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IDP BRIDGES*News*

Zurich-Basel Plant Science Center: Bridging Plant Sciences and Policy

No 6, 2017

Event

IDP BRIDGES – Final Event
Bridging Science and Policy
5 April 2017
University of Zurich, Aula

Mini-Symposium
Public Engagement with Science: Relevance and Methods
10 April 2017
ETH Zurich, Alumni - Pavillon

PSC Training

PSC Policy Workshop
Communicating Science
8 and 22 May 2017
University of Zurich

PSC Summer School
Understanding Risks & Resilience in Plant Systems
29 May - 2 June 2017
Einsiedeln, Switzerland

PSC Policy Training
System Thinking
13 - 15 June 2017
University of Zurich

PSC Policy Workshop
Stakeholder Engagement
25 - 28 September 2017
University of Zurich

IDP BRIDGES At a Glance

- IDP BRIDGES has funded 14 PhD research projects with 18 partner organisations, including academic research and non-academic policy-science interface organisations.

- IDP BRIDGES offered hands-on experience at the science-policy interface through internships. It carried out a training curriculum of 16 ECTS and hosted one international summer school per year.

Some of the highlights of the program

Innovative research in the areas of «Maintaining plant production for food through the advanced use of technologies» and «Ensuring sustainable land use and environmental protection» already contributed to 8 peer-reviewed publications and more than 20 are in preparation; as well as to 1 patent and 1 startup company.

As part of the **unique training program**, we carried out 19 courses providing an understanding of the processes of policymaking, a set of skills to effectively engaging with policymaking, and the methods and approaches for framing societal problems, for contributing with evidence to the policy process, for facilitating participatory dialogue and for building and evaluating different policy options and their implementation.

In the **yearly summer schools** we focused on approaches for systemic analysis of complex problems, critical thinking and reflecting of value frames and transition management of societal changes. During the program the PSC hosted 4 summer schools: Emerging Technologies for Sustainable Crop Production (2014), Tackling Wicked Problems (2015), Agriculture in Transformation (2016), Understanding Risks and Resilience in Plant Systems (2017).

The program resulted in 11 **internships** carried out in 13 organisations and +50 international contacts that the fellows implemented to their research work.

At this point of time (with 6 months for the programme still to go) the **science-policy contributions** will or have contributed to 1 policy report, 2 stakeholder workshops, 2 management recommendations for farmers and experts and several information and dialogue events for the public, including 4 public round tables hosted by IDP BRIDGES and moderated by fellows on «Plant Sciences, Patents and Food Security», «Science in Policy on the use of Systemic Pesticides», «Innovation vs. Regulation of Novel Breeding Technologies» and «Tef - the Cereal that feeds Ethiopia» with +320 participants.
One fellow is contributing with his work to the European Academies Science Advisory Council's working group on Genome Editing and the related report (page 13). Another one organised a stakeholder workshop on the future management of coffee landscapes and the related ecosystem services that culminated in a booklet on «Bees and pollination in the coffee estates» which has been handed to coffee farmers in Kodagu, India (page 11). Another fellow built up a micro-blog, through which stakeholders can receive information about biodiversity and forest ecosystem functioning on their mobile phones (page 15). Another fellowship will result in recommen-dations and a fact sheet for adapted seed mixtures and management of grasslands under drought to Swiss seed breeders and farmers (page 6).

Additionally the fellows engaged in +90 **outreach activities** from contributing to 6 issues of the IDP BRIDGES Newsletter, presenting their research at science fairs, engaging in public lectures, carrying out activities and teaching for school classes, leading excursions, or publishing articles for lay persons or in the social media.



BRINGING SCIENTIFIC EVIDENCE INTO POLICY AND SOCIETY

The decision by the Zurich-Basel Plant Science Center (PSC) to set up a PhD fellowship program that combines natural sciences and policy-work in 2010 was based on the need to train junior natural scientists in their role as translaters of scientific evidence into policy and society. It is essential that the next generation of scientists is comfortable with the idea of opening themselves as honest brokers in society.

Our century is facing major global challenges. Our climate system is approaching a new state. Biodiversity losses are endangering ecosystem services; pests are globally spreading and threatening our food security. All of these problems are complex and urge humankind to act and make decisions in coordinated and global efforts to mitigate their consequences. Scientific policy advice becomes of major importance in the decision-making processes for long-term development as well as immediate emergency management.

The concept for evidence-based policymaking is based on the understanding that policy makers should be well informed by high quality and scientifically sound research evidence provided by scientists or scientific institutions. In addition, the quality and impact of decision-making processes, as well as the policy as an outcome requires the following: a rational analysis, participation of stakeholders in the process, building on pluralistic and democratic principles, and negotiation, social learning and feedback loops for improvement.

