth session 3:30 – 4:45 pm

Chairpersons: Valentin Couvreur



### 13 - Are the enemies of our enemies our best friends? Phages leading the way to control and detect pathogenic bacteria

Manon Nuytten (<u>manon.nuytten@uclouvain.be</u>), Elise July, Annika Gillis – MIAE, ELIM Supervisor(s): Jacques Mahillon - Claude Bragard

**Keywo**rds: Bacteriophage – Antimicrobial defence – Viral Protein – Biocontrol – Biosensor

Antimicrobial resistance is now considered as one of the most urgent threats to public health as it is predicted to cause more deaths than cancer by 2050. In this battle against multi-resistant pathogens, bacteriophages (or phages) – natural bacterial killers – are seen as one promising alternative to conventional antibiotics and diagnostic protocols. In this frame, our laboratory is focussed on studying phages infecting Gram-positive pathogens with medical and agronomical importance as the *Bacillus cereus* group. By isolating new phages from environmental samples, we expand the arsenal of weapons against those superbugs. We also study the mechanisms of phage resistance and antiviral defence systems in bacteria, to allow the wise and long-term use of phages in the food and medical sector. Finally, the characterization of the phage-derived proteins involved in host recognition (i.e. receptor binding proteins) and bacterial lysis (i.e. endolysins) has allowed the development of fast and specific biosensors.



**14** - Pace of life and movement patterns in a freshwater ciliate: the influence of oxygen availability Florent Manzi (<u>florent.manzi@uclouvain.be</u>) - ELIV

Supervisor(s): Nicolas Schtickzelle

Keywords: ciliates; demography; pace of life; cell behaviour; slow-fast continuum

When faced with resource unpredictability and other perceived disturbances (such as lack of oxygen), some species tend to respond by 'fleeing' suboptimal locations. As an alternative strategy, other organisms would rather 'sit-and-wait', switching over to slower movement and metabolism until environmental conditions return to normal. To uncover which, if any, of these strategies could be used by a freshwater unicellular eukaryote in the face of hypoxia, we conducted an experiment where oxygen availability was manipulated in populations of the ciliate Tetrahymena thermophila. The demographic growth curves of 96 populations (including six clonal strains) were quantified until their eventual decline using highly automatized image analysis, allowing us to assess changes in abundance, morphology, and movement patterns. With a high availability of dissolved oxygen, cells displayed a typical 'live-fast, die-young' pace of life, characterized by a steep growth rate and a high, albeit shortlived demographic plateau. With more limited oxygen availability, cells reduced their swimming speed but followed much straighter trajectories, allowing them to achieve the same displacement in space. The general direction of oxygen effects was comparable across all strains, although distinct genotypes differed in their respective sensibility to the treatments. Such a compensation of decreased speed by altered movement paths suggests the existence of an inducible 'flight response' in this species, and could serve as a cost-efficient strategy to escape suboptimal conditions.



### 15 - Detection of soil erosion hotspots in the black soil region Northeast China Sentinel-2 multispectral remote sensing

Lulu Qi (lulu.qi@student.uclouvain.be) - ELIC

Supervisor(s): Bas van Wesemael

Keywords: soil erosion; Northeast China; Sentinel-2; multitemporal composite; mapping; SOC

Global efforts to restore the world's degraded croplands require knowledge on the degree and extent of accelerated soil organic carbon (SOC) loss induced by soil erosion. However, methods for assessing where and to what extent erosion takes place is still inadequate for precise detection of erosion hotspots at high spatial resolution. In this study, we attempted to develop a spectra-based soil erosion mapping approach to pinpoint eroded hotspots in a typical catchment located in the black soil region of Northeast China as characterized by undulating landscapes. We built a ground-truth dataset consisting of three classes of soils representing Severe, Moderate, and Low erosion intensity because of their inter-class contrasts in estimated erosion rates from 137Cs tracing. The spectral separability of different erosion classes was first tested by a combined principal component and linear discriminant analysis (PCA-LDA) against laboratory hyperspectral data and then validated against Sentinel-2 derived broadband spectra. We will present results on the performance of the PCA-LDA model to classify soil erosion intensity classes based on laboratory and satellite-based soil spectra. We further identified distinctive spectral features representative of shifting soil albedo and biochemical composition due to erosion-induced SOC mobilization. A classification scheme comprising the spectral features was applied to the Sentinel-2 bare soil composite for pixel-wise soil erosion mapping, from which 15.9% of the catchment area was detected as erosion hotspots while the Moderate class occupied 65.4%.Our study highlights the potential of the spectral-based remote sensing approach for better targeted cropland management to combat soil degradation.



### 16 - MultiSpecies Canopy Segmentation: Interactive1 Machine-Learning and Pseudo-Labelling are key

Charles Rongione (charles.rongione@uclouvain.be) - ELIA

Supervisor(s): Xavier Draye, Pierre Defourny

**Keywords:** Mixed Cropping - Semantic Segmentation - Phenotyping - Sustainable Agriculture - Artificial Intelligence

This study investigates the challenge of creating datasets for training multiclass deep-learning segmentation models, specifically for segmenting multi-species canopy images. Creating training sets for deep-learning based segmentation of multispecies canopies is currently too labor-intensive and time-consuming to be viable. To address this challenge, we propose a novel pipeline that uses fully convolutional neural networks (FCNNs) to transition from single-species images to segmented multi-species images. This paper demonstrates that FCNNs can effectively generalize learning from single-species canopy images to multispecies canopy images, achieving accurate pixel classification in mixed species canopies even when the network was trained only on images of single-species canopies. Additionally, we introduce Interactive Machine Learning and pseudo labeling as a method for generating a single-species canopy training set in a matter of minutes. We also present two software packages to implement our approach can significantly reduce the human time load required for semantic segmentation of multispecies canopy images, achieving over 90\% accuracy in less than 10 minutes. This new method has the potential to greatly facilitate the study of multispecies canopies.



# Posters abstracts



#### 1 - Hydrogeophysical characterization of a peatland hillslope in the Belgian High Fens

Maud Henrion (<u>maud.henrion@uclouvain.be</u>) - ELIE Supervisor(s): Sébastien Lambot, Kristof Van Oost

Keywords: Peatland, Ground-Penetrating Radar, Electromagnetic Induction

Despite the fact that peatlands play an important role in climate regulation, biodiversity support, water regulation, etc., they are understudied biotopes. The objective of this study, conducted in the Belgian High Fens, was to characterize and understand the soil surface and subsurface long-term characteristics which are conditioning the shorter-term hydrogeophysical processes. To this end, Ground-Penetrating Radar (GPR) and Electromagnetic Induction (EMI) were used and this source of information was complemented with soil coring and in situ soil water conductivity measurements. The GPR and soil coring allows to reconstruct the soil structure which is composed of a layer of approximately 80 cm of peat that developed on an impermeable clay layer issued of the slate bedrock decomposition. The EMI shows a bulk soil electrical conductivity (EC) around 10 mS/m. The EC is lower in the slope, where the water fluxes are higher. The EC was higher (of about 3 mS/m) in summer than in spring. The EC values and dynamics seem to be mainly controlled by the ion content of the soil solution. This ion content is controlled by the water fluxes on the site evacuating the ions downhill to a river. The soil water content is believed to have a low impact on the EC as the site is quite saturated most of the year. This study will also be a basis to interpret further measurements that will be made on the site (water, soil and vegetation monitoring).



### 2 - Interactions between xylem-specialized phytopathogenic bacteria and the xylem-endophytes: case-study

Lena Pesenti (<u>lena.pesenti@uclouvain.be</u>) - ELIM Supervisor(s): Bragard, Claude

Keywords: Endophyte, bacteria, plant, pathogen

Endophytic microbial communities contribute significantly to plant health. If this is widely accepted, the question remains on the mechanisms underlying such protection. This project aims at assessing how endophytes interfere with phytopathogenic bacteria colonizing the specific xylem niche. Our general objective is to study the interactions between phytopathogenic xylem-specialist bacteria (Brenneria salicis and Xylella fastidiosa) and endophytes in Salix and Populus genera. Understanding the modus operandi of pathogens interaction with the endophytes is therefore a major phytosanitary challenge and a breakthrough in the fight against epidemics. X. fastidiosa spread in the 1800's in America and has more recently established in Europe. B. salicis settled in Belgium in 1980 and has also spread to England and Japan. Although pathogenic most of the time, these two bacteria can be found in a latent state where their hosts do not develop symptoms. Our hypothesis is that this symptomology duality could be explained by the interactions between these bacteria and the endophytes. Our study is based on the current knowledge of the interaction between Salicaceae and both bacteria investigated . For this, we have used the GFP-expressing X. fastidiosa KLN59.3 and prepared a B. salicis LMG2698 expressing RFP. After a screening phase by isolation, we have looked for interactions with X. fastidiosa and B. salicis. Based on simple confrontation assays, endophytes showing inhibition activity against one of the bacteria are then tested for siderophore, lipopeptide, acetoin, cellulase, protease and indole related compound production, and also for phosphate solubilization, swimming or swarming motility and biofilm formation. Finally, the endophytic strains of interest will be transformed to express a fluorescent protein to see their interaction in the xylem vessels with the phytopathogenic bacteria.



