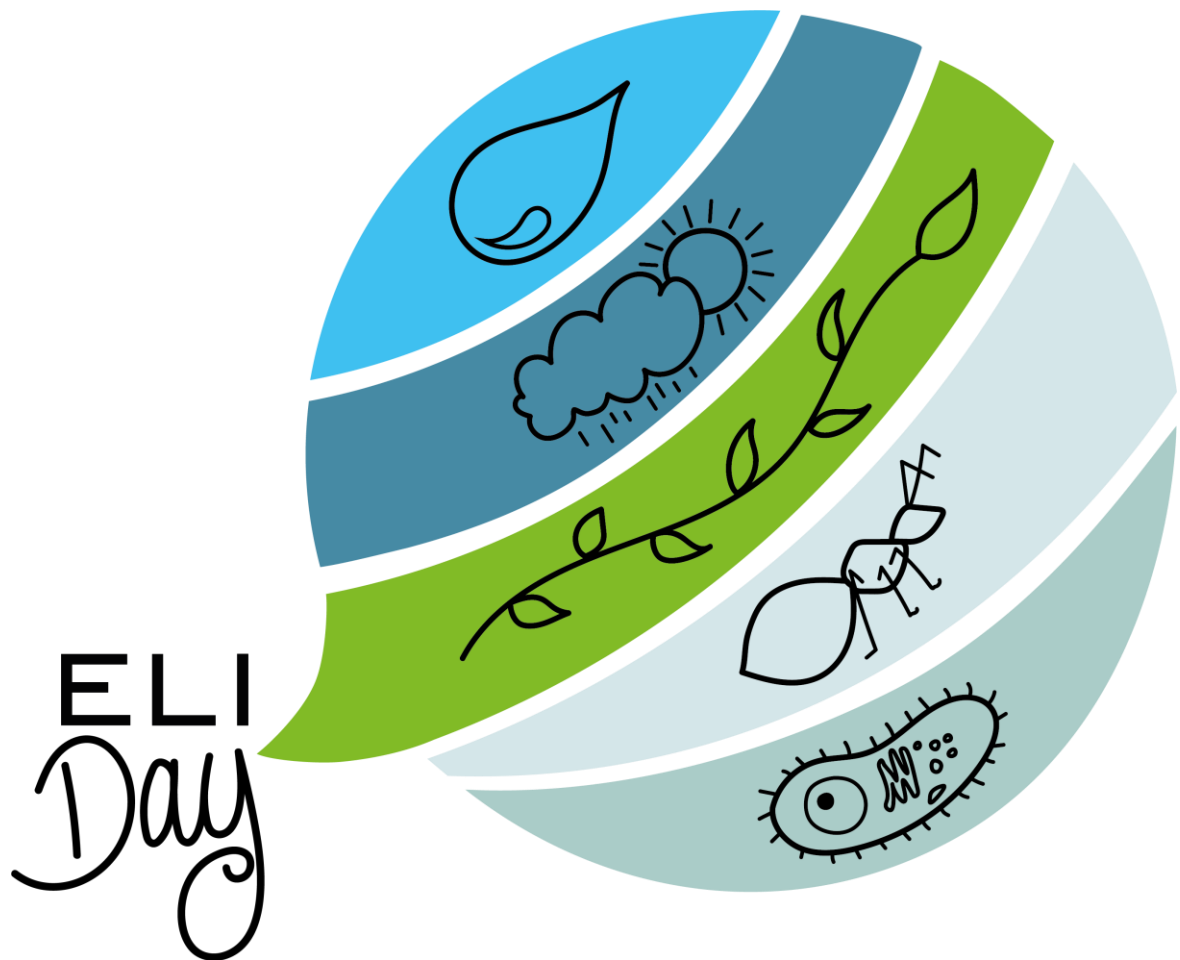


Abstract Book

ELI-Day 2021





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General information

Contact:

Website: <https://uclouvain.be/en/research-institutes/eli/aceli>

Facebook page: <https://www.facebook.com/ACELI.UCLouvain>

Email address: aceli@uclouvain.be



Organising committee: the ACELI team



Céline
CHEVALIER
ELIA
*Website
Training sessions*



Clothilde
COLLET
ELIA
*Representative ELIA & at
ELI's council
FRIA trainings*



Valentin
COUVREUR
ELIA
*Representative at Corsci's
Council
Compost*



Morgane
DENDONCKER
ELIE
*Representative ELIE & at
ELI's council*



Charlotte
DESCAMPS
ELIA
Representative ELIA



Manon
FERDINAND
ELIA
ACELI president



Pauline
GARDIN
ELIB
*Representative ELIB & at
ELI's council
FRIA trainings*



Adrien
HEYMANS
ELIA
*Representative at ELI's
council
24h vélo
Compost*



**Pierre-Vincent
HUOT
ELIC**

*Representative at science
CDD
24h vélo*



**Audrey
LEPRINCE
ELIM**

*Representative ELIM, ELI's
council & Agro CDD
Training sessions*



**Calogero
MONTEDORO
ELIB**

*Vice-president at the
Sector
Representative at Corsci's
Council*



**Manon
NUYTTEEN
ELIM**

*Representative at ELI's
council*



**Jeanne
REZSÖHAZY
ELIC**

*Representative ELIC & at
ELI's council*



**Suzon
RONDEAUX
ELIB**

*Representative at ELI's
council
Website*



**Maxime
THOMAS
ELIE**

*Representative ELIE & at
ELI's council*



**Lilian
VANDERVEKEN
ELIC**

*ACELI president
Representative at ELI's
council*



Introduction

Welcome to this first edition of the ELI-Day organised by the Researchers Association of the Earth and Life Institute (ACELI).

Just in case 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 organs of the Institute, the Sector, and the University. Moreover, ACELI also aims to provide recreational and scientific activities within the institute in order 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), Biodiversity (ELIB), 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, it counts over 400 members and the research themes are various. Moreover, due to the repartition of our office in different buildings (Mercator, Mendel, De Serres, and Carnoy, among others) in the upper part of Louvain-la-Neuve, 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 an association; and we offer you a fun recreational day during the second quadrimester. However, these are mainly social events and we wanted to create a new event that mainly focused on science and research.

During the past two years, a concept emerged within the ACELI members to organise a special scientific day dedicated to the members of ELI during which researchers would present their thematic. This day would allow all ELI members to get to know what we all are doing at the scientific level, to create bonds between members and to develop our general scientific knowledge.

The ELI-Day was born. The organisation of this event required an important investment from all the ACELI members, and it would not have been possible without the support of the ELI-bureau and some other people that we would like to thank here:

- The current ELI's president Claude BRAGARD, and the Poles' representatives: Pierre BERTIN (ELIA), Pierre DELMELLE (ELIE), Thierry FICHEFET and Renate WESSELINGH (ELIB), Hugues GOOSSE (ELIC), Jacques MAHILLON (ELIM) for their support;
- Guillaume LOBET, Jacques MAHILLON, Hugues GOOSSE and Renate WESSELINGH for their help choosing the session themes;
- Brigitte FERAUGE for the production of the publicity posters and the visual identity;
- Céline CHEVALIER for the creation of the ELI-Day logo;
- Stéphane DECONINCK for the website and the registration process;
- Ingrid JANSSENS for facilitating the implementation of the project on several levels and the communication with the different Poles ;



- Pascale PATTYN for the promotion of the event ;
- Manuela GUISET and Pascal VANGRUNDERBEECK from The Louvain Learning Lab for their advice regarding the practical organisation of the online event;
- Jean-Francois REES and Guillaume LOBET for the access to eLouv where the event will take place;
- The chairpersons: Daniele DA RE, Mathilde DE VROEY, Madeleine GUYOT, Marie LUYCKX, Jacques MAHILLON, Muriel QUINET, Julien RADOUX, Kévin TOUGERON, Marnik VANCLOOSTER, Sophie VANWAMBEKE, Renate WESSELINGH for their availability;
- All the scientific contributors to the ELI-Day.



Overall programme

Wednesday, May 26, 2021 – Methodological session "Controlled environments"

8:30 – 10:15: Opening talks and first oral presentations

10:15 – 11:00: Break

11:00 – 12:00: Oral presentations

Thursday, May 27, 2021 – Methodological session "Field data"

9:15 – 10:30: Oral presentations

10:15 – 11:00: Break & Posters

11:00 – 12:00: Oral presentations

Friday, May 28, 2021 – Thematic session "One Health"

9:15 – 10:30: Oral presentations

10:15 – 11:00: Break & Posters

11:00 – 12:00: Oral presentations



Practical information

Due to the COVID-19 situation, the first edition of the ELI-Day will be held online. To avoid any problems during the conference, we invite you to read the following guide.

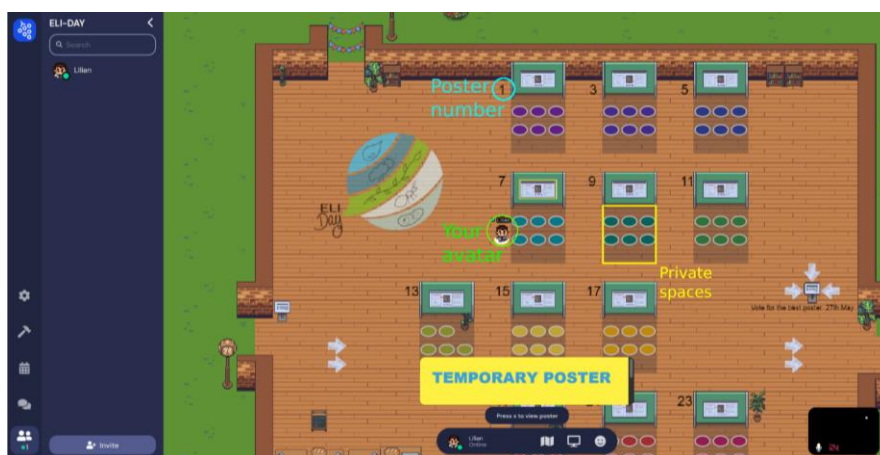
Oral presentations

The oral presentations will be broadcast on Teams. We are going to take advantage of the ELI team to schedule the various sessions. If you are not on the team, please send an email to aceli@uclouvain.be. When the session starts, you can join the meeting. We ask you to cut your microphone and camera during the presentation. After each talk, you are invited to raise your hand in order to ask your question. The chairperson will chair the question session so that it will not exceed 10 minutes per talk.

Poster sessions

Two poster sessions will take place during the ELI-Day. Those sessions are scheduled during the coffee break. To improve the exchanges during those poster sessions, we have chosen to organise them on gather.town. In gather.town, each participant will be an avatar in a virtual conference room. Here is a quick guide to get access to this virtual room:

1. Click on the link given during the conference.
2. Create an account on gather.town with you UCLouvain mail address.
3. Once you are connected, you can move your avatar by using the arrow keys. If your avatar gets close to another one, both your cameras and microphones will turn on and you will be able to talk to each other.
4. Take the blue portal ELI-Day to go to the conference room. In the room, it should look like the image just below.



