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Zurich-Basel Plant Science Center

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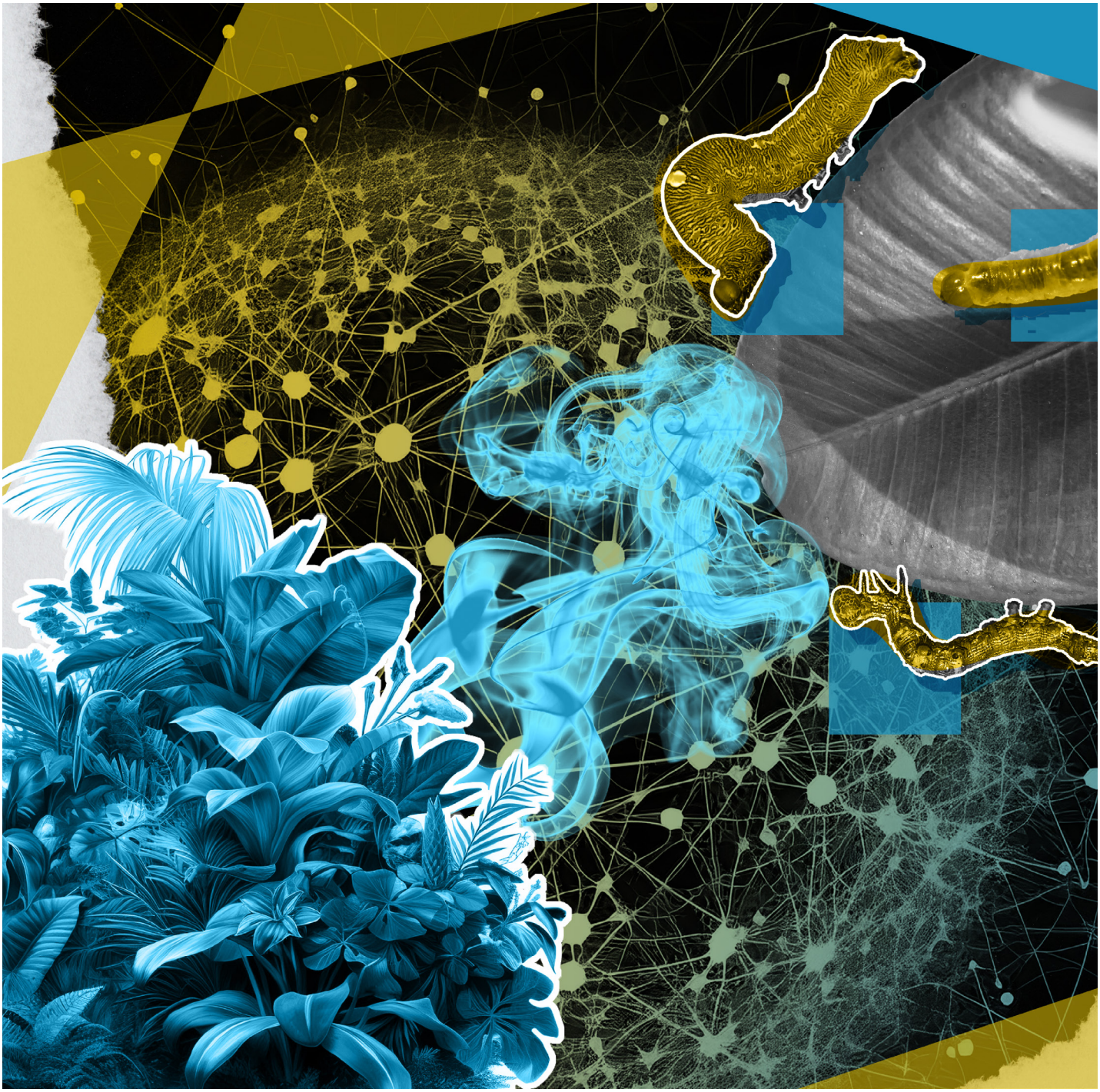

Editorial

Green data: empowering plant sciences

The term “green data” is a concept that has emerged in the discourse of environmental science, data management, and sustainability. Green data refers to environmentally focused datasets and information generated from research, monitoring, or observation related to plants, ecosystems, and the environment. It encompasses a wide range of data types, including biodiversity records, climate measurements, soil analyses, plant genetics, and ecological modelling outputs. The term emphasises the importance of utilising data-driven approaches to promote sustainability, conservation, and informed decision-making in environmental science and policy.

Open science is an increasingly important topic for research politics and funding agencies. However, based on the methodology and design of an research projects, different open science practices my be relevant. There is no one-size-fits-all approach, as social scientist Jürgen Schneider points out in his recent review. Tailored approaches require a careful analysis of barriers as well as facilitators, including ethical considerations such as confidentiality, ownership, safety, and security and respecting diversity, minorities, economically compromised regions. This has implications for the establishment of policies, guidelines and standards concerning open science.

In this issue of the PSC newsletter, we asked our members to share their experiences and ongoing projects with us. For the four projects, we discuss what and how data are collected and what infrastructure, collaboration and training is required.

In its role as a competence center, PSC will continue fostering a culture of open data management through training courses and community-driven initiatives, bringing together different actors along a data value chain to share and use data innovatively.

Sincerely,
Manuela Dahinden and Melanie Paschke, PSC Managing Directors

Swiss National Open Research Data Strategy: www.swissuniversities.ch/fileadmin/swissuniversities/Dokumente/Hochschulpolitik/ORD/Swiss_National_ORD_Strategy_en.pdf

Jürgen Schneider (2024). Sorry we′re open, come in we're closed: different profiles in the perceived applicability of open science practices to completed research projects. Royal Society Open Science.11230595. https://doi.org/10.1098/rsos.230595

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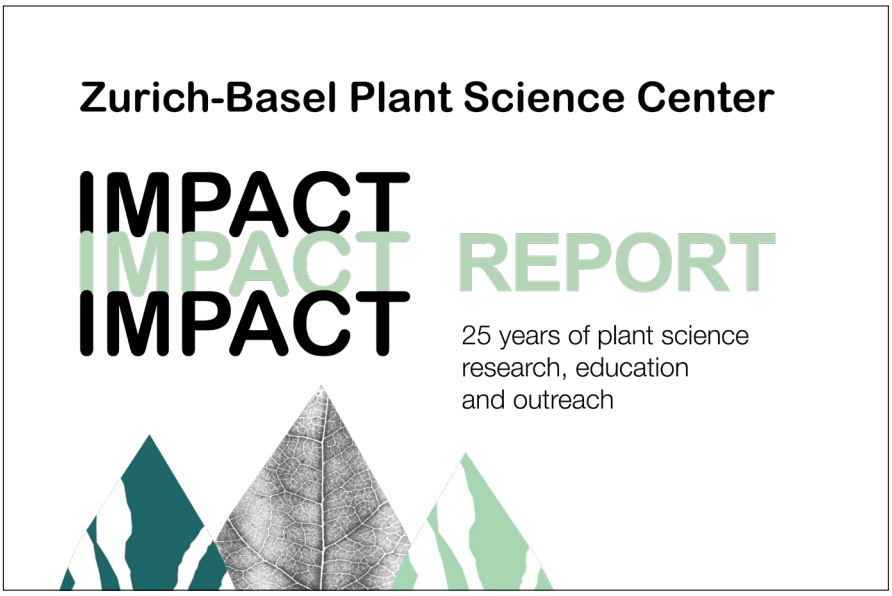

Since it was launched 25 years ago, the Zurich-Basel Plant Science Center (PSC) has contributed significantly to the field of plant sciences. By creating a highly visible platform, and through our innovative collaborations in research programmes, fellowships and educational offering, we show the profound impact that plant sciences can have. PSC facilitates interdisciplinary collaboration and bridges the gap between scientific knowledge and society. This brochure showcases our role in higher education and dynamic research environments, presenting a selection of PSC's successful endeavours. We hope you enjoy reading about them.

PSC Impact Report (2023). 25 years of plant science research, education and outreach. Manuela Dahinden and Melanie Paschke (eds.). Zurich-Basel Plant Science Center, Zurich.

https://www.research-collection.ethz.ch/handle/20.500.11850/645000

Call for proposal for Science & Policy projects

PSC is invited to coordinate the design of a portfolio of Science and Policy projects (by doctoral candidates and postdoctoral researchers) in topics related to biodiversity, land use, climate change, practices of sustainable agriculture, food systems transformation. PCS is looking for UZH-led projects which integrate policy or practice partners in the application process and generate impact. The core of this project will be an internship at the premises of the project partner allowing the doctoral candidates and postdoctoral researchers to focus on the joint policy outcome. As a continuation of the successful research in the PSC Science and Policy fellowship programmes, the doctoral candidates and postdoctoral researchers will be trained at the science and policy interface.

Contact: luisa.last@usys.ethz.ch

Awards

Lorenz Allemann, doctoral student in the Grassland Sciences group, won the Swiss Forum for International Agricultural Research (SFIAR) award for his Master's thesis with the Plant Nutrition group.

https://sfiar.ch/sfiar-activities/sfiar-award

We wholeheartedly congratulate RESPONSE fellow **Linda Brodnicke** (see picture below) for her successful participation in the Marie Skłodowska-Curie Actions (MSCA) Science-Policy Pitch Competition 2023, that took place in Toledo, Spain. During this MSCA Presidency conference, 15 fellows and alumni presented their research or projects on bringing science closer to policy-making in front of a high-caliber jury and the audience. The jury selected Linda Brodnicke as the winner in the category "Contribution to wider EU policy priorities".

Linda Brodnicke at the MSCA Presidency conference.

RESPONSE Doctoral Programme

The RESPONSE Doctoral Programme (DP) is a joint doctoral programme of ETH Zurich, University of Zurich and University of Basel. Since the programme was launched in February 2020, 28 doctoral students have been recruited.

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

KYUSS v2.0 – An improved chromosome-level genome assembly of perennial ryegrass

This new genome assembly is an invaluable genomic resource for the forage and turf grass research and breeding community.

By Yutang Chen

The genome assembly is a digital representation of the DNA sequences in the nuclear genome, which provides the fundamental genetic information for downstream applications, such as genetic analysis and genomics-assisted breeding. Such important digital data is accessible for many model species, but it was not available for perennial ryegrass (*Lolium perenne* L.), one of the most important forage crops. It was not until 2021 that Kyuss, a doubled haploid genotype of *L. perenne*, was sequenced using Oxford Nanopore Technologies (ONT), and a reference-scale genome assembly of Kyuss was released by the Molecular Plant Breeding group of ETH Zurich (Frei et al., 2021).

Since then, this high-quality genome assembly (hereafter referred to as Kyuss v1.0) has become a highlight of *Lolium* species and has served as a great genomic resource for the forage and turf grass community. However, as Kyuss v1.0 was scaffolded to chromosomes based on a barley reference genome, which diverged from perennial ryegrass 30 million years ago (Pfeifer et al. 2013), the pseudo-chromosomes of Kyuss v1.0 might not reflect the true order or orientation of sequences in Kyuss genome.

To thoroughly examine the correctness of Kyuss v1.0, we generated 50-fold coverage high-throughput chromosome conformation capture (Hi-C) data using an Illumina next-generation sequencing platform (NovaSeq6000) in collaboration with IPK Gatersleben, Germany. With the Hi-C data and the state-of-the-art Hi-C mapping bioinformatics pipeline, a pairwise contact map was constructed for Kyuss v1.0 to verify the linkage between loci in the assembly (Figure 1A). Based on the Hi-C contact map, it is obvious that some unlinked loci were wrongly connected, for example, the loci between Chr. 2 and 4 or 6, and the loci between Chr. 5 and 7, reflected by the strong inter-chromosome Hi-C signals.

As the Hi-C data showed that there were errors in Kyuss v1.0, we decided to re-assemble Kyuss with the published ONT sequencing data and use the newly generated Hi-C data to assist scaffolding and pseudo-chromosome construction. By running the bioinformatics assembly and scaffolding pipelines on the high-performance computing server provided by ISG, ETH Zurich, we achieved a new assembly with a higher quality. Kyuss v2.0 shows a very high contiguity with a contig N50 of 120 Mb. It also shows a very high completeness with a total complete BUSCO score of 99%. Most importantly, with the structure of pseudo-chromosomes validated by the Hi-C contact map (Figure 1B), Kyuss v2.0 is a more accurate representation of the genome than Kyuss v1.0.