### **3** - Disentangling the effects of tree characteristics on litter decomposition processes in forests of the northern hemisphere

Joachim Lopez (joachim.lopez@uclouvain.be) - ELIE

Supervisor(s): Quentin Ponette

**Keywords:** Biodiversity functioning, Carbon storage, Above ground below ground interactions, Biogeochemestry, Arboretum of Tervuren

In this project, we want to investigate the complex linkages between above ground tree biodiversity and decomposition. In terrestrial ecosystems, most of the plant net primary production ends on the soils as litter. However, this leaf litter can vary greatly in quality and quantity and consequently have a major impact on the soil and ecosystem functioning. Besides, litter decomposition is a key process affecting the nutrient and carbon cycles of (forest) ecosystems. Therefore, we perform our experiments in the Arboretum of Tervuren which was established 100 years ago with tree species mono cultures and mixtures, representing the major tree communities of boreal and temperate regions. This will allow us to test the effect of tree community composition, corresponding litter (traits), tree characteristics and this for species with varying biogeographical origin (region or continent) for a large, unprecedented, range of tree communities under similar macro climatic and geopedological settings.



### 4 - Towards a better understanding of host-Polymyxa-virus interactions with the first sequencing of Polymyxa graminis genome

Margaux Genard (<u>margaux.genard@uclouvain.be</u>) - ELIM Supervisor(s): Anne Legrève, Claude Bragard

Keywords: Polymyxa, RSNV, rice, genome assembly

Viral diseases transmitted by *Polymyxa* are complex pathosystems involving three actors: a plant host, an obligate endoparasitic protist vector (*Polymyxa* spp.) and a virus. These pathosystems involve major crops such as wheat, rice, sugar beets, etc. and a large diversity of viruses belonging to the *Furovirus, Benyvirus, Pomovirus, Bymovirus* and *Pecluvirus* genera, in temperate and tropical areas. Despite the vast distribution of these pathosystems, only a few genomic and transcriptomic studies involving the vector *Polymyxa* are available. The obligate endoparasitic nature of the vector – which complicates its multiplication and prevents its isolation from the host – is largely the reason why the first *Polymyxa betae* (*Pb*) genome was only recently sequenced. This also explains why almost no genomic data is available for *Polymyxa graminis* (*Pg*). This lack of data is an obstacle to further understanding host-*Pg*-virus interactions, as the sequencing of *Pg* is key to characterize the parasitic lifestyle of this vector and to develop molecular tools to study *Pg* under controlled conditions. Our research aims to provide new *Pg* genomic and transcriptomic data, starting with the first sequencing of *Pg f.sp. colombiana* (*Pgcol*) genome. Methods developed for *Pgcol* multiplication in rice roots, quantification, sequencing, and data analysis are presented, as well as the preliminary results of the first sequencing.



### 5 - Characterizing the drivers of organic matter fluctuations in surface water lakes: the case of the Gileppe water reservoir

Elise Verstraeten (verstraeten.elise@uclouvain.be) - ELIE

Supervisor(s): Marnik Vanclooster

Keywords: organic carbon, peatland, surface water, water quality, Gileppe

Many surface water reservoirs in northern Europe have seen a rise in their organic matter content. When the water is used for human consumption, this has an indirect effect on human health, by increasing the risk of pathogens appearance and of biofilm formation after water treatment. Besides, organic matter negatively affects the color, odor and taste of water, which displeases the consumers. In order to ensure a good drinking water quality at the tap, its treatment should thus be adapted to the organic matter content. In this study we (i) characterize the trend and seasonality patterns of organic matter in the Gileppe Lake over the last 20 years and (ii) unravel mechanisms causing the observed fluctuations using time series statistical modelling. The water reservoir created by the Gilleppe dam in the North of Wallonia has an available volume of 3.100.000 m<sup>3</sup>. It is used to supply a hydro-electric power plant, and to provide drinking water to the city of Verviers and its surroundings. The water producer « Société Wallonne des Eaux (SWDE) » extracts an annual volume of around 14 million m<sup>3</sup> to that end. The SWDE has been measuring the quality of the extracted water since 1991, at an increasing frequency. These measurements include parameters related to organic matter content such as total organic carbon (TOC), color and chemical oxygen demand. The total organic carbon (TOC) concentrations in the Gileppe lake indicate there has been a rise in organic matter in the Gileppe lake since the 90's, as the concentration was 3,7 mg/l in October 1997, and increased to 10,4 m/l in October 2019. The TOC also has a seasonal variability, with the highest concentration peaks being reached during the autumn. We characterize the evolution of the potential drivers of the increasing trend and the seasonality: climate (precipitation, T°), land use (mainly forest cover area and type) and anthropogenic pressure (presence of septic tanks, wastewater release, agricultural runoff). We then investigate if, according to the literature, the evolution of these variables could explain of the observed organic matter trends and seasonality.



### 6 - Integrating UAV-borne remote sensing with Traditional Field Surveys to Study Soil Respiration in a Peatland of Belgian High Fens Soil

Yanfei Li (<u>yanfei.li@uclouvain.be</u>) - ELIC Supervisor(s): Kristof Van Oost, Francois Jonard

Keywords: respiration, Peatland, UAVs, Vegetation structure, Soil temperature

Soil respiration, consisting of heterotrophic respiration and autotrophic respiration, is a key process in the terrestrial carbon cycle. Peatlands are known to store a large amount of carbon stock and play a critical role in CO2 exchange between the pedosphere and the atmosphere. However, due to the unique ecosystem, soil gas efflux exhibits great spatial-temporal variability even on a landscape scale, making it challenging to characterize the interactions between soil respiration and environmental factors using only in-situ measurements. Unmanned aerial vehicles (UAVs) have emerged as costeffective remote-sensing tools for collecting high-resolution data, whereas their integration with traditional field surveys is still in its early stages. Therefore, by integrating UAV sensing with field-based approaches, we aim to capture the full dynamics of soil respiration as well as investigate its connections to environmental factors in the Belgian High Fens. For this purpose, CO2 gas analyzer systems are used to monitor in-situ soil CO2 efflux in representative positions. Soil moisture and soil temperature along a hillslope transect are measured by in-situ probes every ten minutes. Additionally, UAVs equipped with multiple sensors (RGB, multispectral, thermal infrared camera, LiDAR) are used to characterize spatial-temporal dynamics of controlling factors (e.g., vegetation structure, land surface temperature, and microtopography) at a monthly interval. The early findings indicate that soil CO2 flux varies in different slope positions and shows positive relationships with soil temperature and moisture. Our preliminary results provide insights into the magnitude, patterns, and controls of peatland soil respiration, and its sensitivity to global change.



### 7 - How effective are conservation farming practices in mitigating runoff and soil erosion in Western Europe: a meta-analysis

Timothée Clément (timothee.clement@uclouvain.be) - ELIE

Supervisor(s): Charles Bielders

Keywords: runoff ; erosion ; meta-analysis ; conservation agriculture

Soils of the European loess belt are intensively cropped and are known to be prone to slaking and erosion. Runoff and sediment transfer from cropland result in impacts such as soil degradation, muddy floods and the contamination of surface waters by sediments, nutrients, and pesticides. Conservation agriculture, by maximizing soil vegetation cover and limiting tillage, could restore soil structure, ultimately improving resistance against surface flows. However, there is still a wide uncertainty about the magnitude of the mitigation effect of conservation agricultural practices on overland flows. We performed a systematic search and subsequent meta-analyses on the efficiency (to mitigate runoff and soil erosion) of three conservation cropping practices : winter cover crops, furrow dyking potato crop, and conservation tillage. We only selected studies having actually measured runoff and soil losses at the plot scale, under natural rainfall, comparing both control ("conventional") and conservation treatments, in Western or Central Europe. The 6 metadatasets (3 practices x 2 outcomes : runoff and erosion) were analyzed both by linear random effects model and hierarchical nonparametric bootstrapping method. Compared to the corresponding "conventional" control treatment, winter cover crops, furrow dyking potato crops, and conservation tillage significantly reduce seasonal runoff and soil losses respectively by a mean of 68% and 72%, 70% and 92%, and 27 and 66%. Variables related to the application modalities of the farming practices were also identified as significantly explaining the variability between studies outcomes.



### 8 - Identification of winter biogeochemical connectivity in permafrost soils with silicon isotopes (Stordalen, Sweden)

Maëlle Villani (maelle.villani@uclouvain.be) - ELIE

Supervisor(s): Sophie Opfergelt

Keywords: Permafrost, isotopes, silicon, winter

Climate change affects Arctic regions by exposing previously frozen permafrost to thaw and changing hydrological processes. As a result, permafrost soils in Arctic have recently developed unfrozen soil portions in winter. These unfrozen soil portions may increase the soil biogeochemical connectivity by creating lateral subsurface water flow, thereby contributing to the lateral transfer of nutrients including dissolved organic carbon. This winter connectivity is mainly expected if unfrozen soil portions are connected (open system). However, the proportion of connected (open system) relative to unconnected (closed system) unfrozen soil portions remains poorly quantified. Here, we investigate the silicon isotope composition ( $\delta$ 30Si) in soil pore water collected from September to November 2021 on a natural gradient of permafrost degradation from a palsa (closed system) to a fen (open system) in Stordalen, Sweden. We use  $\delta$ 30Si measurements to distinguish between: a closed system in freezing soils where silicic acid concentration in soil pore water is increasing upon freezing, leading to amorphous silica precipitation that induces Si isotope fractionation due to the preferential incorporation of 28Si in colloidal amorphous silica; and an open system in freezing soils where silicic acid concentration in soil pore water is mixed with lateral contributions and amorphous silica precipitation is not induced. We then compare the evolution of the  $\delta$ 30Si values in soil pore waters where freeze-up has occurred (closed system) or where freeze-up is delayed or absent (open system).