5. In order to see a poster, you have to get close to it and press X.
6. We have created a private space for each poster, so if you are interested in one poster please join the private space associated.



7. Have fun!

Selection of your favourite posters and presentations

Each day, you will have the opportunity to vote for your favourite oral presentation and poster. For the oral presentations, the vote will take place at the end of each daily session (Controlled environment, Field data and One Health) on Teams, via the Wooclap platform. For the posters, go to gather.town and look for the white arrows on the floor, pointing to a voting box that contains a link to a Google form. Detailed instructions will be given during the opening talks (May 26, at 8:30). The winners will receive a gift coupon for the Altérez-vous citizen café in Louvain-la-Neuve!



Detailed programme

Wednesday, May 26, 2021

Methodological session « Controlled environment »

8:30 – 8:45	Claude BRAGARD	Institute presentation
8:45 – 9:15	ACELI	ACELI presentation
9:15 – 9:35	Servane BIGOT (ELIA)	Comparison of salinity response of <i>Solanum lycopersicum</i> and its wild relative <i>Solanum chilense</i> during reproductive stage
9:35 – 9:55	Filippo BRIENZA (ELIM)	Lignin valorization via a dithionite-assisted organosolv fractionation of lignocellulosic biomass
9:55 – 10:15	François GASPARD (ELIE)	Waters in hydrothermal and polar environments: further developments for silicon isotope measurements
10:15 – 11:00	BREAK & Test for those who want on gather.town	
11:00 – 11:20	Deborah VERFAILLIE (ELIC)	Investigating the climate predictability in the Southern Ocean and Antarctica using global and regional coupled models
11:20 – 11:40	Michaël LONGIN (ELIM)	Electro-bio-catalysis for bioremediation of polychlorinated biphenyls (PCBs) in dredged sludge.
11:40 – 12:00	Nicolas SHTICKZELLE (ELIB)	Automatization in laboratory microcosms: applying image analysis to counting and phenotyping protists and arbuscular mycorrhizas



Thursday, May 27, 2021

Methodological session "Field data"

9:15 – 9:35	Arthur MONHONVAL (ELIE)	Iron dynamics upon thermokarst formation in the Yedoma domain
9:35 – 9:55	Laura ENTHOVEN (ELIA)	Contracts and certification in local value chains: Safe vegetables in Vietnam
9:55 – 10:15	Catherine HIRST (ELIE)	Can we use Arctic rivers to detect permafrost thaw?
10:15 – 11:00	BREAK – POSTERS on gather.town	
11:00 – 11:20	Mathilde BLANQUET (ELIE)	The use of metallophyte plant species and biostimulant from vermicompost for the phytomanagement of contaminated sites
11:20 – 11:40	Elisabeth MAUCLET (ELIE)	Mineral element cycling through the soil-plant system upon permafrost thaw: case study in Interior Alaska
11:40 – 12:00	Imen EL GHOUL (ELIE)	Combined effects of climate and land use change on hydrological alteration of a Mediterranean catchment: case study of the Silia



Friday, May 28, 2021

Thematic session "One Health"

9:15 – 9:35	Victorine DJACO (ELIE)	Evaluation of the agro-ecological potential of farms in two african regions in order to their transition to sustainable farms
9:35 – 9:55	Daniele DA RE (ELIC)	DynamAedes: an application of causal-based Species Distribution Models in spatial epidemiology
9:55 – 10:15	Benoît PEREIRA (ELIE)	Development of a health risks assessment model-based tool for users of contaminated vegetable gardens in Wallonia (Belgium)
10:15 – 11:00	BREAK – POSTERS on gather.town	
11:00 – 11:20	François RENOZ (ELIB)	The functioning, development and evolution of bacterial mutualism in insects
11:20 – 11:40	Raphaël ROUSSEAU (ELIC)	Heterogeneity in tick abundance and tick-borne pathogens in a Belgian peri-urban forest
11:40 – 12:00	Annalisa CARTABIA (ELIM)	Impact of arbuscular mycorrhizal fungi on primary and secondary metabolites production in medicinal plants



Oral presentations



Wednesday, May 26, 2021

Methodological session: “Controlled environment”

Chairpersons :

Muriel QUINET, Marie LUYCKX-CO, Jacques MAHILLON



9:15 – 9:35

Comparison of salinity response of *Solanum lycopersicum* and its wild relative *Solanum chilense* during reproductive stage

Servane BIGOT (servane.bigot@uclouvain.be) – ELIA

Supervisor: Muriel QUINET

Keywords: salinity, tomato, halophyte, reproduction

Salinization of cultivated lands is of growing concern. Tomato (*Solanum lycopersicum*) is the second most highly produced vegetable in the world but is affected by salinity because of its glycophyte properties. Its wild relative *Solanum chilense* is originated from Atacama desert and is thus able to cope with high salinity in the soil. Because of its halophyte properties and closeness to *S. lycopersicum*, it represents an abundance of genetic diversity for tomato improvement. However, physiological basis of salinity tolerance in *S. chilense* remains largely unknown especially during reproductive stage. The aim of our research is to compare salinity responses of *S. chilense* and *S. lycopersicum* with a special focus on reproductive stage. Plants of *S. chilense* and *S. lycopersicum* submitted to different concentrations of salt (control, 60 and 120 mM NaCl) were grown under greenhouse conditions during 5 months. Vegetative growth and reproductive development were monitored all along the experiment. Gas exchange and fluorescence parameters were monitored 3 times. Repartition of sodium was assessed in the different organs (leaves-stems-roots-flowers-fruits). LA-ICP-MS (Laser ablation - Inductively Coupled Plasma Mass Spectrometry) was conducted on flowers of stressed plants in order to localize minerals in the different floral parts. Relation between minerals localization and flower fertility was evaluated. Expression of sodium transporters will be measured on flowers of both stressed and control plants of both species.



9:35 – 9:55

Lignin valorization via a dithionite-assisted organosolv fractionation of lignocellulosic biomass

Filippo BRIENZA (filippo.brienza@uclouvain.be) – ELIM

Supervisors: Iwona CYBULSKA, Damien DEBECKER

Keywords: lignin valorization, biorefinery, lignocellulose, sodium dithionite

Lignin monomers and short-chain oligomers, as well as purified cellulose and hemicellulose fractions, represent extremely valuable chemicals for green chemistry applications, including biofuel production, polymers manufacturing and pharmaceutical applications. Promising one-step reductive catalytic fractionation (RCF) processes were recently proposed for the simultaneous fractionation of lignocellulose and conversion of lignin toward a handful of phenolics. Inspired by the idea of a reductive cleavage of lignin inter-unit bonds, this research is targeting the simultaneous production of cellulosic pulp and conversion of lignin toward phenolic monomers in the absence of precious metals catalysts and high pressures of hydrogen gas commonly adopted within RCF. Instead, sodium dithionite, an inexpensive and readily available sulfur-based compound, was selected as a reducing agent. The use of dithionite within organosolv fractionation was demonstrated to lead to a considerably increased depolymerization of lignin and a substantial production of phenolic monomers. Along with that, a highly processable cellulosic pulp was produced, while most hemicellulose decomposed toward volatile species, humins and organic acids. The role of dithionite within lignin depolymerization was elucidated via reactions with model compounds, which revealed that the reducing agent favors the reductive cleavage of β -O-4 bonds and the hydrogenation of alkyl side chains in the produced monomers, without, however, suppressing totally the occurrence of repolymerization reactions. Overall, this study shows that dithionite-assisted organosolv fractionation is an attractive process for implementing lignin valorization during pulping, in the perspective of developing an integrated biorefinery approach.



9:55 – 10:15

Waters in hydrothermal and polar environments: further developments for silicon isotope measurements

François GASPARD (francois.gaspard@uclouvain.be) – ELIE

Supervisor: Sophie OPFERGELT

Keywords: silicon isotopes, stable isotope, hydrothermal and polar environments

The number of developed “non-traditional stable isotope systems” has gradually increased over the past 20 years. Some of the earliest systems, such as Si isotopes ($\delta^{30}\text{Si}$), have been applied in planetary, terrestrial and marine environments where measurements on rocks, soils or Si-accumulating plants were not limited by the Si amount available for analysis. For seawater (with low Si concentration), a pre-concentration method was set up. Adaptations were also made to allow $\delta^{30}\text{Si}$ measurement on waters with (i) low anions/Si ratios, or (ii) low dissolved organic carbon. The challenge is now to go beyond existing applications in environments with more complex water matrices (such as high anions/Si ratios acidic hydrothermal environments and organic-rich peatlands), or in environments with low Si concentrations (such as polar environments at snowmelt). We developed sample preparation techniques adapted for acidic and anion-rich water samples, for organic-rich water samples, and for water samples limited in Si amount. Depending on the sample size and sample matrix, adapted sample preparation protocols have been established to add to the commonly used cation exchange column: either a preconcentration, a treatment for organics, and/or an anion exchange column. Checking Si recovery, and removal of cations, anions and organics is needed to prevent mass bias and provide reproducible Multi-Collector Inductively Coupled Plasma Mass Spectrometer measurements. These developments open new avenues for $\delta^{30}\text{Si}$ measurements on water samples previously considered as poorly suited for $\delta^{30}\text{Si}$ analysis, and for more collaborative work on archived water samples. Riverine Si fluxes are linked to the carbon cycle via silicate weathering and diatom Si uptake. Such analytical developments allow for the inclusion of challenging hydrothermal and polar environments in the collective effort to connect Long Term Ecological Research (LTER) network and Critical Zone Observatories (CZO) to assess how riverine Si export respond to global change.



11:00 – 11:20

Investigating the climate predictability in the Southern Ocean and Antarctica using global and regional coupled models

Deborah VERFAILLIE (deborah.verfaillie@uclouvain.be) – ELIC

Supervisor: Hugues GOOSSE

Keywords: climate predictability, Southern Ocean, Antarctica, coupled models

The PARAMOUR project (Decadal Predictability and vAriability of polar climate: the Role of AtMosphere-Ocean-cryosphere mUltiscale inteRactions) is funded in the framework of the Belgian program EOS - The excellence of Science. It aims at revealing fundamental drivers of climate variability and assessing the predictability in high-latitudes by using coupled regional climate models in both hemispheres. In this communication, we will present the ongoing contribution of the Earth and Life Institute in Louvain-la-Neuve and the Barcelona Supercomputing Center to the PARAMOUR project, in the Austral regions. Our efforts centre around two main objectives. The first one is improving our understanding of key processes that control the variability of the ice-ocean-atmosphere system at decadal timescales. The focus will initially be on the interactions between the components at regional scale and, later on, on the links with larger spatial scales. The second one is to determine how those interactions will lead to some predictability of the full ice-ocean-atmosphere system at decadal timescales or of some specific components only. Achieving our goals will require the development of coupled regional models including the atmosphere, ocean, sea ice and ice sheets, driven at their boundaries by the results of global models. Three configurations are proposed in the PARAMOUR project, covering 1/ Greenland, the Arctic and the North Atlantic sector, 2/ Antarctica and the Southern Ocean, 3/ The Totten glacier region. We will focus here on the latter two configurations. Retrospective (1980-2015) and prospective (2015-2045) climate simulations at high resolution will be conducted to evaluate the respective roles of initial conditions, some specific physical processes, teleconnections and couplings in the recent trends and to appreciate the potential fluctuations of key climate indicators within the next decades. A specific aspect will also be to determine the added-value of the regional models compared to the global ones.