Given the outstanding quality, Kyuss v2.0 is considered the best assembly so far for *Lolium* species, and will serve as an invaluable genomic resource for the forage and turf grass community for advancing downstream genomic applications, such as genome-wide association studies and genomic selection.

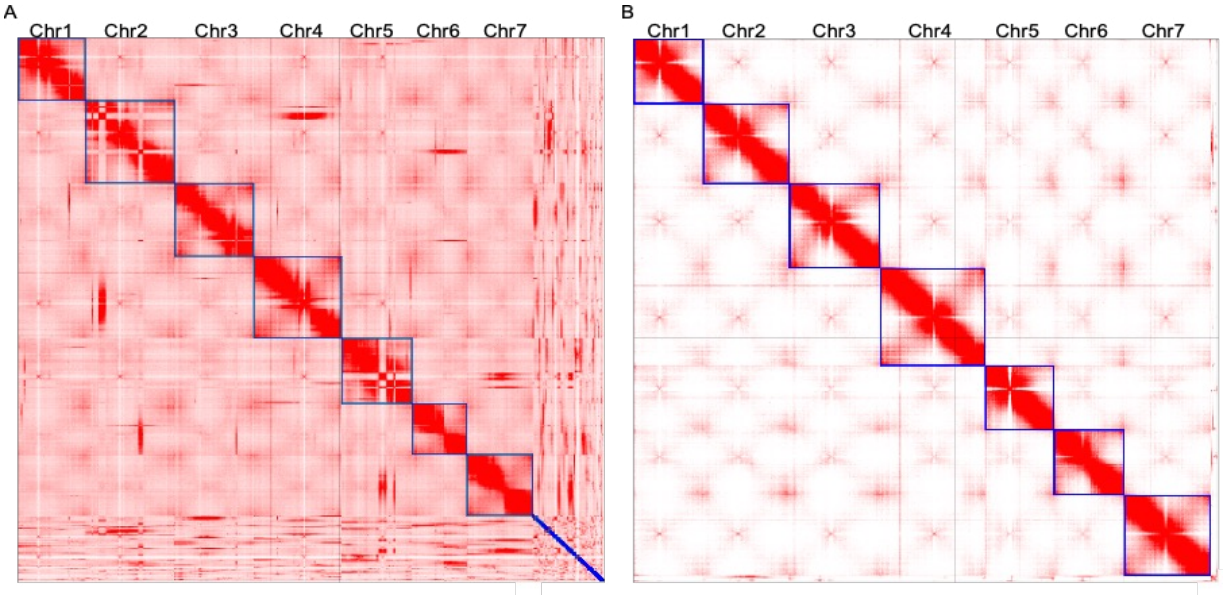

Figure 1: (A) Hi-C contact map of Kyuss v1.0. The contact map shows pair-wise interaction between loci within or between chromosomes. Each red pixel suggests one interaction captured between two loci. Theoretically, more interactions should be observed within chromosomes and between close loci. Therefore, for a correctly ordered and oriented assembly, most of the signals should be observed along the diagonal line within the pseudo-chromosome. Strong signals away from the diagonal suggest assembly or scaffolding errors. (B) Hi-C contact map of Kyuss v2.0. The correct order and orientation of sequences is indicated by the smooth signal along the diagonal line within each pseudo-chromosome.

The genome assembly of Kyuss v2.0 is publicly available in NCBI GenBank for anyone to access, use and enjoy. In the future, to generate more reference-level genome assemblies like Kyuss v2.0 for other forage grasses, high-performance computational resources and strong skills in bioinformatics are needed. Beyond that, collaborating with groups with excellent experience and facilities in whole-genome sequencing would be a great benefit for the project.

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

Fellow: Yutang Chen

Supervisor
Bruno Studer, Department of Environmental Systems Science, Molecular Plant Breeding, ETH Zurich

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Frei et al. 2021. Ultralong Oxford Nanopore Reads enable the development of a reference-grade perennial ryegrass genome assembly. *Genome Biol. Evol.*,13: evab159. https://doi.org/10.1093/gbe/evab159

Pfeifer et al. 2013. The perennial ryegrass GenomeZipper: Targeted use of genome resources for comparative grass genomics. *Plant Physiol.*,161: 571–582. https://doi.org/10.1104/pp.112.207282

Yutang Chen, Roland Kölliker, Martin Mascher, Dario Copetti, Axel Himmelbach, Nils Stein, Bruno Studer (2024). An improved chromosome-level genome assembly of perennial ryegrass (*Lolium perenne* L.), *Gigabyte*. https://doi.org/10.46471/gigabyte.112

PSC-JRC Collaborative Doctoral Programme

The PSC-JRC Collaborative Doctoral Programme is a hosted by ETH Zurich, University of Zurich and the Joint Research Center (JRC). The JRC's mission is to support EU policy and decision-making. Launched in 2019, the programme awarded four fellowships in "Bio-economy and forests" and "Soil and land use change". The doctoral candidates are enrolled in the Science and Policy PhD programme coordinated by PSC.

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

Modelling the phosphorus cycle in European agricultural soils

The DayCent model is used to simulate agricultural management practices in Europe.

By Anna Muntwyler

Phosphorus (P) is an essential nutrient for all crops, yet its excessive use as a fertiliser and subsequent diffuse loss leads to deterioration of water quality, eutrophication, and loss of biodiversity. At the same time, rock P is a critical raw material due to its importance for food production, finite geological deposits, and unequal regional distribution. As a consequence, nutrient management is addressed by numerous environmental policies such as the European Commission's Farm to Fork Strategy that seek to reduce nutrient losses by at least 50% and the use of fertilisers by at least 20% by 2030. But what effect do these policies have? One way to find out is by using an ecosystem process-based model as tool to depict the P cycle in agriculture soils, investigate the effects of management practices and climate change, and ultimately assess policy interventions that affect biogeochemical cycles. Therefore, the objective of this research was to find out how to model the P cycle at high spatial resolution across European agriculture using a calibrated process-based model.

We used the DayCent model due to its detailed representation of soil biogeochemistry, its validated nitrogen and carbon submodels, and its ability to simulate agricultural management practices. DayCent is a terrestrial ecosystem model designed to simulate fluxes of C and N among the atmosphere, vegetation, and soil. To calibrate and assess the P submodel it was essential to use measured field observations from four long-term experiments. They provide stabilised conditions and hold key information about the trends and dynamics of the different soil nutrient pools over time. Although further model assessment and development are needed, DayCent has demonstrated its capability to predict the main P fluxes over time under a wide variety of management practices and European conditions (Muntwyler et al., 2023).

After calibrating and testing the DayCent model, we proceeded to do a large-scale Europe wide integration using e.g., advanced input data sets and representative management practices (Muntwyler et al., 2024). The results depicted a surplus P budget (Fig. 1), P fluxes, and soil P pools consistent with literature and national statistics. Through agricultural management scenarios, we revealed a range of potential changes in the P budget by 2030 and 2050, influenced by the interlink of P with biogeochemical carbon and nitrogen cycles.

Thus, we developed a powerful assessment tool capable of (i) identifying areas with P surplus or deficit at high spatial resolution of 1 km^2, (ii) pinpointing areas where a change in agricultural management would be most urgent to reach policy goals in terms of environmental pollution, food security and resource efficiency of a critical raw material, and (iii) assessing the response of the P cycle to modifications in agricultural management.

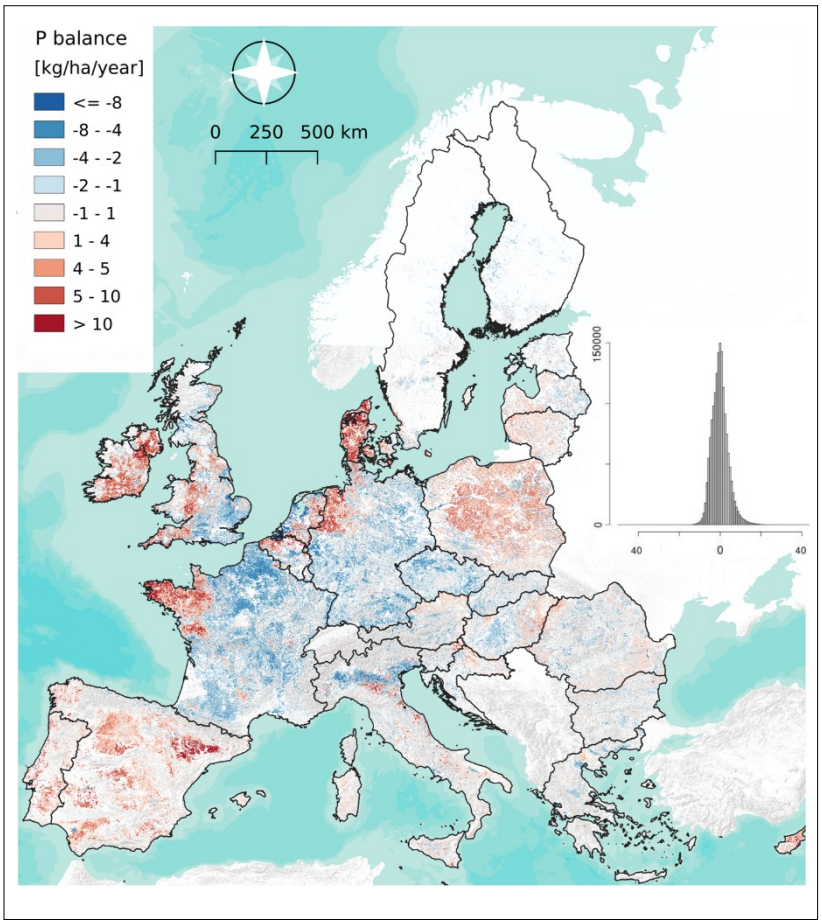


Figure 1: Average P balance for the period 2010–2019. The histograms display the frequency distribution of the P balances of the EU and the UK at pixel level (Muntwyler et al., 2024).

Fellow: Anna Muntwyler

Supervisors
Stephan Pfister and Steffanie Hellweg, Institute for Environmental Engineering (IfU), (ESD, ecological systems design), ETH Zurich

Emanuele Lugato and Panos Panagos, European Commission, Joint Research Centre, Ispra, Italy

References

Anna Muntwyler, Panos Panagos, Francesco Morari, Antonio Berti, Klaus A. Jarosch, Jochen Mayer, Emanuele Lugato (2023) Modelling phosphorus dynamics in four European long-term experiments. *Agricultural Systems*, Volume 206, 2023, 103595, ISSN 0308-521X, https://doi.org/10.1016/j.agsy.2022.103595.

Anna Muntwyler, Panos Panagos, Stephan Pfister, Emanuele Lugato (2024). Assessing the phosphorus cycle in European agricultural soils: Looking beyond current national phosphorus budgets. *Science of The Total Environment* 906: 167143. https://doi.org/10.1016/j.scitotenv.2023.167143.

Q&A

What data was used and how was it obtained?
The P submodel calibration and testing is based on data from four long-term experiments in northern Italy and Switzerland, operational since the 1960s and 1970s. The data provided necessary information on a variety of factors, including soil types, mineral and organic fertilizer treatments, crop rotations, and irrigation practices. We accessed the data by contacting the research centres that conduct long-term field experiments. To calibrate and assess the phosphorus submodel it was essential to use measured field observations from four long-term experiments. They provide stabilised conditions and hold key information about the trends and dynamics of the different soil nutrient pools over time.
The input data needed to run the DayCent model at the EU level were derived from open access state-of-the-art datasets with a detailed representation of agricultural management such as observed meteorological data and data-derived soil characteristics from the EU Soil Observatory, official statistics for land management practices, and the calibrated values for the P submodel (Fig. 2).