#### 9 - Half-precession cycles in ENSO induced by maximum equatorial insolation

Zhipeng Wu (zhipeng.wu@uclouvain.be) - ELIC

Supervisor(s): Qiuzhen Yin

Keywords: ENSO, Half-precession cycle, astronomical forcing, CO2, ice sheets

The El Niño-Southern Oscillation (ENSO) has strong effect on global and regional climate, environment and ecosystems, but the ENSO dynamics are still far from being well understood. The long-term evolution of ENSO in the past is expected to provide more clues, especially the ENSO during past interglacials which could help to understand the ENSO variability and underlying mechanisms under warm climate conditions. Here we investigate the long-term evolution of ENSO in response to different forcing factors during nine glacial-interglacial periods over the past 800,000 years based on transient climate simulations. The results show that insolation plays a dominant role on ENSO on orbital timescale, while the effects of greenhouse gases (GHG) and North Hemisphere (NH) ice sheets are relatively minor. Our model simulates strong half-precession cycles in the ENSO variations, in agreement with proxy reconstructions. Their amplitude is largely affected by the strength of eccentricity, the amplitude of variations of precession and obliquity, and by the variations of GHG and ice sheets. Our results further show that the half-precession cycles in the ENSO are a response to the maximum equatorial insolation. The process involves the ocean heat content (OHC) in the western equatorial Pacific (WEP). A higher OHC in the WEP leads to a larger ENSO amplitude, which may have important implication for future ENSO evolution.



### **10** - A threshold in the collapse and recovery of Atlantic Meridional Overturning Circulation under different interglacial conditions

Wei Liu (wei.liu@uclouvain.be) - ELIC

Supervisor(s): Qiuzhen YIN

Keywords: AMOC, freshwater hosing, LOVECLIM, CESM

Two equilibrium states are considered to exist in AMOC, which may rapidly push the current typical ('on') state to a collapsed ('off') state when the freshwater injection in the regions of deep-water formation across the threshold. Some simulation studies suggest that the threshold may be influenced by several factors, such as the region and the change rate of freshwater hosing. However, it is not fully clear to what extent the stability of the threshold could be affected by different interglacial boundary conditions. In this work, we conducted a set of sensitivity experiments with the Marine Isotope Stage 13 (the coolest interglacial over the last one million years) and the present interglacial boundary conditions employing two Earth system models, the Community Earth System Model and the LOVECLIM, to explore the AMOC and global climate response to freshwater hosing. Both models show a marked response of AMOC to a freshwater flux threshold of about 0.047 Sv in the Greenland-Iceland-Norwegian (GIN) seas. This threshold value is hardly affected by changes of orbital parameters or greenhouse gases between the two interglacials but is sensitive to hosing region and change rate of the freshwater. Further analysis reveals possible and apparent transitions of the magnitude and spatial pattern of the global climate response to freshwater hosing before and after the threshold during the MIS-13 interglacial. Our results imply that the relationship among AMOC, freshwater hosing and associated climate change during past interglacials could be a reference for future AMOC deceleration.



#### 11 - Insolation triggered abrupt cooling at the end of interglacials and implication for the future

Qiuzhen Yin (qiuzhen.yin@uclouvain.be) - ELIC

Keywords: Interglacials, Abrupt climate changes, Insolation threshold

Various paleoclimate records show that the end of interglacials of the late Pleistocene was marked by abrupt cooling events. Strong abrupt cooling occurring when climate was still in a warm interglacial condition is puzzling. Our transient climate simulations for the eleven interglacial (sub)stages of the past 800,000 years show that, when summer insolation in the Northern Hemisphere (NH) high latitudes decreases to a critical value (a threshold), it triggers a strong, abrupt weakening of the Atlantic meridional overturning circulation and consequently an abrupt cooling in the NH. The mechanism involves sea ice-ocean feedbacks in the Northern Nordic Sea and the Labrador Sea (Yin et al., 2021, doi: 10.1126/science.abg1737). The insolation-induced abrupt cooling is accompanied by abrupt changes in precipitation, vegetation from low to high latitudes and in particular by abrupt snow accumulation in polar regions. The timing of the simulated abrupt events at the end of interglacials is highly consistent with those observed in marine and terrestrial records, especially with those observed in high-resolution, absolutely-dated speleothem records in Asia and Europe, which validates the model results and reveals that the astronomically-induced slow variations of insolation could trigger abrupt climate events. Our results show that the insolation threshold occurred at the end of each interglacial of the past 800,000 years, suggesting its fundamental role in terminating the warm climate conditions of the interglacials. The next insolation threshold will occur in 50,000 years, implying an exceptionally long interglacial ahead.



### **12** - How to estimate Soil Extractable Water Capacity of forest soils in Wallonia : challenges related to their specificities

Anne Doat (anne.doat@uclouvain.be) - ELIE

Supervisor(s): Caroline Vincke, Mathieu Javaux

**Keywords:** Soil extractable water capacity (SEWC)– forest soils – retention curves – stoniness – rooting depth

In the context of climate change, an increase in the frequency and intensity of spring and summer droughts and heatwaves is observed. This impacts the health and mortality risk of our forest ecosystems and requires an adaptation of forest management, in particular for what concerns soil water balance and soil water stress occurrence. It is for instance important to be able to correctly assess the soil extractable water capacity (SEWC) of forest soils. However, forest soils have a number of specific characteristics that complicate the estimation of SEWC: stoniness, bulk density, organic matter content, root profiles and turnovers, soil depth etc. The ultimate objective of this research is to make progress on the quality of the prediction of SEWC down to 2m deep in Walloon forest soils from the Ardennes, by taking better account of fine earth and stoniness properties, from field and laboratory measurements (development of pedotransfer functions, for example) and modelling.



#### 13 - Dendroecology : tree growth response to climate

Camille Guisset (<u>camille.guisset@uclouvain.be</u>) - ELIE Supervisor(s): Caroline Vincke, Quentin Ponette

Keywords: forest, tree rings, dendrochronology, ecology

Dendroecology is a method widely used in forest ecology to study the influence of environmental factors such as climate and tree radial growth. The method consists of linking tree rings width (i.e. the amount of wood created by trees in one year) with environmental parameters using linear regressions. Studying radial growth of trees allows us to better understand how species have reacted to climatic variability and disturbances in the past, and therefore how they may react to a future climate. The first step of a dendroecological study is to get wood samples (wood cores or wood disks). These samples are then dried, cut or sanded to make the rings more visible, and scanned in high resolution. Once the ring widths have been measured on the scans, crossdating is a necessary step to ensure that each ring is correctly related to the year of its formation. Mathematical treatments can then be applied to highlight the climate signal. Finally, growth data are related to the climatic factors using for example correlation functions. Some possible applications of dendroecology include: studying the vulnerability of Douglas fir to water deficit; comparing the sensitivity to climatic variations of pure and mixed stands; or evaluating the forestry potential of non-native species in order to increase diversity in our forests.



### 14 - Asynchronous Holocene Optimum in East Asia monsoon region recorded by stalagmites and its underlying climate dynamics

Ming-Qiang Liang (<u>ming-qiang.liang@uclouvain.be</u>) - ELIC Supervisor(s): Qiuzhen Yin

Keywords: climate modeling, stalagmites, East Asia summer monsoon, Holocene optimum

Reconstructions of Holocene Optimum (HO) in East Asian summer monsoon (EASM) regime from speleothem versus other proxy records have yielded divergent phase relationships with the EASM and local precipitation. This apparent discrepancy has been partly attributed to the uncertainties in the climatic representation of Chinese speleothem oxygen isotope ( $\delta$ 180) records. Here we conducted a data-model comparison along with a water moisture budget analysis to assess the role of thermodynamic and dynamic components in controlling mid-summer and spring rainfall during early and mid-Holocene, and to compare with the precipitation changes referred by the stalagmite  $\delta$ 180 records. Our results show that 1) a marked southward shift of the HO period from 10000~6500 yr BP in North China (NC) to 9000~5500 yr BP in Yangtze river valley (YRV). During the Holocene, the variation of the summer total precipitation is dominated by precession in NC, ice sheet in YRV. 2) An incoherent orbital-scale speleothem  $\delta$ 180 variability in EASM regime indicate that speleothem  $\delta$ 180 is largely controlled by the large-scale circulation and concomitant latitude shifts of monsoon rain belt.3) The intensified hydroclimate in YRV in mid-Holocene was contributed to excessive rainfall in summer, especially for increasing the convection/total precipitation ratio, which leads to the lightest speleothem  $\delta$ 180 during the mid-Holocene. The excessive rainfall in summer mainly from the enhancement of convective activities that is caused by the southward shift of monsoon rain belt



#### 15 - Crop successions as a tool to think pesticide use reduction

Noé Vandevoorde (<u>noe.vandevoorde@uclouvain.be</u>) - ELIA Supervisor(s): Philippe Baret, Yannick Agnan

Keywords: crop rotation, pesticide reduction, integrated pest management, province of Luxembourg

In Integrated Pest Management (IPM), long and diverse crop rotations are a key tool to reduce pesticide use. Using historical IACS data, our paper aims to carry out an agronomic diagnosis of crop successions in the province of Luxembourg for the decade 2010-2020, based on the method of Bockstaller and Girardin (1997, 2008). Our analysis, in line with the results of Leteinturier et al. (2006, 2007), reveals a large number of crop successions with no clear cyclicity, rather than dominant rotations. Dominated by cereals, the quality of crop successions in the province of Luxembourg is low, except when temporary grassland or alfalfa are included for more than 3 years. Maize monoculture is the dominant and lowest quality crop succession. Organic crop successions tend to be more diverse or based on better previous crop effects. The average pesticide use (in kg/ha) calculated by the Comité Régional Phyto / Corder (2022) shows a negative correlation with the agronomic quality of the crop successions.