11:20 – 11:40

Electro-bio-catalysis for bioremediation of polychlorinated biphenyls (PCBs) in dredged sludge

Michaël LONGIN (michael.longin@uclouvain.be) – ELIM

Supervisor: Patrick GERIN

Keywords: electro-bio-catalysis, PCBs, bioreactor, dechlorination, dredged sludge

Fine-grained materials from canal dredging can be contaminated with persistent organic pollutants (POP) such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbon (PAHs), as well as mineral oils. Such pollutants prevent their valorization and require their decontamination. Synthesized since the 1920s, PCBs are a family of synthetic chemical molecules of composition $C_{12}H_{(10-n)}Cl_n$. They are based on two aromatic rings in a biphenyl structure, on which chlorine atoms replace some hydrogen atoms (INERIS, 2011). There are multiple possible combinations in the distribution of chlorine atoms (from 1 to 10) on the diphenyl molecule leading to 209 congeners. Highly used between 1930 and 1970 as lubricants (turbines, pumps ...) as well as in electrical transformers and capacitors. The chemical structure of PCB provides them a high stability and a low biodegradability and therefore a very long life. The lipophilic nature of PCBs allows them to accumulate throughout the food chain (Gustafson, 1970). Because PCBs are poorly metabolized, one part is excreted and another accumulates in adipose tissues. Food of animal origin and more specifically fat-rich foods are the most affected. High exposure to PCBs (accidental releases, occupational activities) can cause health effects (Hansen, 1987). During their transfer through the environment, two processes are likely to cause a change in the composition of a PCB mixture: photolysis and biodegradation. Biodegradation proceeds through a dechlorination of the molecule under anaerobic conditions. It is a natural process of detoxification catalyzed by micro-organisms, which requires the addition of reducing equivalents. Aerobic oxidation of the unchlorinated intermediates is then required to completely mineralize PCBs (Bedard, 2003). Our project aims to investigate a design of electro-bio-reactor that can combines: - An anaerobic compartment at the cathode, which provides reducing equivalents to the microorganisms.- An aerobic anodic compartment, where oxidation of dechlorinated residues, PAHs and mineral oils can take place.



11:40 – 12:00

Automatization in laboratory microcosms: applying image analysis to counting and phenotyping protists and arbuscular mycorrhizas

Nicolas SHTICKZELLE (nicolas.schtickzelle@uclouvain.be) – ELIB

Keywords: ecology, conservation biology, automated data collection, 3D printing, customized electronic device

Laboratory microcosms allow a high level of control, manipulation and replication and are becoming very important in the ecological toolbox for the experimental testing of concepts and theories they allow. However, large scale experiments are still often limited by the ability to record data in an efficient and reliable way, thus preventing the true experimental power of microcosms to be unleashed. In this joined talk, we will first document some of the tools that have been created in Prof. Nicolas Schtickzelle's team (ELIB) to allow the recording of data on abundance and phenotypic traits using image analysis, combining several techniques such as 3D printing, laser cutting, Arduino electronic devices, and automatic image analysis using ImageJ. Then two PhD students will illustrate how they use these systems in their research with microcosms: Tessa de Bruin (ELIB) with protists and Tera Shewchenko (ELIM) with arbuscular mycorrhizas. We believe there are opportunities for further implementation of such techniques in ELI.



Thursday, May 27, 2021

Methodological session: “Field data”

Chairpersons :

Marnik VANCLOOSTER, Renate WESSELINGH, Kévin TOUGERON



9:15 – 9:35

Iron dynamics upon thermokarst formation in the Yedoma domain

Arthur MONHONVAL (arthur.monhonval@uclouvain.be) – ELIE

Supervisor: Sophie OPFERGELT

Keywords: permafrost, thaw, redox processes, carbon stabilization, Arctic

Ice-rich permafrost is subject to abrupt thaw, during past and present global warming. Ice-rich domains encompass Yedoma Ice Complex deposits that have never thawed since deposition and Alas deposits that have undergone previous thermokarst processes during the Lateglacial and Holocene warming periods. Upon thaw of these deep ice-rich deposits, organic carbon (OC) and minerals are unlocked and OC is exposed to mineralization. A portion of this OC is associated with iron (Fe) that provides physico-chemical protection of OC or drives the mineralization of OC by redox processes. We hypothesize that post-depositional thaw processes induce changes in redox conditions in Alas deposits and so affect the role that Fe plays in mediating present-day OC mineralization. To test this hypothesis, we quantify the vertical distribution of Fe concentrations and Fe mineralogy in unthawed Yedoma and previously thawed Alas deposits from the Yedoma domain (Alaska, the Kolyma region, the Indigirka region, the New Siberian Archipelago, the Laptev Sea coastal region, and Central Yakutia). Portable XRF-measured concentrations trueness were calibrated from alkaline fusion and inductively coupled plasma optical emission spectrometry (ICP-OES) measurement method on a subset of 144 samples ($R^2 = 0.95$). Iron extractions of unthawed and previously thawed deposits show that ~25% of the total iron is a reactive species, composed of crystalline or amorphous oxides, or complexed with OC, with no significant difference between Yedoma and Alas deposits. We observe a consistent total Fe concentration in Yedoma deposits, but a depletion or accumulation of total Fe in Alas deposits, which experienced previous thaw and/or flooding events. These results suggest that redox-driven processes during the Lateglacial and Holocene thermokarst formation impact the present-day distribution of reactive Fe and its association with OC in ice-rich permafrost.



9:35 – 9:55

Contracts and certification in local value chains: Safe vegetables in Vietnam

Laura ENTHOVEN (laura.enthoven@uclouvain.be) – ELIA

Supervisor: Goedele VAN DEN BROECK

Keywords: contract farming, certification, food value chain, econometrics, discrete choice experiment

Food quality and safety concerns in low- and middle-income countries are often addressed using stringent standards and formal contracts between farmers and buyers. Many studies have investigated the welfare implications of these control mechanisms for small-scale farmers in modern value chains, including exports and supermarkets. On the contrary, only few studies have focused on the potential of certification and contracts to tackle food safety issues within local traditional value chains. This study uses a comprehensive survey and a discrete choice experiment (DCE) among 301 vegetable farmers in peri-urban Hanoi to explore their preferences for different types of certification schemes – including third-party certification and participatory guarantee systems – and contracts. The results point out that farmers are willing to participate in safe vegetable contracts, provided that requirements are feasible and buyers fully committed and trustworthy. However, they are strongly averse to organic farming and selling to unknown buyers. They do not necessarily demand higher prices but highly value contracts that entail large purchase quantities, long duration and pesticide provision. The results are particularly informative when encouraging the establishment of new contracts between farmers and buyers, in turn fostering inclusive and safe local value chains.



9:55 – 10:15

Can we use Arctic rivers to detect permafrost thaw?

Catherine HIRST (catherine.hirst@uclouvain.be) – ELIE

Supervisor: Sophie OPFERGELT

Keywords: permafrost, rivers, size separation, isotopes

Permafrost soils contain a vast stock of mineral elements and organic carbon. With ongoing climate change there is a pressing need to identify tools that can be used to monitor processes in permafrost soils and detect the effect of warming on the mineral element and organic carbon pools. Arctic rivers capture waters that have had direct contact with permafrost soils suggesting that river constituents could be used to detect changes occurring upon permafrost thaw. The mineral elements and organic carbon that are transported to rivers span a range of size and composition. Here we use in-field size separation and non-traditional metal isotopes to connect these fractions in rivers to processes occurring across the permafrost landscape. Examples of these tools-at-work will be presented for a large Arctic river and a headwater stream.



11:00 – 11:20

The use of metallophyte plant species and biostimulant from vermicompost for the phytomanagement of contaminated sites

Mathilde BLANQUET (mathilde.blanquet@uclouvain.be) – ELIE

Supervisor: Stanley LUTTS

Keywords: metallic trace elements, vermicompost, phytomanagement, field study

Pollution of the environment by metallic trace elements (MTEs) is an economic, political and ecological concern. Remediation of this kind of polluted soils is a real challenge because MTEs are not biodegradable, have a high persistence in the environment and threaten human health. Phytoremediation is a technique based on the plant's ability to extract or immobilize pollutant in the environment. This technique is an interesting environmentally friendly and low-cost alternative to manage polluted sites. Numerous lab studies dedicated to the impact of MTEs on plants are performed but field application remain scanty. Indeed, phytomanagement constitutes a complex problem that requires interdisciplinary approaches. It involves to consider both plant and soil properties from a dynamic rather than a static perspective and needs to carry out tests for several years. In this context, the aim of my thesis is to precise the interest of a mixed population of plant species to manage industrial polluted sites and the interest of a natural biostimulant to improve plant behavior in this harsh environment. The selected species – *Silene vulgaris*, *Rumex acetosa*, *Holcus lanatus*, *Deschampsia cespitosa* and *Festuca rubra* – naturally grow on calamine lawns which soils are rich in MTEs. Vermicompost is a natural amendment that significantly improves plant growth. It could optimize the ability of plants to extract or immobilize pollutants from the soil by improving their root growth and so improving the efficiency of phytoremediation. For this study, several field experiments are underway. There are based on two industrial polluted sites, one in Sclessin and another one in Villers-la-Ville. We will investigate the plant population dynamic and the impact of MTEs, the evolution of soil properties and the effect of vermicompost both on plants and soil in order to carry out an assessment of the strategies in terms of phytoextraction or phytostabilization.



