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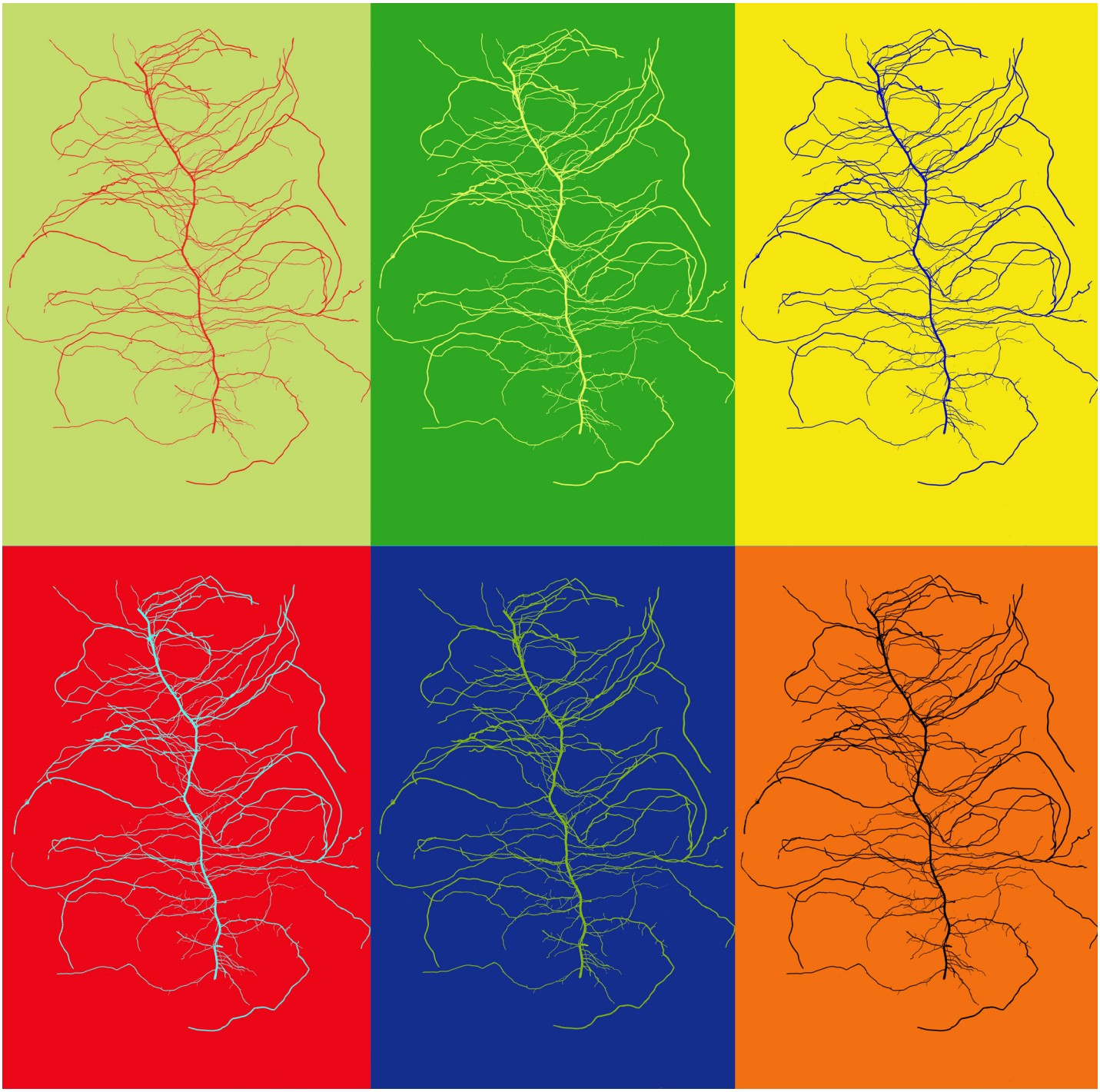
Zurich-Basel Plant Science Center

PlantScienceNews

No 42, Fall 2022



Editorial

Location matters

Biological processes are now seen as inherently spatial. On genomic level, genes are regulated in a multi- dimensional space. Topological configurations, chemical and physical frameworks guide gene expression and the formation of RNA and proteins. On cellular level, each cell's position within a tissue is important for its function. On plant level, the physical arrangement of plants has important implications not only for the plants themselves, but also for interacting organisms such as herbivores, pollinators and even microbes as shown by Tania Galindo-Castañeda on pages 8–9.
On ecosystem level, spatial analysis methods provide insights into composition and structure of vegetation, land surface processes and climate feedbacks. The practical use of spatial ecology research is essential to understanding the consequences of fragmentation and biodiversity loss.

This year's PSC Symposium will highlight the relevance of spatial plant research from the perspectives of the cellular – plant – ecosystem space, and even the outer space! We are particularly excited about this year's edition of the Symposium. After two years of online sessions, it will finally bring the whole Plant Science Center community back together on site (fingers crossed). Join us on the 7th of December 2022 and look forward to exiting talks given by a diverse panel of speakers.

In this edition, we also warmly welcome Gina Garland, Sara Simonini, Joëlle Schläpfer Sasse, Pengjuan Zu. All four received a PRIMA fellowship by the Swiss National Science Foundation and enrich our network with their creative research.

Simona Zahner and Malwina Kowalska introduce us to their science-based approach for urban green space design. Both founded the Spin-off *plantipolis* after participating in the feminno mentoring program.

Enjoy reading.

Sincerely,
Manuela Dahinden & Melanie Paschke, PSC Managing Directors

Content

PSC Managing Office: Manuela Dahinden, managing director research and outreach; **Melanie Paschke**, managing director education and science-society dialogue; **Romy Kohlmann**, finances, events and fellowship program coordinator; **Luisa Last**, coordinator PSC PhD programs & RESPONSE Doctoral Program; **Yvonne Möller-Steinbac**h (interim) coordinator PSC PhD programs; **Barbara Templ**, education specialist for data science; **Ning Wang**, education specialist for value-based design; **Daniela Gunz**, feminno program coordinator; **Juanita Schläpfer**, outreach manager; **Ulrike von Groll**, project coordinator: NACHTAKTIV; **Dubravka Vrdoljak,** project coordinator: Dialog im Quartier; **Sylvia Martinez**, coordinator Basel & Swiss Plant Science Web.

Open call

PSC-SYNGENTA FELLOWSHIP PROGRAM

This funding scheme promotes bottom-up and innovative research in plant sciences focusing on: **Climate change – challenges and opportunities in agriculture (or crop production)**. Topics may include:

- Develop knowledge & tools to better predict the effects of climate change on agriculture systems (at different spatial and temporal scales).
- Advance on fundamental & applied plant science to mitigate adverse climatic events and secure crop protection and crop production.
- Unearth new discoveries and inventions to feed the innovation process in sustainable crop protection / production.

Proposals for PhD or Post doc fellowships can be submitted until 1st of November 2022. Acceptance of research projects include a financial support of either CHF 225,000 for a PhD student (with an expected 4-years PhD duration)) or CHF 175,000 for a Post doc (max. 24 months). Research costs / consumables need to be co-funded by the applicants. A maximum of CHF 450,000 funding will be available for this call. Two projects will be selected. Please take into consideration that applicants of approved projects will have to accept the terms and conditions of the agreement between the three PSC partner universities and Syngenta Crop Protection AG. One proposal per applicant is recommended.

Contact: Manuela Dahinden, mdahinden@ethz.ch

www.plantsciences.ch/research/fellowships/syngenta.html

Awards

Sergei Schaub (former PSC-Mercator-Fellow) received the Hans Vontobel Prize for the best doctoral thesis in Agricultural Sciences entitled "Economic perspective on grasslands, biodiversity and weather extremes", supervised by Nina Buchmann and Robert Finger, ETH Zurich.

In recognition of her achievements **Nina Buchmann** received the Distinguished Alumni Award 2022 of the University of Utah School of Biological Sciences. In the 90s, Nina spent her postdoc at the University of Utah in the lab of Jim Ehleringer working on stable isotopes.

Mana Gharun was appointed Assistant Professor of the University of Münster in Germany. Mana had been a member of the grassland science team for the past 4.5 years. Nina Buchmann group.

New Joint Initiative 2022–2025 of the ETH-Domain: Engagement and Dialogue with Society

The Initiative "Engage – Evidence-based dialogue on trade-offs in wicked societal problems" aims to create a dialogue platform for scientists from different disciplines, public authorities, interest groups and associations, political parties and members of parliament. The objectives are:

- Establish a platform that creates trust between the scientific community and diverse stakeholders to enhance the dialogue on wicked societal problems.
- Make trade-offs related to complex societal challenges and their interdependencies transparent.
- Create collaboration between natural and social scientists to identify, grasp, present and discuss these trade-offs with stakeholders.
- Elaborate innovative tools to enable researchers and stakeholders to co-discuss and jointly learn about the trade-offs and ways of addressing them.
- Strengthen the capacity of academia to address such problems at the science-policy interface.

Contributing Institutions: EAWAG (Lead: Dr. Christian Stamm), EMPA, EPFL, ETHZ, WSL, WFSC, PSC, Agroscope, SCNAT (ProClim, Forum Biodiversität, Forum for Genetic Research), Oeschger Center for Climate Change Research

RESPONSE Doctoral Program

At a glance

The RESPONSE Doctoral Program (DP) is a joint doctoral program of ETH Zurich, University of Zurich and University of Basel. RESPONSE DP is centrally managed by the PSC in collaboration with the ETH competence centers: the World Food System Center (WFSC) and the Energy Science Center (ESC). Since the program`s launch in February 2020, 28 students have started their PhD projects. In this newsletter we introduce four fellows who started in Call 4 (pp. 5–7).

www.plantsciences.uzh.ch/en/research/fellowships/response.html

This program receives funding from the European Union's Horizon 2020 research and innovation program under the Marie Skłodowska-Curie grant agreement No 847585 – RESPONSE.

Citizen Consensus Conferences

The aim of these conferences is to engage researchers, practitioners, and citizens in a dialog on research, ideas, and innovations to become responsive to the needs of society. PhD students of the Response Doctoral Program present their research and discuss with the public. In 2023, PSC will organize a Citizen Consensus Conference on the topic of *Land use change*.

Previous conferences:

16 June 2022
Sustainable Energy System – Who will lead the way?
hosted by ESC, GreenBuzz & Siemens

https://blogs.ethz.ch/Science_and_Policy/2022/06/24/summary-from-response-thematic-event-sustainable-energy-system-who-will-lead-the-way/

2 June 2021
The need for climate resilient food systems
hosted by WFSC & GreenBuzz

Can plants switch on and off genes to rapidly adapt to a changing climate?
Danli Fei and Dusan Denic
https://video.ethz.ch/events/psc/veranstaltungen/response/b23733bd-d057-4f17-9554-e6633b1876de.html

What tools do plant breeders use to improve the resilience of crops?
Katharina Jung, Reah Gonzales, Yuanyuan Liang

https://video.ethz.ch/events/psc/veranstaltungen/response/ad3b7b61-4c80-451f-9cf6-27919e50f92b.html

Upcoming

RESPONSE Lunch-Event on "OpenAIRE and Open Access – Following EU regulations"
On 18th of November 2022, André Hoffmann will provide insight into publishing infrastructures and requirements. André is a specialist in the Data Services and Open Access office at the Main Library of the University of Zurich.
Participants will get insight how to deal with EU open data and open access obligations and dip into resources for increasing the visibility of research related outputs (e.g. ORCID, OpenAIRE, etc.). This event will be held online from 12 am to 2 pm.

Registration
https://doodle.com/meeting/participate/id/bW79Zjnb

3rd RESPONSE Annual Meeting
At this event we finally wish to bring together all program members and collaborators in person.