### 16 - Belowground hydraulic resistance generates stomatal closure of grapevine in soil water-limited conditions

Louis Delval (louis.delval@uclouvain.be) - ELIE

Supervisor(s): Mathieu Javaux, François Jonard

Keywords: Grapevine, soil-plant hydraulics, soil-root interactions, field conditions

In viticulture, the terroir governs the hydraulic behavior of the vine. The terroir is defined as the interactions between climate, soil, plant material (vine and rootstock varieties) and human management practices. The knowledge on grapevine drought stress physiology has increased significantly in recent years, but a holistic comprehension on how soil-plant hydraulic resistances develop and are regulated remains poorly understood. In particular, how different soil-rootstock combinations and their plasticity affect the vine hydraulic condition is still an open question. The objective of this study is to understand the hydraulics of the soil-plant system in grapevines (*Vitis vinifera cv. Chardonnay*) in situ, for different soil-rootstock combinations in a temperate oceanic climate, and to investigate its influence on vine water status. The concomitant and automatic monitoring of soil and collar water potentials, as well as sap flow, made it possible to characterize the evolution of the soil-vine hydraulics in situ in real-time, with hourly measurements for two months. In order to investigate the impact of the soil-rootstock combination, two Belgian vineyards with the same variety (cv. Chardonnay) were selected due to their intra-field heterogeneity of soil physico-chemical properties (two study areas per vineyard). The first observations validate the hypothesis that the increase of belowground hydraulic resistance triggers stomatal closure of vine.



### 17 - Role of common mycelial networks of AMF on mobilizing free-living or symbiotic N-fixing bacteria and stimulating N acquisition

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Supervisor(s): Stéphane Declerck

Keywords: Arbuscular mycorrhizal fungi; rhizobia; nitrogen

Plants are interconnected below ground by arbuscular mycorrhizal fungi (AMF). A fascinating feature of AMF is the ability of their extraradical mycelium (ERM) to develop throughout soil, transport nutrients (P and N, etc.) and water from soil to plant, carbon from plant to soil, and cooperate with bacteria developing at their surface (i.e., the so named hyphosphere). How hyphae of AMF interact with free-living or symbiotic nitrogen-fixing bacteria is almost unknown, while these organisms play key roles in N fixation in plants. The objective of the thesis is to explore the role of the ERM of AMF in the mobilization of free-living or symbiotic nitrogen-fixing bacteria, their transport from soil/artificial substrate to plant and among plants via common mycorrhizal networks, resulting in the higher acquisition of N by the plants. Through some in vitroexperiments, we found that: (a) the hyphosphere is a major pathway for rhizobia to migrate to the host roots; (b) the hyphosphere is a preferential pathway for rhizobia to migrate between plants via common mycorrhizal networks; (c) the association of plants with AMF and rhizobia increases N mobilization faster than the presence of the bacteria alone. We observed that nodules started to form by the fifth day of inoculation with rhizobia in the treatment with AMF, but it took at least two weeks in the treatment without AMF.



### 18 - Are vertically transmitted endophytic bacteria involved in increasing plant drought tolerance provided by humic and fulvic acids

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Keywords: Biostimulant - humic and fulvic acids - endophytes - drought stress - tomato

Positive effects of humic and fulvic acids (HA)-based biostimulants on plant tolerance to drought stress are reported in the literature. The regulation of hormonal and redox metabolisms within plants is one of the mechanisms involved in the action of HA. The effect of HA in increasing drought stress resistance was assessed on tomato plants grown in hydroponics under osmotic stress. Several morphological and physiological parameters, such as the increase of fresh, dry and water weight of aerial and roots parts, plant length and leaf area, as well as a raise of total chlorophyll content, revealed the positive impacts of HA. The reduction of the malondialdehyde concentration in aerial parts of plants treated with HA reflects a reduction of oxidative stress. We hypothesized that the beneficial effects of HA may be directly or indirectly related to seed endophytic bacteria. Seeds are known to be a major vehicle for PGP bacteria through generations and to maintain a stable community in plants. In order to study their implication, a sterile culture system was developed in hydroponics and the positive effects of HA were confirmed. The culture in sterile conditions enabled to isolate seed endophytic bacteria, to identify the culturable core of vertically transmitted endophytic bacteria and, combined with metagenomics, offers new opportunities in studying seed endophytic bacteria – HA interactions.



### 19 - The impact of tephra on agriculture: systemic analysis of farms' structure and functioning reveals contrasting vulnerability

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Keywords: Eruption tephra agriculture vulnerability

Young volcanic soils have outstanding agronomical potential and attract a large population that draws its livelihood from their use. Ironically, being often collocated with Holocene volcanoes, agriculture on these soils is threatened by tephra fall during explosive eruptions. Most studies about agriculture vulnerability to tephra focus on crops, using a "dose-response" model where the expected yield loss relates to tephra thickness. However, agriculture cannot be reduced to crops only, as it is comprised of farming systems, themselves consisting of combinations of cropping and livestock activities and the resources available to the farmers to raise them. Here we aim to assess the potential vulnerability to tephra fall of farms that diverge in their structure and functioning. Our study took place in the rural region near Taal volcano, Philippines. We conducted semi-structured interviews in seven farms. The data collected allowed us to quantitatively describe the farming systems' components, inputs, outputs, and production fluxes. Visualisation of the results with a System Network Analysis revealed contrasting structures, ranging from a pineapple monoculture to a complex system with field crops, trees, and livestock. We then assessed the farms' vulnerability to tephra fall by considering two fictitious scenarios of tephra accumulation on the ground and their potential impacts on each component of the farm. We used the holdings' gross revenue as a metric of impact intensity. The findings suggest complex patterns of vulnerability depending on the level of interactions between the farm's components. We argue for the use of a systemic approach for assessing volcanic risk to agriculture.



### 20 - Crop vulnerability to tephra fall in volcanic regions: field, experimental and modelling approaches

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Supervisor(s): Pierre Delmelle

Keywords: Volcanic ash; Crop vulnerability; Risk assessment; Natural hazard; Volcanic eruptions

Approximately 800 million people populate areas within 100 km of a potentially active volcano. Since the beginning of human settlements, communities in volcanically active regions have enjoyed various benefits from volcanic eruptions, notably the occurrence of volcanic soils with outstanding agricultural capabilities. However, these populations are also exposed to the potentially disastrous impacts of volcanic hazards, of which tephra fall produced during explosive activity is the most frequent and widespread, affecting areas of up to several tens to hundreds of thousands km<sup>2</sup>. Agriculture is the economic sector most impacted by tephra emissions during explosive volcanic activity, posing serious threats to agricultural activities and rural livelihoods. Crops are particularly vulnerable to tephra, with impacts ranging from reduced yields to total destruction. Although the detrimental effect of tephra on vegetation has long been recognised, our current understanding of crop vulnerability to tephra suffers from a significant deficit in knowledge. This situation is rooted in limited data availability and poor descriptions of the intertwined volcanic and non-volcanic factors dictating the level of tephra damage to crops. As a result, our capacity to inform appropriate risk reduction, management, and long-term recovery strategies in regions exposed to volcano-related hazards is limited. Our research identifies the factors dictating crop yield losses and quantifies crop vulnerability to ash based on these factors. The study we conduct is interdisciplinary and involves controlled experiments, interview data collection and remote sensing. The outcomes aids in a better quantification of the risk of ash fallout on crops.