11:20 – 11:40

Mineral element cycling through the soil-plant system upon permafrost thaw: case study in Interior Alaska

Elisabeth MAUCLET (elisabeth.mauclet@uclouvain.be) – ELIE

Supervisor: Sophie OPFERGELT

Keywords: thawing permafrost, vegetation, nutrient cycle

Climate warming affects the Arctic region by exposing previously frozen permafrost to thaw, unlocking mineral nutrients, boosting plant growth, and modifying the carbon balance from permafrost regions. In changing Arctic environments, how will permafrost degradation affect plant mineral nutrient availability and soil-plant nutrient cycling via litter degradation? Studies have highlighted that upon thawing, deep-rooted plants benefit from new pools of essential nutrients such as N or P. Therefore, we hypothesized that other mineral elements such as Ca, K, or Mg may also be bio-lifted and recycled in surface soil horizons through deep plant uptake and litter production, providing a source of nutrients for shallower rooted plants. To test this hypothesis, plant leaves and soil samples were collected across a permafrost thaw gradient at Eight Mile Lake, Alaska in September 2019, corresponding to the season of maximal permafrost thaw depth. The sampling transect (vegetation and soil profiles) encompasses a range of active layer depth (–48 to –96 cm) and water table depth (0 to –40 cm). We investigate the influence of permafrost thaw on mineral element distribution in plants and soils by measuring the total content in Ca, K, Mg, Na, P, Si, and Mn: (i) in plant species from three different plant functional types (sedges, deciduous and evergreen shrubs); and (ii) in the corresponding soil profiles. The plant selection includes species with shallower (*Vaccinium* spp.) and deeper (*Carex* spp.) rooting depth. In soils, we also determined the content in exchangeable Ca, Mg, K, and Na. The large contrasts between the element distribution in organic and mineral horizons confirm the central role of the vegetation in the mineral elements cycling in these permafrost-affected ecosystems, and highlight the importance to consider jointly active layer depth, water table depth and plant rooting depth to assess the nutrient availability for the vegetation.



11:40 – 12:00

Combined effects of climate and land use change on hydrological alteration of a Mediterranean catchment: case study of the Silia

Imen EL GHOUL (imeneelghoul91@gmail.com) – ELIE

Supervisor: Marnik VANCLOOSTER

Keywords: hydrological impact, land use change, climate change, uncertainty

Water resources in Tunisia are limited in space and time. With an annual average of less than 500 m³ per inhabitant, Tunisia is classified as a water-poor country. On the other hand, the hydro-climatic models predict a reduction in water availability, yet limited, with exacerbated forms of pollution as a result of both climate and land use/cover changes. However, how climate and land use changes will affect the hydrological cycle at the catchment scale in Tunisia is still not clear and remain among the challenges that hydrologists are still facing and trying to arise. The challenges for assessing the combined effect of changes in climate and land use on the catchment flow regime stem from the lack of scientific knowledge regarding the hydro-climate processes and their representation into a model or a set of models to accurately simulate the actual natural processes. Indeed, hydrological impacts of climate and land use changes are prone to uncertainty. The latter needs to be appropriately addressed and the hydrological projections also should be communicated with uncertainty. However, there is no a common toolkit or approach to address the combined impacts of climate and land use change on catchment hydrology within an uncertainty framework. Therefore, in this project I am aiming to develop a modeling platform that combines both climate and hydrological models. Based on historic knowledge and future projections, model projection underpinned with land use and water management scenarios will guide to develop a decisional supporting system tool that will assist water management process under changing climate and land use conditions.



Friday, May 28, 2021

Thematic session: “One Health”

Chairpersons :

Julien RADOUX, Mathilde DE VROEY, Sophie VANWAMBEKE, Madelein GUYOT, Daniele DA RE



9:15 – 9:35

Evaluation of the agro-ecological potential of farms in two african regions in order to their transition to sustainable farms

Victorine DJAGO (victorinedjago@yahoo.fr) – ELIE

Supervisor: Charles BIELDERS

Keywords: agroecology, typology, survey, Benin, Burkina-Faso

The major challenge of West African agriculture to ensure food security is to promote the agro-ecological transition of farms and its amplification on a territorial scale. The present study aims at assessing the potential for the evolution of farms from cereal and market garden agrosystems to more ecological farms in two regions with similar pedoclimatic conditions. A typology based on soil fertility management and conservation practices was carried out from surveys of 650 farmers in six areas of Atacora (Benin) and Houët province (Burkina-Faso) regions. Actually, in neither region is there an exclusively organic or agroecological farm. The typology made it possible to define the types of farms on the basis of their surface area, the intensity of use of mineral and organic fertilizers and pesticides, the density of livestock and the intensity of implementation of agro-ecological practices. It is noted a greater diversity of agro-ecological practices implemented on farms in Burkina Faso compared to farms in Benin. Vegetable crops benefit more from organic fertilization compared to cereal crops. Livestock farming is extensive and characterized by traditional production systems. Moreover, these farms present common assets but also specific challenges to be met in terms of the use of synthetic pesticides and reasoned fertilization, the valorization of crop residues and the integration of agriculture and livestock for an agro-ecological transition. Strengthening the capacity of farmers to satisfy their empowerment about agro-ecological inputs and facilitating access to agro-ecological inputs at the territorial scale must be a priority for public authorities and development partners to develop strategies to support farms in a dynamic agro-ecological transition.



9:35 – 9:55

DynamAedes: an application of causal-based Species Distribution Models in spatial epidemiology

Daniele DA RE (daniele.dare@uclouvain.be) – ELIC

Supervisor: Sophie VANWAMBEKE

Keywords: Aedes mosquitoes, biological invasion, Environmental Niche Models, mechanistic models, Process-based Models

Understanding the causal processes determining a species spatial distribution is crucial for several applications in biodiversity conservation, invasive species monitoring and spatial epidemiology. In the past twenty years, the prompt availability of new spatial and temporal explicit data has allowed an extensive use of Species Distribution Models (SDMs), contributing to the increase in popularity of these methods. The ever-present threat of infectious disease to humans, livestock and wildlife has fostered interest in tools allowing to delineate areas exposed to an epidemic risk. Many studies have highlighted the potential of SDMs to provide such information and to map suitable areas for the species involved in diseases: pathogens, vectors, hosts. However, most applications of SDMs in epidemiology focus on a single species, often not the pathogen, and rely on the abiotic component (e.g. temperature, precipitation) of the species niche without a clear causal link to the target species physiology, poorly addressing biotic interactions and without informing on abundance or population dynamics. We developed a spatio-temporal process-based model for the invasive mosquito *Aedes aegypti*, which is a competent vector for several arboviruses. In the study we considered i) the effect of daily mean temperature on the survival probability of different life stages of the species, ii) juvenile interspecific competition, and iii) both active and passive dispersal. With this study, we tried to bring further the use of SDMs in spatial epidemiology, exploring the role and importance of the spatio-temporal dynamics and biological interactions of the species involved in the disease system and proposing a causal-based and spatially-explicit interpretation of complex ecological systems.



9:55 – 10:15

Development of a health risks assessment model-based tool for users of contaminated vegetable gardens in Wallonia (Belgium)

Benoît PEREIRA (benoit.pereira@uclouvain.be) – ELIE

Supervisor: Pierre DELMELLE

Keywords: health risk assessment, vegetable garden, trace metal element, soil-to-plant transfer, Wallonia

Vegetable gardening in urban soils increases food security and offers a wide range of social and ecosystem benefits. However, elevated soil trace metal element concentrations in urban and industrial areas may pose a health hazard, limiting the development of urban gardening. Such a situation is encountered in Wallonia where former industrial activities have substantially increased trace metal topsoil content. To provide appropriate recommendations for users of contaminated vegetable gardens in Wallonia, we developed a web tool, called SANISOL, which is described in this work. SANISOL provides recommendations concerning (1) the health risks posed by the presence of As, Cd, Cr, Cu, Hg, Mn, Mo, Ni, Pb and Zn in soil and (2) the products that can be cultivated safely in the vegetable garden. The recommendations concerning health risks are provided from a health risks assessment model. The gardener's exposure is estimated based on the gardener's profile (age, garden products consumed, etc.) and the garden's soil trace metal contents. If there is a potential health risk, SANISOL tool reports information on the health risk causes and provides recommendations to reduce the gardener's exposure. The quality of garden produce is provided for 14 fruits and vegetables based on the expected trace metal content in the products calculated from soil-to-plant transfer models. SANISOL tool indicates if a specific garden product is likely to have trace metal contents higher than a commercially purchased product, or than the maximum level in foodstuffs. In conclusion, while this work demonstrates that it is possible to develop a tool that provides appropriate and tailored recommendations for gardeners living in areas with high trace metal content in soil, it also highlights the uncertainties and progress that needs to be made to properly manage the human health risks associated with soil trace metals such as As, Cd and Pb.



11:00 – 11:20

The functioning, development and evolution of bacterial mutualism in insects

François RENOZ (francois.renoz@uclouvain.be) – ELIB

Supervisor: Thierry HANCE

Keywords: ants, aphids, endosymbionts, thermal fluctuations, parasitoids

Many insects thriving on unbalanced diets have evolved intimate relationships with symbiotic bacteria that are maternally inherited throughout generations and can influence many aspects of their hosts' biology. The aphid-associated symbiont *Serratia symbiotica* has emerged as a valuable model for dissecting the mechanisms underlying endosymbiosis development and evolution as its reported diversity to date provides a comprehensive picture of the various associations that bacteria may share with insects, along a continuum depending on the degree of intimacy between the two partners. While certain strains have free-living abilities and display a lifestyle at the interphase between pathogenicity and mutualism, others are confined in specialized host cells called bacteriocytes and involved in intracellular mutualism that may be either facultative or obligate. In recent years, our team has implemented an integrated research strategy that ranges from field studies to genome analyses to better understand the functioning and evolutionary dynamic of bacterial mutualism in insects. Here, we first present an overview of our recent advances in the field before developing three new areas of research that have recently started within our team: 1) the evolutionary developmental biology of endosymbiosis (François Renoz), 2) the effects of climate change (in a world of fluctuating temperatures) on insect–bacterial symbioses (Corentin Iltis & Kévin Tougeron) and 3) the cascading effects of symbiotic bacteria on multiple trophic levels (Benoît Geelhand de Merxem).



11:20 – 11:40

Heterogeneity in tick abundance and tick-borne pathogens in a Belgian peri-urban forest

Raphaël ROUSSEAU (raphael.rousseau@uclouvain.be) – ELIC

Supervisor: Sophie VANWAMBEKE

Keywords: ticks, tick-borne disease, forest, spatial heterogeneity, multilevel analysis

Humans and domestic animal are exposed to *Ixodes ricinus* tick bites during their outdoor activities. These bites constitute a threat for their health because ticks harbor large bacterial communities, and can transmit various diseases, e.g. Lyme disease. Forests are considered as tick primary habitat as they provide favorable micro-conditions. As such, they are often considered as a homogenous land cover harboring abundant tick populations. However, little is known about the heterogeneity in tick density within a peri-urban forest, where human visits, and therefore exposure, is high. We collected ticks in seven sites in the Bois de Lauzelle, to investigate the homogeneous character of tick abundance in a forest unit and assessed the role of intra-forest habitat characteristics. These sites were sampled every two weeks during the period of tick activity, from March to November. Ticks were collected, stored, identified and screened for the presence of three zoonotic pathogens: *Borrelia burgdorferi* s.l., *Coxiella burnetii*, *Francisella tularensis*, the causative agents of Lyme disease, Q-fever and tularemia respectively. 868 nymphal and adult ticks were collected. The abundance was temporally and spatially variable, with the highest abundance during late-spring. Only the most typical *I. ricinus* habitat yielding consistently higher abundances than the other sites. Mean abundance was also lower in sites assumed to have higher human exposure. The prevalence of *B. burgdorferi* s.l. was estimated below 5%, *C. burnetii* was only detected twice and *F. tularensis* was not detected. Fine-scale characteristics affected tick abundance but no clear association with pathogen presence was identified. Tick-borne diseases constitute a challenge in public and animal health because of the implication of specific environmental characteristics, animal presence and movements, and human behaviors. Our results question the assumption that forest constitute a homogeneously suitable tick habitat and underline the necessity to account for micro-environmental conditions and human exposure.