While policy is interested in predictions on how to react to the future, science can offer explanations and establish causal relationships from past or present data. Moving from current to future scenarios includes uncertainties and maybe the most important role for scientists contributing to the science-policy interface is the translation of scientific uncertainties and to facilitate the discussion about these uncertainties and their consequences.

Scientists engaging in processes of social valorization of knowledge become honest brokers. The honest broker is involved in the policymaking process by offering evidence and contributing to clarifying policy alternatives. Often engagement takes the form of a formal committee in order to include a variety of areas of expertise and also a diversity of perspectives. Honest brokers have to legitimate their policy advice on the principles of independence as well as transparency and critical reflectiveness of their own and disciplinary/institutional value frames.

How is the Innovative Doctoral Program «IDP BRIDGES» contributing to the training of junior natural scientists?

The program aims to make young scientists aware of their role at the science-policy interface, to engage them into the dialogue about the social valorization and social relevance of knowledge and to support them in understanding how to make effective contributions in the process of policymaking. Our successful and unique model is combining **research work** with **policy training** and **tandem-supervision** of their theses through their academic principal investigators and representatives of organizations that are carrying out the science-policy dialogue. Together with the partner organisations of the PSC the PhDs students seek for ways to implement their research into the policy process. For example, they get advice on how to put research results into a wider social context and to communicate scientific knowledge into a suitable form for stakeholders during their **internships** at the collaborating organisation.

Is this an efficient approach? Currently we prepare a **Delphi study** as synthesis to analyze the success factors but also the barriers for junior scientists that get involved at the science-policy interface. On a preliminary basis we have identified some frequently nominated success factors from recent fellowships, for example, the complementarity of expertise of the organisations partnering in a fellowship that can already improve the scientific output. The interest of the science-policy organisation into the fellows work and their valuing of fellows expertise was seen as key factor for successful supervision at the science-policy interface. Frequently nominated barriers include the long time frames for policy work and implementation that are in conflict with the regular PhD time, the challenge to be the only person to deal with the science-policy interface in the research group or the difficulties to plan the internship when research results have not been completed yet.

Melanie Paschke
PSC Managing director

The PhD fellowship and training program «Science and Policy» was started 2009 as a ProDoc with 11 fellowships. The Mercator foundation Switzerland contributes with 8 fellowships between 2011 – 2020. We opened the program to an international dimension with IDP BRIDGES, (2013 - 2017). Currently the training program involves 52 PhD students from the areas of plant sciences, earth sciences or atmospheric and climate sciences.

Native potatoes from Chiloé island
© Guillaume Lacavé

Collaborators
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Growth and bioactive properties of native potatoes from Chile: Ancestral genetic resources for modern human needs

Guillaume Lacavé

Plant genetic resources are the keystone of the creation of any new plant variety. They are crucial for introducing new traits valuable for the agro-food system. For instance, farmers are highly interested in varieties resistant to diseases and the industry is concerned with the uniformity of the product, as well as its protein and starch contents. In the field of logistics, resistance to transport plays a major role. Finally, consumer's demand is today mainly focused on traits related to specific uses, taste and conservation.

The objectives of our work were to assess the potential of native Chilean potatoes to provide interesting traits regarding resistance to drought stress, and health benefits thanks to antioxidants content or resistant starch. These native varieties, also called landraces, are an important heritage of Chile, created by ancestral farming systems throughout generations of farmers. Our results showed a high diversity in the response of the landraces to drought stress in the field. Regarding nutrition traits, a broad spectrum of contents in anthocyanins, polyphenols, starch, resistant starch, proteins contents could be described in Chilean landraces, as well as interesting antioxidant potential. Though the impact of drought was observed on the yield of potatoes, no impact was detected on the concentration of the different bioactives analysed (anthocyanins, polyphenols, starch, resistant starch). Additionally, the receptivity of the Chilean market to new potato products was also investigated through a stakeholders and consumer's analysis in Chile. This study focused on specific marketing advantages such as local origin, attractive colours and high antioxidants content. The results showed an interest of the potato market for innovative products, including products rich in antioxidants.

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Media

www.diarioeldigital.com/2016/01/20/experto-frances-estudia-el-crecimiento-y-las-propiedades-bioactivas-de-la-papa-nativa-sometida-a-estres-hidrico/

www.elinformador.cl/index.php?idnoticia=39576

www.mundoagropecuario.com/experto-frances-estudia-el-crecimiento-y-las-propiedades-bioactivas-de-la-papa-nativa-sometida-a-estres-hidrico/

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Web

www.creas.cl/papas-nativas/

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Presentation

Potato tuber growth dynamics – Lecture for agronomists in Valdivia, Chile

Grapevine field experiment at Agroscope in Nyon, Switzerland © Silvia Turco

Collaborators
Silvia Turco[1], Victor Golyaev[1], Olivier Shumpp[2], Jean-Sèbastien Reynard[2], Thomas Boller[1], and Mikhail M. Pooggin[1,3]

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[3] INRA, UMR BGPI, Montpellier, France

Small RNA-omics for diagnostics: Improve measures and management practices of viral disease

Silvia Turco

In modern agriculture, horticulture and farming, it is critical to assess the risk of emerging plant infections and to control the spread of plant viral diseases, which requires a fast and reliable virus diagnostic and genome reconstruction tool.