Wednesday, March 15, 2023
PhD Retreat (Part 1)
Keynote talk
Integration workshop
(organised by ESC)
Social event

Thursday, March 16, 2023
PhD Retreat (Part 2)
Keynote talk
Integration workshop
(organised by PSC)

Friday, March 17, 2023
Mentoring workshop
Board meeting

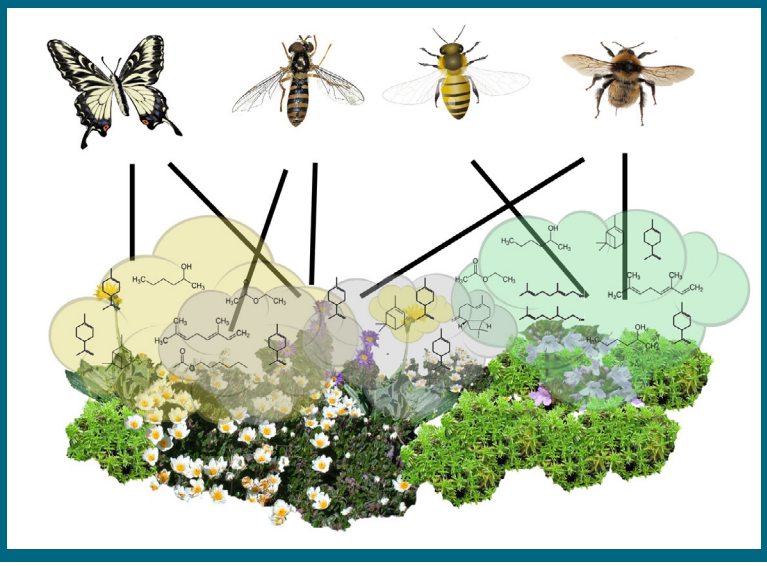
Roles of chemical communication in forming plant-insect networks in a changing world

Fellow: Roberto Rebollo Hernandez

PI: Dr. Pengjuan Zu, Department of Environmental Systems Science, ETH Zurich

Project Partner: Luis Lietha, Project manager in species and habitat conservation, Office for Nature and Environment Grisons, Switzerland

Plant-insect interactions constitute a paramount component of ecosystems, and they play a key role in the maintenance of biodiversity, ecosystem functioning, and ecosystem services. In the context of rapid global change and biodiversity loss, a deeper understanding of plant-insect interactions is especially relevant. Extensive work in chemical ecology has demonstrated the critical role of chemical traits of plants in modulating these interactions, by either deterring or attracting particular insect species. Most studies in chemical ecology have been conducted on a few species at a time. Biological communities, in contrast, are characterized by a diversity of species and interactions. However, the lack of practical and conceptual frameworks has hindered the development of scalable approaches capable of addressing community-level questions. For instance, what is the role of plant secondary metabolites in structuring species-rich trophic networks? To address this central question, our project will integrate an approach based on plant chemical traits, trophic networks, and information theory. Specifically, we are interested in the role of Volatile Organic Compounds (VOCs), and other traits that may convey information for insects (e.g., flower color), in shaping pollination networks in Alpine meadows. Together with the Cantonal Office for Nature and Environment of Grisons (Switzerland), we will translate our research results into a factsheet with recommendations for the management of the Alpine vegetation, with a focus on the role of chemical diversity for the conservation of local biodiversity, and its potential link to ecosystem services (e.g., pollination). Additionally, we will create opportunities for dissemination of our results with landholders, local organizations, and citizens interested in conservation.



The scent and colour of flowers are chemical traits that contribute to shape interactions between plants and pollinators. By studying Alpine meadows, we aim to integrate an information theory approach to understand the role of these traits in shaping pollination networks in diverse communities.

Policy designs for addressing societal acceptance challenges in Carbon Dioxide Removal (CDR)

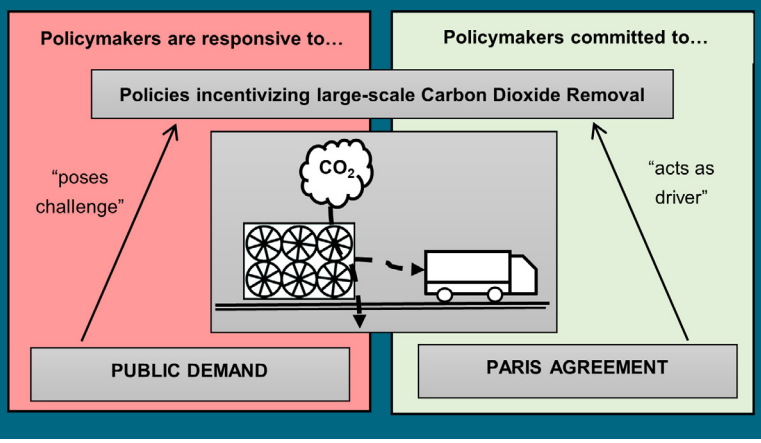
Fellow: Susanne Rhein

PI: Prof. Thomas Bernauer, Political Science, ETH Zurich, Institute of Science, Technology and Policy (ISTP)

Project partner: Brilé Anderson, Environmental Economist, OECD Sahel and West Africa Club

Removing carbon dioxide emissions from the atmosphere is essential for complying with the Paris Agreement's goal to limit global warming to well below two degrees. In order to remove CO_2 from the atmosphere a variety of methods can be applied ranging from biological (e.g., afforestation) to technological (e.g., direct air capture) solutions. The costs of biological Carbon Dioxide Removal (CDR) methods are usually low, but they only constitute temporary carbon sinks and often lack scalability. While technological CDR options can store removed carbon dioxide in the ground for thousands of years and are more scalable, implementation costs make this option economically uncompetitive for the time being. In addition, perceived risks associated with the storage of CO_2 in the ground raise public concerns. Therefore, this project relies on survey-embedded experiments to examine the feasibility of policy interventions that address these public acceptance challenges and aim at incentivizing technological CDR in Switzerland from a public opinion viewpoint.

Early public investment in technological CDR methods is essential to reduce costs, while large-scale deployment and the co-benefits associated with the technology will mainly occur in the second half of this century. Since people discount future benefits if short-term costs are high, this doctoral project assesses whether temporal discounting drives preferences for technological CDR deployment. Additionally, it identifies possible solutions to this public acceptance challenge by highlighting anomalies in citizens' discounting behavior (e.g., loss aversions, norms) and the role of policy design for preference formation. Perceived risks associated with the geological storage of CO_2 also raise concerns among the public, especially if they live close to potential storage sites. Therefore, political initiatives to promote cross-border transport and storage of CO_2 have become more common. The doctoral project engages in this debate by identifying under which conditions these political initiatives increase public acceptance among citizens in CO_2 exporting countries.



Policymakers' responsibilities stemming from the Paris Agreement incentivize policies for large-scale CDR deployment while public demand might counteract policy progress. In democratic countries, politicians are usually responsive to citizens' needs. For this reason, it is unlikely that the necessity for CDR deployment translates into political action if citizens disapprove of the policies used to deploy technological CDR. This highlights the relevance of research on public acceptance of policy interventions incentivizing technological CDR.

Effective policy mixes to mobilize finance along the CDR / CCS supply chain

Fellow: Katrin Sievert

PIs: Prof. Bjarne Steffen, Climate Finance and Policy, ETH Zurich, Department of Humanities, Social and Political Sciences, Center for Comparative and International Studies (CIS)

Project partner: Dr. Ivetta Gerasimchuk, Lead for Sustainable Energy Supplies, IISD-Europe

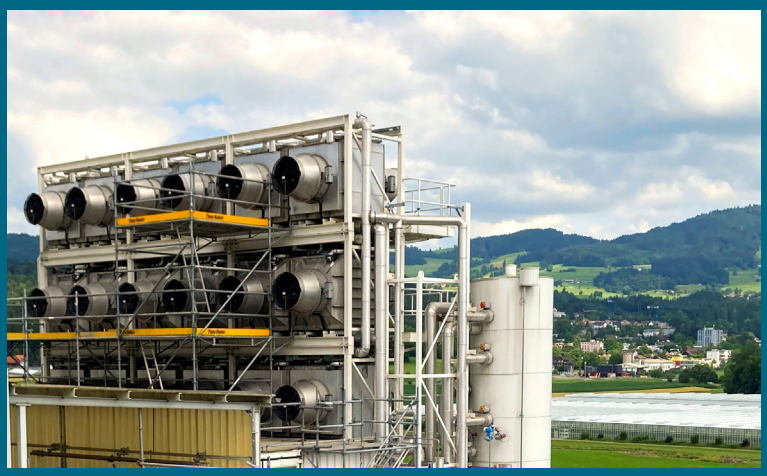
Carbon Dioxide Removal (CDR) and Carbon Capture and Storage (CCS) could in principle contribute to reaching the Paris Agreement goals of decarbonizing the economy by 2050 and keeping global warming below 1.5–2 °C. But major hurdles for large-scale deployment remain. Besides overcoming technical and logistical challenges, deploying technological CDR (such as Direct Air Capture) and CCS will require the mobilization of finance for the capital-intense technologies, and requires effective support policies to allow for investments into assets along the supply chains.

Specifically, this research project studies the large investment needs of technological CDR and CCS and the design of effective policies that are a necessity for finance flows towards such investments. The research project will collaborate with a larger project based at ETH Zurich on Negative Emissions Technologies, using their pilot as a case study.

Specifically, the work uses techno-economic modelling and expert interviews to study investment and financing needs along the supply chain of technological CDR and CCS and to evaluate appropriate financing sources. In a second step, the effectiveness of potential support instruments will be evaluated, using financial modelling of the risk/return effects of policies for investors.

In collaborating with the energy supply team of the International Institute for Sustainable Development, avenues and best practices for policy intervention will be readily experienced and discussed first-hand by the ESR during the secondment and thus incorporated in the research.

Finally, upon completion, the results of the quantitative and qualitative analysis will be published in scientific journals for future researchers to build upon and for other relevant industry stakeholders to reference.



Climework's first industrial-scale direct air capture plant in Hinwil has the capacity to capture 900 tons of CO_2 from the atmosphere per year.

© Katrin Sievert

Shape matters

The role of root architecture and anatomy in beneficial microbial associations

by Tania Galindo-Castañeda and Martin Hartmann

Microorganisms inhabiting the roots of crops actively participate in nutrient cycling, pest and disease regulation and resilience to abiotic stress tolerance. Therefore, the services that root microbes provide in agroecosystems are of major interest in the development of sustainable agriculture. However, we still do not understand the mechanisms of how microbes associate with roots and modulate plant resource uptake, and how plants regulate microbial associations in their roots in crops. Our research aims at identifying synergistic associations between root traits and beneficial microbiomes that may help crop plants to cope with abiotic stress conditions such as drought, low nutrient availability or soil compaction (Galindo-Castañeda et al., 2022).