11:40 – 12:00

Impact of arbuscular mycorrhizal fungi on primary and secondary metabolites production in medicinal plants

Annalisa CARTABIA (annalisa.cartabia@uclouvain.be) – ELIM

Supervisors: Stéphane DECLERCK, Ismahen LALAYMIA

Keywords: arbuscular mycorrhizal fungi, Boraginaceae plants, semi-hydroponic cultivation system, micropropagation, plant metabolism

Plants continuously contribute as a source to discover new molecules with healing effects. Several pharmaceutical-relevant plant species belong to the Boraginaceae family (e.g., *Anchusa officinalis* L., *Alkanna tinctoria* L. Tausch). Their therapeutic properties are due to the content of biologically active substances (e.g., naphthoquinones, flavonoids, terpenoids). Biotechnological tools such as plant tissue culture, metabolic engineering and in vitro micropropagation have been applied to produce these active compounds from lab to industrial scale. Interestingly, plant-associated microorganisms can markedly impact the chemical composition of their host plants. Among these, the obligate arbuscular mycorrhizal fungi (AMF) root symbionts are suspected to modify the production of primary and secondary metabolites (PMs and SMs, respectively). In this project, maintenance and growth of both *A. officinalis* and *A. tinctoria* plants has been achieved in vitro and in vivo conditions. Moreover, *A. officinalis* plants were used in a circulatory semi-hydroponic (S-H) cultivation system associated or not with AMF to investigate the up and/or down regulation of specific PMs and SMs in shoot and root tissues, as well as in the nutrient solution. Qualitatively and quantitatively differences were noticed in the production of several metabolites suggesting that specific biosynthetic pathways are influenced by AMF. Thus, opening the door to further exploitation of these root symbionts in the metabolome manipulation of medicinal plants. In addition, trapping the metabolites directly from the nutrient solution represents a potential solution to the problem of plants exploitation and availability of the metabolites. Further studies are ongoing to verify the efficacy of the S-H cultivation system for *A. tinctoria* associated with AMF



Posters



Poster programme

Thursday, May 27, 2021

Poster number	Title	Names of presenter(s)
1	Deciphering salinity resistance in <i>Amaranthus cruentus</i> in relation to its nutritional value: a bright future for an old plant	Adrien LUYCKX (ELIA)
3	The impacts of the quality and the quantity of floral resources on the pollinator's health	Léna JEANNEROD (ELIA)
5	Waterfrogs (<i>Pelophylax</i> spp.): a study at the intersection between systematics, biological invasions and emerging diseases	Christiane LEFÈVRE-PERCSY, Béranger WATERSCHOOT, Renate A. WESSELINGH (ELIB)
7	Challenges and opportunities for the spatial analysis of georeferenced weather-related disasters	Rémi FROMENT (ELIC)
9	Modelling of interglacial paleosol development in the Chinese Loess Plateau	Keerthika Nirmani RANATHUNGA ARACHCHIGE (ELIC)
11	Non-response determinants and resulting biases in the analysis of the association between mental health and the urban environment in Brussels	Madeleine GUYOT (ELIC)
13	Control of fermentation bio-physico-chemical conditions to produce biobased chemicals from agroindustrial residues	Grégoire HENRY (ELIM)
15	La Ville à la métrique cyclable : une solution pour la densification urbaine en Wallonie ?	Barbara STINGLHAMBER (ELIE)
17	Mapping water resources exposure of fate agricultural pesticides in the Lake of Guiers basin and environs (Senegal)	Alousseynou BAH (ELIE)
19	Tracking water limitation in photosynthesis with sun-induced chlorophyll fluorescence	Simon DE CANNIERE (ELIE)
21	Antagonistic activities of <i>Bacillus</i> spp. and <i>Paenibacillus</i> spp. against wheat pathogens	Louis MORANDINI (ELIM)



Friday, May 28, 2021

Poster number	Title	Names of presenter(s)
2	The plant water pump: Did vascular plants miss thermodynamics classes at school?	Valentin COUVREUR (ELIA)
4	Unravelling impact of Na ⁺ , Cl ⁻ and their respective transporter in detrimental effects of salt stress on the African rice species	Hermann PRODJINOTO (ELIA)
6	Unveil the modes of action of essential oils on the granary weevil <i>Sitophilus granarius</i> to develop new biocides	François RENOZ (ELIB)
8	Climate-ice sheet interactions during Marine Isotope Stage 11 (MIS-11), an interglacial 400,000 years ago	Benjamin VAN BOCXLAER (ELIC)
10	Spatial coevolution of malaria and schistosomiasis in Rwanda, Central Africa	Joseph TUYISHIMIRE (ELIC)
12	Mechanisms driving precipitation changes in North Africa	Arab DJEBBAR (ELIC)
14	Collecting and analysing historical data to empirically assess water pollution risks of Walloon catchments.	Elise VERSTRAETEN (ELIE)
16	Hydraulics of the soil-vine system in Walloon terroirs and influence on berry quality	Louis DELVAL (ELIE)
18	Factors driving cereal response to fertilizer microdosing in sub-saharan Africa: A meta-analysis	Yacouba OUEDRAOGO (ELIE)
20	Antagonistic activities of <i>Pseudomonas</i> spp. against wheat pathogens	Mathieu DELITTE (ELIM)
22	Acquisition and transfer of antibiotic resistance genes in organic amendments of animal origin	Marie VERHAEGEN (ELIM)



Posters abstracts



1 – Deciphering salinity resistance in *Amaranthus cruentus* in relation to its nutritional value: a bright future for an old plant

Adrien LUYCKX (adrien.luyckx@uclouvain.be) – ELIA

Supervisors: Stanley LUTTS, Muriel QUINET

Keywords: plant physiology, salinity, Amaranth, antioxidant, reproduction

Some amaranths (*Amaranthus* spp.) are valuable crops used either for leaf production (mainly in Africa) or seed production. *Amaranthus cruentus*, domesticated by Aztec civilization in Central America, is used for both purposes. It produces highly nutritive seeds with about 15% proteins whose amino acid profile is particularly suitable for human diet, 50-60% starch, dietary fibers and unsaturated fatty acids. Its leaves are rich in several essential minerals (e.g. Fe, Zn), vitamins and proteins. This species has been shown to be tolerant to several abiotic stresses, including drought, heat and salinity. Soil salinity, mainly caused by NaCl accumulation, is today a widespread problem that affects more than 800 million hectares (mainly in arid- and semi-arid areas) and is expected to worsen in the future decades. It is however urgent to keep these areas productive despite salinity because of the strong expected increase in food demand. Major staple crops (rice, wheat, soybean) breeding has been performed for a long time without consideration for this recent problem. Therefore, there is few genetic variability for salt-tolerance among these species. That is why some salt-tolerant and under-domesticated crops like amaranths gain more and more attention from agronomists and plant scientists as crop candidates that could be grown on salt-contaminated areas. In this context, it is necessary to better understand how *A. cruentus* copes with soil salinity. My PhD thesis project is divided into two main objectives: (1) deciphering the mechanisms underlying salt tolerance across several 'leaf' and 'grain' *A. cruentus* varieties, with physiological, proteomic and metabolomic approaches; (2) understanding how salinity modulates the nutritive qualities of seeds and leaves, including health-promoting metabolites. The project will include experiments in controlled environments (greenhouses at SeFy, UCLouvain) and field work on salt-contaminated areas in Benin.



2 – The plant water pump: Did vascular plants miss thermodynamics classes at school?

Valentin COUVREUR (valentin.couvreur@uclouvain.be) – ELIA

Supervisor: Xavier DRAYE

Keywords: modelling, root, water, thermodynamics, osmosis

Guttation is the exudation of xylem sap from vascular plant leaves. This process is particularly interesting because in its configuration root water uptake occurs against the hydrostatic pressure driving force. Hence, it emphasizes the contribution of another driving force that lifts water in plants: the osmotic potential gradient. The current paradigm of root water uptake explains that, due to the endodermal apoplastic barrier, water flows across root radius from the same principles as through selective membranes: driven by the total water potential gradient. This theory relies on the idea that during guttation, osmolites loaded in xylem vessels decrease xylem total water potential, making it more negative than the total soil water potential, and generating water inflow by osmosis as in an osmometer. However, this theory fails at explaining reported experiments in which guttation occurs without sufficient solute loading in root xylem of maize and arrowleaf saltbush among others; studies concluding that experimental observations “could not be explained with the current theories in plant physiology”. Such flow rates towards combined increasing pressure potentials and increasing osmotic potentials between separate apoplastic compartments would necessitate an effective root radial conductivity that is negative; a mind bender. What piece of hydraulic network would make it possible for water to flow against the total water potential driving force? We implemented Steudle’s composite water transport model in the explicit root cross-section anatomical hydraulic network MECHA. All apoplastic, transmembrane and symplastic pathways are interconnected in the network. The results show that while root radial conductivity is particularly sensitive to cell membrane permeability, the combination of conductive plasmodesmata and increased dilution of protoplast osmotic potentials inwards is a key to explain root water flow towards increasing total potentials. A triple cell theory is suggested as new paradigm of root radial flow.



3 – The impacts of the quality and the quantity of floral resources on the pollinator’s health

Léna JEANNEROD (lena.jeannerod@uclouvain.be) – ELIA

Supervisor: Anne-Laure JACQUEMART

Keywords: floral resources, pollinator health, agricultural landscapes

Intensification of human activities drives pollinator decline and leads to a loss of floral resources in the landscapes, especially in agriculture. However, pollinators have a major position in the ecosystem and are highly involved in agricultural production. Therefore, it is important to understand the influence of the structure and the diversity of the agricultural landscape on insects. This involves analysing the disponibility of floral ressources in order to stop the decline of pollinators on which they depend for their sustainability. In such biotopes, floral resources availability differs within the area and throughout foraging season. Having classified agricultural landscapes according to landscape elements and floral resources quantity, we will analyze the effect of abundance and the ressources diversity (nectar and pollen) on wild bees’ health (bumblebee and solitary bees). In addition, we will determine the conditions (landscape elements, climatic factors, and soil conditions) that influence disponibility, nutrional quality of floral ressources and their effect on health of wild bees. We will identify which resources are the most exploited by the pollinators according to the type of landscape in order to suggest beneficial plant species for bee conservation.