The siRomics approach based on small RNA sequencing and bioinformatics analysis was used for virus detection and genome reconstruction. In a potato sample from a local shop, a combination of RT-PCR and bioinformatics was used to reconstruct two closely related strains of the same *Potato virus Y*. In another sample, a complex of *Potato virus Y* and *Potato virus X* was identified. In collaboration with Agroscope, many more samples have been analyzed. As expected, grapevine samples showed a crowded virome, including viroids. In cherry trees affected by little cherry disease, we confirmed that the presence of two strains of *Little cherry virus* in one of the samples, induce more severe symptoms compared with the sample where only one virus was detected. In a fig tree exhibiting virus-like symptoms coming from a private garden, a local isolate of *Fig mosaic virus* was identified and reconstructed. Finally, in the forest bush plant *Ligustrum vulgare* (privet) showing yellow mosaic disease, a totally novel virus distantly related to *Barley yellow strip virus* and *Lychnis ring-spot virus* was identified, fully reconstructed and named *Ligustrum mosaic virus*. The siRomics approach was also used to evaluate the cross-protection in tomato plants pre-inoculated with a protective strain of *Pepino mosaic virus* against a more severe local isolate.

The results of our study are informative for further understanding the mechanisms of RNA silencing-based antiviral defenses, which would contribute to basic research in the field of plant-pathogen interaction, and for developing novel strategies of virus control, which could potentially be implemented in the future in Swiss agriculture though our recommendations to the policy makers.

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Publications

Zvereva e al. (2016) **Viral protein suppresses oxidative burst and salicylic acid-dependent autophagy and facilitates bacterial growth on virus-infected plants.** *New Phytol. 211(3):1020-34*

Karthikeyan et al. (2016) **Emergence of a latent Indian Cassava Mosaic Virus from Cassava which recovered from infection by a non-persistent Sri Lankan Cassava Mosaic Virus.** *Viruses. 28;8(10). pii: E264*

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Presentations

Poster at the «Lange Nacht der Wissenschaft» University of Basel, 2015
Poster at the PSC Summer School «Green Revolution Reloaded», 2014
Poster at the Bioinformatics of Plants and Plant Pathogens Course, EBI, Cambridge 2016

Harvesting and measuring aboveground biomass with an experimental plot harvester on the field site in Rümlang. In the background: Rain-out shelters for simulating seasonal drought events. © Claudia Hahn

Effects of seasonal drought on the productivity of grasslands: Recommendations for a sustainable fodder production in a changing climate

Claudia Hahn

Collaborators
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[2] Institute for Sustainability Sciences – ISS, Agroscope, Zurich, Switzerland

The response of grassland productivity to projected future increases in extreme weather events, such as droughts, is of high interest. In particular, the timing of a drought events in the course of the growing season and its impact on the functioning of the ecosystem remains unclear.

In our experiment drought had an impact on the seasonal productivity of highly managed grasslands in every season. However, absolute growth was reduced under spring drought more than under summer or fall drought. Most interestingly, though, the total annual biomass production (ANPP) was only affected by summer drought events, while spring and fall drought events did not lead to a reduction of ANPP. This surprising pattern was caused by biomass production levels in the post-drought phase after a drought event exceeding the productivity of the control. However, under future climate change agricultural production is at stake. Understanding the effects of extreme weather events on yield will help stakeholders to make future fodder production more predictable and, thus, sustainable. In addition, the individual responses of different grassland species on drought events occurring at different times in the growing season will help farmers and seed companies to design adapted seed mixtures that will help to sustain productivity in a more variable climate. To successfully integrate our results into actual policy work we are liaising closely with the AGFF, which is an association of farmers and other institutions interested in fodder production. The AGFF regularly organises information events, field excursion or other events to inform farmers and other stakeholders about recent research and state of the art farming practices.

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Presentations

Talk and poster at GfÖ Annual Meeting, 2014

Poster at the PSC PhD Symposium «Rooted – successful strategies for sessile beings», 2014

Poster at the 17th Swiss Global Change Day, 2016

Talk at the Annual Meeting of the Ecological Society of America, 2016

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PSC Teacher Workshop

«Den Puls der Pflanzen fühlen» University of Berne, 2015

«Results of this project were already used several times this year for field days with farmers as well as with extension specialists and teachers from agricultural colleges. This demonstrates the importance and practical relevance of the work carried out.»