Root physiology, biochemistry and genetics are being intensively studied as determinants of root microbial associations. An important but understudied layer of these associations is the interaction of root architectural and anatomical phenotypes with microbes. With our research we are trying to find associations between root anatomy and architecture that might be linked to specific beneficial or detrimental microbial taxa under contrasting levels of nutrients and water in maize. This research is important because plants in agricultural fields have indirectly evolved to adapt to agricultural management regimes and resource availabilities by changing root architecture and anatomy. Root ideotypes have been proposed as potential targets in plant breeding to select cultivars that forage for soil resources in more efficient ways. Rooting angle and depth, root branching, root cortical traits, epidermal and endodermal barriers, xylem vessel size and number are some of the architectural and anatomical traits that have been proposed as possible factors that determine plant adaptation to low resource availability in agricultural soils (Galindo-Castañeda et al., 2022). But the importance of these traits for beneficial microbial associations remains unclear and the following questions need to be addressed. *Are roots with contrasting root architectures and anatomies recruiting different microbes to the rhizosphere and root endosphere? Do adaptations in root traits change these associations with microbes? What is the root physiological mechanisms underlying such associations?*

In the project ROOTPHENOBIOME funded by the Horizon 2020 Marie Skłodowska-Curie action, we have tested the hypothesis that maize plants with contrasting root architecture and anatomy maintain contrasting root microhabitats that promote recruitment of different microorganisms (Figure 1). We first studied the distribution of microbes along the root system and the associations with root architectural and anatomical traits under suboptimal levels of nitrogen fertilization using a special mesocosm system and one inbred maize genotype (Figure 2). We subsequently studied the inter-genotype variation of root microbial communities

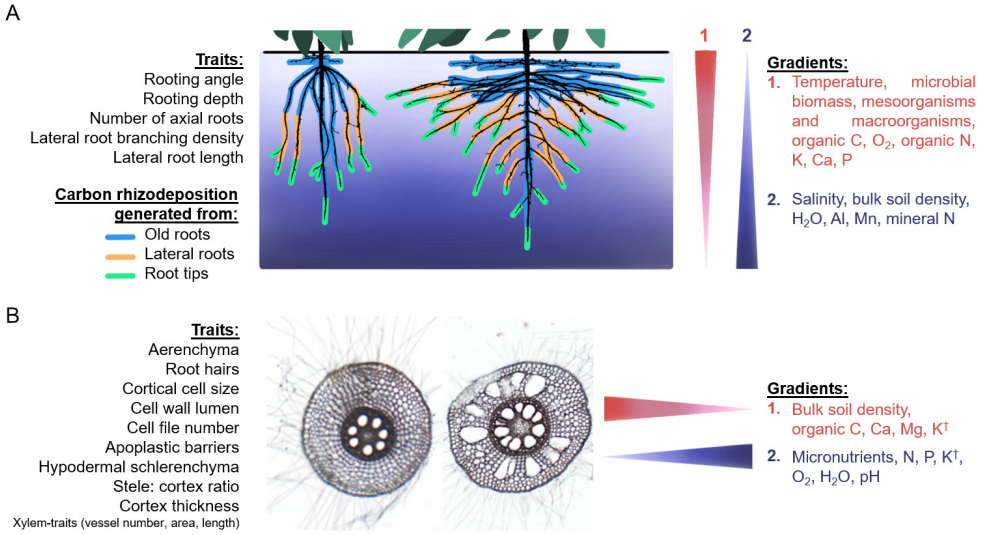


Figure 1. Hypothesized modifications of microhabitats in the endosphere and rhizosphere caused by vertical (A) and horizontal (B) soil gradients, shown as narrow triangles to indicate the direction of the gradient. (A) Two common-bean root systems with contrasting root architectures and hypothesized differences in carbon rhizodeposition. (B) Two root cross-sections of maize taken in the same spot within the root crown in two different plants showing differences in root anatomical traits. Anatomical traits and environmental gradients that we hypothesize to be related to microbial associations in the rhizosphere or endosphere are listed.

using four inbred genotypes with contrasting root anatomies and architectures under limited nitrogen availability. In both experiments, we are identifying plant metabolites associated with the presence and abundance of specific microbial taxa under the different nitrogen levels to understand possible mechanisms of root-microbe interactions.

Root-associated bacterial and archaeal communities differed in their composition between seminal and nodal roots as well as between nodal roots at 0-40 and 40-150 cm depth along the soil profile. Changes were observed across three different nitrogen levels (low, intermediate and high) with unique taxa enriched or depleted at each nitrogen level. Significant effects of lateral root branching density on community composition were observed both within a single genotype and across the four evaluated genotypes, regardless of the fertilization regime. Different root and shoot metabolic responses were observed across N levels and genotypes. Significant taxa-phenotype and taxa-metabolite associations are currently being explored to reveal possible mechanisms of associations of microbes with roots under limited nitrogen availability and the implications of these associations for nitrogen cycling.

Outlook

We continue to study other aspects of root-microbe associations such as the interactions with anatomical, architectural and physiological traits under drought and low phosphorus with two new research projects recently funded by ETH and the Swiss National Science Foundation. Our results will inform plant breeding and microbiome engineering efforts about the possible synergies and tradeoffs of selecting plants with adaptive root traits under abiotic stress. This knowledge is crucial to harness the plant growth promoting capacities of root-associated microbes in a more efficient and sustainable fashion to face the challenges of modern agriculture.

Reference

Galindo-Castañeda, T., Lynch, J.P., Six, J., and Hartmann, M. (2022). Improving Soil Resource Uptake by Plants Through Capitalizing on Synergies Between Root Architecture and Anatomy and Root-Associated Microorganisms. Front. Plant Sci., 577.

Tania is postdoc and Martin senior researcher in the group of Sustainable Agroecosystems at the Department of Environmental Systems Science at ETH Zurich, Switzerland.

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Figure 2. Mesocosm system to study the spatial distribution of microbes along the root system and their interactions with specific root traits under suboptimal nitrogen fertilization. © Hannier Pulido and Tania Galindo.

Science (2022)
https://doi.org/10.1126/science.abf2232

A keystone gene underlies the persistence of an experimental food web

Matthew A. Barbour, Daniel J. Kliebenstein, Jordi Bascompte

Genes encode information that determines an organism's fitness. Yet we know little about whether genes of one species influence the persistence of interacting species in an ecological community. Here, we experimentally tested the effect of three plant defense genes on the persistence of an insect food web and found that a single allele at a single gene promoted coexistence by increasing plant growth rate, which in turn increased the intrinsic growth rates of species across multiple trophic levels. Our discovery of a "keystone gene" illustrates the need to bridge between biological scales, from genes to ecosystems, to understand community persistence.

Nature Microbiology (2022)
https://doi.org/10.1038/s41564-022-01132-w

Mapping phyllosphere microbiota interactions in planta to establish genotype-phenotype relationships

Martin Schaefer, Christine M. Vogel, Miriam Bortfeld-Miller, Maximilian Mittelviefhaus, Julia A. Vorholt

Host-associated microbiomes harbour hundreds of bacterial species that co-occur, creating the opportunity for manifold bacteria-bacteria interactions, which in turn contribute to the overall community structure. The mechanisms that underlie this self-organization among bacteria remain largely elusive. Here, we studied bacterial interactions in the phyllosphere microbiota. We screened for microbial interactions in planta by adding 200 endogenous strains individually to a 15-member synthetic community and tracking changes in community composition upon colonization of the model plant *Arabidopsis*. Ninety percent of the identified interactions in planta were negative, and phylogenetically closely related strains elicited consistent effects on the synthetic community, providing support for trait conservation. Community changes could be largely explained by binary interactions; however, we also identified a higher-order interaction of more than two interacting strains. We further focused on a prominent interaction between two members of the Actinobacteria. In the presence of Aeromicrobium Leaf245, the population of Nocardioides Leaf374 was reduced by almost two orders of magnitude. We identified a potent antimicrobial peptidase in Aeromicrobium Leaf245, which resulted in Nocardioides Leaf374 lysis. A respective Leaf245 mutant strain was necessary and sufficient to restore Nocardioides colonization in planta, demonstrating that direct bacteria-bacteria interactions were responsible for the population shift originally observed. Our study highlights the power of synthetic community screening and uncovers a strong microbial interaction that occurs despite a spatially heterogeneous environment.

Nature Sustainability (2022)
https://doi.org/10.1038/s41893-022-00881-0

Strategy games to improve environmental policymaking

Claude A. Garcia, Sin Savilaakso, Rene W. Verburg, Natasha Stoudmann, Philipp Fernbach, et al.

While the scientific community documents environmental degradation and develops scenarios to identify the operational margins of system Earth, less attention is given to how decisions are made that steer the system in one direction or the other. We propose to use strategy games for this purpose, increasing the representation of human agency in scenario development and creating spaces for deliberation between different worldviews. Played by the right people, strategy games could help break free from established norms and support more transparent democratic dialogues, responding to the human and social limitations of current decision-making. The question is, who gets to play?

Trends In Plant Science (2022)
https://doi.org/10.1016/j.tplants.2022.02.003

Plant biodiversity promotes sustainable agriculture directly and via belowground effects

Seraina L. Cappelli, Luiz A. Domeignoz-Horta, Viviana Loaiza, Anna-Liisa Laine

While the positive relationship between plant biodiversity and ecosystem functioning (BEF) is well established, the extent to which this is mediated via belowground microbial processes is poorly understood. Growing evidence suggests that plant community structure influences soil microbial diversity, which in turn promotes functions desired for sustainable agriculture. Here, we outline the 'plant-directed' and soil microbe-mediated mechanisms expected to promote positive BEF. We identify how this knowledge can be utilized in plant diversification schemes to maximize ecosystem functioning in agroecosystems, which are typically species poor and sensitive to biotic and abiotic stressors. In the face of resource overexploitation and global change, bridging the gaps between biodiversity science and agricultural practices is crucial to meet food security in the Anthropocene.

Nature Ecology & Evolution (2022)
https://doi.org/10.1016/j.molcel.2021.07.029

Agricultural management and pesticide use reduce the functioning of beneficial plant symbionts

Anna Edlinger, Gina Garland, Kyle Hartman, Samiran Banerjee, Florine Degrune, et al.

Phosphorus (P) acquisition is key for plant growth. *Arbuscular mycorrhizal* fungi (AMF) help plants acquire P from soil. Understanding which factors drive AMF-supported nutrient uptake is essential to develop more sustainable agroecosystems. Here we collected soils from 150 cereal fields and 60 non-cropped grassland sites across a 3,000 km trans-European gradient. In a greenhouse experiment, we tested the ability of AMF in these soils to forage for the radioisotope P-33 from a hyphal compartment. AMF communities in grassland soils were much more efficient in acquiring P-33 and transferred 64 % more P-33 to plants compared with AMF in cropland soils. Fungicide application best explained hyphal P-33 transfer in cropland soils. The use of fungicides and subsequent decline in AMF richness in croplands reduced P-33 uptake by 43 %. Our results suggest that land-use intensity and fungicide use are major deterrents to the functioning and natural nutrient uptake capacity of AMF in agroecosystems.

Nature Ecology & Evolution (2022)
https://doi.org/10.1038/s41559-022-01663-9

Alternative stable states of the forest mycobiome are maintained through positive feedbacks

Colin Averill, Claire Fortunel, Daniel S. Maynard, Johan van den Hoogen, Michael C. Dietze, Jennifer M. Bhatnagar, Thomas W. Crowther

Most trees on Earth form a symbiosis with either arbuscular mycorrhizal or ectomycorrhizal fungi. By forming common mycorrhizal networks, actively modifying the soil environment and other ecological mechanisms, these contrasting symbioses may generate positive feedbacks that favour their own mycorrhizal strategy (that is, the con-mycorrhizal strategy) at the expense of the alternative strategy. Positive con-mycorrhizal feedbacks set the stage for alternative stable states of forests and their fungi, where the presence of different forest mycorrhizal strategies is determined not only by external environmental conditions but also mycorrhiza-mediated feedbacks embedded within the forest ecosystem. Here, we test this hypothesis using thousands of US forest inventory sites to show that arbuscular and ectomycorrhizal tree recruitment and survival exhibit positive con-mycorrhizal density dependence. Data-driven simulations show that these positive feedbacks are sufficient in magnitude to generate and maintain alternative stable states of the forest mycobiome. Given the links between forest mycorrhizal strategy and carbon sequestration potential, the presence of mycorrhizal-mediated alternative stable states affects how we forecast forest composition, carbon sequestration and terrestrial climate feedbacks.