4 – Unravelling impact of Na⁺, Cl⁻ and their respective transporter in detrimental effects of salt stress on the African rice specie

Hermann PRODJINOTO (hermann.prodjimoto@uclouvain.be) – ELIA

Supervisor: Stanley LUTTS

Keywords: salt stress, *Oryza glaberrima*, sodium, chloride, transporter.

Salinity resistance of the African rice species (*Oryza glaberrima*) is poorly documented and the specific responses of the plant to Na⁺ and Cl⁻ toxic ions remain unknown. Moreover, the roles of Na⁺/H⁺ antiport and cation-chloride-cotransporter in salt stresses still remain unclear. In 1st experiment, two distinct cultivars TOG5307 and TOG5949 were maintained for 15 days on iso-osmotic nutrient solutions containing 50 mM NaCl, or a combination of Cl⁻ salts (Cl⁻ - dominant) or Na⁺ salts (Na⁺ - dominant). Plant water status, ion accumulation, gas exchange and fluorescence related parameters; carbon ($\Delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope discrimination were analyzed. TOG5307 exhibited a higher level of resistance than TOG5949 in terms of growth and photosynthesis maintenance and control of Cl⁻ and Na⁺ accumulation. NaCl was the most detrimental treatment, followed by Na⁺ -dominant treatment while Cl⁻ -treatment had the lowest effect. Impact of Na⁺ and Cl⁻ on considered parameters are additive. In 2nd experiment, the two contrasted cultivars (TOG5307 and TOG5949) were exposed during 3 days in nutrient solutions to 75 mM NaCl containing 100 μM amiloride (inhibitor of Na⁺-H⁺ antiporters) or 200 μM bumetanide (inhibitor cation-chloride-cotransporters). Amiloride increased Na⁺ accumulation in roots and leaves to a higher extent in salt-resistant TOG5307 than in salt-sensitive TOG5949. Bumetanide reduced Cl⁻ accumulation in both cultivars as well as K⁺ accumulation in TOG5307 and Na⁺ accumulation in TOG5949. Cultivars exhibiting contrasting levels of salinity resistance are available in *Oryza glaberrima* and salt-tolerant genotypes may constitute a valuable source of gene for classical rice improvement.



5 – Waterfrogs (*Pelophylax* spp.): a study at the intersection between systematics, biological invasions and emerging diseases

Christiane LEFEVRE-PERCSY (christiane.lefevre@uclouvain.be), Béranger WATERSCHOOT, Renate A. WESSELINGH – ELIB

Supervisor: Renate WESSELINGH

Keywords: waterfrogs, invasive species, mtDNA, phylogeography, chytridiomycosis

1- The genus *Pelophylax* covers a series of taxa that are not yet fully circumscribed, including hybridogenetic complexes. The indigenous water frog species in Wallonia are *Pelophylax lessonae* and *Pelophylax kl. esculentus*, which belongs to a hybridogenetic complex formed by *P. lessonae* and *Pelophylax ridibundus*. This latter taxon, as well as other taxa from central Europe and around the Mediterranean Sea, have been introduced in our region: they behave as invasives and threaten our two native species. Our study on the mitochondrial DNA of 144 frog samples from Wallonia revealed 9 waterfrog haplotypes, as well as the presence of hybrids between indigenous and exotic species. One of the discovered haplotypes is “bergeri”, with an Italian ancestry. The presence of this haplotype is surprising et could be due, not to a recent introduction, but to an ancient introgression of this Italian haplotype into a European lineage of *Pelophylax lessonae*.

2 - Chytridiomycosis is a fungal disease caused by *Batrachochytrium dendrobatidis* (Bd), which has caused the extinction of several amphibian populations in South and Central America, California and Australia. Bd is now widespread in Europe, but it doesn't cause the same damage there, and up to now, chytridiomycose had not been studied in Wallonia. The waterfrog samples collected for the first study were also analysed for the presence of Bd by A. Martel (Ghent University), and it turns out that the disease is present in Wallonia and found most frequently in Walloon Brabant. It appears that Bd is not specifically linked to exotic frog species, but more prevalent in urbanised areas.



6 – Unveil the modes of action of essential oils on the granary weevil *Sitophilus granarius* to develop new biocides

François RENOZ (francois.renoz@uclouvain.be) – ELIB

Supervisor: Thierry HANCE

Keywords: essential oils, insecticide, modes of action, proteomics, stored-product pest

In recent years, greater efforts have been made to develop healthier and more environmentally friendly pesticides to control insect pests. Because of their insecticidal properties, botanical essential oils (EOs) are a promising alternative to the use of synthetic insecticides. Within the framework of a public-private partnership, we evaluated the insecticidal activity of various EOs on the granary weevil *Sitophilus granarius* (Coleoptera: Curculionidae) in order to develop new biocides to control stored-product pests. Here, we present the methodology we developed to test a large array of EOs in the same experimental bioassay and in a standardized way. This method allowed us to show that *Gaultheria procumbens*, *Mentha arvensis* and *Eucalyptus dives* oils have a good potential in terms of toxicity/cost ratio for the further development of a plant-derived biocide. In the light of these results, we conducted experiments to determine the modes of action of *M. arvensis* EO on *S. granarius* adults. We found that the contact toxicity of the EO leads to rapid paralysis and altered walking behavior. Our label-free quantitative proteomics approach revealed that *M. arvensis* EO induces dramatic physiological changes and affect a variety of biological processes such as the development and functioning of the muscular and nervous systems, cellular respiration, protein synthesis, and detoxification. Our work is a first step towards the development of new biocides for alternative pest management strategies for stored products.



7 – Challenges and opportunities for the spatial analysis of georeferenced weather-related disasters

Rémi FROMENT (remi.froment@uclouvain.be) – ELIC

Supervisor: Sophie VANWAMBEKE

Keywords: georeferenced disasters, spatial analysis, floods

Each year, weather-related hazards kill thousands of people, and affect hundreds of thousands around the globe, resulting in human disasters. This situation is expected to worsen in the future with an increase in exposed populations in relation to climate change and population growth. A better understanding of the vulnerability of population to these events is crucial. The spatially explicit analysis of weather-related human disasters has great potential in understanding what turns these events into disasters, based on the spatial characteristics of hazard and exposure. Events recorded in the WHO-reference database of disasters EM-DAT are georeferenced backward until 2000, using administrative units down to level two, or alternatively level one. This database offers a unique opportunity to dwell into the potential of spatial analysis of the vulnerability of population exposed to weather-related human disasters. In this paper, we use the case study of georeferenced floods in 7 countries heavily affected by floods but with diverse geographic contexts. Based on the EM-DAT georeferenced disaster database and a set of standard geographic databases on risk and exposure, we estimate both the number of people exposed and affected by major floods during the period 2000-2019. We then compare the modelled estimate to the recorded number of people affected. These estimates allow us to study the vulnerability of the national population to floods. There are large discrepancies between estimated and recorded numbers of affected people. The relation between estimated and recorded numbers of affected people is not linear, the proportion of affected people compared to exposed people increase with the number of exposed people. These observations show the capability of global datasets to bring important information on how populations are affected by natural disasters and better define the concept of vulnerability to natural disaster. This work can shed light on determinants of vulnerability and on the challenges of using standard geodata and other georeferenced sources for spatial analysis.



8 – Climate-ice sheet interactions during Marine Isotope Stage 11 (MIS-11), an interglacial 400,000 years ago

Benjamin VAN BOCXLAER (benjamin.vanbocxlaer@uclouvain.be) – ELIC

Supervisor: Qiuzhen YIN

Keywords: ice sheet modelling, paleoclimate, MIS-11 interglacial, Northern Hemisphere ice sheets, Antarctica

Marine Isotope Stage (MIS) 11 has long been considered as a good analogue of our present interglacial and its future mainly due to a similar astronomical configuration. Numerous geological evidence show that MIS-11 was a “super” interglacial characterized by exceptional warmth and length as well as high-stand sea level and reduced ice sheets in Antarctica and Greenland as compared to today. However, both insolation and greenhouse gases concentration were not exceptionally high during MIS-11 even with a CO₂ concentration much lower than present-day. In this project, I aim to investigate the ice sheet-climate interactions during MIS-11, how different ice sheets in both hemispheres respond to different climate forcings and how they influence the global and regional climate. The research approach includes both ice sheet and climate modelling and paleoclimate proxy data analysis. Synthesis of paleoclimate records during MIS-11 will be made to provide a large picture of the MIS-11 climate and will also be used to compare with model results. The Antarctic and Northern Hemisphere (NH) ice sheets will first be simulated with standalone ice sheet models driven by outputs of the climate model (uncoupled mode). A NH ice sheet model will then be interactively coupled with the model LOVECLIM to develop a new and fully coupled ice sheet-climate model at the global scale. This coupled model will be used to simulate the ice sheets and climate during MIS-11, and the results will be compared with those obtained from the uncoupled mode to assess the effect of coupling. Finally, the future climate and ice sheets will be simulated by the same model and will be compared with those of MIS-11 to investigate the difference and similarity between the two periods.



9 – Modelling of interglacial paleosol development in the Chinese Loess Plateau

Keerthika Nirmani RANATHUNGA ARACHCHIGE (keerthika.ranathunga@uclouvain.be) – ELIC

Supervisors: Qiuzhen YIN, Peter FINKE

Keywords: loess-paleosol sequences, Chinese loess plateau, soil modelling, soil development

The loess-paleosols deposits in the Chinese Loess Plateau are a huge archive of a continuous record for paleoclimates. These loess-paleosols sequences have long been studied and correlated with modelled paleoclimates. However, measured soil data would not be straightforward to identify relations between modelled paleoclimate intensity and paleosol development, as five key soil-forming factors drive soil formation (“CLORPT”): Climate, Organisms, Relief, Parent material and Time. Therefore, not only the past climate (precipitation, temperature) has an effect on soil development, but also vegetation, interglacial duration and dust deposition play a vital role. Additionally, observed soil parameters may have been affected by pedogenetic overwriting in later periods. Therefore, we combine a dynamic climate and –soil model to identify important drivers for paleosol development. The intention of this research study is to identify the relative importance of soil-forming factors (temperature, precipitation, vegetation, interglacial duration and dust deposition) on soil development during each of the Quaternary interglacials (MIS-1, MIS-5, MIS-7, MIS-9, MIS-11 and MIS-13) over the past 500 kyr in the Chinese loess-paleosol sections.