Andreas Lüscher

PlantScreen™ Compact System is conveyer-based integrated robotic solution for high-precision digital plant phenotyping and plant cultivation of small and mid-size scale plants (e.g. *Arabidopsis*). The platform is developed on the plant-to sensor concept and is equipped with three modules: the adaptation tunnel with LED panels and the weighing and watering unit, a second module with thermal and hyperspectral camera and a third module including three RGB cameras and the chlorophyll fluorescence imaging unit. © PSI

Revealing the importance of sugars for plant performance: Development of a high-throughput phenotyping protocol

Arianna Nigro

In plants sugar transporters localized at the cellular membrane mediate the exchange of sugars. Sugar Transport Proteins (STPs) are one of the major classes of sugar transporters in *Arabidopsis thaliana*.

Using the quantitative high-throughput phenotyping protocol developed at Photon Systems Instruments (PSI, Czech Republic) (Awlia et al. 2016), we show for the first time that *Arabidopsis* plants lacking both STP1 and STP4 transporters are significantly impaired in growth and photosynthesis. These plants have also lower capacity to take up carbon dioxide through stomata – pores on the leaf surface –, partially explaining their reduced growth and photosynthesis.

Our scientific achievements result from the successful application of cutting-edge technology to basic research. Working at the science-innovation interface has made possible to combine technological advances with scientific knowledge, overcoming previous difficulties and achieving the foreseen goals. Different missions and languages embraced by academia and industry can constitute a challenge in the decision-making process for the development of the project. The main outputs of this project are knowledge generation together with the creation and validation of standardized methodological protocol now integrated in the portfolio of the screening approaches offered by PSI.

Collaborators
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[2] Photon Systems Instruments PSI, Czech Republic

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Publications

Horrer et al. (2016) **Blue Light induces a distinct starch degradation pathway in guard cells for stomatal opening**. *Current Biology,* Vol. 26/Issue 3

Thalmann et al. (2016) **Regulation of leaf starch degradation by abscisic acid is important for osmotic stress tolerance in plants**. *Plant Cell*, Vol. 28/Issue 8

Awlia et al. (2016) **High-throughput non-destructive phenotyping of traits that contribute to salinity tolerance in *Arabidopsis thaliana***. *Frontiers in Plant Sciences. 28;7:1414*

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Presentations

Poster and talk at theGordon Research seminar and conference «Salt and water stress in plants», 2016
Poster and talk at the International Plant and Algal Phenomics (IPAP) Meeting, Prague, Czech Republic, 2015 and 2016

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Public panel

Moderation of the public panel discussion «Plant Sciences, Patents and Food Security» together with Guillaume Lacavé and Sofia Nobre, 2015

Tef breeding in greenhouse Addis Ababa, Ethiopia
© Wuyan Wang

Developing starch diversity in the orphan crop tef: Improve breeding programs in Africa

Wuyan Wang

Tef (*Eragrostis tef*) is an important food grain in Ethiopia, where it is used to make injera or keyta. Tef seeds have high fiber, iron, and are gluten-free. Yet tef lacks diversity in its grain starch properties.

To address this, we are using reverse genetics (TILLING and high-throughput DNA sequencing) to find new tef lines with altered starch. We found six lines with mutations in the Granule Bound Starch Synthase 1 gene. By sequencing many starch related genes amplified from pooled genomic DNA of 4000 plants, a single nucleotide polymorphism (SNP) database can be established. Validation of these SNPs is presently ongoing. The essential role of tef as a crop in Ethiopia and the increasing demand for tef products in global food market underscore the significance of our research work towards its improvement. In the future, tef varieties with altered starch properties from our project can have long-term impact, enhancing the use and value of tef within and outside Ethiopia.

Furthermore, if successful our program can serve as a flagship case in Ethiopia, demonstrating that international scientific collaborations can bring real benefits to ordinary people. The cooperation with the Ethiopian Institute of Agricultural Research offers us the possibility to transfer our scientific outputs to society. With bringing new tef varieties into their breeding program, increasing amount of high quality tef with new starch traits will be selected out and be chosen by the local farmers. Thus, then the food market will also be enriched both at the national and international level.

Collaborators
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[2] University of Berne, Institute of Plant Sciences, Berne, Switzerland

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Presentation
Poster at the PhD Symposium of the Institute of Agricultural Science, 2014

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Stakeholder workshop
Tef seeds workshop in Ethiopia with Syngenta foundation, researchers, Ehiopian farmers and seed companies, 2016

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Public panel
Co-organisation of a seminar in Zurich «Tef- the cereal that feeds Ethiopia», 2016

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Exhibition
«Vom Licht zur Nahrung» Scientifica 2015, Public Science Fair in Zurich

Field trial with the next generation of cold-stressed and drug-treated Soybeans (*G. max*) in the Botanical Garden in Basel. © Michael Thieme

Unlocking sealed genetic resoures: Making use of epigenetics in plant breeding

Michael Thieme

Collaborators
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[2] Institut de Recherche pour le Développement, Diversité Adaptation et Développement des Plantes, Université Montpellier, France
[3] University of Perpignan, Laboratory of Plant Genome and Development Perpignan, France
[4] IRHS, INRA, AGROCAMPUS-Ouest, Université d'Angers, Beaucouzé cedex, France

Plant genomes consist in large parts of repetitive elements that are capable of making new copies of themselves under certain conditions (transposable elements). Interestingly, some of these elements can serve as genetic sensors for external stimuli such as heat stress, making them in theory a powerful tool for plant breeding. However, to avoid their uncontrolled proliferation under normal growth conditions these elements are strictly repressed by the plant.