Nature Communications (2022)
https://doi.org/10.1038/s41467-022-30954-9

Drought-exposure history increases complementarity between plant species in response to a subsequent drought

Yuxin Chen, Anja Vogel, Cameron Wagg, Tianyang Xu, Maitane Iturrate-Garcia, Michael Scherer-Lorenzen, Alexandra Weigelt, Nico Eisenhauer, Bernhard Schmid

Growing threats from extreme climatic events and biodiversity loss have raised concerns about their interactive consequences for ecosystem functioning. Evidence suggests biodiversity can buffer ecosystem functioning during such climatic events. However, whether exposure to extreme climatic events will strengthen the biodiversity-dependent buffering effects for future generations remains elusive. We assess such transgenerational effects by exposing experimental grassland communities to eight recurrent summer droughts versus ambient conditions in the field. Seed offspring of 12 species are then subjected to a subsequent drought event in the glasshouse, grown individually, in monocultures or in 2-species mixtures. Comparing productivity between mixtures and monocultures, drought-selected plants show greater between-species complementarity than ambient-selected plants when recovering from the subsequent drought, causing stronger biodiversity effects on productivity and better recovery of drought-selected mixtures after the drought. These findings suggest exposure to recurrent climatic events can improve ecosystem responses to future events through transgenerational reinforcement of species complementarity.

Nature Communications (2022)
https://doi.org/10.1038/s41467-022-30888-2

Global relationships in tree functional traits

Daniel S. Maynard, Lalasia Bialic-Murphy, Constantin M. Zohner, Colin Averill, Johan van den Hoogen, Haozhi Ma, Lidong Mo, Gabriel R. Smith, … Thomas W. Crowther

Due to massive energetic investments in woody support structures, trees are subject to unique physiological, mechanical, and ecological pressures not experienced by herbaceous plants. Despite a wealth of studies exploring trait relationships across the entire plant kingdom, the dominant traits underpinning these unique aspects of tree form and function remain unclear. Here, by considering 18 functional traits, encompassing leaf, seed, bark, wood, crown, and root characteristics, we quantify the multidimensional relationships in tree trait expression. We find that nearly half of trait variation is captured by two axes: one reflecting leaf economics, the other reflecting tree size and competition for light. Yet these orthogonal axes reveal strong environmental convergence, exhibiting correlated responses to temperature, moisture, and elevation. By subsequently exploring multidimensional trait relationships, we show that the full dimensionality of trait space is captured by eight distinct clusters, each reflecting a unique aspect of tree form and function. Collectively, this work identifies a core set of traits needed to quantify global patterns in functional biodiversity, and it contributes to our fundamental understanding of the functioning of forests worldwide.

Nature Communications (2022)
https://doi.org/10.1038/s41467-022-31414-0

Mutations in DNA polymerase delta subunit 1 co-segregate with CMD2-type resistance to Cassava Mosaic Geminiviruses

Yi-Wen Lim, Ben N. Mansfeld, Pascal Schläpfer, Kerrigan B. Gilbert, ...Wilhelm Gruissem, Rebecca S. Bart

Cassava mosaic disease (CMD) suppresses cassava yields across the tropics. The dominant CMD2 locus confers resistance to cassava mosaic geminiviruses. It has been reported that CMD2-type landraces lose resistance after regeneration through de novo morphogenesis. As full genome bisulfite sequencing failed to uncover an epigenetic mechanism for this loss of resistance, whole genome sequencing and genetic variant analysis was performed and the CMD2 locus was fine-mapped to a 190 kilobase interval. Collectively, these data indicate that CMD2-type resistance is caused by a nonsynonymous, single nucleotide polymorphism in DNA polymerase delta subunit 1 (MePOLD1) located within this region. Virus-induced gene silencing of MePOLD1 in a CMD-susceptible cassava variety produced a recovery phenotype typical of CMD2-type resistance. Analysis of other CMD2-type cassava varieties identified additional candidate resistance alleles within MePOLD1. Genetic variation of MePOLD1, therefore, could represent an important genetic resource for resistance breeding and/or genome editing, and elucidating mechanisms of resistance to geminiviruses.

Nature Communications (2022)
https://doi.org/10.1038/s41467-022-30013-3

Competition contributes to both warm and cool range edges

Shengman Lyu and Jake M. Alexander

Competition plays an important role in shaping species' spatial distributions. However, it remains unclear where and how competition regulates species' range limits. In a field experiment with plants originating from low and high elevations and conducted across an elevation gradient in the Swiss Alps, we find that both lowland and highland species can better persist in the presence of competition within, rather than beyond, their elevation ranges. These findings suggest that competition helps set both lower and upper elevation range limits of these species. Furthermore, the reduced ability of pairs of lowland or highland species to coexist beyond their range edges is mainly driven by diminishing niche differences; changes in both niche differences and relative fitness differences drive weakening competitive dominance of lowland over highland species with increasing elevation. These results highlight the need to account for competitive interactions and investigate underlying coexistence mechanisms to understand current and future species distributions.

Science Advances (2022)
https://doi.org/10.1126/sciadv.abl9734

Impairment of the cellulose degradation machinery enhances Fusarium oxysporum virulence but limits its reproductive fitness

Francisco M. Gamez-Arjona, Stefania Vitale, Aline Voxeur, Susanne Dora, Sascha Mueller, Gloria Sancho-Andres, Juan Carlos Montesinos, Antonio Di Pietro, Clara Sanchez-Rodriguez

Fungal pathogens grow in the apoplastic space, in constant contact with the plant cell wall (CW) that hinders microbe progression while representing a source of nutrients. Although numerous fungal CW modifying proteins have been identified, their role during host colonization remains underexplored. Here, we show that the rootinfecting plant pathogen *Fusarium oxysporum* (Fo) does not require its complete arsenal of cellulases to infect the host plant. Quite the opposite: Fo mutants impaired in cellulose degradation become hypervirulent by enhancing the secretion of virulence factors. On the other hand, the reduction in cellulase activity had a severe negative effect on saprophytic growth and microconidia production during the final stages of the Fo infection cycle. These findings enhance our understanding of the function of plant CW degradation on the outcome of host-microbe interactions and reveal an unexpected role of cellulose degradation in a pathogen's reproductive success.

EMBO Journal (2022)
https://doi.org/10.15252/embj.2022110741

Ca^{2+} signals in plant immunity

Philipp Koster, Thomas A. DeFalco, Cyril Zipfel

Calcium ions function as a key second messenger ion in eukaryotes. Spatially and temporally defined cytoplasmic Ca^{2+} signals are shaped through the concerted activity of ion channels, exchangers, and pumps in response to diverse stimuli; these signals are then decoded through the activity of Ca^{2+}-binding sensor proteins. In plants, Ca^{2+} signaling is central to both pattern- and effector-triggered immunity, with the generation of characteristic cytoplasmic Ca^{2+} elevations in response to potential pathogens being common to both. However, despite their importance, and a long history of scientific interest, the transport proteins that shape Ca^{2+} signals and their integration remain poorly characterized. Here, we discuss recent work that has both shed light on and deepened the mysteries of Ca^{2+} signaling in plant immunity.

Plant Cell (2022)
https://doi.org/10.1093/plcell/koac040

Plant-microbe interactions in the apoplast: Communication at the plant cell wall

Susanne Dora, Oliver M. Terrett, Clara Sanchez-Rodriguez

The apoplast is a continuous plant compartment that connects cells between tissues and organs and is one of the first sites of interaction between plants and microbes. The plant cell wall occupies most of the apoplast and is composed of polysaccharides and associated proteins and ions. This dynamic part of the cell constitutes an essential physical barrier and a source of nutrients for the microbe. At the same time, the plant cell wall serves important functions in the interkingdom detection, recognition, and response to other organisms. Thus, both plant and microbe modify the plant cell wall and its environment in versatile ways to benefit from the interaction. We discuss here crucial processes occurring at the plant cell wall during the contact and communication between microbe and plant. Finally, we argue that these local and dynamic changes need to be considered to fully understand plant-microbe interactions.

Environment International (2022)
https://doi.org/10.1016/j.envint.2022.107252

No evidence for impaired solitary bee fitness following pre-flowering sulfoxaflor application alone or in combination with a common fungicide in a semi-field experiment

Janine Melanie Schwarz, Anina C. Knauer, Matthew J. Allan, Robin R. Dean, Jaboury Ghazoul, Giovanni Tamburinie, Dimitry Wintermantel, Alexandra-Maria Klein, Matthias Albrecht

Pesticide exposure is considered a major driver of pollinator decline and the use of neonicotinoid insecticides has been restricted by regulatory authorities due to their risks for pollinators. Impacts of new alternative sulfoximine-based compounds on solitary bees and their potential interactive effects with other commonly applied pesticides in agriculture remain unclear. Here, we conducted a highly replicated full-factorial semi-field experiment with the solitary bee *Osmia bicornis*, an important pollinator of crops and wild plants in Europe, and *Phacelia tanacetifolia* as a model crop. We show that spray applications of the insecticide sulfoxaflor (product Closer) and the fungicide azoxystrobin (product Amistar), both alone and combined, had no significant negative impacts on adult female survival or the production, mortality, sex ratio and body size of offspring when sulfoxaflor was applied five days before crop flowering. Our results indicate that for *O. bicornis* (1) the risk of adverse impacts of sulfoxaflor (Closer) on fitness is small when applied at least five days before crop flowering and (2) that azoxystrobin (Amistar) has a low potential of exacerbating sulfoxaflor effects under field-realistic conditions.

Nature Plants (2022)
https://doi.org/10.1038/s41477-022-01134-w

A conserved module regulates receptor kinase signalling in immunity and development

Thomas A. DeFalco, Pauline Anne, Sean R. James, Andrew C. Willoughby, Florian Schwanke, Oliver Johanndrees, Yasmine Genolet, Paul Derbyshire, Qian Wang, Surbhi Rana, Anne-Marie Pullen, Frank L. H. Menke, Cyril Zipfel, Christian S. Hardtke & Zachary L. Nimchuk

Ligand recognition by cell-surface receptors underlies development and immunity in both animals and plants. Modulating receptor signalling is critical for appropriate cellular responses but the mechanisms ensuring this are poorly understood. Here, we show that signalling by plant receptors for pathogen-associated molecular patterns (PAMPs) in immunity and CLAVATA3/EMBRYO SURROUNDING REGION-RELATED peptides (CLEp) in development uses a similar regulatory module. In the absence of ligand, signalling is dampened through association with specific type-2C protein phosphatases. Upon activation, PAMP and CLEp receptors phosphorylate divergent cytosolic kinases, which, in turn, phosphorylate the phosphatases, thereby promoting receptor signalling. Our work reveals a regulatory circuit shared between immune and developmental receptor signalling, which may have broader important implications for plant receptor kinase-mediated signalling in general.

Nature Climate Change (2022)
https://doi.org/10.1038/s41558-022-01381-x

Climate change reshuffles northern species within their niches

Laura H. Antão, Benjamin Weigel, Giovanni Strona, Maria Hällfors, Elina Kaarlejärvi, Tad Dallas, Øystein H. Opedal, Janne Heliölä, Heikki Henttonen, Otso Huitu, Erkki Korpimäki, Mikko Kuussaari, Aleksi Lehikoinen, Reima Leinonen, Andreas Lindén, Päivi Merilä, Hannu Pietiäinen, Juha Pöyry, Maija Salemaa, Tiina Tonteri, Kristiina Vuorio, Otso Ovaskainen, Marjo Saastamoinen, Jarno Vanhatalo, Tomas Roslin, Anna-Liisa Laine

Climate change is a pervasive threat to biodiversity. While range shifts are a known consequence of climate warming contributing to regional community change, less is known about how species' positions shift within their climatic niches. Furthermore, whether the relative importance of different climatic variables prompting such shifts varies with changing climate remains unclear. Here we analysed four decades of data for 1,478 species of birds, mammals, butterflies, moths, plants and phytoplankton along a 1,200 km high latitudinal gradient. The relative importance of climatic drivers varied non-uniformly with progressing climate change. While species turnover among decades was limited, the relative position of species within their climatic niche shifted substantially. A greater proportion of species responded to climatic change at higher latitudes, where changes were stronger. These diverging climate imprints restructure a full biome, making it difficult to generalize biodiversity responses and raising concerns about ecosystem integrity in the face of accelerating climate change.