10 – Spatial coevolution of malaria and schistosomiasis in Rwanda, Central Africa

Joseph TUYISHIMIRE (joseph.tuyishimire@student.uclouvain.be) – ELIC

Supervisors: Sophie VANWAMBEKE, Elias NYANDWI

Keywords: coevolution, malaria, schistosomiasis, Rwanda

The geographical location of Rwanda has created favourable environmental conditions for vector-borne diseases especially malaria and schistosomiasis. As both diseases remain a burden, the government has been putting efforts in their control through the mass administration of drugs and the interruption of contacts between vectors and hosts. The ecology of malaria vectors (*Anopheles* mosquito) and schistosomiasis intermediate host (*Bulinus* and *Biomphalaria* snails) having many commonalities, there is a high probability of their coevolution and therefore, joint interventions would be financially and technically efficient. Also, infection to schistosomiasis as well as other immunity-modulating parasites is hypothesized to affect the occurrence of asymptomatic malaria, the prevalence of which has been identified as an obstacle to efficient control. The ability to identify areas at highest risk of spatial co-evolution is thus highly relevant. The current study combined two knowledge-based models, the Resources-Based Habitat Concept (RBHC), and the Spatial Multicriteria Evaluation (SMCE) to model the coevolution of malaria and schistosomiasis in Rwanda. The determinants selected based on the RBHC were climate (temperature and precipitation), land cover, proximity to water bodies and wetlands, and demography (population density and population under 12 years old). They were integrated in the SMCE model with specific thresholds depending on the disease and the variable. The results showed that the east and south-eastern lowlands, the bottom south west and the western parts around Kivu lake were highly suitable to both malaria and schistosomiasis. The central plateaus were moderately suitable to both diseases. The western and northern highlands were either unsuitable or less suitable to both diseases except some schistosomiasis hotspots found around Burera-Ruhondo lakes in the north. The current study showed that areas with the same ecological conditions, referred to as “agro-ecological zones” in Rwanda, had approximately the same probability of malaria and schistosomiasis coevolution and therefore suggested location-specific joint intervention efforts would ease the epidemiological control and be resources-efficient.



11 – Non-response determinants and resulting biases in the analysis of the association between mental health and the urban environment in Brussels

Madeleine GUYOT (madeleine.guyot@uclouvain.be) – ELIC

Supervisors: Isabelle THOMAS, Sophie VANWAMBEKE

Keywords: mental health, non-response, urban morphometrics, urban fabric, Brussels

Analysing the link between the urban environment and mental health is a challenging exercise. This exercise is even more complicated because health surveys are always confronted with problems of incomplete data. In the case of the Belgian Health Interview Survey (BHIS), three types of non-response can be highlighted. (i) Initial nonresponse: refusal to participate in the survey, not addressed in this paper. (ii) Self-administered questionnaire (SAQ) nonresponse: for those over 15 years of age, the survey consists in two parts: a face-to-face interview and a SAQ (iii) Item nonresponse: some questions were not answered by the participants. In a sample of 4355 individuals (BHIS participants in 2008 and 2013, over 15yrs and resident for at least one year), 18% did not respond to the household income item. The SAQ is not available for 36.5% of participants: for 19%, SAQ is required but not available and for 17.5%, SAQ is not required and not available (when the interview is done by a proxy such as a parent). Non-response to mental health items ranged from 1% to 11%. If we analyse the sample of participants for whom the SAQ is available and who answered all mental health and socio-economic items, we have a sample of 1929 individuals (or 44% of the initial sample). This reduction of the sample induces a loss of power and bias in the analysis that is interesting to quantify. In this paper, the determinants of non-response are analysed, taking into account socio-economic as well as urban environmental factors. The resulting bias is analysed through the link between the urban environment and the mental health item "Self-reported depression" answered by 99% of the participants. This analysis highlights a major challenge: spatial, as well as socio-economic, distribution of this bias may be non-random, it is likely that it also affects the results.



12 – Mechanisms driving precipitation changes in North Africa

Arab DJEBBAR (arab.djebbar@uclouvain.be) – ELIC

Supervisor: Hugues GOOSSE

Keywords: numerical simulation, drought, precipitation, North Africa, climate change

Drought is a recurring phenomenon in North Africa, and extended dry periods can have a serious impact on economic and natural environment. Consequently, understanding the mechanisms underlying precipitation variability is a key driver of sustainable economic growth in activities such as agriculture and energy. Our interest is to improve water management by tracking, anticipating and responding to seasonal hydroclimate variability and climate changes. We analyze reanalysis data set and global climate models, to quantify the role of atmospheric circulation in North Africa precipitation response to the present climate as well as in future climate changes during the cold season (November–April). The results revealed that not only the transient eddies moisture flux which contributes to North Africa precipitation variability in present climate. Nonetheless, precipitation changes also depends on the atmospheric mean flow response as described by U850 index over North Africa. Under the future changes, the atmospheric moisture budget is also dependent on both the transient eddies and the mean flow convergence as in the present period. North Africa region is impacted differently from West to East and have distinct behavior than the whole Mediterranean region. The anticyclonic circulation, observed over the western part of North Africa in present climate, impacts differently, the pattern of the westerlies, going from the West to the East of North Africa. It deviates the atmospheric flux from North-West in the central and eastern parts which drives moisture and precipitation, to East in western parts, which drive aridification. Under future changes, both North African anticyclone as well as the eastern Mediterranean pressure anomaly, will impact not only North Africa western part, but all the three sub-regions. It will advect dry air from the Sahara and deviates the westerlies circulation towards North Europe and thus blocks moisture supply and causes more precipitation reduction over North Africa.



13 – Control of fermentation bio-physico-chemical conditions to produce biobased chemicals from agroindustrial residues

Grégoire HENRY (gregoire.henry@uclouvain.be) – ELIM

Supervisor: Patrick GERIN

Keywords: acidogenic fermentation, mixed microbial community, carboxylates platform, agroindustrial Residues

Our consumer society relies mainly on fossil carbon sources for the production of chemicals and fuels. The continuous population growth increases the resources consumption and the production of waste including biodegradable ones. To change these trends, the development of renewable technologies to transform our agroindustrial organic residues into high valuables bio-based platform chemicals at industrial scale is deeply required. An established recovery path for bio-waste valorization is Anaerobic Digestion (AD). It is a four steps microbial catalyzed process, by which, methane-rich biogas is produced. However, during the last few years, some studies have been carried out on the production of Medium Chain Carboxylic Acids (MCCAs) from the AD intermediary metabolites (alcohols and Short Chain Carboxylic Acids (SCCAs)). Indeed, under specific physicochemical fermentation conditions, some microorganisms, such as *Clostridium Kluyveri*, are able to use these intermediates as building block for MCCAs production, thanks to several metabolic elongation pathways. In contrast to pure culture, the use of an environmental Mixed Microbial Culture (MMC) naturally selected by the imposed conditions is much more profitable at industrial scale. Indeed, it does not need axenic culture conditions, can demonstrate resistance to operational upsets and is able to degrade complex feedstock's like organic residues due to their versatile metabolic capacity. MCCAs are more interesting than methane and SCCAs because they have a higher market value and are easier to extract from the broth owing to their higher hydrophobicity. Overall, MCCAs have a wide range of applications; they can be converted thanks to different kind of bio-, thermo-, or electrochemical process into bio-based alcohols, fuels, solvents and polymers. This thesis aims first at identifying, and then controlling, the key physicochemical parameters that allow to select the MCCA-producing microbial community and metabolism. It will then aim at continuously recovering the MCCAs and assess the technical and economic feasibility of the process at pilot scale.



14 – Collecting and analysing historical data to empirically assess water pollution risks of Walloon catchments

Elise VERSTRAETEN (elise.verstraeten@uclouvain.be) – ELIE

Supervisor: Marnik VANCLOOSTER

Keywords: data mining, time series analysis, water pollution, nitrates, pesticides

The EGERIEC project aims at evaluating and managing water catchment resources in Wallonia based on modern data mining techniques and on solutions oriented towards hydroecology and green infrastructures. This project is financed by the SPGE. The poster will present the progress on the first part of the project, which consists in finding possible pressures on water quality taking an empirical approach. As a first step a database has been created with existing historical data about the water quality, the hydrology, the external forcing, the land-use and the agricultural practices for five pilot water catchments. Time-series are constructed using the available data. The most recent data mining techniques for time series analysis are evaluated in order to detect the causal relations between the hypothetical pressures and the water quality. This is the first time to our knowledge that these data are analysed to unravel the pollution dynamics of Walloon water resources. The main take-away at this point of the project is that some relationships are found, however the time-series are for the moment too short or have too few time steps to make any robust conclusion.



15 – La Ville à la métrique cyclable : une solution pour la densification urbaine en Wallonie?

Barbara STINGLHAMBER (barbara.stinglhamber@uclouvain.be) – ELIE

Supervisors: Pierre DEFOURNY, Yves HANIN

Keywords: mobilité, transfert modal, aménagement du territoire, accessibilité cyclable

L'être humain voyage depuis toujours, avec le temps, son mode de transport a évolué et, avec lui, les tissus urbains. L'Histoire montre comment les villes se sont transformées avec l'arrivée de nouveaux modes de transport : de la construction, autours des centres piétons du Moyen-Âge, de voiries pour accueillir les chevaux et calèches à l'élaboration de voies de chemin de fer, permettant une dissociation des lieux de résidence et de travail. La généralisation de l'automobile après la Seconde Guerre mondiale a redessiné le territoire belge : la métrique automobile est devenue la norme urbanistique conduisant à l'étalement urbain. Aujourd'hui, une convergence de processus s'observe : évolution technologique, vision politique pour plus de mobilité douce, nouvelle représentation culturelle du déplacement en vélo, budget d'aide aux aménagements cyclable... Le vélo serait-il la prochaine norme modale ? Le projet de recherche tente d'alimenter les réflexions politiques sur la densification urbaine en offrant un outil d'aide à la décision construit en partant des besoins de l'utilisateur quotidien. Les objectifs de la recherche sont d'identifier :

- Les logiques de structuration de l'urbanisation des modes cyclables ? En étudiant la structure urbaine correspondant à une généralisation de métrique de la petite roue nécessitant d'identifier les nouveaux axes, les nouvelles infrastructures ainsi que les types d'activités à promouvoir autour de l'urbanisation destinée à la promotion du vélo ;
- Dans quelle mesure la métrique cyclable pourrait répondre aux besoins de densification urbaine en Wallonie ? En quantifiant la demande en espace de l'urbanisation en modes cyclables ;
- Comment ce mode de transport pourrait répondre aux besoins des navetteurs wallons ? Il s'agit d'éclairer les réflexions politiques sur la densification urbaine en offrant une vision de la ville orientée usagers s'adaptant à la métrique cyclable ;
- Comment intégrer la métrique cyclable dans les différentes stratégies de mobilité à diverses échelles (locale, provinciale, régionale).