Who can or should use the data?
The results can be used by researchers in agronomy, soil science and environmental science, environmental modellers and data scientists, as well as stakeholders in policy interested in the effect of agricultural management on the nutrient cycle. Agricultural managers can use these findings to optimise fertilisation practices, while policymakers can employ the model for crafting environmentally sustainable and economically feasible agricultural policies.

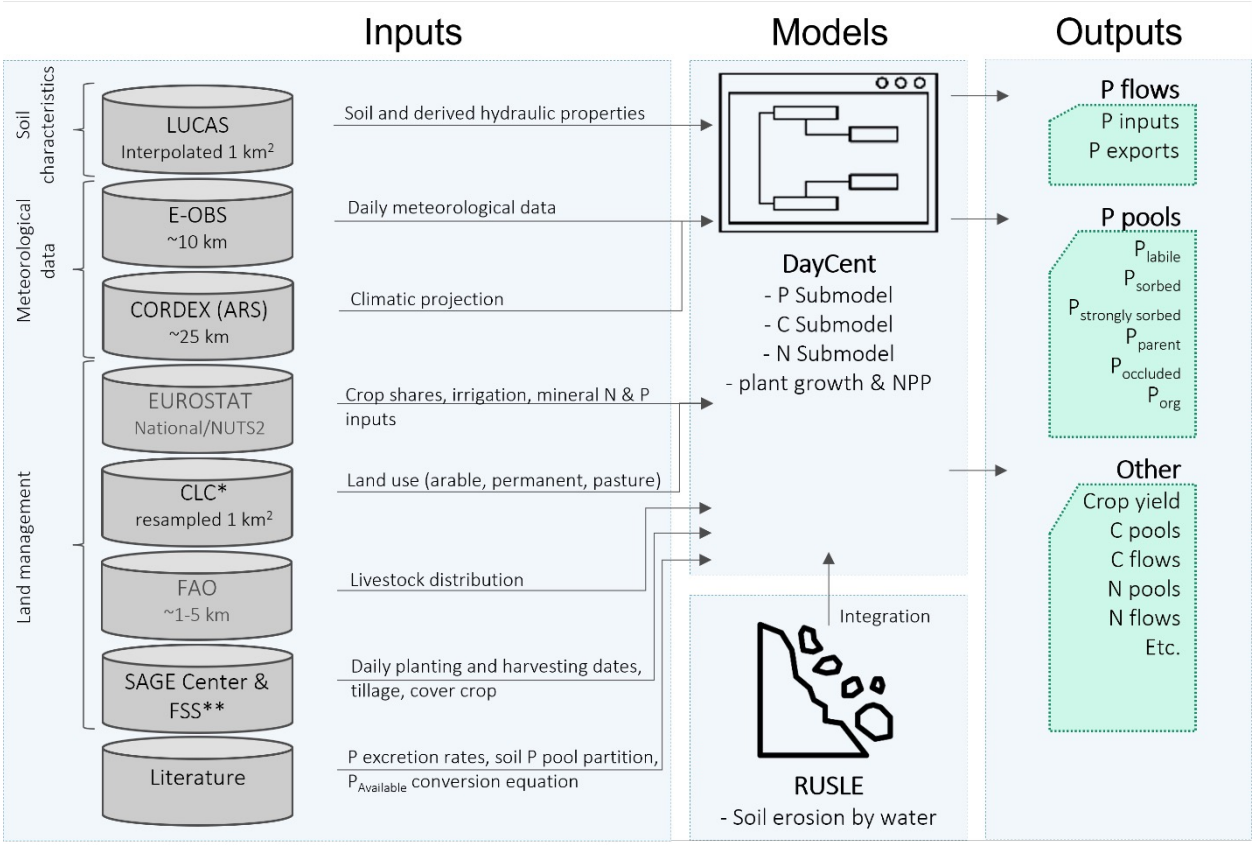


Figure 2: Flow chart showing the data inputs, their spatial resolution, the model integration, and the model outputs (Muntwyler et al., 2024). The inputs needed to run the DayCent model were derived from observationally derived datasets for soil characteristics and meteorological data, official statistics for land management practices, and calibrated values for the P submodel. * Corine Land Cover, ** Farm Structure Survey.

This project receives funding from the European Union under the Collaborative Doctoral Partnership Agreement No. 35317 with the European Commission Joint Research Centre and ETH Zurich.

This research has also received funding from the Mercator Research Programme of the World Food System Center (project “GOA”).

What infrastructures does that require?

The use of the model framework requires a robust digital infrastructure including data storage and management systems, and computational resources. It also requires the management of long-term field experiments for data calibration.

What training does it require?

Modelling Expertise: This kind of research requires an understanding of ecosystem models, particularly DayCent. **Data Analysis Skills:** Competence in handling and interpreting complex data sets. **Technical Knowledge in Agronomy and Environmental Science:** To contextualize data within the agricultural and environmental frameworks. **Computational Proficiency:** Familiarity with the software and hardware used in model simulation and data analysis.

The results of the upscaling of the model framework including all P flows and pools are openly accessible through the EU Soil Observatory

https://esdac.jrc.ec.europa.eu/content/phosphorus-cycle-european-agricultural-soils

Digital research data for open science: The long path from collection to reuse

By Nina Buchmann

Open science strategies, FAIR principles (Findability, Accessibility, Interoperability, and Reuse of digital assets), open-access data and publications: all these endeavours require scientific data not only to be collected in field and lab studies, but also to be transferred to servers or manually digitised, then quality-checked, complemented with metadata, stored, archived, curated, and advertised before finally being used again by students, colleagues or stakeholders. This long path of data, from collection to reuse, requires not only highly specific technical skills, databases and easy-to-use software in the research groups, good IT infrastructure, sufficient storage and archive facilities but also easy-access interfaces for potential users at institutions. Most importantly, it requires the willingness of the researchers (and their supervisors) to provide data and metadata to others, e.g., under Creative Commons licenses that allow different levels of free use (maybe also without an obligatory co-authorship), and users who cite DOIs of such datasets, acknowledging the work of experimentalists.

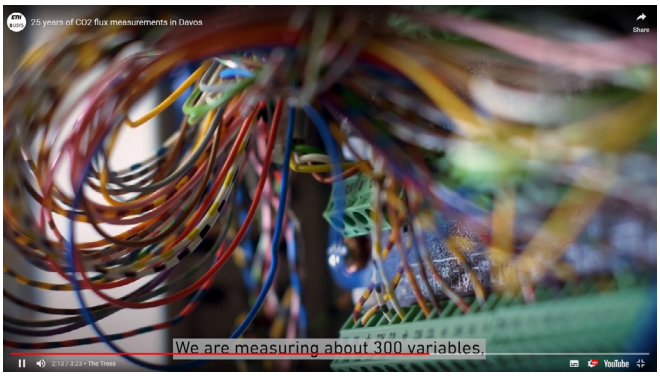
There are many excellent examples to draw from, pitfalls to avoid, and lessons to be learned, at group level, from collaborative projects, and in global networks. Within a group, standardised data collection, clear variable naming, processing and post-processing procedures, protected raw data partitions, dedicated servers for processed data as well as archiving with standardised metadata help to increase data coverage and quality as well as potential for data reuse. Where there are clear group policies on data management and sharing, students can “live” open science, assisted by data scientists and experienced researchers in the group, and drawing on informatics support and library services. Yet ensuring open science within a research group doesn’t come for free; it calls for dedicated finances, the support of university leadership and funding agencies.

Training students in computational competences during their studies, and exchanging best practises, protocols and experiences between groups helps to increase awareness, allay fears, provide examples (such as this one), and advertise open research data widely. Our experiences show that the benefits clearly outweigh the effort required.

The European Research Infrastructure ICOS RI provides harmonised greenhouse gas measurements throughout Europe.

Within large projects, such as the Integrated Carbon Observation System ICOS RI or ICOS-CH, further coordination across institutions and countries is needed. In some disciplines such as Earth System Sciences or Life Sciences, a common understanding has been developed over decades, pushed by some, discussed by all, implemented by many. The benefits of data sharing are numerous, ranging from new research ideas to additional insights and high impact studies, and even the adoption of new policies. New research infrastructures can learn from such experiences. Global networks, such as Fluxnet, bring data sharing and reuse to the next global level, providing long-term flux data from over 1000 active flux sites including the six sites within the Swiss FluxNet.

www.icos-switzerland.ch
www.icos-cp.eu



https://youtu.be/by-CERkxde0

25 years of CO_2 flux measurements in Davos

The Swiss FluxNet data have been downloaded 57,500 times from November 2016 to February 2024, used in many global-scale publications, with sometimes several hundred co-authors (Pastorello et al. 2020 with 208 co-authors; Lembrechts et al. 2022 with 402 co-authors), both with and without data providers. Such open and FAIR reuse of research data enhances student education, offers novel scientific insights, supports innovation, and increases the impact of own research.

A clear win-win for science at large!

https://gl.ethz.ch/research/bage/fluxnet-ch.html

Swiss Canopy Crane II research site for a large-scale climate manipulation experiment in forests

Since 2018, the Physiological Plant Ecology group at the University of Basel has run a large-scale experimental research site in a mature temperate forest near Hölstein (BL).

By Ansgar Kahmen

The extremely hot and dry European summers of 2003 and 2018 have demonstrated the severe impacts that a changing climate will have on forest ecosystems. Critical mechanisms that determine how drought will impact the functioning of trees and forests are, however, poorly understood. Most studies addressing the impact of reduced water availability on tree functioning have – for practical reasons – worked with potted seedlings and saplings. Albeit insightful, the results from these experiments are difficult to extrapolate to mature trees and real-world forest ecosystems. Resolving the drought response strategies of mature trees and their acclimation potential to a new climate therefore calls for substantial experimental efforts. This requires the experimental manipulation of water availability in mature forest ecosystems and a digital infrastructure that allows a comprehensive assessment of the physiological and morphological responses to drought at multiple spatial and temporal dimensions.

Since 2018, the Physiological Plant Ecology group at the University of Basel has established, together with national and international partners, a large-scale climate manipulation experiment in a mature mixed forest near Basel, referred to as the Swiss Canopy Crane II (SCCII) research site. The site is located on a typical plateau of the Jurassic mountains at an elevation of 550 m a.s.l.. Within an area of 1.6 ha, the site contains 458 mature trees from 14 different species and tree heights of up to 35 m.

In spring 2018, a 50 m-tall canopy crane with a 62.5 m jib was installed that provides canopy access to 312 trees. The site is divided in seven randomly distributed blocks containing control and a treatment plots. In the treatment plots, 50% of the growing season's precipitation is excluded by roofs that were installed below the trees' canopy in 2022. The size of the roofs range from 412 m^2 to 720 m^2 with a total area of 3100 m^2. They contain mobile panels that are closed (manually) prior to the onset of the growing season in the first week of April and re-opened in early October. This treatment resembles the natural seasonal oscillation of the soil moisture regime in temperate forests with high moisture availability in the winter and accentuates summer drought conditions as they are predicted by state-of-the-art climate models for the future.

Physiological and morphological responses to the experimental treatment are assessed for a total of 78 individual mature "target" trees and a large number of below-ground "next-generation" saplings at different temporal and spatial resolution. These assessments include conventional manual measurements of stomatal conductance and photosynthesis combined with measurements of water potential in the canopy on a monthly basis throughout the growing season. These measurements are complemented by samples collected regularly in the canopy and below ground for nutrient-, carbon reserve- and stable isotope analyses. These point-in-time data are embedded in a wealth of continuously assessed variables that are transferred to the lab in real time. These include climatic variables and continuous physiological variables, such as the flow of water through the trees' sapwood or high-resolution point-dendrometer measurements that provide real-time information on the trees' increment growth and water use.

Next to physiological variables, morphological adjustments above and below ground are most likely key strategies of trees to respond to and acclimate to a shifting climate. Tree and forest structure above and below ground is therefore regularly assessed at the site with state-of-the-art technology, such as below-ground rhizo-scanners, terrestrial and drone-operated laser scanners, delivering a 3D representation of the experimental forest. New tools for digital image analysis involving machine learning algorithms and convolutional neural networks are employed for change detection in these large data clouds.