During my PhD project, I discovered a key regulator at the origin of TE-silencing that can easily be targeted with a simple drug application. Thus, I developed a method to open a so far sealed endogenous genetic resource that can now be used for plant breeding. My findings significantly contributed to the development of a highly innovative and patented approach for plant breeding that could contribute to food security of a growing population under changing environmental conditions. Cultivation of more efficient and stress tolerant crops would come along with a decreased need for pesticides and fertilizers. Hence, our approach that fully relies on the stimulation of endogenous genetic resources could be of particular interest to achieve the main objectives of organic farming.

To bring this new method to the market, evidence is needed for the scientific progress but also as a basis for a successful dissemination to and discussion with identified stakeholders such as breeders, farmers and consumers. A positive perception of these stakeholders will be essential for establishing this approach and to be considered in political decision making. Therefore, a socio-economic assessment of acceptance of this technology by stakeholders will be the next step.

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Our results were patended and resulted in founding the startup company **epibreed AG**

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ERC Consolidator grant
BUNGEE: Directed crop breeding using jumping genes (Project # 725701)

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Presentations
Poster at the PSC Summer School «Green Revolution Reloaded», 2014
Talk «Mobilized transposable elements as a tool for crop improvement» at Les Rencontres du Végétal, 2016
Talk at the «Fachtagung Dialog Grün: Neue Technologien in der Pflanzenforschung – eine Alternative zu Pflanzenschutzmitteln?», 2016

Palm oil fruit
© John Garcia

Collaborators
Lisa King[1], Lian Pin Koh[2], Jaboury Ghazoul[1]

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[2] University of Adelaide, Applied Ecology and Conservation, Adelaide, Australia

Biodiversity conservation in the tropics: Investigate transition and development pathways of commodities

Lisa King

The availability and quality of land use data has improved considerably, however, we remain limited in the recommendations, we can make given that much important information is still not readily available from satellite imagery. Better understanding local dynamics and ensuring the implementation of research recommendations remain an ongoing challenge.

Within this project, we modeled the competing demands for land from agricultural commodity crop development in Indonesia, specifically palm oil, rubber and cocoa. The main results were that there is an important potential for continued land conflicts given the overlap in areas of high suitability for the crops studied, and the overlap with existing crops essential to food security. Current governmental and voluntary conservation measures have the potential to protect large areas of forest, however, this will depend on their effective implementation and whether differences in sustainability standards in different industries can be reconciled.

Evidence is necessary to ensure that policies for reducing deforestation and biodiversity loss are effective in achieving their intended effects, including the mitigation of unintended side effects. My work highlighted that without better integration of conservation initiatives with regards to agricultural commodity development, environmental degradation will continue.

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Presentation
Association for Tropical Biology and Conservation Annual Meeting, 2016

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Public panel
Moderation of the public panel discussion «Science in policy on the use of systemic pesticides» together with Charlotte Pavageau, 2014

The picture shows an experimental plot in a coffee plantation. © Charlotte Pavageau

Co-production of pollination services in coffee plantations: Developing sustainable management scenarios

Charlotte Pavageau

Designing optimal land-use is a key challenge for decision makers and policies aiming at promoting sustainable development for a given region. However, optimal land-use planning is very uncertain and embedded with high complexity. Thus, research on modelling landscape-scale ecosystem services and land-use planning contribute to this debate.

My PhD project focused on how the landscape is driving pollination services in a coffee growing region. We underlined the importance of land-use mosaic, in particular the imbrication of agroforests and forest fragments, as well as local management practices to attract pollinators in coffee plantations. Besides, we developed two alternative management scenarios potentially impacting pollination service: a better coordination between farmers by irrigation scheduling and nesting site conservation. We explored how pollination services and crop production could be optimized under those two scenarios. While coordination between farmers displays higher benefits, the implementation of such strategy would pose many challenges, from the integration of many individual decisions to the creation of dedicated institutions. This scenario is also associated with uncertain risks for the production of coffee, as well as other environmental impacts on forest cover.

My work is helping to assess the consequences and risks of different scenarios, using the example of pollination service. We started to overcome these challenges by using participatory approaches such as stakeholder workshop with farmers and local authorities and information leaflet to share different views on the future of agricultural landscapes.