New Phytologist (2022)
https://doi.org/10.1111/nph.18065

Lack of hydraulic recovery as a cause of post-drought foliage reduction and canopy decline in European beech

Matthias Arend, Roman Mathias Link, Cedric Zahnd, Günter Hoch, Bernhard Schuldt, Ansgar Kahmen

European beech (*Fagus sylvatica*) was among the most affected tree species during the severe 2018 European drought. It not only suffered from instant physiological stress but also showed severe symptoms of defoliation and canopy decline in the following year.

To explore the underlying mechanisms, we used the Swiss-Canopy-Crane II site and studied in branches of healthy and symptomatic trees the repair of hydraulic function and concentration of carbohydrates during the 2018 drought and in 2019.

We found loss of hydraulic conductance in 2018, which did not recover in 2019 in trees that developed defoliation symptoms in the year after drought. Reduced branch foliation in symptomatic trees was associated with a gradual decline in wood starch concentration throughout summer 2019. Visualization of water transport in healthy and symptomatic branches in the year after the drought confirmed the close relationship between xylem functionality and supported branch leaf area. Our findings showed that embolized xylem does not regain function in the season following a drought and that sustained branch hydraulic dysfunction is counterbalanced by the reduction in supported leaf area. It suggests acclimation of leaf development after drought to mitigate disturbances in canopy hydraulic function.

Nature Plants (2022)
https://doi.org/10.1111/nph.18065

Two-step regulation of centromere distribution by condensin II and the nuclear envelope proteins

Takuya Sakamoto, Yuki Sakamoto, Stefan Grob, Daniel Slane, Tomoe Yamashita, Nanami Ito, Yuka Oko, Tomoya Sugiyama, Takumi Higaki, Seiichiro Hasezawa, Maho Tanaka, Akihiro Matsui, Motoaki Seki, Takamasa Suzuki, Ueli Grossniklaus, Sachihiro Matsunaga

The arrangement of centromeres within the nucleus differs among species and cell types. However, neither the mechanisms determining centromere distribution nor its biological significance are currently well understood. In this study, we demonstrate the importance of centromere distribution for the maintenance of genome integrity through the cytogenic and molecular analysis of mutants defective in centromere distribution. We propose a two-step regulatory mechanism that shapes the non-Rabl-like centromere distribution in *Arabidopsis thaliana* through condensin II and the linker of the nucleoskeleton and cytoskeleton (LINC) complex. Condensin II is enriched at centromeres and, in cooperation with the LINC complex, induces the scattering of centromeres around the nuclear periphery during late anaphase/telophase. After entering interphase, the positions of the scattered centromeres are then stabilized by nuclear lamina proteins of the CROWDED NUCLEI (CRWN) family. We also found that, despite their strong impact on centromere distribution, condensin II and CRWN proteins have little effect on chromatin organization involved in the control of gene expression, indicating a robustness of chromatin organization regardless of the type of centromere distribution.

PRIMA Fellow Gina Garland, ETH Zurich

View of growth chamber trial with carrot and spinach plants growing in African soils with various human excreta-derived fertilizers.

© Gina Garland

Gina Garland joined ETH Zurich in August 2021 as a SNF PRIMA Grantee and the Group Leader of the Soil Ecology of Agricultural Landscapes group within the Institute of Terrestrial Ecosystems. She is also a Research Scientist in the Soil Quality and Use group at Agroscope, the Swiss National Institute for agricultural research. Gina's interest in agriculture first began while working with farmers in Bolivia, which led her to pursue a MSc degree in Horticulture and Agronomy at the University of California, Davis. From there, Gina worked as an Agronomist and Agricultural Extension Agent in New Mexico, working directly with farmers to develop individualized techniques to improve soil health and plant protection in low-input desert cropping systems. Gina then moved to Switzerland, where she received her PhD from ETH Zurich in Sustainable Agroecosystems. Working with Prof. Johan Six, her research focused on the mechanistic role of maize-pigeon pea intercropping on soil nutrient cycling and crop yields in heavily weathered tropical soils of Malawi.

As a postdoctoral researcher, Gina continued her studies of agricultural systems within the Plant-Soil Interactions group of Prof. Marcel van der Heijden at Agroscope. Here, she investigated the impact of crop species diversity on soil microbial diversity and ecosystem multifunctionality in European agroecosystems. This was followed by a second postdoctoral position in the Soil Resources group of Prof. Sebastian Doetterl at ETH Zurich where she studied the role of geochemistry in soil carbon stabilization mechanisms.

Broadly speaking, Gina's research is motivated by her desire to help improve global food security and livelihoods. Scientifically, she aims to better understand how agricultural management practices impact soil ecology, biological, chemical, and physical soil functions, and ultimately crop productivity and resilience. Her current project is based within the context of a circular economy, whereby various organic wastes can be utilized as soil amendments for improving crop production.

Specifically, Gina and her team are investigating how antibiotics derived from human excreta-based fertilizers impact soil quality, the soil microbial community structure and functions, and the uptake of antibiotics into edible crop tissues. Multiple different fertilizers from Rwanda and South Africa are currently under investigation. They are being applied to African soils with highly contrasting physicochemical properties to ascertain how absorption dynamics may impact these important abiotic and biotic transformation dynamics. Yet, although this project is based on African soils and fertilizers, Gina plans to ultimately extend this focus to the European and especially the Swiss context as well. Here, the movement to reduce wastes and environmental pollution by harnessing this rich organic matter to produce soil amendments is increasing exponentially, thus paving the way for many exciting research questions in the future.

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PRIMA Fellow Sara Simonini, University of Zurich

Embryo development in *Arabidopsis* imaged by propidium iodide staining. The different tissues and their progenitor cells are false-coloured to follow them through the different stages.

© Sara Simonini

In July 2022, Sara Simonini started as SNF PRIMA Assistant Professor of Molecular Embryology at the Department of Plant and Microbial Biology at the University of Zurich. Sara obtained her PhD in Molecular and Cellular Biology at the University La Statale of Milan (Italy) working in the group of Prof. Martin Kater, studying the transcriptional regulation of homeotic genes involved in flower development in *Arabidopsis.* In 2013, right after her graduation, Sara moved to UK for a first postdoc joining the group of Prof. Lars Østergaard at the John Innes Centre in Norwich. There, she investigated and characterized a novel mechanism of auxin perception important for organ patterning, setting the foundation for new parallelisms of hormonal mode of action between animals and plants. In summer 2017, Sara arrived in Switzerland, joining the group of Prof. Ueli Grossniklaus at the University of Zurich as postdoc, and to work on the epigenetic regulation of seed development. Here, her research focused on understanding how cell division is controlled around the moment of fertilization and during embryogenesis. It is indeed during this period that she closely approached embryology and found it the perfect model to answer her biological questions.

Despite the difference in topics embraced during her career, the common denominator characterizing Sara's research is the understanding of how cells make decisions, whether it is to divide, or differentiate, or stay quiescent.
Cell proliferation and growth is a key aspect that must be tightly regulated in multicellular organism. To ensure such level of control, many organisms including animals and plants, regulate cell development and growth through epigenetic mechanisms. This allows changes in gene expression independently of the DNA sequence. Sara's research focuses on understanding the regulation and the activity of highly conserved epigenetic machineries, to identify the molecular mechanisms underlying cell behavior, particularly during the context of embryonic development. Currently, her group is interested in exploring canonical and non-canonical functions and regulation of such complexes, looking at how cells make decision that are kept over time and generations, or differently, how they adapt and reacts to stimuli and stresses. Thus, Sara's research aims to answer fundamental biological questions that are not only peculiar of the plant world, but of multicellular organisms in general.
Sara has always enjoyed scientific challenges and embraces with enthusiasm new technologies and techniques. This interest and attitude brought her also to visit and establish collaboration with different laboratories in Europe and US, and also to experience research at the industry level. This is also something that she is actively promoting in her group, through the development of new tools and optimization of techniques to reach cellular resolution, and by establishing collaboration with experts in and outside Switzerland.

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PRIMA Fellow Joëlle Schläpfer Sasse, University of Zurich

Arabidopsis thaliana dug out from field soil for microbiome analysis. © Joëlle Schläpfer Sasse

In March 2020, just before the Covid-19 lockdown, Joëlle Schläpfer Sasse started her Plant Soil Interactions Assistant Professorship position at the Institute of Plant and Microbial Biology at the University of Zurich. Since then, she finally has her lab up and running, with a great team of researchers.

Joelle performed her studies at the ETH of Zurich and moved to the University of Zürich for her PhD, working with Prof. emeritus Enrico Martinoia on transporters involved in plant-organism interactions (2010–2014). During that time, she realized that metabolite transport is crucial for interactions of plants with beneficial organisms such as mycorrhiza, but also for deterring pathogens and herbivores. Moving to the lab of Dr. Wolf Frommer in Stanford, CA, USA (2014–2016), she expanded her scope working on sugar transporters in maize kernel loading and tried to find sugar exporters in roots. Working on the latter, she recognized that knowledge on metabolite export from roots (root exudation) was sparse not only regarding sugars, but on a very general level. She thus joined the lab of Dr. Trent Northen in Berkeley, CA, USA (2016–2019) and started to investigate root exudation dynamics. Returning to Switzerland to the lab of Prof. Cyril Zipfel at the University of Zurich, Joelle incorporated the aspect of plant immunity in her work (2019–2020).

With her current SNSF PRIMA fellowship (2020–present), Joelle combines her expertise to advance our knowledge on the mechanistics of root exudation. Plants produce a variety of primary and secondary metabolites. Some of the root-derived compounds are exuded and serve as nutrients and signaling compounds to the root-associated microbial community. Exudates are presumably one means how plants shape their interaction with various microbes, feeding beneficials and deterring pathogens. However, we are only beginning to understand how exudation profiles change in different conditions, with biotic or abiotic stresses, and how this influences the association of plant tissues with different microbes.

Joëlle's team currently focuses on several aspects: i), the analysis of exudation profiles and microbiomes of phylogenetically diverse plant species to identify key metabolite-microbe interactions, ii), the effect of elicitor recognition by plant immunity on exudation, and iii) the characterization of plant transporter proteins involved in exudation, affecting microbiome composition. Joelle's research aims at understanding the effects of exudation of a specific metabolite on the microbial community. With this, further steps can be made to generate crops with improved capability to attract and interact with beneficial microbes, which are supporting growth and yield in a suboptimal, agricultural setting.

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PRIMA Fellow Pengjuan Zu, ETH Zurich

Calanda fieldsite (in Canton Graubünden, Switzerland).
© Tobias Weisskopf

© Grant Lewison

Pengjuan Zu (she would like to be known as Zu) is an SNSF PRIMA group leader at ETH Zurich since September 2021. She is interested in deciphering the chemical communication between plants and insects in ecological communities. Zu is always fascinated by nature. After earning her bachelor's degree in biological science in Beijing, she went abroad and studied Ecology and Conservation at Uppsala University in Sweden for her masters. Then she moved to University of Zurich and received her PhD on evolutionary biology in 2017. Her PhD work, supervised by Prof. Florian Schiestl, focused on understanding and predicting floral scent evolution in a Rapid-Cycling *Brassica rapa* plant species under its insect pollinators. Since then, she is interested in plant-insect chemical communication, and curious how communication evolves in nature, where various co-existing plants and insects interact in a complex way.

It is challenging to scale up plant-insect chemical communication from species to community level because empirically it relies on extensive field data collection and theoretically it requires a novel framework to conceptualize the complex processes. We know that plants and insects are the core components in both natural and agricultural systems. Understanding their communication and interactions is crucial for ecosystem conservation and restoration, especially under the currently pressing situation of global change. With this goal in mind, Zu developed her chemical-ecology skills at Royal Botanic Gardens Kew with Prof. Phil Stevenson, and theoretical skills at Massachusetts Institute of Technology (MIT) with Prof. Serguei Saavedra and at Swiss Federal Institute of Aquatic Science and Technology (EAWAG) with Prof. Carlos Melian.