The wealth of conventional and digital data collected at the SCCII research site in combination with new digital approaches for data analyses offers exciting opportunities for better anticipating how mature trees and forest will cope with and respond to the environmental challenges that they face in a changing climate. The project is of collaborative nature and the Physiological Plant Ecology group at the University of Basel invites researchers at PSC to get in touch if the experiment has sparked their interest.

https://ppe.duw.unibas.ch/en/sccii/

Figures. The research site is located in an exceptionally diverse forest that harbours more than 400 trees from 14 different species. The site is equipped with the latest infrastructure, including 88 automated point dendrometers, automated soil respiration chambers, 128 ceramic suction cups at various locations and depths across the site, and a range of automated environmental sensors in the soil, the forest floor and the canopy. A key piece of infrastructure is the new Swiss Canopy Crane II (SCC II), a 50 m-tall crane with a 62.5 m jib that provides canopy access to 312 trees from 12 different species. © Orsolya Haarberg

Trends in Ecology & Evol (2023)
ttps://doi.org/10.1016/j.tree.2023.08.017

The importance of Indigenous and local people for cataloging biodiversity

Juan C. Copete, Alfred Kik, Vojtech Novotny, Rodrigo Cámara-Leret

Indigenous and local peoples' (ILPs) role in cataloging life on Earth has been significant but underappreciated. ILPs knowledge faces growing cultural and biological threats. Greater participation by ILPs in research would make science more efficient, conservation more sustainable, and traditional knowledge stronger, but formidable obstacles remain.

Nature (2023)
https://doi.org/10.1038/s41477-023-01583-x

Subtilase-mediated biogenesis of the expanded family of SERINE RICH ENDOGENOUS PEPTIDES

Huanjie Yang, Xeniya Kim, Jan Skłenar, Sébastien Aubourg, Gloria Sancho-Andrés, Elia Stahl, Marie-Charlotte Guillou, Nora Gigli-Bisceglia, Loup Tran Van Canh, Kyle W. Bender, Annick Stintzi, Philippe Reymond, Clara Sánchez-Rodríguez, Christa Testerink, Jean-Pierre Renou, Frank L. H. Menke, Andreas Schaller, Jack Rhodes & Cyril Zipfel

Plant signalling peptides are typically released from larger precursors by proteolytic cleavage to regulate plant growth, development and stress responses. Recent studies reported the characterization of a divergent family of Brassicaceae-specific peptides, SERINE RICH ENDOGENOUS PEPTIDES (SCOOPs), and their perception by the leucine-rich repeat receptor kinase MALE DISCOVERER 1-INTERACTING RECEPTOR-LIKE KINASE 2 (MIK2). Here, we reveal that the SCOOP family is highly expanded, containing at least 50 members in the Columbia-0 reference *A. thaliana* genome. Notably, perception of these peptides is strictly MIK2-dependent. How bioactive SCOOP peptides are produced, and to what extent their perception is responsible for the multiple physiological roles associated with MIK2 are currently unclear. Using N-terminomics, we validate the N-terminal cleavage site of representative PROSCOOPs. The cleavage sites are determined by conserved motifs upstream of the minimal SCOOP bioactive epitope. We identified subtilases necessary and sufficient to process PROSCOOP peptides at conserved cleavage motifs. Mutation of these subtilases, or their recognition motifs, suppressed PROSCOOP cleavage and associated overexpression phenotypes. Furthermore, we show that higher-order mutants of these subtilases show phenotypes reminiscent of *mik2* null mutant plants, consistent with impaired PROSCOOP biogenesis, and demonstrating biological relevance of SCOOP perception by MIK2. Together, this work provides insights into the molecular mechanisms underlying the functions of the recently identified SCOOP peptides and their receptor MIK2.

PNAS (2023)
https://doi.org/10.1073/pnas.230466312

Enumerating soil biodiversity

Mark A. Anthony, S. Franz Bender, Marcel G. A. van der Heijden

Soil is an immense habitat for diverse organisms across the tree of life, but just how many organisms live in soil is surprisingly unknown. Previous efforts to enumerate soil biodiversity consider only certain types of organisms (e.g., animals) or report values for diverse groups without partitioning species that live in soil versus other habitats. Here, we reviewed the biodiversity literature to show that soil is likely home to 59 ± 15% of the species on Earth. We therefore estimate an approximately two times greater soil biodiversity than previous estimates, and we include representatives from the simplest (microbial) to most complex (mammals) organisms. Enchytraeidae have the greatest percentage of species in soil (98.6%), followed by fungi (90%), Plantae (85.5%), and Isoptera (84.2%). Our results demonstrate that soil is the most biodiverse singular habitat. By using this estimate of soil biodiversity, we can more accurately and quantitatively advocate for soil organismal conservation and restoration as a central goal of the Anthropocene.

Nature Ecology & Evolution (2023)
https://doi.org/10.1038/s41559-023-02189-4

Indirect genetic effects are shaped by demographic history and ecology in *Arabidopsis thaliana*

Germain Montazeaud, Quentin Helleu, Samuel E. Wuest & Laurent Keller

The phenotype of an individual can be affected by the genes of its conspecifics through indirect genetic effects (IGEs). IGEs have been studied across different organisms including wild and domesticated animals and plants, but little is known about their genetic architecture. Here, in a large-scale intraspecific interaction experiment, we show that the contribution of IGEs to the biomass variation of *A. thaliana* is comparable to values classically reported in animals. Moreover, we identify 11 loci explaining 85.1% of the variability in IGEs. We find that positive IGE alleles (that is, those with positive effects on neighbour biomass) occur both in relict accessions from southern Eurasia and in post-glacial colonizers from northern Scandinavia, and that they are likely to have two divergent origins: for nine loci, they evolved in the post-glacial colonizers independently from the relicts, while the two others were introgressed in the post-glacial colonizer from the relicts. Finally, we find that variation in IGEs probably reflects divergent adaptations to the contrasting environments of the edges and the centre of the native range of the species. These findings reveal a surprisingly tractable genetic basis of IGEs in *A. thaliana* that is shaped by the ecology and the demographic history of the species.

Nature Communications (2023)
https://doi.org/10.1038/s41467-023-43275-2

Dominance in self-compatibility between subgenomes of allopolyploid *Arabidopsis kamchatica* shown by transgenic restoration of self-incompatibility

Chow-Lih Yew, Takashi Tsuchimatsu, Rie Shimizu-Inatsugi, Shinsuke Yasuda, Masaomi Hatakeyama, Hiroyuki Kakui, Takuma Ohta, Keita Suwabe, Masao Watanabe, Seiji Takayama & Kentaro K. Shimizu

The evolutionary transition to self-compatibility facilitates polyploid speciation. In *Arabidopsis* relatives, the self-incompatibility system is characterized by epigenetic dominance modifiers, among which small RNAs suppress the expression of a recessive *SCR/SP11* haplogroup. Although the contribution of dominance to polyploid self-compatibility is speculated, little functional evidence has been reported. Here we employ transgenic techniques to the allotetraploid plant *A. kamchatica*. We find that when the dominant *SCR-B* is repaired by removing a transposable element insertion, self-incompatibility is restored. This suggests that *SCR* was responsible for the evolution of self-compatibility. By contrast, the reconstruction of recessive *SCR-D* cannot restore self-incompatibility. These data indicate that the insertion in *SCR-B* conferred dominant self-compatibility to *A. kamchatica*. Dominant self-compatibility supports the prediction that dominant mutations increasing selfing rate can pass through Haldane's sieve against recessive mutations. The dominance regulation between subgenomes inherited from progenitors contrasts with previous studies on novel epigenetic mutations at polyploidization termed genome shock.

Nature Communications (2023)
https://doi.org/10.1038/s41467-023-43396-8

Diversification of flowering plants in space and time

Dimitar Dimitrov, ..., Bernhard Schmid, Jingyun Fang, Carsten Rahbek & Zhiheng Wang

The rapid diversification and high species richness of flowering plants is regarded as 'Darwin's second abominable mystery'. Today the global spatiotemporal pattern of plant diversification remains elusive. Using a newly generated genus-level phylogeny and global distribution data for 14,244 flowering plant genera, we describe the diversification dynamics of angiosperms through space and time. Our analyses show that diversification rates increased throughout the early Cretaceous and then slightly decreased or remained mostly stable until the end of the Cretaceous–Paleogene mass extinction event 66 million years ago. After that, diversification rates increased again towards the present. Younger genera with high diversification rates dominate temperate and dryland regions, whereas old genera with low diversification dominate the tropics. This leads to a negative correlation between spatial patterns of diversification and genus diversity. Our findings suggest that global changes since the Cenozoic shaped the patterns of flowering plant diversity and support an emerging consensus that diversification rates are higher outside the tropics.

Nature Microbiology (2023)
https://doi.org/10.1038/s41564-023-01520-w

Soil microbiome indicators can predict crop growth response to large-scale inoculation with arbuscular mycorrhizal fungi

Stefanie Lutz, Natacha Bodenhausen, Julia Hess, Alain Valzano-Held, Jan Waelchli, Gabriel Deslandes-Hérold, Klaus Schlaeppi & Marcel G. A. van der Heijden

Alternative solutions to mineral fertilizers and pesticides that reduce the environmental impact of agriculture are urgently needed. Arbuscular mycorrhizal fungi (AMF) can enhance plant nutrient uptake and reduce plant stress; yet, large-scale field inoculation trials with AMF are missing, and so far, results remain unpredictable. We conducted on-farm experiments in 54 fields in Switzerland and quantified the effects on maize growth. Growth response to AMF inoculation was highly variable, ranging from −12% to +40%. With few soil parameters and mainly soil microbiome indicators, we could successfully predict 86% of the variation in plant growth response to inoculation. The abundance of pathogenic fungi, rather than nutrient availability, best predicted (33%) AMF inoculation success. Our results indicate that soil microbiome indicators offer a sustainable biotechnological perspective to predict inoculation success at the beginning of the growing season. This predictability increases the profitability of microbiome engineering as a tool for sustainable agricultural management.

Nature Climate Change (2023)
https://doi.org/10.1038/s41558-023-01627-2

Increasing the number of stressors reduces soil ecosystem services worldwide

Matthias C. Rillig, Marcel G. A. van der Heijden, Miguel Berdugo, Yu-Rong Liu, Judith Riedo, Carlos Sanz-Lazaro, Eduardo Moreno-Jiménez, Ferran Romero, Leho Tedersoo & Manuel Delgado-Baquerizo

Increasing the number of environmental stressors could decrease ecosystem functioning in soils. Yet this relationship has not been globally assessed outside laboratory experiments. Here, using two independent global standardized field surveys, and a range of natural and human factors, we test the relationship between the number of environmental stressors exceeding different critical thresholds and the maintenance of multiple ecosystem services across biomes. Our analysis shows that having multiple stressors, from medium levels (>50%), negatively and significantly correlates with impacts on ecosystem services and that having multiple stressors crossing a high-level critical threshold (over 75% of maximum observed levels) reduces soil biodiversity and functioning globally. The number of environmental stressors exceeding the >75% threshold was consistently seen as an important predictor of multiple ecosystem services, therefore improving prediction of ecosystem functioning. Our findings highlight the need to reduce the dimensionality of the human footprint on ecosystems to conserve biodiversity and function.

Nature Communications (2023)
https://doi.org/10.1038/s41467-023-41260-3

Seasonal pigment fluctuation in diploid and polyploid *Arabidopsis* revealed by machine learning-based phenotyping method PlantServation

Reiko Akiyama, Takao Goto, Toshiaki Tameshige, Jiro Sugisaka, Ken Kuroki, Jianqiang Sun, Junichi Akita, Masaomi Hatakeyama, Hiroshi Kudoh, Tanaka Kenta, Aya Tonouchi, Yuki Shimahara, Jun Sese, Natsumaro Kutsuna, Rie Shimizu-Inatsugi & Kentaro K. Shimizu

Long-term field monitoring of leaf pigment content is informative for understanding plant responses to environments distinct from regulated chambers but is impractical by conventional destructive measurements. We developed PlantServation, a method incorporating robust image-acquisition hardware and deep learning-based software that extracts leaf color by detecting plant individuals automatically. As a case study, we applied PlantServation to examine environmental and genotypic effects on the pigment anthocyanin content estimated from leaf color. We processed >4 million images of small individuals of four *Arabidopsis* species in the field, where the plant shape, color, and background vary over months. Past radiation, coldness, and precipitation significantly affected the anthocyanin content. The synthetic allopolyploid *A. kamchatica* recapitulated the fluctuations of natural polyploids by integrating diploid responses. The data support a long-standing hypothesis stating that allopolyploids can inherit and combine the traits of progenitors. PlantServation facilitates the study of plant responses to complex environments termed "*in natura*".