Collaborators
Charlotte Pavageau[1], Jaboury Ghazoul[1], Uma Shaanker[2]

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[2] University of Agricultural Sciences, Bangalore, India

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Article

C. Gaucherel, C. Pavageau (2017) Abeilles en danger, le café menacé. La Recherche, Février 2017, No. 520, p. 68-70

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Presentations

Talk at the Annual Meeting of the Association for Tropical Biology and Conservation, 2015 and 2016

Talk «Science on your plate – Coffee Research» in the Swiss Pavilion at the EXPO 2015 in collaboration with ETH Global and the WFSC

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Public panel

Moderation of the public panel discussion «Science in policy on the use of systemic pesticides» together with Lisa King, 2014

Panelist at the Global landscape forum, Paris, France, 2016

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Stakeholder workshop

Co-organisation of a workshop for coffee planters and beekeepers, public officials, local associations, managers from private companies, and scientists. and the public, Bittangala, Kodagu District, India

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Web and social media

Bees and pollination in the coffee estates – Booklet for coffee farmers of Kodagu, India

Blog article for SWISSNEXINDIA
www.swissnexindia.org/blog/indo-swiss-coffee-connections/

Blog article for the ETH Zukunftsblog
www.ethz.ch/de/news-und-veranstaltungen/eth-news/news/2016/01/beekeeping-to-prevent-the-pollination-problem.html

Comparing crop growth of pigeon pea-finger millet intercropping with (left) and without (right) the application of mycorrhiza. © Lukas Schütz

Collaborators
Lukas Schütz[1], Thomas Boller[1], Paul Mäder[2], Mathimaran Natarajan[1,2]

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[2] Research Institute of Organic Agriculture (FiBL), Frick, Switzerland

Reliability of biofertilizers: Improving food security and nutrient use efficiency

«The meta-analysis will advance the field of biofertilizers as it provides for the first time figures and identifies main factors for the application of biofertilizers.»
Paul Mäder

Lukas Schütz

Microbial inoculants or biofertilizer are a promising tool for future agriculture. Biofertilizer exist in various forms such as rhizobia, azospirilla, or mycorrhiza. Particularly in dry regions, the use of these microorganisms may provide a potential solution to improve water and nutrient use efficiency. However soils are highly diverse in their composition and soil biota which makes the inoculation success hard to predict.

My PhD thesis is dedicated to the application of biofertilizers mostly to South India, and my results support the successful application of biofertilizers in this region. My research topic is the use of biofertilizers such as arbuscular mycorrhizal fungi (AMF) in a pigeon pea-finger millet mixed cropping system in South India. In my experiments, I studied the complex interactions between the two plant species, arbuscular mycorrhizal fungi and soil fertility. I could show that AMF species differ in their ability to spread through soil to colonize neighboring plants, and also in their ability to promote the growth of the plants.

Furthermore, I conducted a meta-analysis of 171 field studies to compare the yield responses of various crops and their phosphorus and nitrogen use efficiency in response to biofertilizers. We identified key factors like pH and soil carbon influencing the success of biofertilization. However, the study of soil biodiversity is only at the beginning and the success of biofertilizer application is still difficult to predict. In the future, there will be more tools and better soil maps to study the soil community and develop a better understanding of their interactions with plants and biofertilizers, which will advance this field furthermore.

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Presentation
Poster at the PSC Summer School «Green Revolution Reloaded», 2014
Poster at the Tropentag conference in Berlin and Vienna, 2015 and 2016
Talk at the World Sustainability Forum 5 at the University of Basel, 2015

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Web
Das Potential von nachhaltigen Landnutzungssystemen zur Anpassung an den Klimawandel – Web article for FiBL, 2016
www.fibl.org/de/themen/klima/fibl-klimaprojekte/landnutzungssysteme.html

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PSC School class Workshop
«Mykorrhiza – Ein Pilz gegen den Welthunger?!» University of Basel, 2016

Perennial ryegrass flowers showing a wild type phenotype. © Timothy Sykes

Molecular breeding strategies: Control pollination for improved forage and turf grass breeding

Timothy Sykes

Grasslands are important agro-ecosystems; worldwide, they account for 80% of milk production and 70% of meat production. Perennial ryegrass (*Lolium perenne* L.) is a major component of temperate grassland systems and accounts for almost 50 per cent of total grass production, making it the most important grass species in Europe. In forage grasses, biomass is the primary yield target, but despite intensive breeding efforts over the last decades, increases in biomass yield are below that of major crop species.

My research has focussed on the restoration of cytoplasmic male sterility in perennial ryegrass (*Lolium perenne* L.). This trait is important for plant breeders as it allows pollination-direction control during the commercial production of potentially higher yielding hybrid seed. My research has identified the genomic regions likely responsible for fertility restoration and I am currently developing molecular markers that will allow breeders to quickly identify if their plants are carrying the gene responsible for fertility restoration, ultimately speeding up the breeding process. As I am working within molecular plant breeding techniques I have been actively involved in the policy debate surrounding the emergence of these new plant breeding techniques. I have organised and moderated a stakeholder debate at Europe's premier plant breeding and research conference (EUCARPIA), as well as being interviewed for Swiss national radio and newspapers. This has culminated in being chosen by the Swiss Academies of Science to represent Switzerland at the European Academies Science Advisory Council's working group on genome editing, providing science-policy advice to the European parliament.