### 21 - Dynamics of bacterial populations in soils and in organic amendments of animal origin exposed to antibiotics

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Keywords: Agricultural soil, antibiotic resistance genes, doxycycline, manure, mobile genetic elements

Antibiotics are largely used in veterinary medicine to control bacterial infections. Abuse of antibiotics in livestock raises concerns not only on the antibiotic residues but also about antibiotic resistant bacteria and antibiotic resistance genes (ARGs) released in the environment through manure spreading on arable land. Moreover, this risk is likely to be increased when ARGs are located on mobile genetic elements (such as plasmids, phages or transposable elements) that could then be transferred among bacteria from manure, crops, soil or food. In this context, manure samples from different livestock farms and agricultural soils at different time points (before, immediately after and 2-3 weeks after spreading of manure) were collected in order to follow the growth profiles of cultivable bacteria in the presence and absence of four antibiotics of interest. A previous study had indicated that doxycycline, lincomycin, oxytetracycline and sulfadiazine residues were the most frequently detected and/or used at the highest concentrations in these soil and manure samples. At a given time, for all manure and soil samples analysed, doxycycline affected the bacterial density the most, with a drop of about two to four logs in cell density, as opposed to sulfadiazine, oxytetracycline and lincomycin that displayed only modest reduction of bacterial density. Over time, the observed bacterial density was significantly increased in soil immediately after manure spreading for all antibiotics tested, except for lincomycin. The bacterial density was always higher 2-3 weeks after spreading of manure in comparison to before spreading, for all four antibiotics studied.



#### 22 - What distribution channels use market gardeners in Cœur de Condroz (Belgium)

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Supervisor(s): Guillaume Lobet (UCLouvain) & Nicolas Dendoncker (UNamur)

Keywords: vegetables, market gardening, food chain, Local Food Systems, distribution channels

Our current food production system has proven to have environmental and socio-economic limitations, such as ecosystem destruction, malnutrition, declining local food self-sufficiency, and a decrease in the number of producers. This has led to a growing demand from consumers and institutional promotion for more local and sustainable food production systems. The aim of these future food production systems is to provide equitable nourishment while preserving the environment and human health. However, studies evaluating alternative and/or local food systems have shown that local production is not always correlated with more sustainable production. Results vary depending on factors such as the type of product, geographic context, and marketing channels. In addition, the advantages of local agriculture have been questioned in terms of aspects such as difficulty including all social classes, low profitability for producers, and lack of logistics within supply chains. Therefore, interdisciplinary and contextualized studies are necessary to define trajectories for transitioning towards more sustainable food systems. The objective of the thesis is to examine the sustainability of short supply chains for vegetable production at the scale of a territory. This first study aims to evaluate which part of the turnover is dedicated for each distribution channel by market gardeners.



#### 23 - From the delta to the sea: Challenges in modelling the Danube-Black Sea continuum

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Supervisor(s): Emmanuel Hanert

Keywords: Hydrobiogeochemical modeling - Danube - Black Sea - SLIM

The Danube River is the second longest river in Europe. The Danube Delta, largest nearly undisturbed wetland in Europe, plays a buffering role between the river and the Black Sea. Eutrophication in the coastal zone due to the increase of nutrients coming from the river causes important biological and financial losses since the 1970s. However, despite this and the importance of the Danube-Danube Delta-Black Sea system, the hydro and biogeochemical fluxes in this system remain largely understudied. We aim to model and quantify the interactions between the Danube delta and the Black Sea, from hourly to multi-annual time scales, using an unstructured-mesh hydrodynamic model. More specifically, we aim to evaluate how the biogeochemical fluxes of the North-western shelf (NWS) (i.e. limited by the 100m isobath) impact and are impacted by the small-scale variability of the three branches of the Danube Delta (i.e. Chilia, Sulina and Sfântul Gheorghe). We will then assess the potential impact of climate change and socioeconomic development on the transfer of water, salt and biogeochemical elements to the sea by running the model under different IPCC scenarios (SSP1-2.6 and SSP5-8.5). This poster will present the challenges and preliminary results of the hydrodynamic modelling process in the Danube-Black Sea continuum.



### 24 - Understanding the biogeochemical interactions of the Scheldt-North Sea river-ocean-continuum through multiscale modelling

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Supervisor(s): Emmanuel Hanert

Keywords: Scheldt; North Sea; Modelling; Biogeochemical; Finite-Elements Model

The multi-scale interactions between river and ocean are poorly understood. With this project, we aim to quantify these multi-scale interactions along the river- estuary-ocean-atmosphere continuum from hourly to multi-annual time scales over the Scheldt- North Sea region. In particular, we will assess how the physical and biogeochemical dynamics of the North Western Continental Shelf (NWCS) (i.e. limited by the 200m isobath) and Southern Bight of the North Sea (SBNS) are influenced by the small-scale variability of the Scheldt river- estuary and the atmosphere. For solving the multiscale interactions along the land sea continuum, we propose to develop an unstructured (finite-elements) grid model. Then coupling this model with a structured (finite- differences) grid model, for fully resolving in three dimensions the continuum of scales and processes from a few hundreds of meters up to several tens of kilometers. For the atmosphere, simulations coupling in one way (i.e. the atmosphere forces the ocean with no feedback from the ocean on the atmosphere) will be performed in order to assess the impact of particular weather events (e.g. storms, heat wave) on the ocean physics and how oceanic surface conditions feedback on the simulated local wind (e.g. sea breezes). From a biogeochemical point of view, the modelling system developed will offer an optimal way to quantify the transfer of organic and inorganic materials (e.g. suspended particulate materials, SPM) from the land to the sea and to track pollution events.


#### 25 - Automated counting of spores in arbuscular mycorrhizal fungi in vitro cultures

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Supervisor(s): Stéphane Declerck

Keywords: Image analysis – Automated counting – AMF spores - In vitro system

Quantification of the abundance of individuals is often a key aspect of studying populations or communities. Obtaining such count is still regularly done manually, which is often time-consuming and limited in the type of additional data that can be acquired (e.g. morphology).

With improvements in computer and photographic technologies, it is now possible to use images analysis to identify, count and characterize organisms, with several clear advantages over manual counting. Firstly, once parameterized, it can be highly automated, freeing the researchers from such repetitive and time-consuming tasks. Secondly, images can be stored and reanalyzed later with better or different approaches. Finally, it makes possible to perform additional, simultaneous analyses to obtain information on other aspects than abundance only (e.g. phenotypic trait, spatial positioning). Here, we describe how automatized image analysis can be used to replace time-consuming manual counting of spores of arbuscular mycorrhizal fungi (AMF) cultured in vitro. Automated measurement methods of spores of AMF already exist. However, these methods are only suitable for isolated spores (not for spores within a system with roots and hyphae). We describe how we developed the techniques to image AMF in existing in vitro systems, and how we developed automatized image analysis to identify, count and characterize spores.



# 26 - Short- and long-term changes in soil physical properties following biochar addition to soils in Wallonia

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Supervisor(s): Charles Bielders

Keywords: biochar, soil texture, soil physical properties, Wallonia

In the context of global soil degradation, biochar is being promoted as a potential solution to improve soil quality in addition to its carbon sequestration potential. Burying biochar in soils has been shown to affect soil physical properties, but the intensity of this effect depends, among others, on soil properties and application rates. Moreover, the long-term effects of biochar remain largely undocumented yet they are important to quantify given biochar's persistency in soils. The objective of this study was therefore to determine the short-term and long-term effects of biochar on soil physical properties in function of soil texture and biochar application rates. For this purpose, experiments were conducted in Wallonia (southern Belgium) at two sites with different soil texture (silt loam and sandy loam). Both sites are characterized by the presence of former kiln sites that were used for studying the long-term (> 150 years) effect of hardwood biochar. In addition, fresh biochar produced from Picea abies at 500°C by GreenPoch SA was buried in subplots at both sites at rates of 1% and 2% in mass in the top 10 cm just before the spring sowing in 2021. Samples were collected on September 2021 in kiln sites, in fresh biochar (1 & 2%) subplots and in biochar-free reference plots, in triplicate. The measured soil physical properties were the bulk density, the water retention curve and the hydraulic conductivity curve. Reference subplots were characterized by higher bulk density and lower saturated water content than biochar subplots. The presence of biochar increased the water content for pF < 1.5. These biochar effects were higher for the sandy loam compared to the silt loam and in the shortterm compared to the long-term. The plant available water capacity increased with the presence of biochar on the sandy loam, but was unaffected on the silt loam. The hydraulic conductivity was slightly higher for pF < 1.5 in the biochar subplots compared to the reference subplots. On the silt loam, this effect was more visible for fresh biochar whereas on the sandy loam, this effect was higher in the kiln sites. Therefore, the study highlighted a positive effect of biochar in the short-term and in the longterm on soil physical properties for the range of soils and biochar application rates investigated here. Further research may be needed to confirm the observed trends over a wider range of soil types, biochar types and biochar application rates as well as to better understand the underlying mechanisms.



# 27 - Resistance and resilience of mixed tree species communities associated to ectomycorrhizal fungi under drought stress

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Keywords: mycorrhiza, tree, forest, drought, climate change

In the context of climate change, and in particular drought stress, developing new management strategies increasing the resistance and resilience of forests to extreme climatic events is crucial. It is often admitted that mixed forests suffer less drought stress than single species forests. However, it is unclear whether this statement is also valid for plants at the seedling stage and whether their association with ectomycorrhizal (EcM) fungi increases their resilience. Therefore, the general objective of the project is evaluate whether mixed tree species communities associated to EcM fungi are more resilient to drought stress and efficient in water use than single tree species communities. We address this general objective in the context of forest regeneration, therefore, considering trees only at their seedling stage. Tree seedlings with contrasting drought strategies (Pinus sylvestris, Fagus sylvatica and Quercus petraea) will be associated to single or mixed EcM species (i.e. Paxillus involutus, Hebeloma crustuliniforme and Cenococcum geophilum). Three hypotheses will be tested: 1) the presence of EcM fungi increases the resistance (i.e. during stress) and resilience (i.e. during recovery from stress) of tree seedlings to drought stress, improving their survival, nutrition and water status; 2) a community of EcM fungi improve the resistance and resilience of seedlings to drought stress significantly more than a single EcM fungus; 3) EcM fungi associated with mixed seedlings of tree species with different drought resistances attenuate competition between these species and increase their resilience compared to a single species under drought conditions. These hypotheses will be challenged under controlled growth chamber conditions with different water regimes and measurements will be conducted on morphology (growth and biomass, root colonization by EcM fungi) and physiology (photosynthesis and transpiration parameters, water potential, nutrients uptake) of plants. Biochemical and molecular analysis (sugars and enzyme assays, quantification of each EcM fungi within roots using molecular barcodes) will also be conducted.