During her postdoc time, Zu worked together with experts and collaborators from different fields. In 2020, they published a proof-of-concept paper in *Science*, where they integrated information-theory into ecological and evolutionary theories, and proposed an information arms race theory that successfully explained how the plants and insect herbivores' network structure and the chemical communication patterns can emerge in an ecological community. The work was supported by SNSF Early Postdoc Mobility awarded to Zu. She also received an SNSF Spark grant to further explore the theoretical potentials.

Now, with the SNSF PRIMA grant hosted by Prof. Consuelo De Moraes at the Department of Environmental Systems Sciences at ETH Zurich, she has started an exciting new project, aiming to continue deciphering plant-insect communication with different interaction types (mutualistic *vs.* antagonistic) and study how global changes may play a role.

In addition, Zu is interested in transdisciplinary studies. She has worked with Prof. Maria Santos and Prof. Meredith Schuman from University of Zurich on a University Research Priority Project (URPP) on global change and biodiversity, aiming to understand how both social-economic and ecological processes affect global change and biodiversity.

Her current SNSF PRIMA project receives funding from the PSC-RESPONSE Doctoral Program, aiming to provide insightful scientific evidence for science policies and public awareness on ecosystem conservation.

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PhD Courses in fall 2022

Writing a Post-doctoral Grant
22.09. & 23.09. 2022, 2 days

Value-based Design
27.09. & 30.09. & 25.10. 2022, 3 days

Transdisciplinary Seminar on Research: Challenges of Interdisciplinarity and Stakeholder Engagement
28.09./12.10./26.10./9.11./23.11. 2022, Every 2nd Wednesday morning

Scientific Writing 1
05.10. & 26.10. 2022, 2 days

Sustainable Plant Systems
07.10.22 & 02.12. 2022, 2 afternoons

Next Generation Sequencing 1 (UZH VVZ: BIO610)
01.11. & 02.11.2022, 2 days

Colloquium: Challenges in Plant Sciences
03.11.22 & 01.12. 2022, 1.5 days

Current Challenges in Plant Breeding
04.11.2022 & 25.01.2023, 1.5 days

Genetic Diversity: Techniques (ETH VVZ 701-1425-01L)
09.11. & 30.11.2022, 2 days

Intro to UNIX/Linux and Bash scripting (UZH VVZ: BIO609)
30.11.2022, 1 day

Scientific Visualisation Using R
09.12. & 16.12.2022, 2 days

Introduction to R
09.12. & 16.12.2022, 2 days

Science & Policy Courses

Contributing to Policy Action – Analysis and Communication of Risks and Uncertainties
02.11.-04.11.2022, 3 days

Understanding Policy Evaluation
22.08. & 19.9.2022, 2 days

Contact
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New digital skills courses

Introduction to Structural Equation Modeling

Lecturer: Frank Pennekamp, University of Zurich, 3 days

Dates: 08.11.– 10.11.2022

Structural equation models are increasingly used in ecology and evolution to disentangle the complex direct and indirect interactions that occur in nature. This course is an introduction to structural equation modeling (SEM) aimed at biologists who want to answer questions in observational and experimental settings. Thereby, the introduction to SEM includes the philosophy of SEM, comparison with linear/multiple regression, history and assumptions/limitations. Students work with examples on teaching dataset, model comparison, evaluation (GOF etc.), interpretation and pruning, visualization of SEMs. The last day covers self-study with opportunities provided to consult with lecturers. Students will have the opportunity work on datasets and their own data. Dr. James Grace will be available for group/one-on-one meetings in the afternoon.

Introduction to ML for Plant Scientists

Lecturer: Prof. Jan Dirk Wegner, University of Zurich, 3 days

Dates: 23.11.– 25.11.2022

This course will introduce machine learning with emphasis on plant sciences. Topics like data pre-processing, feature extraction, clustering, regression, classification will be discussed and first steps towards modern deep learning will be taken. The course will consist of 50 % lectures and 50 % hands-on programming: basic machine learning concepts to demystify the subject, equip participants with all necessary insight and tools to develop their own solutions. Specific importance is placed upon the reconciliation of the predictions, which have been generated by automated processes, with reality. By the end of the course, students will be able to decide where (and where not) to use machine learning, what method to choose for which research task, and how to critically evaluate model outputs in the context of plant sciences.

Compositional Data Analysis

Lecturer: Prof. Dr. Matthias Templ, ZHAW, 3 days

Dates: 16.01.–18.01.2023

Compositional data analysis is a methodology used to describe the parts / compounds of a whole, conveying relative information. Typical examples in different fields are: geology (geochemical elements), medicine (body composition: fat, bone, lean), food industry (food composition: fat, sugar, etc.), chemistry (chemical composition), ecology (abundance of different species), agriculture (nutrient balance ionomics), environmental sciences (soil contamination), plant science (water, carbon and nitrogen content, composition of soil or microbial communities, species composition) and genetics (genotype frequency). This type of data appears in most applications, and the interest and importance of consistent statistical methods cannot be underestimated. Compositional data analysis is the solution to the problem of how to perform a proper statistical analysis of this type of data i.e., to solve the problem of spurious correlation as it was named by Karl Pearson. This course will introduce compositional data analysis with emphasis on plant sciences.

PSC course registration

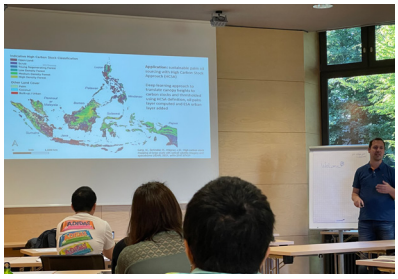
www.ethz.ch/services/en/service/courses-continuing-education.html

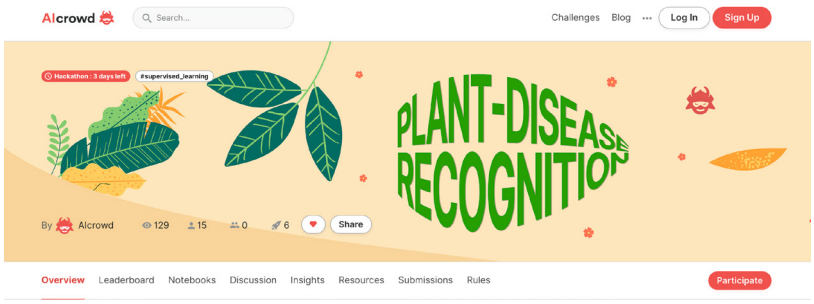
Select: Plant Sciences

Summer School 2022

Application of Machine Learning in Plant Sciences

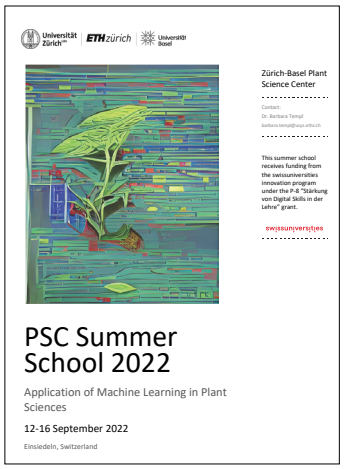
12–16 September 2022, Einsiedeln, Switzerland





The challenge of the hackathon was to correctly identify a disease class from low-resolution images of plant leaves. The winner team received a drone. © PSC

www.aicrowd.com/challenges/eth-psc-summer-school-minileaves-hackathon/



Abstract booklet for download:

www.plantsciences.uzh.ch/en/teaching/summerschool.html

The summer school was organized by Barbara Templ.

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The Summer School was very well organised! I could greatly benefit from all the inputs and provided codes/scripts, it will for sure help my future carreer. Even though I was already familiar with the application in Soil Sciences, I could still profit from the exchange with experts, the comparison of the methods used and the transfer of the predictions to an actual map in a defined coordinate system. It was really interesting to get an overview on the manifold applications in Plant Sciences and to work with a dataset in the Hackathon that I normally do not work with. Applying the methods in another context improved my understanding of their functioning.

– Dr. Jolanda Reusser (Agroscope)

The Summer School brought together plant and data scientists to communicate about new methods and technologies, best practice, and the cutting edge of plant data science research. On the first day, participants received an introduction to the fundamentals of machine learning (ML). Talks were complemented with hands-on programming sessions given by Dr. Carol Alexandru and Prof. Manuel Günther from the University of Zurich.

The second day focused on the theory and applications of deep learning in various fields of plant sciences (from plant identification to detection of deforestation). Speakers were Prof. Jan Dirk Wegner (University of Zurich), Prof. Fernando Perez Cruz (SDSC), Dr. Michael Rzanny (Max Planck Institute for Biogeochemistry, Germany), Dr. Andreas Hund (ETH Zurich) and Dr. Thales S. Körting (National Institute for Space Research, Brasil).

The third day was devoted to the applications of machine learning in plant breeding, i.e., how to analyze plantomics data at different phenotype levels. Speakers were Dr. Hai Wang (China Agricultural University), Dr. Christian Ahrens (Agroscope), Dr. Aalt-Jan van Dijk and Dr. Gert Kootstra (both, Wageningen University, Netherlands), as well as Prof. Shinhan Shiu (University of Wisconsin, USA).

On the following day, applications of machine learning in ecology and soil sciences were demonstrated. Participants heard about data mining and ML in macro-ecological research (Prof. Nick E. Zimmermann, WSL), application of ML to predict ecosystem-atmosphere fluxes (Prof. Benjamin Stocker, University of Bern). Application of ML for spatial mapping were demonstrated with soil maps by Dr. Madlene Nussbaum (Bern University of Applied Sciences), furthermore various biodiversity research applications by Dr. Andrea Paz (ETH Zurich), Dr. Luca Pegoraro (WSL), and Dr. Daniele Silvestro (University of Fribourg).

The last day was devoted to applications of machine learning in agriculture. Participants learned about crop phenotyping (Dr. Andreas Hund, ETH Zurich), plant electrophysiology (Dr. Elena Najdenovska, HES-SO), including robotic methods for precision agriculture (Prof. Stefano Mintchev, ETH Zurich).

During the week participants worked on a hackathon challenge to further deepen their programming skills. Congratulation to the winner team: Hongyuon Zhang from Estonian University of Life Sciences, Damian Käch, Yutang Chen and Fabio Turco from ETH Zurich.

The Nerd Gardeners: science-based approach for urban green space design

Interview with Simona Zahner and Malwina Kowalska, co-founders of plantipolis – plant a city. Malwina was participating in the feminno mentoring program.

Which important societal and environmental problem is your company plantipolis addressing and what makes your service unique?

Plantipolis wants to increase biodiversity in the city for the benefit of both, citizens and native wildlife.
Undoubtedly more and more people are moving to the cities. Growing cities offer many opportunities, but there are also certain drawbacks such as heat island effects, and, air and noise pollution that make cities a less healthy place to live. With better use of green spaces and roofs, we can solve such issues and cities can contribute to carbon sequestration.

Living in a city can sometimes be isolating, lonely, and above all, stressful. This harms our health. You might be surprised to hear that biodiverse green spaces encourage social interaction, improve our wellbeing, boost immunity, and even reduce the incidence of depression.
We believe that urban biodiversity is equally important for citizens as the conservation of nature in Switzerland.

Our service is targeted at companies, municipalities, and real estate developers. It is unique because we have a methodological approach to green space design. We use animal distribution data and information about their movement patterns and movement barriers to create landscape connectivity maps for target species. Using the results of this connectivity analyses we optimize the design of each green space to support target species which have a chance of reaching this green city space.

In addition, we predominantly use native plant species in our transformed spaces and make sure to integrate a variety of habitat structures for different animal species.

We also believe in a participatory design process to ensure that the designed green spaces are suited to the people who will use them, whether they are company's employees or local residents.

plantipolis
plant a city

Why and how did this innovative idea originate in your research and academic environment?