Nature Communications (2023)
https://doi.org/10.1038/s41467-023-43793-z

Identifying microbiota community patterns important for plant protection using synthetic communities and machine learning

Barbara Emmenegger, Julien Massoni, Christine M. Pestalozzi, Miriam Bortfeld-Miller, Benjamin A. Maier & Julia A. Vorholt

Plant-associated microbiomes contribute to important ecosystem functions such as host resistance to biotic and abiotic stresses. The factors that determine such community outcomes are inherently difficult to identify under complex environmental conditions. In this study, we present an experimental and analytical approach to explore microbiota properties relevant for a microbiota-conferred host phenotype, here plant protection, in a reductionist system. We screened 136 randomly assembled synthetic communities (SynComs) of five bacterial strains each, followed by classification and regression analyses as well as empirical validation to test potential explanatory factors of community structure and composition, including evenness, total commensal colonization, phylogenetic diversity, and strain identity. We find strain identity to be the most important predictor of pathogen reduction, with machine learning algorithms improving performances compared to random classifications (94-100% versus 32% recall) and non-modelled predictions (0.79-1.06 versus 1.5 RMSE). Further experimental validation confirms three strains as the main drivers of pathogen reduction and two additional strains that confer protection in combination. Beyond the specific application presented in our study, we provide a framework that can be adapted to help determine features relevant for microbiota function in other biological systems.

Nature Microbiology (2023)
https://doi.org/10.1038/s41564-023-01555-z

Leaf microbiome dysbiosis triggered by T2SS-dependent enzyme secretion from opportunistic *Xanthomonas* pathogens

Sebastian Pfeilmeier, Anja Werz, Marine Ote, Miriam Bortfeld-Miller, Pascal Kirner, Andreas Keppler, Lucas Hemmerle, Christoph G. Gäbelein, Gabriella C. Petti, Sarah Wolf, Christine M. Pestalozzi & Julia A. Vorholt

In healthy plants, the innate immune system contributes to maintenance of microbiota homoeostasis, while disease can be associated with microbiome perturbation or dysbiosis, and enrichment of opportunistic plant pathogens like *Xanthomonas*. It is currently unclear whether the microbiota change occurs independently of the opportunistic pathogens or is caused by the latter. Here we tested if protein export through the type-2 secretion system (T2SS) by *Xanthomonas* causes microbiome dysbiosis in *Arabidopsis thaliana* in immunocompromised plants. We found that *Xanthomonas* strains secrete a cocktail of plant cell wall-degrading enzymes that promote *Xanthomonas* growth during infection. Disease severity and leaf tissue degradation were increased in *A. thaliana* mutants lacking the NADPH oxidase RBOHD. Experiments with gnotobiotic plants, synthetic bacterial communities and wild-type or T2SS-mutant *Xanthomonas* revealed that virulence and leaf microbiome composition are controlled by the T2SS. Overall, a compromised immune system in plants can enrich opportunistic pathogens, which damage leaf tissues and ultimately cause microbiome dysbiosis by facilitating growth of specific commensal bacteria.

Remote Sensing of Env. (2023)
https://doi.org/10.1016/j.rse.2023.113835

Extracting single species flowering phenology from grassland species mixtures using time-lapse cameras

Davide Andreatta, Christoph Bachofen, Michele Dalponte, Valentin H. Klaus, Nina Buchmann

Understanding the impacts of climate change on plant phenology is crucial for predicting ecosystem responses. However, accurately tracking the flowering phenology of individual plant species in grassland species mixtures is challenging, hindering our ability to study the impacts of biotic and abiotic factors on plant reproduction and plant-pollinator interactions. Here, we present a workflow for extracting flowering phenology from grassland species mixtures using near-surface time-lapse cameras. We used 89 image series acquired in plots with known

species composition at the Jena trait-based experiment (Germany) to develop random forest classifiers, which were used to classify images and compute time series of flower cover for each species. The high temporal resolution of time-lapse cameras allowed to select images in proper light conditions, and to extract vegetation indices and texture metrics to improve discrimination among flowering species. The random forest classifiers showed a high accuracy in predicting the cover of *Leucanthemum vulgare*, *Ranunculus acris*, and *Knautia arvensis* flowers, whereas graminoid flowers were harder to predict due to their green-to-brownish colours. The proposed workflow can be applied in climate change studies, ecosystem functioning, plant community ecology, and biodiversity change research, including the investigation of effects of species richness on individual species' flowering phenology. Our method could be a valuable tool for understanding the impacts of climate change on plant reproduction and ecosystem dynamics.

Science of The Total Env. (2023)
https://doi.org/10.1016/j.scitotenv.2023.162490

Soil (microbial) disturbance affect the zinc isotope biogeochemistry but has little effect on plant zinc uptake

Xiaowen Liu, Yi Huang, Hang Guan, Matthias Wiggenhauser, Veronica Caggìa, Klaus Schlaeppi, Adrien Mestrot, Moritz Bigalke

Zinc (Zn) is an important micronutrient but can be toxic at elevated concentrations. We conducted an experiment to test the effect of plant growth and soil microbial disturbance on Zn in soil and plants. Pots were prepared with and without maize and in an undisturbed soil, a soil that was disturbed by X-ray sterilization and a soil that was sterilized but reconditioned with the original microbiome. The Zn concentration and isotope fractionation between the soil and the soil pore water increased with time, which is probably due to physical disturbance and fertilization. The presence of maize increased the Zn concentration and isotope fractionation in pore water. This was likely related to the uptake of light isotopes by plants and root exudates that solubilized heavy Zn from the soil. The sterilization disturbance increased the concentration of Zn in the pore water, because of abiotic and biotic changes. Despite a threefold increase in Zn concentration and changes in the Zn isotope composition in the pore water, the Zn content and isotope fractionation in the plant did not change. These results have implications for Zn mobility and uptake in crop plants and are relevant in terms of Zn nutrition.

Nature Ecology & Evolution (2024)
https://doi.org/10.1038/s41559-023-02287-3

Transnational conservation to anticipate future plant shifts in Europe

Yohann Chauvier-Mendes, Laura J. Pollock, Peter H. Verburg, Dirk N. Karger, Loïc Pellissier, Sébastien Lavergne, Niklaus E. Zimmermann & Wilfried Thuiller

To meet the COP15 biodiversity framework in the European Union (EU), one target is to protect 30% of its land by 2030 through a resilient transnational conservation network. The European Alps are a key hub of this network hosting some of the most extensive natural areas and biodiversity hotspots in Europe. Here we assess the robustness of the current European reserve network to safeguard the European Alps' flora by 2080 using semi-mechanistic simulations. We first highlight that the current network needs strong readjustments as it does not capture biodiversity patterns as well as our conservation simulations. Overall, we predict a strong shift in conservation need through time along latitudes, and from lower to higher elevations as plants migrate upslope and shrink their distribution. While increasing species, trait and evolutionary diversity, migration could also threaten 70% of the resident flora. In the face of global changes, the future European reserve network will need to ensure strong elevation and latitudinal connections to complementarily protect multifaceted biodiversity beyond national borders.

Nature Reviews (2024)
https://doi.org/10.1038/s43017-023-00514-w

Crop traits and production under drought

Vincent Vadez, Alexandre Grondin, Karine Chenu, Amelia Henry, Laurent Laplaze, Emilie J. Millet & Andrea Carminati

Drought limits crop productivity and threatens global food security, with moderate drought stress — when crops grow at a reduced rate — commonly experienced. Increasing plant tolerance to moderate drought is a key target for adaptation and management, but efforts to understand and increase drought tolerance often focus on more extreme drought that causes complete crop failure and only consider crop genetics. In this Review, we discuss the influence of moderate drought on crop productivity and the role of physiological traits in drought tolerance and adaptation. Traits related to crop water use, water capture, water availability, transpiration efficiency and phenology impact drought adaptation, but their overall effect varies situationally. For example, early restrictions in transpiration, higher transpiration efficiency or altered tillering increase water availability during grain filling and can double yield in some drought scenarios. However, these same traits under less severe drought scenarios can also lead to yield penalties. To assess when and under what conditions traits will be beneficial, crop models are used to integrate the effects of genetics, the environment and management, estimating the expected yield responses under these combinations of scenarios and traits. More robust characterization of moderate drought tolerance and better integration between plant genetic information and modelling will enable the local selection of crop varieties suited to the expected drought scenarios.

Nature Communications (2024)
https://doi.org/10.1038/s41467-023-44073-6

Biotic homogenization, lower soil fungal diversity and fewer rare taxa in arable soils across Europe

Samiran Banerjee, Cheng Zhao, Gina Garland, Anna Edlinger, Pablo García-Palacios, Sana Romdhane, Florine Degrune, David S. Pescador, Chantal Herzog, Lennel A. Camuy-Velez, Jordi Bascompte, Sara Hallin, Laurent Philippot, Fernando T. Maestre, Matthias C. Rillig & Marcel G. A. van der Heijden

Soil fungi are a key constituent of global biodiversity and play a pivotal role in agroecosystems. How arable farming affects soil fungal biogeography and whether it has a disproportional impact on rare taxa is poorly understood. Here, we used the high-resolution PacBio Sequel targeting the entire ITS region to investigate the distribution of soil fungi in 217 sites across a 3000 km gradient in Europe. We found a consistently lower diversity of fungi in arable lands than grasslands, with geographic locations significantly impacting fungal community structures. Prevalent fungal groups became even more abundant, whereas rare groups became fewer or absent in arable lands, suggesting a biotic homogenization due to arable farming. The rare fungal groups were narrowly distributed and more common in grasslands. Our findings suggest that rare soil fungi are disproportionally affected by arable farming, and sustainable farming practices should protect rare taxa and the ecosystem services they support.

Nature Communications (2024)
https://doi.org/10.1038/s41467-024-45155-9

Effects of climate and environmental heterogeneity on the phylogenetic structure of regional angiosperm floras worldwide

Hong Qian, Shenhua Qian, Jian Zhang & Michael Kessler

The tendency of species to retain ancestral ecological distributions (phylogenetic niche conservatism) is thought to influence which species from a species pool can persist in a particular environment. Thus, investigating the relationships between measures of phylogenetic structure and environmental variables at a global scale can help understand the variation in species richness and phylogenetic structure in biological assemblages across the world. Here, we analyze a comprehensive data set including 341,846 species in 391 angiosperm floras worldwide to explore the relationships between measures of phylogenetic structure and environmental variables for angiosperms in regional floras across the world and for each of individual continental (biogeographic) regions. We find that the global phylogenetic structure of angiosperms shows clear and meaningful relationships with environmental factors. Current climatic variables have the highest predictive power, especially on phylogenetic metrics reflecting recent evolutionary relationships that are also related to current environmental heterogeneity, presumably because this favors plant speciation in various ways. We also find evidence that past climatic conditions, and particularly refugial conditions, play an important role in determining the phylogenetic structure of regional floras. The relationships between environmental conditions and phylogenetic metrics differ between continents, reflecting the different evolutionary histories of their floras.