Collaborators
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[2] Department of Molecular Biology and Genetics, Research Centre Flakkebjerg, Aarhus University
[3] Plant Energy Biology, ARC Centre of Excellence, The University of Western Australia, Australia

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Publication

Sykes et al. (2016) ***In-silico* identification of candidate genes for fertility restoration in cytoplasmic male sterile perennial ryegrass (*Lolium perenne* L.).** *Genome Biology and Evolution*, evw047

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Presentations

Talk at the SwissMito Conference, 2014
Talk at the EUCARPIA General Congress ETH Zurich, 2016

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Public panel

Moderation of the public panel discussion on «Innovation vs. Regulation» EUCARPIA General Congress, ETH Zurich, 2016

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Social media

Article for the PSC blog «Engaging in a science and policy dialogue»
https://blogs.ethz.ch/Science_and_Policy/

Cassava leaf © www.croptrust.org

Collaborators
Devang Mehta[1], Willi Gruissem[1], Hervé Vanderschuren[2]

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[2] University of Liége, The Netherlands

Engineering virus resistance in cassava: Towards a sustainable production system in Africa

Devang Mehta

Cassava is a staple food crop for almost a billion people worldwide and especially in sub-Saharan Africa. Unfortunately, cassava production in Africa is severely limited by the effects of cassava mosaic geminiviruses (CMGs). Genetic engineering thus holds great promise for rapid improvement of cassava varieties, and without promoting a reliance on chemical measures to limit insect vectors which transmit damaging viruses. Unfortunately, DNA viruses are often fast-evolving species and to-date no successful release of transgenic plant resistant to DNA viruses has been carried out.

In my project we sought to study the field effectiveness of engineered virus resistant cassava plants. Our results from a confined field trial of these transgenic plants in Kenya indicate that transgenic plants displayed moderate resistance in the field as compared to controlled lab experiments. We have subsequently worked on developing a novel long-read enrichment sequencing approach to precisely sequence the geminiviruses that infected our plants in the field. The results from this sequencing experiment will provide us with additional insights into the populations of geminiviruses present in Africa, as well as populations of geminiviruses present in individual plants, and the effect of our transgene on these populations. Additionally, we have developed new transgenics, using both RNA silencing and CRISPR/Cas9, which are being assessed for resistance to the CMGs in lab experiments.

The long term vision for my project is to disseminate transgenic sources of resistance which can help farmers in sub-Saharan Africa sustainably deal with the endemic problem of cassava geminiviruses. We also plan on working with our partners in South Africa to help develop cassava as a commodity crop for starch production, leading to greater economic returns for farmers who currently use cassava as a subsistence crop with very poor marketability.

Publication

Anjanappa et al. (2016) **Characterization of brown streak virus-resistant cassava.** *Molecular Plant-Microbe Interactions. 29 (7), 527–534*

Public panels

Moderation of the panel discussion on Gene Drives at Imperial College London, 2016
Moderation of the panel discussion on «Natural products: from plant based production to synthetic biology» at the PSC PhD Symposium «Plants for Health», 2016
Panelist at the LS2 Meeting - panel discussion on Biosecurity organised by the Forum for Genetic Research, SCNAT, 2017

Social media

Blog article on «Dangers of our own creation - Talking biosecurity in the era of synthetic biology»
https://devang.atavist.com/dangers-of-our-own-creation

Blog article on «Rewriting our food supply»
https://devang.atavist.com/rewriting-our-food-supply

Exhibition

«Vom Licht zur Nahrung»Scientifica 2015, Public Science Fair in Zurich

Interview with local famer in Jiangxi province in southeast China
© Yuanyuan Huang

Collaborators
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Fixing carbon in subtropical forest to mitigate climate change: How to transfer the knowledge to farmers

Yuanyuan Huang

Forest ecosystems contain the majority of the carbon stored in terrestrial ecosystems, and play an important role in helping mitigate climate change. A central question in biodiversity research is how experimental manipulations of plant diversity affect primary productivity including carbon storage. Grassland experiments have shown a positive relationship between the two variables, but it is not clear if the same holds for forests.

We tried to understand whether more diverse forests provide more forest ecosystem services. With observational studies, we found that biodiversity can promote tree growth in natural forest. By monitoring tree growth of around 13.000 trees in 512 plots with six biodiversity levels (1, 2, 4, 8, 16 or 24 species) for four years (2013–2016) in a field-manipulated experiment, we discovered that more diverse plantations during the initial 7 years of growth accumulated more biomass, and this positive diversity effect increased with time. It turned out pathogens and herbivores inhibited productivity more in low than in high diversity. Thus, it is important to take species' richness into account in afforestation. Our results can be directly linked to on-going assessments that sup-port forest policy design, strengthening the science - policy interface for the conservation and sustainable development.