I am an epidemiologist. I started looking at population health from a wider perspective. It became very clear to me that "natural health" and human health are interconnected. Disease and lifestyle choices are related. Urban residents really need more nature, and we show that this is also an opportunity for biodiversity.
Simona's and my academic backgrounds drive us to optimize. Every green area that we modify is monitored, we collect data, and improve designs over time. We share data with other researchers. Everyone who chooses to work with us receives an annual report that includes indicators that measure the impact of the transformation. Companies can share this information publicly.

You already have a co-founder. How did you meet?

During one of the *feminno* workshops, I came into contact with Daniel Balmer (Floretia). "He might be intrigued", said Isabelle Siegrist (Sandborn). When we met, he gave me new contacts and encouragement. That's when the thought first occurred to me, "My idea might be worth a try". I was aware that my project was too big for one person. So, I wrote emails describing my dream and to find a business partner. Simona answered. I have to say, it is a perfect match.

What's the most exciting about the traction you already have?

The recent heat waves clearly show how important green spaces are to our wellbeing. I believe citizens are aware of this and of other problems that humanity is facing. People are ready for a change in green space management. Growing social pressure pushes companies and government to make a greater commitment for sustainability and nature. This is an opportunity for us. Basel has already implemented that every new flat roof must be green.
I'm most certain, that what we plan to do with *plantipolis* will have an immediate impact on human and nature's health. We receive a lot of positive feedback, and researchers are open to collaboration, which is motivating us.

On the other hand, what's your biggest challenge?

Definitely the funding. We would like to refine our mapping and monitoring system. For this, we require additional investment and ideally a collaboration with a big partner (public institution or a company) that owns urban green space and would like to modify them. Office areas are a perfect environment as staff would benefit and enjoy the transformed areas. Currently, we are working to gain visibility and to attract such a partner. Together we could apply for additional funding, e.g., from Innosuisse.

In what way is *feminno* important as an innovation hub for academia?

feminno is crucial. To academics it is a window into a different world. Scientists rarely have the opportunity to talk to people whose ideas have become profitable businesses. It certainly encouraged me to start my own company. In my view, *feminno* also encourages corporate and academic cooperation by showing mutual benefit and offering network opportunities. Targeting young females is pivotal, we have a lot of determination.

Interview by Daniela Gunz

www.plantipolis.com/
info@plantipolis.com
www.linkedin.com/company/plantipolis/

feminno

More information on the feminno mentoring program:

https://blogs.ethz.ch/feminno/

Green Labs

How we can optimize our lab practice and lab environment to make research CO_2 neutral in a near future! - The University of Zurich (UZH) wants to be Carbon Neutral by 2030 in research, education and public relations and is developing measures to achieve this goal. Every member of UZH is encouraged to accelerate the process by identifying resource waste in daily work and developing sustainable strategies against it.
Green Labs UZH federates ideas and scientists who want to improve the ecological impact of research. We aim to integrate PhD students of Plant Sciences to the Green Labs UZH community by establishing a "Green Lab" teaching module. In this module, doctoral students will be further trained on sustainable research, by developing or implementing a scalable project. This can be the development of a concept, the creation of a survey, the analysis of available data to study the impact of a particular practice, the provision of concrete recommendations, or the implementation of a new practice in the laboratory validated by the mentors in charge. Thereby, students will be under supervision by the host institution, the UZH Sustainability office, MNF Sustainability Committee or Green Labs Zurich working group.
Students will increase their awareness of sustainability issues in research and their skills in communication and networking in/for future civic engagement. They will understand the interrelations between system levels: research needs, research product availability, working culture, ecological footprint (Systems thinking) and gaining skills in practical problem solving.

www.plantsciences.uzh.ch/en/teaching/coursecatalogue/engagement.html

www.sustainability.uzh.ch

www.mnf.uzh.ch/en/fakultaet/policies/nachhaltigkeit.html

twitter.com/greenlab_zh

Career Talk

Communicating Science and Policy in Fact Sheets and Policy Briefs

Lecturer: Dr. Sascha Ismail
Location: tbd, ETH Zentrum
Date: November 16, 2022: 17:00 – 18:30
Credit Points: not ECTS assigned

How can you prepare for a career at the science and policy interface? In the Science and Policy Career Series, professionals working in different roles at the science and policy interface explain how they got there and how they communicate research findings to have an impact on policies.

Sascha Ismail will give personal insights on his career path from science to the science-policy interface work in Switzerland. He will explain how he impacts conservation and biodiversity policies with studies that he coordinates in collaboration with Swiss research institutions. And, what important considerations are when communicating science-based policy recommendations in policy briefs and factsheets.
Very concretely, he will share experiences and answer your questions on how to plan and write a factsheet or a policy brief and what factors increase its impact in the policy domain.

Sascha Ismail is working at the Swiss Academies of Sciences in the Swiss Biodiversity Forum in Bern. His main goals are to support biodiversity research and create a link between scientists in this field and policy-makers. At the Swiss Academies of Sciences one of his responsibilities is writing a monthly newsletter on biodiversity research to summarizing the scientific basis on policy relevant topics such as renewable energies and biodiversity, biodiversity-harming subsidies or climate change and biodiversity. Additionally he's also a lecturer at the Eastern Switzerland University of Applied Sciences, where he teaches plant ecology to bachelor students in landscape architecture.

Registration

www.plantsciences.uzh.ch/en/rssnews/20221116.html

Dialog im Quartier

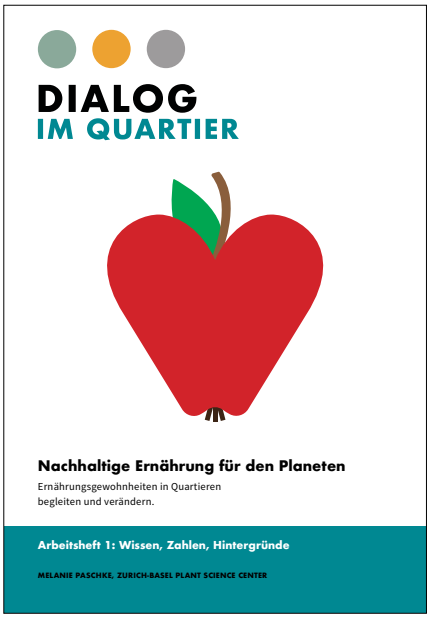
Workbooks for a transformation of the food system in neighborhoods

PSC has published two workbooks with methods on how to interact and communicate in neighborhoods on sustainable eating. The publications are aimed at initiatives and multipliers that accompany the transformation of our food systems at the local level.

What are the impacts of nutrition on planetary boundaries? What possibilities does each individual have to halve these negative environmental impacts through their own diet? The numbers, key figures, the necessary background knowledge and arguments facilitate the communication with the interested public.

What methods can be used to empower people to change their individual eating habits towards sustainability? Multipliers can use the workbook to learn about methods and integrate them into their own work. Instructions and templates are available for copying. The authors share experiences in applying these methods and give examples on what actions have been triggered.

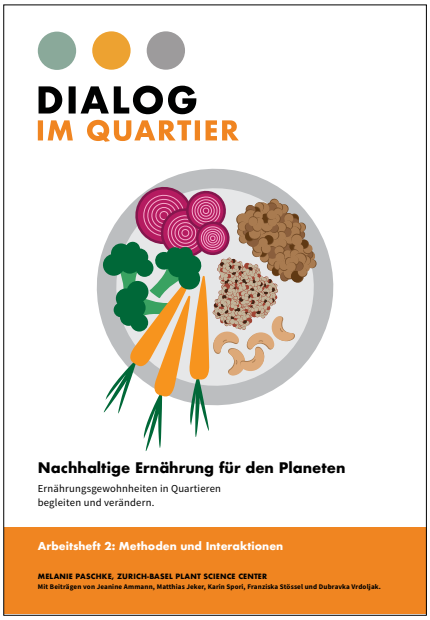
https://deinquartiernachhaltig.org/werkzeuge-fur-den-ernahrungswandel/



Zurich-Basel Plant Science Center (2022). Nachhaltige Ernährung für den Planeten: Ernährungsgewohnheiten in Quartieren begleiten und verändern.

Arbeitsheft 1: Wissen, Zahlen, Hintergründe. Melanie Paschke

https://doi.org/10.3929/ethz-b-000547709



Zurich-Basel Plant Science Center (2022). Nachhaltige Ernährung für den Planeten: Ernährungsgewohnheiten in Quartieren begleiten und verändern.

Arbeitsheft 2: Methoden und Interaktionen. Melanie Paschke. Mit Beiträgen von Jeanine Ammann, Matthias Jeker, Karin Spori, Franziska Stössel, Dubravka Vrdoljak.

https://doi.org/10.3929/ethz-b-000547601

K3-Preis für Klimakommunikation

Nomination!

Dialog im Quartier was among 22 projects from Switzerland, Germany and Austria that were nominated for this year's K3 prize for climate communication. The award ceremony took place on September 15, 2022 at the K3 Congress on Climate Communication.

The K3 Prize for Climate Communication honors projects and initiatives from German-speaking countries that want to motivate people to act sustainable through innovative formats and offers for climate protection. The list of projects that made it onto the shortlist can be viewed on the K3 website:

https://k3-klimakongress.org/k3-preis/

Upcoming events in Lucerne

To reach the 1.5°C climate scenario we need to target towards 2.5 t CO_2 emission per capita per year in 2030 and even less in 2050 (currently 14 t CO_2 e / cap / yr in Switzerland). How to follow such a challenging and urgent decarbonization pathway? One important step is de-carbonization of lifestyles at the household level.

In *Dialog im Quartier* consumers and producers in the Lucerne area work together in defining their food-related low-carbon life style patterns. Every participant will take home one micro habit that can make a change in their neighbourhoods and in their homes.

Supported by the Federal Office of the Environment (FOEN) and Energiefond der Stadt Luzern.

Registration
https://deinquartiernachhaltig.org

My Nutrition, my Healthy Planet

26.10.2022 Kulturhof Hinter Musegg
19:00–21:30 Apéro included
Lecturers: Dr. med. Sabine Heselhaus: Co-President "Ärztinnen und Ärzte für Umweltschutz ZS (AefU") and Regula Hasler: cath. church of Lucerne, project manager «Planet A», Quartier Garten Michael
Moderators: Julia Beck: Nutritionist (Hofladen Kulturhof Hintermusegg), Ernst Erb (Gründer Stiftung Gesundheit und Ernährung Schweiz), Marie-Isabelle Bill (Präsidentin Slow Food Convivium Zentralschweiz), Dr. med. Ralph Guggenheim (Hausarzt, AefU), Elena Lustenberger (https://www.wild-rose.ch/)
Astrid Burri-Huber (Bio Luzern), Marcel Schürmann (Founder App Food-secrets)

Redesign Local Food Provision

08.11.2022 Kunstpavillon Lucerne
19:00–21:30 Apéro included
Lecturers: Stefan Galley, Agroscope, Julia Beck, Kulturhof Hinter Musegg
Moderators: Urban Gardening / Stadtgrün Luzern, Solidarische Landwirtschaft, GemüseAckerdemie, «Gemüsetasche» & Slow Food and Kulturhof Hintermusegg, Wild-Rose, Unfahrpackt, Vision Landwirtschaft

Collective & Digital – Reinventing Consume and Sale

23.11.2022 Kunstpavillon Lucerne
19:00–21:30 Apéro included
Lecturers: Dr. Hans-Dieter Hess, LAWA Kanton Luzern, Rebeca Frick, FiBl, UNISECO Seetal, LAWA Kanton Luzern, Forschungsinstitut für biologischen Landbau FIBL
Moderators: Luzerner Bäuerinnen- und Bauernverband LBV, BioLuzern, RegioFair Agrovision Zentralschweiz AG, Slow Food, Kulturhof Hinter Musegg