16 – Hydraulics of the soil-vine system in Walloon terroirs and influence on berry quality

Louis DELVAL (louis.delval@uclouvain.be) – ELIE

Supervisors: Mathieu JAVAUX, François JONARD

Keywords: *Vitis vinifera*, belgian viticulture, hydraulics, terroir, fruit quality

Grapevine (*Vitis vinifera*) is one of the most economically important fruit crops worldwide and is cultivated in more than 90 countries nowadays. In ten years, the Belgian wine-growing area has more than quadrupled and this continues to increase. A reason is that drought events will be more frequent in Belgium, resulting from climate change. Grapevine has emerged as a model perennial fruit crop for the study of drought effects, as it affects hydraulics of the plant and fruit composition. There are numerous hydraulic traits that determine a vine's response to water availability: stomatal regulation, root characteristics, xylem architecture, aquaporin regulation, ABA dynamics and osmotic adjustment. All these traits can also be influenced by the grape variety, the rootstock, the soil, other environmental variables such as VPD and light, and their interactions, which also play important roles in the composition and quality of grapes. How different couples variety-rootstock respond to drought, in terms of hydraulics and fruit quality, remains an open and critical question. It is also unclear to what extent regulations of vine hydraulics result from innate genotypic traits or environmental factors. Numerous gaps remain in our understanding of the vine's behavior in oceanic temperate climate and how climate change could affect Belgian viticulture.



17 – Mapping water resources exposure of fate agricultural pesticides in the Lake of Guiers basin and environs (Senegal)

Alousseynou BAH (alousseynouh.bah@uclouvain.be) – ELIE

Supervisor: Marnik VANCLOOSTER

Keywords: exposure, water resources, GIS, Analytical Hierarchy process (AHP), agricultural pesticides

Water is essential for human life and for the socio-economic development of countries. However, it is a limited resource and highly vulnerable because of global changes. The high pressure on the Lake of Guiers basin requires a continuous assessment of water quality for the adequate management of the resource. The aim of this publication is to identify the potential sites of exposure of water resources to agricultural pesticides in the lake of Guiers basin by aggregating thematic layers in a GIS. For weighting the layers, the hierarchical analysis process (AHP) was used: Leaching (L), Sedimentation (S), Soil Storage and Infiltration Capacity (SS&FC), Surface Runoff-Generation (SR-G), Surface Runoff-Transfer (SR-T) and Surface Runoff-Accumulation (SR-A). The weights were assigned and normalized for each layer according to their spatial characteristics and their relationship with the exposure of the hydrological system being studied. According to this method, the surface waters are highly exposed to agricultural pesticides for 57%, moderate for 25% and low for 18% of the area of the Lake of Guiers basin. The groundwater is highly exposed to agricultural pesticides for 53%, moderate for 46% and low for 1% of the total basin surface. The results of the research are most relevant for the planning of the basin management, as they indicate the potential areas of exposure of water resources. The methodology based on logical conditions and generic data can be tested in all watersheds with appropriate adaptations.



18 – Factors driving cereal response to fertilizer microdosing in sub-saharan Africa: A meta-analysis

Yacouba OUEDRAOGO (yacouba.ouedraogo@student.uclouvain.be) – ELIE

Supervisor: Charles BIELDERS

Keywords: fertilizer microdosing, meta-analysis, variability in crop response

Fertilizer microdosing (FM) is being promoted in sub-Saharan Africa (SSA) to boost crop productivity on smallholder farms. This technique consists in applying small amounts of mineral fertilizer (2 to 6 g) in the planting holes at planting or next to the seedlings after emergence. However, yield response variability is a barrier to adoption. We conducted a meta-analysis to analyze the variability in cereal crop yield response to FM and to determine the main factors associated with this variability. Thirty publications pertaining to millet (*Pennisetum glaucum* (L.) R. Br.), sorghum (*Sorghum bicolor* L. Moench) or maize (*Zea mays* L.) were assessed. Factors analyzed were crop type, rainfall, soil texture, type and rate of fertilizer, and complementary practices. On average, FM improved millet, sorghum and maize crop yields by 68%. Yield response tended to increase with increasing rainfall. The largest yield gains were observed in medium-textured soils (81%) as compared to light (61%) and heavy-textured soils (30%). The combined application of N and P performed better than either element alone. Crop response tended to increase with increasing rates of N irrespective of soil type. In the case of P, this was true only on light textured-soils. On medium-textured soils, the response appeared independent of the rate of P. There was a synergetic effect of water conservation measures on the performance of FM, while combining FM with organic amendments decreased its performance. Results highlighted major trends in cereal crop response to FM that could be used to prioritize target areas. However, these may require additional, site-specific field experiments, especially for factors for which little data is currently available.



19 – Tracking water limitation in photosynthesis with sun-induced chlorophyll fluorescence

Simon DE CANNIÈRE (simon.decanriere@uclouvain.be) – ELIE

Supervisors: François JONARD, Pierre DEFOURNY

Keywords: chlorophyll fluorescence, SIF, drought stress, FLEX, photosynthesis

Sun-induced chlorophyll fluorescence (SIF) has an inherent link to photosynthesis. It is therefore very sensitive to subtle, stress-induced changes in photosynthetic activity. This study shows the evolution of the SIF emission of a yellow mustard stand grown in plant boxes under varying water supply and under varying meteorological conditions, causing changes in the evaporative demand. Affected by both plant physiological processes and by changes in the plant canopy structure, we combined the fluorescence measurements at different wavelengths with reflectance measurements to assess the effect of both components. Using the Fluorescence Correction Vegetation Index, we are able to separate the contribution of the vegetation structure and the plant physiology to the SIF signal. A decrease in water availability causes an instantaneous drop in the SIF emission at 760 nm (SIFA). This decrease is not shown in the SIF emission at 687 nm (SIFB). Because of the difference in behavior between the SIF emission at the two bands, their ratio is a promising metric for detecting a stress-induced reduction in photosynthetic activity. Soon after the decrease in SIFA, we notice structural changes in the canopy architecture. These structural changes cause additional changes in the SIFA emission. Due to the increase in the non-photochemical quenching component, the decrease in SIFA emission is associated with a decrease in the photochemical reflectance index (PRI). This presentation illustrates the relative importance of each process at every step of the plant's reaction to drought stress by means of field data collected over a mustard canopy.



20 – Antagonistic activities of *Pseudomonas* spp. against wheat pathogens

Mathieu DELITTE (mathieu.delitte@uclouvain.be) – ELIM

Supervisors: Claude BRAGARD, Jacques MAHILLON

Keywords: pseudomonas, biocontrol, wheat, phytopathology

Wheat is one of the major crops in Belgium. Nowadays, up to three fungicide treatments are still used each year to guarantee optimal yield. Nevertheless, the crop is facing the challenge to switch towards a more sustainable use of plant protection strategies, among which biocontrol agents offer a promising alternative. There is still work ahead to achieve crop protection level as efficient as the one offered by conventional phytosanitary products. This work aims at isolating and studying indigenous cereal associated-bacteria from the *Pseudomonas* genus, well known for their biocontrol abilities [1]. Three wheat and one spelt fields, managed under different cropping systems have been selected in Belgium. Each field was sampled at four different times during the 2019 season, resulting in the isolation of up to 700 strains from Walloon agricultural soils, roots, leaves and heads. Extensive in vitro screenings of antagonistic activities against *Zymoseptoria tritici* and *Fusarium graminearum* were performed in order to find isolates displaying a high biocontrol potential. A collection of 36 active *Pseudomonas* was obtained. Identification of the isolates was performed based on sequence analysis of the 16S rRNA, *gyrB*, *rpoB* and *rpoD* genes. The absence of genes potentially harmful to humans was also assessed. The potential for antagonistic metabolites was tested by PCR screening of the selected bacteria for genetic determinants. Additionally, in vitro assays for the detection of enzymatic activities involved in biocontrol or siderophore production were also performed. The proposed methodology provides a framework for rapid identification and selection of biocontrol agents of a given crop, thus confirming the interest of the developed approach [1].

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21 – Antagonistic activities of *Bacillus* spp. and *Paenibacillus* spp. against wheat pathogens

Louis MORANDINI (louis.morandini@uclouvain.be) – ELIM

Supervisors: Jacques MAHILLON and Claude BRAGARD

Keywords: *Bacillus* spp., *Paenibacillus* spp., biocontrol, wheat

Wheat is a major crop in Belgium. Nowadays, up to three fungicide treatments are used per season. Chemical fungicides are usually used to guarantee an optimal crop production. Yet ensuring a sustainable use of phytosanitary products is one of the greatest challenges of agriculture. Biocontrol agents might play a key role to face such challenge, but works are still needed to improve their efficiency and to equal those of chemical pesticides. This work aims at studying indigenous cereal associated-bacteria, with a particular focus on *Bacillus* spp. [1] and *Paenibacillus* spp., genera well known for their biocontrol properties, as observed in a previous campaign targeted on potato-associated bacteria [2]. Three wheat and one spelt fields managed under different crop systems, such as organic or conventional farming and with or without tilling, were selected. Each field was sampled at different times during the 2019 season resulting in the isolation of more than 500 strains from Walloon agricultural soils, cereal plants and seeds. Extensive in vitro screening of antagonistic activities against *Zymoseptoria tritici* and *Fusarium graminearum* were performed in order to select isolates displaying a high biocontrol potential. A collection of 53 active bacteria was obtained and most were isolated from roots and soil. Thirty-three *Bacillus* spp. and twenty *Paenibacillus* spp. were identified based on the 16S rRNA gene sequencing. They were also checked for the absence of genes potentially harmful to humans or honeybees. The potential for antagonistic metabolites was tested by PCR screening of the selected bacteria for genetic determinants and additionally by in vitro assays for the detection of enzymatic activity involved in biocontrol or siderophore production. The methodology carried out provides a framework for identification and selection of biocontrol agents, thus confirming the interest of the developed approach [2].

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22 – Acquisition and transfer of antibiotic resistance genes in organic amendments of animal origin

Marie VERHAEGEN (marie.verhaegen@uclouvain.be) – ELIM

Supervisor: Jacques MAHILLON

Keywords: antibiotics, antibiotic resistance, one health, manure, conjugation

Antibiotics are largely used in veterinary medicine to cure pathogenic infections but they have also been used as growth promoters for livestock in the past. Abuse of antibiotics in livestock animals brings out concerns about antibiotic resistant bacteria, antibiotic residues and antibiotic resistance genes (ARG) in manure. The spreading of manure on arable land may lead to dispersion of the aforementioned concerns in the environment and the exertion of a selective pressure for antibiotic resistance. An additional risk is that of antibiotic resistant bacteria circulation if ARG are located on mobile genetic elements, such as plasmids. These genes could then be transferred between bacteria from manure to crops and plants and finally to the consumers via food, or back to livestock via feeding. In this context, this study aims to characterize ARG transfer that can occur between manure and environmental (soil or plant) bacteria. For this purpose, several approaches have been adopted: i) analysis of the antibiotic resistant bacterial population in environmental samples (manure, soil after spreading of manure) through selection on several antibiotic combinations and 16S rRNA identification, ii) exploration of the influence of an environmental matrix on the transfer and mobilization rates of different known plasmids and iii) recovery of unknown conjugative plasmids carrying ARG from the environmental matrix itself with conjugation and mobilization experiments. The different approaches will be tested using both Gram-positive and Gram-negative conjugative systems. A detailed characterization of these conjugative plasmids (transfer rate and host spectrum) and their ARG will then be performed.

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