Science (2024)
https://doi.org/10.1126/science.adg8028

The global distribution of plants used by humans

S. Pironon, I. Ondo, M. Diazgranados, R. Allkin, A. C. Baquero, R. Cámara-Leret,C. Canteiro, Z. Dennehy-Carr, R. Govaerts, S. Hargreaves, A. J. Hudson, R. Lemmens, W. Milliken, M. Nesbitt, K. Patmore, G. Schmelzer, R. M. Turner, T. R. van Andel, T. Ulian, A. Antonelli, K. J. Willis

Plants sustain human life. Understanding geographic patterns of the diversity of species used by people is thus essential for the sustainable management of plant resources. Here, we investigate the global distribution of 35,687 utilized plant species spanning 10 use categories (e.g., food, medicine, material). Our findings indicate general concordance between utilized and total plant diversity, supporting the potential for simultaneously conserving species diversity and its contributions to people. Although Indigenous lands across Mesoamerica, the Horn of Africa, and Southern Asia harbor a disproportionate diversity of utilized plants, the incidence of protected areas is negatively correlated with utilized species richness. Finding mechanisms to preserve areas containing concentrations of utilized plants and traditional knowledge must become a priority for the implementation of the Kunming-Montreal Global Biodiversity Framework.

Professor Sabine Rumpf, University of Basel

sabine.rumpf@unibas.ch
@EcologyBasel

In 2022, Sabine Rumpf joined the Department of Environmental Sciences of the University of Basel as Assistant Professor. Sabine received her PhD from the University of Vienna in 2018. During her PhD, she studied climate-driven range dynamics and current disequilibrium in Alpine vegetation. Since completing her PhD, Sabine has focused on alpine and arctic regions, because these relatively pristine areas allow her to study the impact of environmental change without too much interference from human action. Furthermore, alpine and arctic regions are warming even faster than other areas on Earth, have a disproportionately high level of biodiversity, and provide fundamental ecosystem services.

In her research, she combines field observations and experiments, remote sensing, and historical online data sources with modelling techniques to infer impacts of environmental change on the distribution, diversity and performance of plant species. Understanding past and predicting future changes of these ecosystem is essential to conserve global biodiversity, fulfill global sustainability commitments, and ensure the integrity of ecosystems vital to humankind.

https://duw.unibas.ch/en/eco/

Fieldwork in Svalbard, Spitsbergen. © Marcel Schütz

Future of land use in Switzerland

With 48% of habitats in Switzerland endangered, more action for biodiversity conservation and restoration are needed. Here we present insights from our recent stakeholder event.

At the 15th UN Biodiversity Conference (COP15, 2022) in Montreal, Canada, all 195 countries agreed that 30% of land and water areas should be reserved for habitat and species protection.

On 26 September 2023, PSC organised a fireside chat in collaboration with the Franxini Project. Here, some 40 participants comprising PSC scientists, the Franxini team, and representatives of governmental and non-governmental organisations discussed what Switzerland could look like, assuming that the biodiversity targets set in Kunming and Montreal are achieved in 2030.

Food for thought was provided by presentations from Dr. Eva Spehn, Swiss Academy of Sciences (SCNAT), on the implementation of the Global Biodiversity Framework in Switzerland (Title of talk: Ecological infrastructure and land use conflicts), and from Professor Maria J. Santos, University of Zurich, on international biodiversity targets and implications for national implementation.

The participants were divided into six groups, each of which focused on a specific aspect of the two overarching questions: First, despite the increasing demand for land for food, animal feed and energy production and also for living space, how can we protect species and habitats? Second, what challenges and possible solutions to the biodiversity crisis are emerging in the various types of landscape use in Switzerland – urban settlement areas (SA), rural SA, agricultural zones, natural forests and woodlands, high alpine areas and water bodies?

To address this task, co-creation and design thinking approaches were adopted; the answering of the questions in a series of steps and the brainstorming processes were moderated so as to include the perspectives of all discussion participants.

The discussion hinged on six scenarios based on the COP15 objectives. For the first part in the small groups, participants immersed themselves in the scenario and imagined what it would take to achieve a target by 2030. To this end, scientific, technological, societal, and political factors were collected to provide an overview of the necessary developments in various sectors and areas. In the second part, the focus was on specific types of landscape, in order to determine concrete challenges and opportunities for the actors concerned. Ultimately, this made it possible to start a discussion on possible leverage points at the political, societal, technological and scientific level. The outcomes were compiled in a technical report.

Upcoming: Together with the Swiss Biodiversity Forum, Reatch and the Franxini Project, the Risk Dialogue Foundation and members of the Engage Joint Initiative team, PSC is planning a follow-up stakeholder event.


University of Zurich | ETH zürich | University of Basel | FX | Reatch

Zurich-Basel Plant Science Center

Report

Science & Policy Stakeholder Event: The future of land-use in Switzerland under the new Global Biodiversity Framework (COP15). Technical Report

Synthese: Melanie Paschke, Hannah Schoch, Luisa Last
Protokolle & Moderationen: Lucius Arn, Anna Krebs, Simon Landauer, Paul Donadieu de Lavit, Monika Katarzyna Goralczyk, Fabian Hess, Xeniya Kim, Josianne Kollmann, Luisa Last, Alberto Linares Quirós, Carles Quesada Traver, Roberto Rebollo Hernandez, and Hannah Schoch

Zitiervorschlag: Zurich-Basel Plant Science Center, Science & Policy: The future of land-use in Switzerland under the new Global Biodiversity Framework (COP15), Franxini Fireside Chat, September 26, 2023, Technical Report 2023.

Online available at:
https://blogs.ethz.ch/Science_and_Policy/2023/10/20/science-policy-stakeholder-event/#more-3004

The future of land-use in Switzerland under the new Global Biodiversity Framework (COP15). Technical Report.

https://blogs.ethz.ch/Science_and_Policy/2023/10/20/science-policy-stakeholder-event/

This event was part of the RESPONSE Doctoral Programme and received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie (MSC) grant agreement No. 847585.

Unlocking valuable protein sources in buckwheat

Interview with Fabian Hess, doctoral candidate and RESPONSE fellow at ETH Zurich, on his research, policy work and public engagement.

Pseudocereals such as buckwheat (*Fagopyrum esculentum Moench*) are underutilised as sources for plant-based proteins. Fabian Hess, doctoral candidate of the Molecular Plant Breeding group at ETH Zurich and RESPONSE fellow, seeks to describe the great diversity of buckwheat in a unique collection of buckwheat accessions and to understand how these accessions behave under Swiss conditions. This detailed knowledge will lay the foundation for the establishment of efficient breeding programmes in the future. Together with collaborators such as ProSpecieRara, Fabian is especially interested in aligning his evaluation with needs formulated by stakeholders along the value chain, including farmers, processors, retailers and also researchers and policymakers.

Interview with Fabian Hess

What are the benefits for farmers, gardeners and breeders?

Buckwheat breeders will certainly get the most direct value out of this project. The phenotypic information from the field combined with genetic data from the lab will enable breeders to integrate new germplasm into their breeding programmes much more easily. Moreover, we also hope that there might be some interesting accessions in our collection that have previously not been accessible or known to farmers and gardeners. The rigorous testing and the detailed information on development and yield in different environments can help farmers to choose the right accession for the specific conditions on their land.

What evidence could be useful for policymaking?

Collecting and conserving genetic resources has been regarded as essential for the development of sustainable and resilient agroecosystems. However, while large gene banks have been established, the usage of these resources often remains disappointingly low. This project can serve as an example of how such valuable resources can be made available. Large collections of genetic resources (especially those including many local and traditional varieties) may display an astonishing diversity and contain many exciting traits that could inspire the imagination of any plant breeder. However, the integration of these resources into modern breeding programmes is no trivial matter as these accessions usually lag far behind elite varieties that have been systematically improved for many decades. This is especially true when it comes to neglected and underutilised crops that will struggle to compete with major crops in terms of yield and market potential. Therefore, continuous support from politics and governments will be needed to develop diverse genetic resources and promote the usage and cultivation of niche crops, as they will ultimately add great ecological and nutritional value to the food system.

And how can civil society engage and benefit?

We opened up our research project to a wider public, by using a participative seed propagation approach and the organisation of a stakeholder workshop in September 2023. Participative seed propagation made it possible for hobby gardeners to get involved in our research and help us multiply seed for the field trials. Besides the practical value of producing seed, this kind of involvement also sparks valuable conversations and discussions that would not evolve otherwise. For example, about the diversity and aesthetic value of our agricultural landscapes, but also the tediousness and hardship of unmechanised agriculture. The stakeholder workshop on the other hand was involving people who already have experience and knowledge about buckwheat and would like to share their expertise and discuss ideas to foster the usage of buckwheat in Switzerland. Through this workshop we were able to share our work with an interested public and demonstrate the value and diversity of our buckwheat collection. Additionally, the exchange with experienced practitioners allows us to better align our research activities with the requirements of society.

https://blogs.ethz.ch/Science_and_Policy/2022/12/06/plant-based-proteins-unlock-valuable-protein-sources-in-the-pseudocereal-buckwheat/

Download flyer.

Brownbag series for lecturers with focus on the use of generative artificial intelligence in teaching at the Bachelor's, Master's and PhD level at D-USYS.

Please find further information on all previous Monthly MondAI events on our Moodle site:
https://moodleapp2.let.ethz.ch/course/view.php?id=20321

Organised by:
ETH Zurich, Department of Environmental Systems Sciences and Zurich-Basel Plant Science Center.

The POT-AI Innovedum team:
Melanie Paschke, Manuel Sudau, Réka Mihálka.

Monthly MondAI #4:Insights from pioneers

4 March 2024, 12.00-13.30

The HS23 "pioneer" lecturers of the Innovedum project will have a round table discussion about the insights gained from working with AI-based tools in their courses. They will share their experiences regarding adaptation strategies, preferred tools, the range of tasks on which AIbased tools were used, the assessment of students' work, and, potentially, any open questions. The round table will be followed by a Q&A with the audience.

Monthly MondAI #5: AI-based tools beyond writing

8 April 2024, 12.00-13.30

This Monthly MondAI event will highlight the diversity of educational applications of AI-based tools. To help lecturers conceptualise their own teaching scenarios, we will showcase examples where AI-based tools were used for tasks beyond scientific writing, including coding, visualisation, gamification, and more. Get some hands-on training on different educational examples with AI-based tools.

Monthly MondAI #6: Students' perspectives

6 May 2024, 12.00-13.30

Students who have already collected valuable experiences while working with AI-based tools will offer their perspectives on how they incorporate AI-based tools in the learning process. The students will demonstrate a few typical use cases and discuss with participating lecturers some best practices for AI-based tools in and outside of the classroom.

All participants are kindly requested to register before the events here:
https://doodle.com/meeting/participate/id/avZ13l8a

New field course

Loch Melfort from the Kilchoan estate which has several rewilding projects. © J.Schlaepfer.

Creating cyanotypes in situ, always a surprising result. © J. Schlaepfer

Marine ecology and art

Jaboury Ghazoul and Juanita Schläpfer from the PSC outreach team are developing a new field course in marine ecology and art, to be held in Scotland from 19 to 24 August 2024.

How do we cultivate societal values that recognise the diversity and importance of life on earth, and which respect the limits of Earth's planetary boundaries? What roles do knowledge, imagination, and creativity play in enabling such values?

This course introduces students to a new environment that they are not likely to be familiar with – the marine ecosystems of the Scottish West Coast. Students will explore and seek to understand both the marine environment and the culture and people of these coastal areas. It is precisely because the ecosystem, the geography, and the culture are unfamiliar, that we will be able to explore many ideas and concepts with a more open mind, and through diverse perspectives, than might otherwise be the case.

We will visit the people and projects involved in marine science and coastal economies, exploring marine diversity and the ecology of different coastlines, stepping back into ecological history to gain a better understanding of the foundations and basic principles of modern ecology. We will also investigate how people are restoring the marine environment and deriving new economic opportunities from it. We will use scientific as well as artistic documentation methods and tools. The course is open primarily to doctoral students at ETH Zurich and University of Zurich.

Registration and information here: https://ethz.ch/staffnet/en/service/courses-continuing-education/details.10646o.html

Pre-registration is mandatory. Apply with motivation letter to juanita.schlaepfer@usys.ethz.ch

Greenhouse at the Botanical Garden of University Basel.
Photo by Mark Niedermann. © Universität Basel

Science Communication and Excursion Management in the Botanical Gardens

The course aims to provide students with the didactic and technical foundations for knowledge transfer between the scientific community and the general public, using the example of guided tours in the Botanical Garden of the University of Basel. In the theoretical part of the course, students are taught the didactic concepts of knowledge transfer, which they can then apply by independently preparing and organising a guided tour in the botanical garden in the practical part. The course thus lays the basis for scientific public relations work, excursions and the organisation of guided tours in botanical gardens and other scientific collections. The course is taught by Prof. Ansgar Kahmen from the University of Basel, Ursina Studer from the Botanical Garden Association at the Spalentor, and Yvonne Barmettler and Angelo Bolzern from the Natural History Museum Basel.