# 28 - Diversity of hydraulic responses to water deficit in major crops and trees in controlled conditions and natural habitats

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Supervisor(s): Valentin Couvreur

Keywords: water deficit, soil and plant hydraulic responses, root traits, major crops, forest trees

Drought is one of the most serious environmental stresses for crop production and forest trees. The general objective of this thesis will be to quantify plant root hydraulic responses to drought, and explore how diverse these responses are in major crops and trees. Therefore, we will conduct water deficit trials in controlled conditions to monitor soil and plant water status, including plant transpiration and root osmotic responses in maize and tomato at UCLouvain as well as grapevine and almond in collaboration with the University of California Davis. The range of sensors will be adjusted to the plant specifications, from sap flowmeters to weighing scales and lysimeters for water fluxes; from microtensiometer to in situ psychrometers to monitor water potential in the plant. Additionally, we will study these responses in natural forest habitats in Europe and the USA for a range of tree species (essentially oaks, pines, beech, spruce and eucalyptus) with different levels of drought tolerance. The data from this last experiment in natural habitats will allow us to analyze the variation of hydraulic and osmotic traits within/across Plant Functional Types (e.g., broadleaf / needleleaf and evergreen / deciduous). Finally, we will produce simple empirical functions describing the relationship between soil water potential, plant transpiration and root osmotic potential gradients to obtain proxys which can be used in large scale simulations, for which detailed parametrizations are not available.



### 29 - Characterization and causes of North Atlantic cold bias in climate models

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Keywords: Climate models, SST cold bias, Gulf Stream, Surface heat fluxes, Mixing

The North Atlantic sea surface temperature (SST) cold bias is a remarkable feature of general circulation models (GCMs). This bias is a primary concern in climate science because they directly affect the skill of predictions and the confidence in projections on the North Hemisphere climate. Here the characterization and causes of the cold bias are investigated by combining Atmospheric, Ocean, and Coupled Model Inter-comparison Project (AMIP6/OMIP6/CMIP6) simulations with observations. It is found that the cold North Atlantic SST bias in CMIP6 is primarily caused by weak heat transport in ocean models induced by weak Gulf Stream currents. The weak atmospheric fluctuations induced shallow mixed layer depth also plays a role. These biases are much reduced by increasing the atmospheric and oceanic model resolution to around 1° and 0.25° in HadGEM3-GC31-MM, respectively. The radiation heat flux bias in AMIP6 and CMIP6 model are small. The large turbulent heat flux bias linked to SST bias in CMIP6 models is not shown in AMIP6 models, which implies that the SST bias dominates the turbulent heat flux bias in coupled models. Our results suggest that to reduce the North Atlantic SST bias in the coupled models, representing unresolved oceanic and atmospheric processes is crucial.



### 30 - Impacts of soil aggregation on the mobility of silicon in model variable charge soils

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Keywords: aggregation; silicon; soil; phytolith; clay

Phytoliths are considered by biogeochemists and soil scientists as an important reservoir of mobile Si in the soil-plant system due to their relatively high dissolution rate. However, they are used in other disciplines as microfossils to reconstruct paleoenvironments because of their stability over millennia. Thus, on one side, phytoliths contribute massively to the continental export of dissolved silica to rivers and oceans, hence to the global silicon (Si) cycle, and, on the other side, they persist in soils and sediments. In addition to phytolith properties, soil processes can enhance their resilience, e.g., surface passivation through aluminum (Al) loading or redox-dependent iron (Fe) coating, pH buffering and aggregation. Here, we highlight the impact of aggregation on the release of dissolved Si (DSi) from aggregates built up from assemblages including organic matter, phytolith, quartz, clay mineral and Fe oxide. The source of DSi was assessed using Al/Si and Ge/Si ratios in aqueous extracts obtained kinetically. Soil and sediments may thus contain two pools of phytoliths: fresh and stabilized phytoliths. The first reservoir is an important source of aqueous Si, and contributes actively to the Si soil-to-plant cycle and the DSi transfer to the hydrosystem. Yet, Si can be retrieved from the global Si cycle through phytolith entrapment in aggregates. This process contributes to the second pool of stabilized phytoliths. However, pH buffering significantly affects the impact of aggregation and the source of DSi. Indeed, acidic conditions enhance the dissolution of clay minerals while they decrease the dissolution rate of phytoliths.



### 31 - Cropland mapping in southern Africa over the last 30 years

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Keywords: cropland mapping

Global cropland expansion is accelerating over the past several decades. This is quite notable in Africa, where a more than twofold increase in annual cropland expansion rate was reported. The rapid increase in cropland extent is expected to have significant impact on soil resources, as reflected by decline in SOC content. Many efforts have been done for cropland mapping in recent years, with the help of spatiotemporally consistent satellite images. However, the cropland mapping accuracy seems to be quite low in Africa, due to its highly fragmented agricultural landscape. Existing cropland extent products fail to provide accurate spatial information on the temporal evolution patterns of cropland extent, and this has hampered quantitative assessment of the effects of cropland expansion and cultivation on soil property dynamics. In this project, we aim to develop an accurate cropland mapping methodology in the copper-belt region of southern Africa, to enable temporal assessment of the cropland expansion in the region during the past 30 years (1990-2021). The objective is to perform preliminary groundwork to facilitate a later assessment of the impact of cropland cultivation history on soil degradation in a spatially explicit manner.



#### 32 - Can agricultural practices among small-scale cassava farmers influence root crop yield?

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Supervisor(s): Bruno Delvaux

Keywords: Field management, cassave yield, environment

Cassava, Manihot esculenta Crantz, is a major foodcrop in the tropics. Cassava tubers and leaves are consumed throughout DRC, while production surplus generate income to improve livelihoods. DRC production stagnates at low yields (~ 8 t ha-1 yr-1) despite increasing cropped surfaces and strong pressure on land, due to a poorly developed value chain lacking support services at almost all levels. Here we study the drivers of cassava yield in three agroecological zones in South-Kivu, DRC, differing in altitude and mean annual rainfall: Uvira (770-900 m / 981 mm), Kalehe (1100-1200 m / 1637 mm) and Walungu (1700-1800 m / 1620 mm). Out of 720 surveyed smallholders' households, 360 plots (120/zone) were followed until harvest through soil-plant analyses, plant growth and crop yield. Highly weathered Kalehe and Walungu soils (Ferralsol, Acrisol) derived from very old materials, while moderately weathered Uvira soils formed in younger deposits (Fluvisols, Cambisols). Cassava tuber crop yield varied from 0.5 to 18 t ha-1 yr-1 regardless of soil type. Yet, cassava tuber crop yield and leaf biomass were strongly impacted by agricultural practices. The key practices were: using improved varieties, burning biomass or incorporating it into the soil, planting on levelled surface, early planting in September/October, intercropping, weeding. Our data show that improving the technological package can lead to increased cassava yields in diverse environments. In other words, when land is scarce and access to markets improves, agricultural intensification, even with extremely low inputs, can generate higher crop yields and an improved land resource base.



### 33 - A new framework for mapping conservation agricultural fields using time-series imagery

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Supervisor(s): Bas van Wesemael

Keywords: conservation agriculture; conventional agriculture; classification methods; remote sensing

The importance of conservation agriculture is undeniable. However, to date, survey statistics on conservation agriculture plots have been limited to farmer declarations or field inspections. This is a major impediment to the promotion or monitoring of conservation agriculture. In this paper, a total of 262 conservation agriculture plots and 262 conventional agriculture plots were collected in the Walloon region of Belgium between 2015 and 2019, with the aim of developing a classification model for the prediction of conservation agriculture by combining remote sensing data with field data. The input variables of the model are constructed based on the three main criteria of conservation agriculture (Species diversification, Permanent soil organic cover and Minimum mechanical soil disturbance), and using optical images (Sentiel-2, Landsat-7, Landsat-8), radar data (Sentiel-1), and the precipitation data. After preparing all the indicators, the most important ones were first selected by decorrelation and recursive feature elimination, and then build models using random forest (RF) method. The results of the ten-fold cross-validation showed that RF model performed well, with an overall accuracy of 80%, 86% for producers and 77% for users of CA fields. The RF model was chosen to forecast all agricultural land in the entire Hesbaye region. The final map shows that there are 4,151 conservation agricultural plots in 18,287 croplands. Conservation agricultural fields tend to have shorter bare soil lengths and fewer number of cultivations.