Eating without Food Waste

14.12.2022 Laboratorium (mit Neugarten)
19:00–21:30 Apéro included
Lecturers: ZHAW research group for food technology and president of foodwaste.ch, Laszlo Csoma, RestEssBar Ebikon
Moderators: RestEssBar Ebikon, Ässbar, Kitro

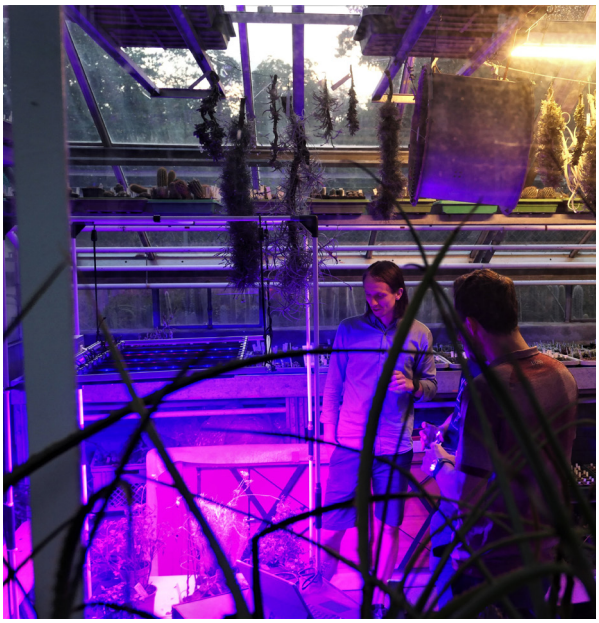
NACHTAKTIV – Scientainment for Youth

NACHTAKTIV combines entertainment, art and science. Once per month on a Friday evening, PSC organizes a party-style event in a museum. Science activities are led by students of ETH Zurich, University of Zurich and University of Basel. Selected Spin-offs enrich the program with their inventions. Each event focuses on a different theme.
www.nachtaktiv.live

This program receives funding from the Gebert Rüf Foundation (2020–2023).

Dr. Hannes Vogler at University of Zurich shared his experience with us:

"As supervisor of one of the four scientific booths, I experienced the evening as an excellently organized, inspiring mixture of popular science, state-of-the-art science and cultivated entertainment. Probably due to the compulsory registration, the interest of the visitors was noticeably more profound than at other outreach events I had attended before. This led to very interesting conversations. In short, a successful event that should set a precedent."



Impressions of NACHTAKTIV "Plant Sex" at the Succulent collection Zurich on 24th June 2022. Flashy disco light illuminated Cacti, and techno beat sound welcomed visitors to the stunning succulent collection of the city of Zürich. This greenhouse atmosphere was a perfect fit for this outreach program for young people, which combines entertainment, art and knowledge transfer. Several scientists demonstrated various types of pollination mechanism and how plants prepare for sex. (Hannes Vogler, Elena Zahner and Tiago Meier, Department of Plant and Microbial Biology, UZH; Adrian Gonzalo und Aditya Prasad, Institute of Molecular Plant Biology, ETH Zurich). In a workshop, led by students of art education, visitors could create a love letter from flower colors, and the start-up company Cropled revealed which color mixtures are most attractive for plants. During a guided tour visitors learned more about sexual diversity in succulent plants. © PSC

NACHTAKTIV «Touch Wood» ZAZ BELLERIVE Center for Architecture Zurich on September 23rd. © PSC

Link Instagram Reels:
www.instagram.com/nachtaktiv.live/reels/

Upcoming

«Hop-On» Tram-museum in Zurich

The evening on 20th of October 2022 will be filled with many attractions on the future of sustainable mobility. Self-driving racing cars, futuristic transport capsules, drones, electric race cars and even autonomous robotic guided dogs for blind people. Save the date and Hop-on!

We are happy to announce that NACHTAKTIV will continue throughout 2023 in six additional museums. The program starts at the Kulturama with the topic "Earth at the limit" in February 2023.

If you are interested in presenting your work, please contact us. We are looking for topics which might fit under the broad heading.

Contact: Ulrike von Groll
ulrike.vongroll@usys.ethz.ch

Plant Blindness

Sometimes transdisciplinary partnerships are hard work, and sometimes wonderful things just happen. This was the case earlier this year with our partnership with the Zurich University of the Arts. PSC welcomed three art education students for their eleven-week internships and they produced really outstanding work. It may well have been due to the inspiring talks by Cyril Zipfel and Jordi Bascompte in September 2021.

Simona Winkler-Fishyan developed a workshop on “Plant Blindness” examining why and what are the effects of people not “seeing” plants (Wandersee 1999). This workshop was held several times in different settings, most notably in the Kunsthaus Zürich at our *Nachtaktiv* event for youth. The exhibition at that time was Yoko Ono, whose poetic work on the environment, love and war always maintains its cultural relevance.

The second internship was a tandem. Lisa Fasching and Mauro Bischoff were interested in themes ranging from coastal erosion mediation, to monotype printing with chlorophyll. They created a wave machine with 3D printed blocks of kelp or seagrass to model coastal wave patterns. This is now part of the *Wellen Tauch Ein!* exhibition at focusTerra, ETH Zurich.

Treffpunkt Science City

Both activities, the wavenator and the monotype workshop creating plant images with chlorophyll will be part of Treffpunkt Science City on 30th October 2022.

https://ethz.ch/de/news-und-veranstaltungen/veranstaltungen/treffpunkt/tagesprogramm-30-10-2022.html

Wandersee, J. H., & Schussler, E. E. (1999). Preventing plant blindness. The American biology teacher, 61(2), 82–86.

Monotype printing with chlorophyll. © PSC

3D printed seegras model. © PSC

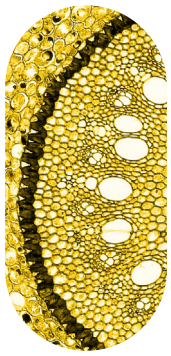
PSC SYMPOSIUM 2022

From place to space – tracing the spatial dimension of plant sciences

7 Dec 22
9:00–18:00

ETH Zurich
Audimax, HG F 30

THE CELL SPACE



9:30 **Prof. Dr. Sara Simonini** University of Zurich, CH
When it is the right time to divide: parental regulation of cell division during reproduction

10:00 **Dr. Markus Geisler** University of Fribourg, CH
A twist in the thale: an update on auxin-mediated cell elongation

10:30 **Dr. Stefania Giacomello** KTH Royal Institute of Technology, SE
The cell space – A journey in spatially resolved transcriptomics: from animal tissues to plants

THE PLANT SPACE

11:30 **Dr. Chrysoula Pantazopoulou** University of Utrecht, NL
How can Arabidopsis perceive neighbors in space and time?

12:00 **Prof. Dr. Philippe Reymond** University of Lausanne, CH
Intra- and interplant responses to insect egg deposition in Arabidopsis

12:30 **Dr. Desalegn Etalo** Netherlands Institute of Ecology, NL
The tri-partite interaction between parasitic plants, host, and their microbiome

THE ECOSYSTEM SPACE

14:30 **Prof. Dr. Sabine Rumpf** University of Basel, CH
Effects of environmental change on arctic and alpine vegetation

15:00 **Prof. Dr. Eliana M. Jimenez** Universidad Nacional de Colombia-Sede Amazonia, CO
Spatial and temporal variation of forest net primary productivity components on contrasting soils in northwestern Amazon

16:00 **Flash Talks**
by four selected PhD students and postdocs

THE OUTER SPACE

17:00 **Prof. Dr. Stefania di Pascale** University of Naples Federico II, IT
Bioregenerative systems to sustain human life for Long-Term Space Missions: the challenges of plant cultivation

17:30 **Poster awards**
and concluding remarks

Scan to sign up

University of Zurich[UZH] | ETH zürich | University of Basel

XPRIZE Rainforests Competition

The sharp decline in global animal and plant biodiversity has put nearly one million species (one in eight) at risk of extinction. Loss of life on this scale and its effect on all ecosystems and the services they provide to humans will push the planet across what we expect are tipping points for a safe operational state for humanity. Scientific and technological advances to monitor biodiversity and its functions to supply clean water, food security and a healthy biosphere are urgently needed. However, currently there is a lack of viable and cost-effective ways to examine biodiversity change on Earth.

Technologies to assess biodiversity and understand ecosystems

At ETH, a multidisciplinary team called ETH BiodivX (https://www.biodivx.org) was formed. The goal is to develop new technologies to rapidly and comprehensively detect rainforest biodiversity, use the data to improve our understanding of this complex ecosystem, and accelerate the development of more sustainable management practices and bioeconomies. The BiodivExplorer team is led by Prof. Kristy Deiner (Environmental DNA) and Prof. Stefano Mintchev (Environmental Robotics) and David Dao (PhD candidate on AI and Data Systems for the SDGs). The project is participating at the five-year competition XPRIZE Rainforest launched in November 2019 by the XPRIZE Foundation. The goal of this competition is to accelerate the innovation of autonomous technologies needed for biodiversity assessment and to enhance the understanding of rainforest ecosystems. The ETH BiodivX team has already successfully qualified to compete alongside 16 other teams in the Semifinal Testing in summer 2023, where an initial survey of rainforest biodiversity will take place in Singapore. The top 10 teams will compete one year later for the final prize. The 1st place winner of the competition will be rewarded with USD 5 Mio.

www.youtube.com/watch?v=mEYHUEGNgXk

www.zdf.de/dokumentation/planet-e/planet-e-roboter-als-retter-100.html

www.biodivx.org

www.xprize.org

More plant science events

https://swissplantscienceweb.unibas.ch/en/events/

PSC General Assembly

2 November 2022
Start at 17:15

We coordinally invite all PSC members to the General Assembly 2022. On this annual occasion, we will brainstorm on new and emerging research topics that the PSC could implement in its activities (education, outreach and research). This should be of special interest to our new members and to our current members who wish a representation of their interest field at the PSC level. The general assembly will take place in person at the ETH Dozentenfoyer (Rämistrasse 101, on the J-floor).

Please register by the 20th of October latest:

https://doodle.com/meeting/participate/id/e58BZ9qd

SwissPLANT 2023

23–25 January 2023
Les Diablerets
Scientific committee: Klaus Schläppi, Jurrian de Vos, Günter Hoch, Sabine Rumpf, Yvonne Willi, University of Basel.
Contact: sylvia.martinez@unibas.ch

https://swissplantscienceweb.unibas.ch/en/swissplant/

In 2023 the Swiss Society of Plant Biology launches the **Early Career Plant Scientist Meeting** that addresses advanced PhD students and postdoc fellows. This event will be held on: **22–23 January 2023** in Les Diablerets (immediately preceding the SwissPLANT conference and in the same venue).
The selection of participants will be based on the submitted abstract. The call will be published soon.

www.plantsciences.ch

The Zurich-Basel Plant Science Center is a competence center linking and supporting the plant science research community at ETH Zurich, University of Zurich and University of Basel.
The center promotes plant and environmental research, education and outreach. It provides platforms for interactions with peers, policymakers, industry, stakeholders, and the public.

PSC MEMBER INSTITUTIONS

ETH Zurich
Department of Environmental Systems Science
Department of Biology
Institute for Environmental Decisions

University of Zurich
Department of Evolutionary Biology and Environmental Studies
Department of Geography
Department of Plant and Microbial Biology
Department of Systematic and Evolutionary Botany
Institute of Evolutionary Medicine

University of Basel
Department of Environmental Sciences

Zurich-Basel Plant Science Center, Managing Office

BLOGS
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@ nachtaktiv.live

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Pictures
Courtesy of PSC staff or indicated.
Front image: Pop art composition by Hannier Pulido and Tania Galindo. Maize root segment collected below 70 cm depth from a 4-week old plant growing in 30 L mesocosms under low nitrogen fertilization. The image shows nodal roots and their lateral roots. Image acquired with a flat-bed scanner by Elias Barmettler to perform root phenotyping for a microbiome study.

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