Welcome Jelena Rajkov

Dr. Jelena Rajkov joined our team as coordinator for the University of Basel in September 2023. Jelena is an evolutionary biologist by training with more than 10 years of experience in international higher education and science outreach. She is also a coordinator at the Department of Environmental Sciences at the University of Basel, where she is supporting doctoral students in administrative matters, organising courses and various outreach events for the department, and establishing a new PhD Programme in Environmental Sciences.

Contact: jelena.rajkov@unibas.ch

Upcoming

Online Information Events

Get to know the PhD Programme in Plant Sciences
13 May 2024, 12:00–13:00
(Online)

Registration
https://doodle.com/meeting/participate/id/aQOvPg0d

Get to know the PhD Programme in Science and Policy
13 May 2024, 13:00–14:00
(Online)

Registration
https://doodle.com/meeting/organize/id/dwkROzJ

Science & Policy Talk

19 June 2024, 17:00 - 18:30
Perspectives for science-based policy advice as a young researcher in Switzerland

Registration
https://ethz.ch/staffnet/en/service/courses-continuing-education/details.10425o.html

PhD Welcome Event

2 September 2024, 12:00–13:30
ETH Zurich, on-site

Registration
http://https//doodle.com/meeting/participate/id/dwnAM51b/vote

GreenLab Zurich Group

An initiative run by graduate students, technicians, postdoctoral researchers and group leaders at University of Zurich and ETH Zurich to promote sustainability in research.

PSC members are heading up two sustainability projects supporting the University of Zurich's aim to become carbon-neutral by 2030. The Green4Clim project uses Irchel Campus as a real-world laboratory. The project team led by Maria J. Santos and Eugenie Paul-Limoges deploys complex measurements and experiments to investigate how the vegetation on campus should be managed – on the one hand to extract as much climate-damaging carbon dioxide from the atmosphere as possible, and on the other to cool the buildings more efficiently and thus reduce energy consumption.

The Tip Wash project implements a standardised process for cleaning pipette tips with a special device, thus enabling multiple use. The project also examines legal issues, work processes and biosecurity. It is led by Célia Baroux, Hanspeter Schöb, Barbara Keller, Valeria Gagliardini Fankhauser, Eva Marina Stirnemann, Lena Stransfeld.

The Sustainability Team at the University of Zurich supports ongoing activities relating to sustainability in research, teaching, and daily operations. It coordinates the implementation of associated measures and fosters communication between all members of the university community working for sustainability.

www.sustainability.uzh.ch/en/about-us/team.html

The ETH Sustainability team is committed to increasing ETH Zurich's contribution to sustainable development and to communicating this internally and externally. It supports initiatives, projects and individuals that boost sustainability at the university.

https://ethz.ch/en/the-eth-zurich/sustainability/eth-sustainability/team-eth-sustainability.html

PhD Programme in Plant Science	
Research & Technical Skills	
Concepts in Evolutionary Biology (UZH BIO395)	11.03.-12.03.2024 (2 days, 1 ECTS)
Biology of Orchids	27.04.-04.05.2024 (2 days, 1 ECTS)
Genetic Diversity: Analysis (ETHZ 701-1425-01L)	17.06.-28.06.2024 (10 days, 2 ECTS)
Managing your Publication Workflow and your Open Data	19.06.-03.07.2024 (3 days, 1 ECTS)
Alpine Plant Ecology – International Summer School	14.07.-20.07.2024 (6 days, 3 ECTS)
Marine Ecology and Art – Field course	19.-24.08.2024 (5 days, 2 ECTS)
Digital Skills	
Statistical Modelling	18.03.-20.03.2024 (3 days, 1 ECTS)
Introduction to Genome-wide Association Studies (GWAS) (UZH BIO692)	21.05.-23.05.2024 (3 days, 1 ECTS)
General Linear and Linear Mixed Models in R (UZH ECO331)	03.06.-27.06.2024 (6 days, 2 ECTS)
Advanced Data Management and Manipulation using R	07.06.-14.06.2024 (2 days, 1 ECTS)
Microbiomics II: Metabarcoding – from Bioinformatics to Statistics (ETHZ 751-5127-01L)	10.06.-13.06.2024 (4 days, 1 ECTS)
Reporting using R Markdown, Quarto & Shiny	05.07.-12.07.2024 (2 days, 1 ECTS)
Next Generation Sequencing 2 (UZH BIO634)	12.11.-13.11.2024 (2 days, 1 ECTS)
Transferable Skills	
Science Communication and Excursion Management in the Botanical Gardens	05.03.-21.05.2024 (10x 2h, 1ECTS)
Ethics and Scientific Integrity for Doctoral Students (ETHZ 751-1040-00L)	08.03.-12.04.2024 (2x half days, 1 ECTS)
Scientific Writing Practice II	24.04.-06.05.2024 (3 days, 1 ECTS)

Fore more information and registration:
www.plantsciences.uzh.ch/en/teaching.html

ETH webpage for courses and continuing education:
https://ethz.ch/staffnet/en/service/courses-continuing-education.html

For additional courses from UZH:
https://lsz-tsc-training.lifescience-graduateschool.uzh.ch/en/page/transferable-and-methodological-skills-courses

PhD Programme in Plant Science (cont.)

Crosslisted Courses

ETHZ Library https://library.ethz.ch/en/news-and-courses/courses.html	
Research Data Management and Related Topics	06.3.-27.03.2024 (1-4 h, 6 indivdual workshops)
Center for Reproducible Science (UZH) https://www.crs.uzh.ch/en/training.html	
Good Research Practice (K_GRPe)	15.03.2024 (1 day)
5 Steps to Good Data Science Practice in R (10SMOS_2)	27.02.-28.05.2024 (every 2nd Tuesday 16:15-18:00)
Open Access Basics (10SMOA_1)	13.03.2024 (1 day)
Open Data Basics (10SMOD_1)	18.03.2024 (1 day)
Making your Data FAIR (10SMOD_2)	27.03.2024 (1 day)
ReproducibiliTea Journal Club (https://www.crs.uzh.ch/en/training/ReproducibiliTea.html)	
Functional Genomics Center (UZH-ETHZ) https://fgcz.ch/education.html	
RNA Next Generation Sequencing (UZH BIO675) – Training & Data Analysis	18.-22.03.2024 or 17.-21.06.2024
RNA Next Generation Sequencing (UZH BIO675) – Data Analysis	20.-22.03.2024 or 19.-21.06.2024
Introduction to Next Generation Sequencing Data Analysis with SUSHI	26.04.2024
Next Generation Sequencing Applied to Metagenomics (UZH BIO638)	24.-28.06.2024 or 26.-28.06.2024
DNA Next Generation Sequencing (UZH BIO680)	13.-17.05.2024 or 15.-17.05.2024
CRISPR-Cas: A Versatile and Scalable Gene Perturbation System for Genetic Screens (UZH BIO 695)	09.-11.04.2024

PhD Programme in Science and Policy

Science & Policy Workshop F: Understanding Policy Evaluation	13.03.-10.04.2024 (2 days, 1 ECTS)
Science & Policy Workshop E: Contributing to Policy Action – Analysis and Communication of Risks and Uncertainties	27.05.-29.05.2024 (3 days, 2 ECTS)
Science & Policy Talk: Perspectives for Science-based Policy Advice as a young Researcher in Switzerland	19.06.2024 (1.5 h, 0 ECTS)

PSC course catalogue:
www.plantsciences.uzh.ch/en/teaching/coursecatalogue.html

Contact:
psc_phdprogram@ethz.ch

Finest printing precision

Interview with Barbara Horvath, co-founder of Inveel. Barbara was a participant in the feminno career development and innovation programme.

Which important societal and technical problem is addressed by your company Inveel and why is your service unique?

We have developed a technology that allows the printing of electronics in unparalleled resolution of 100 nanometre line-widths on all sorts of curved surfaces. This way, we can print high resolution sensors on robot body parts, which gives them the "feeling of touch". Since with our method almost any kind of circuit can be printed, all sorts of different sensors can be placed across large areas of the robot's body, which can give them additional functionalities, like being able to sense heat, humidity, and so on with their skin.

After completing your postdoc at PSI, you moved to industry for almost three years. What brought you back to PSI as a scientist?

I left academia because I wanted to gain first-hand experience in industry and understand life beyond the academic bubble. In academia, I felt somewhat insulated from real-world dynamics. The years spent in industry were crucial for acquiring insights into product development, project management, and business operations. This knowledge gave me the confidence to believe that I can succeed in my own entrepreneurial venture. However, while I was working in the corporate world, I could never forget my former research and always thought it had great potential. Then, thanks to the Founder Fellowship I had the opportunity to go back to PSI as a scientist, and now my job is solely focusing on creating a spin-off company utilising the technology we developed at PSI. It's a fascinating position to have and I am enjoying every minute of it.

You are currently in the feminno programme, what are your milestones for 2024?

I am just about to found the company Inveel GmbH. 2024 is already extremely busy – we have started developing the prototype of high-resolution robotic skins that provide haptic feedback and plan to complete this by the middle of 2024. Then by the end of the year we want to develop the MVP to start gaining revenue!

Tell us about your recent success and your biggest challenge.

One of the advantages of printing electronics in such high resolution is that they require less power to operate. We received funding from the Energy Lab Innobooster to further improve our process, which was a huge help because it allowed us to hire a student in the lab, and this sped up our process development time-lines significantly. Now we are in the next phase of product development, which is a very exciting challenge as it requires us to not just focus on process, but also on hardware and software development. And of course, as for all start-ups, our other challenge is to find funding to continue our journey and grow in the next years.

In what way feminno and the PSI fellowship did support you in your endeavours?

Without the PSI Founder Fellowship, I would not have had the opportunity to launch Inveel, not just because of the lack of funding, but also because it provides free use of PSI infrastructure during the period of the fellowship – and this is particularly important especially during the development phase. The feminno programme has a different purpose – this is a very positive group of fantastic, uplifting women who provide a lot of support (both emotional and informational). During training sessions, a huge set of business data is transferred, which is an advantage for entrepreneurs. And on top of that there is a huge networking possibility – I am grateful to be one of the feminno alumni.

Interview by Daniela Gunz

Contact
www.linkedin.com/in/barbarahorvath/

https://inveel.com

feminno

www.feminno.ch

Participants of feminno in 2023. © Daniela Gunz

Are you ready to unleash your innovative potential and to become a female founder?

Join the 10-day feminno training and embark on a journey of discovery and growth. We teach you all you need to get started with your spin-off. feminno is an entrepreneur and career development for female researchers, including doctoral candidates, postdoctoral researchers, group leaders, (associate) professors. Even if you bin your start-up idea at the end of the programme, you will still learn a lot about entrepreneurship, leadership, communication, and you will grow as a person, to be ready for your next career move in academia or outside.

We start call 8 in September 2024, and the programme ends early March 2025, with you maybe pitching your idea at the closing event? Get training from lots of female coaches and mentors: a career retreat, an innovation workshop, seminars on pitching, fundraising, patents as well as a course to train your negotiation skills all await you!

Secure your spot amongst 20 enthusiastic women from Swiss Universities. We accept applications from June 2024 onwards, see here for more information:

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

In doubt about the programme and whether it's right for you?
Don't hesitate to contact Daniela Gunz, feminno programme coordinator.
daniela.gunz@usys.ethz.ch

New partnership

Feminno is now part of a Swiss-wide initiative which brings together organisations and initiatives that foster diversity in the Swiss start-up ecosystem, for more transparency, collaboration and joint impact. It was founded in 2023 at the start-up days in May in Bern.