# 34 - Solution pH, weathering degree and organic matter content control fluoride adsorption in volcanic soils

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Supervisor(s): Pierre Delmelle

Keywords: Fluoride, Adsorption, Volcanic soil

Fluoride in volcanic regions occurs in gas emissions or in ash fallout from eruptive activity. Overexposure to fluoride poses risks to humans, livestock and plants. Fluoride may also be released from volcanic rocks during water-rock interaction, which enhances aluminosilicate dissolution. However, the mobility of fluoride is considerably reduced due to its strong binding affinity for mineral surfaces such as ferrihydrite and short-range-order aluminosilicates (allophanes) which typically occur in volcanic soils. We measured the fluoride adsorption envelopes (pH 2.8–7) of five volcanic soils with contrasting weathering degrees (slightly weathered Vitric Andosol (VA) and well-developed Brown Andosol (BA)) and three soils with varying organic matter content (Histic Andosol (HA) and two Histosols (HI1 and HI2)). Minimum and maximum adsorption occurs at pH 2.8 and  $\geq$ 6, respectively. It's attributed to the effect of pH and soil anion exchange capacity (AEC) on fluoride adsorption. At pH <6, fluoride forms positively charged alumino-fluoride complexes. Because the AEC of allophanes (point of zero charge, PZC=6) and ferrihydrite (PZC=6.5) increases with decreasing pH, adsorption of aluminofluoride complexes is restricted. At higher pH, the fluoride ion dominates in solution, but its adsorption becomes limited as AEC decreases. The order of increasing maximum fluoride adsorption capacity is VA<HI1<HI2≈BA≈HA. VA has a low allophanes+ferrihydrite content. HI2, BA and VA have significant amounts of these, providing reactive surfaces for fluoride adsorption. The organic-rich HI1 soil contains less allophanes+ferrihydrite than VA but can adsorb more fluoride. This suggests that organoaluminium/iron complexes provide abundant surface sites (=AIOH and =FeOH) for fluoride adsorption.



# 35 - Impact of streetlights on moth communities under low and high light pollution at night: a citizen science approach in Belgian gardens

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Keywords: Light pollution - Moths - Citizen science

There is mounting evidence for strong alterations in moth communities, including many species and population declines. Multiple drivers have been put forward as causes, but recently, light pollution caused by artificial light at night (ALAN) receives growing scientific attention. ALAN has been shown to affect biological cycles, feeding and pollination behaviour, but it can also disturb organisms by attracting or repelling them. We study the impact of ALAN on moths across their life cycle combining both field studies in gardens (i.e., community-level responses) and controlled laboratory experiments (i.e., intra-specific responses). For the laboratory experiments, we reared first and second-generation caterpillars of the Garden Tiger moth (Arctia caja) under dark night and ALAN-conditions with a splitbrood design. We monitored several life-history traits like caterpillar growth and survival. In this talk we will mainly focus on our first results of a field study in gardens. With the help of twenty-four volunteers, we sampled moth communities in gardens with either high or low skyglow levels and presence or absence of street lighting to obtain a full factorial design. Besides the effects on species diversity, also changes in species traits within these communities are investigated considering multiple environmental factors.



### 36 - Another record low for Antarctic sea ice in 2023

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Keywords: sea ice; Antarctic; extremes

Antarctic sea ice extent (SIE) hit a new record low of 1.766 million km2 on 19 February 2023, 0.142 million km2 smaller than the minimum in 2022 and 39% lower than the climatology. This year's event is characterized by a consistently low SIE since March 2022, an extremely high melting rate in December and an annular melting in February. In winter (JJA), advection-induced surface temperature anomalies reduced the sea ice in the Weddell Sea and Bellingshausen Sea, preconditioning an ice-free Bellingshausen Sea in October. A stronger Amundsen Sea Low (ASL) set up in spring (SON) transported more ice in the Eastern Ross Sea northward, pushing the ice edge further north in spring but also contributing to severe melting in December. Meanwhile, a large polynya appeared along the coast of Amundsen Sea in December, which seems to result from the sea ice thickness anomalies. This new minimum as well as the extremes in the recent decade imply that Antarctic sea ice might experience a regime shift.



# **37** - Combined influences of floral resources, soil environment, and land use on plant-bee interactions at the landscape scale

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**Keywords:** pollination, landscape, crop, soil, modelling

Most wild and cultivated plant species depend on insects to ensure their pollination. With the intensification of agricultural practices via land use change and the use of pesticides in crops against insects, a large proportion of pollinators species have seen their population decrease for a few decades. Thus, it is important to understand the underlying mechanisms of pollinators decline for conservation purposes. In landscape ecology, the way in which the influence of a landscape on the distribution of a species is conceived is too often based on our perception of the landscape structure and not on features or characteristics that would directly reflect the perception that studied species can have of the quality of its environment. The first part of our project aims to apprehend pollinator population dynamics by using pollinator health of bumblebees. We link pollinator health with landscape composition, soil structure and soil content, pollution of trace elements and neonicotinoids molecules in 30 crop sites in Wallonia. Our project aims secondly to implement a regional predictor model of pollinator health at the scale of Wallonia, by using satellite remote sensing data and databases information. The model will be calibrated and tested on field data carried out during the first part of the project. This model has the intent to greatly contribute to future conservation and agricultural landscape decision in Wallonia.



# 38 - Fast characterizations of pavement layered Media using deep learning-based GPR full-wave inversion

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Supervisor(s): Sebastien Lambot

**Keywords:** Ground Penetrating Radar (GPR); Deep learning; Full-waveform inversion; Layered Media characterizations

The use of ground-penetrating radar (GPR) to accurately estimate subsurface electric properties through inverse modelling is hindered by the efficacy of the forward model describing the GPR subsurface system. In this paper, we improve a recently developed approach by Lambot et al., which relies on a stepped-frequency continuous-wave (SFCW) radar combined with an off-ground monostatic transverse electromagnetic horn antenna. The deep-learning method was used to train an intelligent model incorporating the waveform of the Green's functions. The proposed method was applied and validated in a laboratory setting, using a tank filled with a two-layered sand subjected to different water contents. The results showed excellent agreement between the predicted Green's functions from the deep-learning model and the measured ones. Furthermore, model inversions for the dielectric permittivity and antenna heights were compared to demonstrate the efficacy of the presented method.



# **39** - Hydrological controls on soil processes controlling carbon- and nutrient-efflux in the Critical Zone at the landscape scale

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Keywords: Critical Zone, Remote Sensing, Geophysics, Geochemistry, Modelling

The Critical Zone (CZ) provides many ecosystem services that are endangered by both climate change and human activities. It is subject to multiple processes in interaction at the interface of the atmosphere, biosphere, hydrosphere, and lithosphere, which complicate its integrative study. This project will develop a truly interdisciplinary CZ research allowing to understand more precisely some key CZ processes and their interactions. The use of advanced sensing technologies will also provide a framework for future CZ research. This project focuses on the spatio-temporal variations of soil hydrology and its control on carbon and nutrient fluxes in hillslope systems. This project will start by studying the long-term patterns of the Critical Zone (subsurface structure, soil characterization, topography, vegetation characterization, etc.) known to influence the shorter-term (sub)surface processes. Soil moisture and temperature will then be monitored using in-situ sensors and UAVs equipped with Ground-Penetrating Radar and thermal infrared camera. Their control on soil respiration, soil nutrients and dissolved organic carbon fluxes will be studied. These processes will then be used for smart modelling. First, a 3-D physical-based model will be developed to characterize water and heat dynamics. Then, using a deep neural network, additional data will be integrated to predict water, nutrient and carbon fluxes at the landscape scale. Despite the fact that peatlands play an important role in climate regulation, biodiversity support, water regulation, carbon storage, they are still understudied. Hence, this methodology will be first developed in a peatland landscape characterized by a clear topographic gradient in the Belgian High Fens. Then, it will be applied on a frozen peatland located in Alaska (USA), presenting a natural permafrost degradation gradient.



### 40 - Comprendre les systèmes agricoles et alimentaires, analyser les dynamiques de transition écologique

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Supervisor(s): Philippe Baret

Keywords: Modes de production; Systèmes agroalimentaires ; Trajectoires de transition

L'équipe de recherche Sytra (pour "Transition of food Systems") s'intéresse aux dynamiques de transition qui s'opèrent dans nos systèmes agroalimentaires. Nous abordons la complexité de ces enjeux de manière interdisciplinaire grâce à l'intégration des aspects techniques et agronomiques des modes de production agricoles et des dimensions sociales et économiques des systèmes alimentaires. Nos travaux portent en particulier sur la durabilité des systèmes et adoptent une démarche inclusive: nous analysons les modes de production dans leur diversité, en considérant la multiplicité des échelles territoriales pertinentes, et en s'appuyant sur un vaste réseau d'acteurs actifs dans de nombreux domaines. Cette méthodologie constitue une approche multifocale qui permet une analyse approfondie : elle renforce notre capacité de compréhension des systèmes agroalimentaires actuels ; elle facilite l'analyse des possibilités d'évolution futures ; elle permet d'identifier des phénomènes de verrouillage freinant la transition. Notre expertise est mise à profit dans la réalisation de travaux de recherche et d'études stratégiques qui s'adressent principalement aux institutions publiques, aux organisations du secteur agricole ou à des ONG environnementales.