The goal is to connect with organisations and individuals, to share expertise and learn from each other, to build a critical mass and voice our shared interests and issues, and to improve the framework conditions for diversity, equality, and inclusion.

https://collective.startupdays.ch/

Collective
stronger together

Next feminno call starts in Sept 2024.

Join the information session to learn about feminno and other women's programmes before you decide.
28 May 2024, 12:15–13:00 at University of Zurich, room KOL-G-221 (no need to register, just join).

NACHTAKTIV

With the support of the cogito foundation and several museums in Zurich, our scientainment programme for youth goes into the next round.

NACHTAKTIV combines entertainment, art and science. Every two months on a Thursday evening, PSC organises a party-style event in a museum for young people aged between 15 and 30. Science activities are led by students of ETH Zurich, University of Zurich and University of Basel. Selected spin-offs enrich the programme by presenting their inventions. Each event is dedicated to a different theme, complementing the current exhibition. What's new is that we will be focusing on the scientific method and its creative aspects.

www.nachtaktiv.ethz.ch

Call for participation

PSC invites you to join NACHTAKTIV at the Zurich Succulent Plant Collection on 18 April 2024. The theme that evening is “Plant World” and will be about collecting and trading environmental data in all its forms, discovering innovative devices to extract the data, and exploring its potential for the future.

Upcoming NACHTAKTIV events
30 May, FIFA Museum
27 June, Botanical Garden UZH
12 September, WOW Museum
24 October, Museum Mühlerama
5 December, Museum Rietberg

If you are interested in participating, please contact us. We are looking for students and scientists who would like to present their work in an entertaining way, preferably with hands-on experiments.

Contact:
beatrice.kiser@usys.ethz.ch

Biotinkering for youth

PSC successfully completed its recent Agora project in the flourishing area of maker-education.

After three years an exciting project has been completed. The grant from SNSF Agora funds allowed us to develop "making-activities" combining plant sciences with digital and creative skills development among youth. We created eight different workshops, which we carried out a total of 30 times during school project weeks and holiday camps, reaching 900 young people. We also co-organised conferences with the Zurich University of Teacher Education (PH Zurich) and organised training workshops, reaching 870 teachers and young researchers. While the grant has ended, the learning materials we developed will continue to be used in schools, particularly in the new regime of day schools in the city of Zurich. Learning materials include four biotinkering magazines with detailed instructions and video tutorials.

https://data.snf.ch/grants/grant/200184

Setting up a time-lapse experiment with Gazania. In this workshop, pupils use machine learning to get a computer to tell them when a flower is open or closed and thus, what time it is. © CreativeLabZ

Thank you to Diana Santelia, ETH Zurich, for hosting us and the project as well as all scientists who contributed with ideas, experiments, lab visits, talks and advice: Kate Ammann, ETH Zurich; Mark Anthony, ETH Zurich; Sylvain Aubry, University of Zurich; Jordi Bascompte, University of Zurich; David Basler, University of Basel; Thomas Buchner, ETH Zurich; Rodrigo Cámara Leret, University of Zurich; Andrea Carminati, ETH Zurich; Elizabeta Cavar, ETH Zurich; Nay Dia, ETH Zurich; Peter Endres, University of Zurich; Michael Greeff, ETH Zurich; Manuel Günter, University of Zurich; Janneke Hille Ris Lambers, ETH Zurich; Günter Hoch, University of Basel; Robert Katzschmann, ETH Zurich; Michael Kessler, University of Zurich; Alex Kocyan, University of Zurich; Jana Mittelstrass, WSL; Henning Mühlenbeck, University of Zurich; Reto Nyffeler, University of Zurich; Sarah Richman, ETH Zurich; Joelle Schläpfer, University of Zurich; Klaus Schläppi, University of Basel; Jan Schnyder, ETH Zurich; Katja Stengele, University of Basel; Elizabeth Truernit, ETH Zurich; Julia Vorholt, ETH Zurich; Fabian Wegmüller, ETH Zurich; Cyril Zipfel, University of Zurich; and Pengjuan Zu, ETH Zurich.

Joint publication with PH Zurich

Furrer, Florian, Juanita Schläpfer-Miller, Bernadette Spieler, und Manuela Dahinden (2023). BioTinkering – Biologie als faszinierendes Making-Thema in den Naturwissenschaften. Überlegungen zur Konzeption und Durchführung von BioTinkering-Aktivitäten. *MedienPädagogik*56 (Making & more): 69–97. https://doi.org/10.21240/mpaed/56/2023.12.03.X

Transformative learning

Climate change is challenging as a school subject, as although it can improve pupils' knowledge, it is less evident how such knowledge translates into decreasing the value-action gap.

Climate change education is an integral part of Education for Sustainable Development, which has manifold aims to develop transformative learning from primary to tertiary pupils. The *Climate Garden 2085* is a participatory art-science experiment that engages school pupils as social groups, and in emotional ways with scientific questions related to the effects of climate change on food production and gardening. The garden experiment has so far been carried out 24 times at schools and public gardens, reaching around 40,000 people. In our recent paper, based on qualitative observation and some quantitative data, we discuss possible reasons for the attractiveness of the methodology for schools and explore how it might affect awareness and behavioural changes of participants.

Schlaepfer-Miller, J., Kueffer, C. & Dahinden, M. (2023). Climate Garden 2085: An easily applicable transdisciplinary public art-science experiment for transformative learning about climate change. *Environment, Development and Sustainability*. https://doi.org/10.1007/s10668-023-03899-2

www.klimagarten.ethz.ch

Vocational education

PSC is developing new workshops together with vocational schools in the area of Education for Sustainable Development (ESD).

Together with the Federal Office for Environment (FOEN) and the Leopold Bachmann Stiftung, we are expanding our educational offers in vocational schools (Berufsschulen) in the ESD competencies and in competencies for mitigation of climate change in the professional fields of participants. In 2024, we offer training in the Planetary Health Diet for cooks (Koch/Köchin EFZ), farmers (Landwirt/Landwirtin EFZ) and gardeners (Gärtner/Gärtnerin EFZ). Between 2024 and 2025 we aim for ten vocational schools in agriculture, gastronomy, gardening, fashion and material design. In both 2022 and 2024, we visited the BMS Luzern (BBZB Berufsbildungszentrum Bau und Gewerbe Luzern) and presented a workshop on the Planetary Health Diet. See here for some of the participants' outputs:

https://deinquartiernachhaltig.org/inspirationen-fur-deine-planetary-health-diet/

Four different workshops cover the following areas:

- Planetary Health Diet
- Adaptation of agricultural practice to climate change
- Biodiversity and climate change in garden design
- New plant-based materials

Contact: melanie.paschke@usys.ethz.ch

Fascination of Plants Day 2024

PSC is national contact point for the largest international science festival in the area of plant sciences.

We encourage each of you to share your public events scheduled for spring 2024 by submitting a short text along with a captivating picture. This is an excellent opportunity to spotlight the diverse range of events taking place within the Swiss plant science community and make the Fascination of Plants Day engaging for all. Your event could be an exhibition, outreach activity, public experiment, botanical garden tour, or any activity connected to your research. Please note that it does not need to take place on 18 May 2024.

Feel free to send your contributions at any time, and we'll publish them on the Fascination of Plants Day 2024 country website:
https://plantday18may.org/countries/

Contact: romy.kohlmann@usys.ethz.ch

Universität Zürich | ETH zürich | Universität Basel

Zurich-Basel Plant Science Center

Picture: by Pascale Flury, University of Basel

PSC & Syngenta
Symposium 2024

PROGRAM

Opening session

Chair: Prof. Cyril Zipfel, PSC

10:00-10:10
Welcome
Dr. Manuela Dahinden, PSC

10:10-10:30
Tracking and predicting resistance in Disease Control
Dr. Gabriel Scalliet, Syngenta Senior Fellow

10:30-10:50
Microbiome management, soil health and sustainable agriculture
Prof. Marcel van der Heijden, University of Zurich

10:50-11:10
Tackling soil-borne pathogens with beneficial compost microbes
Dr. Pascale Flury, University of Basel

11:10-11:30
Questions & answers

Fellow presentations

Chairs: Dr. Pascale Flury and Prof. Marcel van der Heijden, PSC

11:30-11:45
Improving biostimulants to cope with future climate for sustainable agriculture
Dr. Marta Torres Bejar, University of Zurich

11:45-12:00
Toward the engineering of plant pattern recognition receptors for durable disease resistance
Songyuan Zhang, University of Zurich, PhD student

12:00-13:45
Lunch break and tour through research facilities

13:45-14:00
Plant ecological airborne indicators for response, Plant Eco-AIR
Dr. Sergio Ramos, University of Zurich

14:00-14:15
Unearthing the mechanisms of carbon retention in soil and linking them to farmer practices
Dr. Luiz Alberto Domeignoz Horta, Previous postdoc at University of Zurich / Tenure-track INRAE Campus AgroParisTech Paris-Saclay University

14:15-14:30
Mycorrhiza-facilitated bioirrigation in intercropping systems in dryland agriculture as a new tool to stabilize and increase yields of small holder farmers
Santiago Perez, University of Basel, PhD student

14:30-14:45
Deciphering plant exudate and root microbiota dynamics during pathogen attack
Charlotte Joller, University of Basel, PhD student

14:45-15:00
araChromID: Unraveling the Plant Epiproteome
Miguel Wente, University of Zurich, PhD student

15:00-15:30
Coffee break

Closing session

Chair: Willy Rueegg, Syngenta, Head CPRB

15:30-16:00
Process-based soil-plant nitrogen cycle modelling to manage ecological systems
Dr. Nina Mafalda, Syngenta Fellow

16:00-16:30
feminno spin off tbc

16:30-16:50
Questions & answers

16:50-17:00
Final remarks
Willy Rueegg

WEDNESDAY, March 27th, 2024

PLANTSCIENCES.CH

REGISTRATION LINK

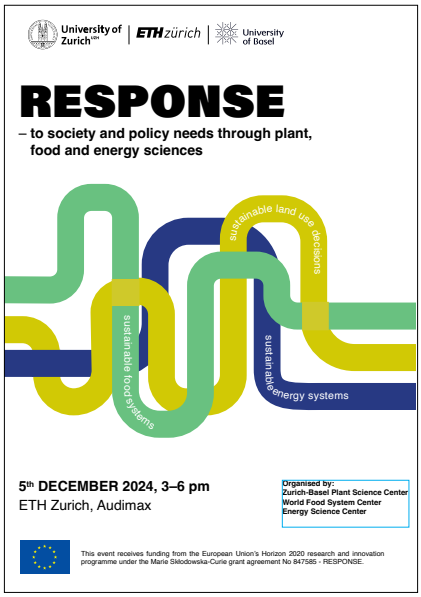
Registration

www.plantsciences.uzh.ch/en/research/fellowships/syngenta/symposia.html

Contact: romy.kohlmann@usys.ethz.ch

Save the date

for the RESPONSE final event taking place at ETH Zurich on 5 December 2024.



IPMB 2024 which takes place in Cairns, Australia, will address a wide variety of topics in plant molecular biology, including Abiotic Challenges, Applied Technologies, Biotic Interactions, Cell Biology, Development, Evolution, Genome Regulation, Large Scale Biology, Photosynthesis, Plant Biochemistry, Signalling and Transport.

Link to programme:

www.ipmb2024.org/program

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 that enable interaction with peers, policymakers, industry, stakeholders and the public.

PSC MEMBER INSTITUTIONS

ETH Zurich
Department of Environmental Systems Science
Department of Biology

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

University of Basel
Department of Environmental Sciences

Zurich-Basel Plant Science Center, Managing Office

BLOGS

blogs.ethz.ch/Science_and_Policy
feminno.ch
klimagarten.ethz.ch
creativelabz.ethz.ch
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deinquartiernachhaltig.ch

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Zurich-Basel Plant Science Center
Tannenstrasse 1, ETH Zurich, TAN D 5.2
8092 Zurich, Switzerland

info-plantscience@ethz.ch

Editor
Manuela Dahinden

Proofreading
Clare Bourne

Text contributions
Nina Buchmann, Yutang Chen, Fabian Hess, Ansgar Kahmen, Anna Muntwyler, and PSC staff.

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