### 41 - Bacillus mycoides as a candidate for controlling potato late blight

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Keywords: P. infestans ; Bacillus mycoides ; Biocontrol ; Late blight ; Antagonism

In the sustainable production of potatoes, there is a need for alternative methods to synthetic fungicides for controlling potato late blight. Although members of the *Bacillus subtilis* group are known to possess antimicrobial properties, the potential of *Bacillus mycoides* for biocontrol is not well documented. This study evaluated the biocontrol activity of three strains of *B. mycoides*, which were isolated from soil, against *Phytophthora infestans*. The study assessed the in vitro antagonistic activity of these strains using dual culture assays in Petri dishes with both single and double-plate systems. Results from both systems showed a significant reduction in hyphal growth, suggesting the presence of active compounds in the solid medium, as well as the involvement of volatile organic compounds released in the air. The efficacy of these bacterial strains against potato late blight was also tested in planta, by comparing the disease infection progress on plants inoculated with *P. infestans* after a treatment of leaves or roots with the bacteria. The results showed a reduction of disease intensity after the application of the three bacterial strains on the leaves. This study provides a basis for further investigation into the different *B. mycoides* antagonistic compounds involved in these activities.



### 42 - Herbaria, a scientific heritage to protect and promote!

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Keywords: Herbaria, trees, scientific collection

Did you know that the Earth and Life Institute owned a collection of herbarium? Herbaria are collections of dried plants, fixed on paper sheets and accompanied with various information, for instance about the plants description or about the environment where the plants were collected. Herbaria were initially constituted by botanists to describe, name and classify newly discovered species. But soon other uses began to emerge. Indeed, herbarium specimens can be used, among others: (i) to document biological changes such as species extinction; (ii) to understand to link between the plants and their environment; (iii) to study the long term evolution of plants functional traits. The collections held in the pole of environmental sciences of ELI have been gathered by former professors and researchers in forestry and botany of UCLouvain. More than half of the specimens are trees, collected in Africa between 1930 and 1970. During the summer 2022, a considerable amount of work has been accomplished to sort and describe the specimens of the ELI-e herbarium. The aim is to valorize these collections by opening their access to researchers working in ecology, biogeography, botany etc. Here we present how herbaria are constituted, their usefulness to various scientific disciplines, and an overview of the collections of the ELI-e herbarium, along with some ongoing research carried on in the forestry science lab of ELI-e. The ultimate goal is to make the herbarium visible, accessible and open to the scientific community.



#### 43 - Who refills my tank? Coelenterazine as fuel for Amphiura filiformis luminescence

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Keywords: Luminescence; Ophiuroid; Trophic acquisition; Coelenterazine

Bioluminescence is the capability to emit visible light thanks to a biochemical reaction. This reaction implies the oxidation of a substrate called luciferin by the catalytic action of a luciferase. Coelenterazine is the most widespread luciferin, found in at least eight phyla. The broad phylogenetic distribution of this light-emitting molecule led to the hypothesis of its dietary acquisition. To date, this acquisition has been demonstrated in a jellyfish, a shrimp, and a brittle star. The latter, *Amphiura filiformis*, is a suspensive feeder known to depend on coelenterazine supply to maintain its bioluminescence. This study aims to identify the natural sources of coelenterazine within the planktonic communities preyed on by the brittle star. *A. filiformis* luminous capabilities were measured each season to evaluate potential variations. In parallel, luminometric assays confirm the presence of species containing coelenterazine within each seasonal planktonic community's samples. Both planktonic communities and *Amphiura filiformis* stomach content DNA-barcoding are still in progress to identify coelenterazine-based luminous plankton and brittle star diet. Thanks to literature and a marine station monitoring list, few species were suspected to provide coelenterazine to *A. filiformis*. All the data aims to spot the brittle star's prey from plankton communities known to contain and supply them in coelenterazine.



#### 44 - Is silicon useful for cassava?

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Keywords: Si uptake, cassave yield, environment

In DRC, cassava (Manihot esculenta Crantz) is consumed daily and offers commercial added-value. While yields are stagnating with a national average at ~ 8 t ha-1 yr-1, several threats such water stress and plant diseases. Silicon (Si) uptake mitigates abiotic and biotic stresses in several crops. Cassava genome has genes encoding NIPs involved in water and Si influxes in plants, while Si uptake induces cassava resistance to cassava bacterial blight. Cassava Si and nutrient status was studied in three agroecological zones in South-Kivu, DRC, differing in altitude (760-1800 m), mean annual rainfall (981-1637 mm) and soil weathering stage. From 720 surveyed farms, 120 plots were selected for topsoilfoliar analysis and yield measurement. Cassava tuber yield varied from 0.5 to 18 t ha-1 yr-1 regardless of soil type while plant available Si was lowest in highly weathered soils. Regardless of soil type, cassava leaf Si concentration ranged from 2.1 to 14.1 g kg-1, a similar range to that of major nutrients. The structural equation model (SEM) was used to decipher the respective impacts of cassava mosaic disease (CMD), plant nutrients and Si uptake on tuber yield. The CMD incidence decreased with highest Si and lowest nitrogen (N) plant uptake, suggesting that the N/Si balance might impact plant tolerance to CMD. Yet, both Si and N plant uptake positively impacted crop yield. These preliminary observations suggest that Si uptake by cassava deserves more attention on the role of Si in this plant than is currently given.



#### 45 - How to improve an AMF assist phytoremediation system?

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Supervisor(s): Stéphane Declerck

**Keywords:** AMF, phytoremediation, hydrocarbon polluted soils, gene expression, methodological improvement

Organic soil pollution is one of the world's major environmental problems. In Ecuador, soil and groundwater are often contaminated with hydrocarbons fuel due to accidental spills and leakage from pipelines. Although the Amazonian region is a hotspot of biodiversity, it is also a major reservoir of hydrocarbons. The measure of environmental consequences of weathered crude oil in terms of microbial diversity has been most often ignored. A promising biological method proposed to clean-up contaminated environment is phytoremediation that involves plants and their associated microorganisms. Its efficacy depends on plant interactions with the rhizosphere microflora e.g., arbuscular mycorrhizal fungi (AMF) that stablish ubiquitous mutualistic interactions with roots of ~80% of vascular plants species. In this work, we present a methodological improvement to test the efficiency of phytoremediation of oil polluted soils at laboratory scale. After a first experiment developed with two consortia of AMF (isolated from polluted and non-polluted soils), both associated with M. sativa growing on substrate contaminated with three different concentrations (0%; 0.5%; 5%), we propose a methodological improvement with the objective of prove if AMF can increase the tolerance to hydrocarbon of well-known heavy metals bio accumulator grass species. We will test a mix of grass species with individual AMF species. This colonized grass layer will be transferred to substrate contaminated with diesel at the aforementioned concentrations under greenhouse conditions in order to measure the plant biomass, the plant oxidative stress, the degradation rate of pollutant and the gene expression of GintPT (P transporter). With this methodology we expect solve some drawbacks when establishing phytoremediation systems.



#### 46 – The MOCA platform

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The MOCA platform offers a wide range of physico-chemical analyses of complex mineral and organic matrices, (water, soil and sediments, waste, biomass, food, living organisms, samples from biotechnological and chemical processes, etc.). The expertise of the team is dedicated to:

- (i) Operating and maintaining specialized analytical instruments that are made available to the scientific community, for high quality and validated results;
- (ii) Performing physico-chemical analyses; the platform performs a series of routine analyses; the platform can develop customized analytical solutions or assist applicants in the development of new analytical protocols, from experimental design to scientific interpretation.
- (iii) Training users to the appropriate use of specific equipment and critical assessment of the analytical results.

From <a href="https://uclouvain.be/en/research-institutes/eli/moca">https://uclouvain.be/en/research-institutes/eli/moca</a>



#### 47 – The SEFY platform

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The SeFy platform is first and foremost 2000 m<sup>2</sup> of cultivation area divided into greenhouses and phytotrons. In 2014, UCLouvain equipped itself with new greenhouses to meet the economic and ecological challenges of the future: through the choice of construction materials that allow energy savings, the automation of cultivation conditions, and LED lighting adapted to the needs of the plants. These cultivation areas are primarily intended for the university community for its teaching and research missions, but also welcome external companies. Finally, the platform also plays an awareness-raising role for the general public and regularly offers visits for schools, associations, etc., particularly during the Spring Science Festival.

From https://uclouvain.be/en/research-institutes/eli/greenhouses.html



#### 48 - Une nouvelle filière wallonne de moutarde en agriculture biologique de conservation

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Keywords: agriculture, filière, durabilité, collaboration

The *Fermes universitaires de Louvain* are a technological platform aiming at studying the Walloon agriculture and its diversity. Our activities include support to teaching and research as well as service to society. The latter focusses on the validation of innovative practices for a transition towards sustainable agricultural systems.

In 2021, we were contacted by a network of farmers trying to develop a mustard seed sector in Belgium, in partnership with a local industry. Mustard, whose culture demands very few inputs, is nowadays produced mainly in Canada. How can the UCLouvain, with its diversity of resources and knowledges, support this initiative?

# See you next year!