We carried out questionnaire surveys and interviews with stakeholders in five villages near the field site to obtain a good understanding of their attitudes toward forest ecosystem and biodiversity. We also built up a micro-blog, through which people can receive information about «biodiversity and forest ecosystem functioning» on their mobile phones. However, it is not easy to successfully integrate decision makers into the project without any immediate practical profits for them. This causes some difficulties to translate the scientific data into actual management decisions.

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Presentations

Poster at the PSC PhD Symposium «Unlocking the Potential of Diversity», 2015
Talk at the Annual Meeting of the Ecological Society of America, 2016
A talk «Resilience of tropical ecosystems – Future challenges and opportunities» at Annual Conference of the Society for Tropical Ecology, 2015
A poster at PopBio, 2015

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PSC Teacher Workshop

«Plant ecophysiology» University of Berne, 2016

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School class Workshop

«I love forest» for primary school in the BEF-China experimental area, Xingangshan, JiangXi province China, 2014

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Web and social media

Micro-blog «Biodiversity and ecosystem functioning» with the platform of Wechat on cellphone (Wechat ID: BEF-China)

https://befchina.wordpress.com/

Rooftop flagpole structure and skylight of the Australian Parliament House. © Sofia Nobre

Evaluating the potential of apomixis for sustainable agriculture and food security

Sofia Nobre

Apomixis, the asexual reproduction through seed, leads to the formation of offspring that are clones of the mother plant. Apomixis occurs naturally in about 500 species of flowering plants spread over diverse taxonomical groups, some ancient lineages, some more recent. The exact way the clonal seed is formed also varies from one species to another. It is evident, then, that the process must have arisen independently in each group. By reproducing clonally, a plant's features will remain unchanged (as opposed to having a mix of the features of both parents). In nature, this allows the colonization of specific niches, often harsh growing conditions, to which those features are particularly suited. For agriculture, however, the appeal is in the genetic fixation of hybrids and thus hybrid vigor. Hybrids, generated by crossing to distinct inbred parental lines, perform better in the field, showing a higher robustness against biotic and abiotic stresses and producing higher yields. However, hybrids are either sterile or lose their advantages in the following generation, so the original cross must be recreated every season, to great cost in time and money. Therefore, the harnessing of apomixis in crops has been a long sought-after goal to preserve hybrid vigor via clonal seed production.

Apomixis is considered a consequence of the misregulation of genes (in time and/or space) regulating sexual reproduction. It is well known that hybridization events lead to metastable changes in gene expression, such that one can postulate that apomixis might result from hybridization. Indeed, most apomictic species either are allopolyploids, i.e. hybrids of two distinct species, or have gone through a period of allopolyploidization in their evolutionary history. Since such primary hybrids are often sterile, apomixis could be a way to overcome sterility.

Collaborators
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[2] CAMBIA, Australia

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Publication

Pereira et al. (2016) **'Love Is Strong, and You're so Sweet': JAGGER is essential for persistent synergid degeneration and polytubey block in *Arabidopsis thaliana*.** *Molecular Plant 9, 601–614*

Pereira et al. (2014) **Differential expression patterns of arabinogalactan proteins in *Arabidopsis thaliana* reproductive tissues.** *Journal of Experimental Botany*, Vol. 65/Issue 18

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Presentations

Poster at the International Association of Sexual Plant Reproduction Research IASPRR, 2016

Poster at the URPP Evolution in Action annual meeting, 2016

Poster at the European Society for Evolutionary Biology ESEB, 2015

Poster at the Genome-enabled approaches towards molecular functions in ecology and evolution DFG, 2014

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Exhibitions

Frühlingsfest der Universität Zürich, 2014

«Der Weg zur 3D-Pflanzenzelle im Licht des Mikroskops» Scientifica 2015, Public Science Fair in Zurich

Apomictic seeds are formed in various ways. In common, they must avoid meiosis (apomeiosis) to end up with a diploid embryo sac (containing the egg cell that will become the embryo, and the central cell that will become the endosperm) that will not require fertilization of the egg cell to develop into an embryo (parthenogenesis). This can either happen by independent means (autonomous apomixis), or require fertilization of the central cell (pseudogamous apomixis).

In this project, we worked with the genus Boechera. These mountain plants are the closest relatives to the model system *Arabidopsis thaliana* in which apomixis occurs. Importantly, in the Boechera genus there are species that reproduce sexually, apomictically, or one or the other in a gradual and facultative way. Moreover, while many species are polyploid, apomixis was also reported at the diploid level, simplifying molecular analyses.

We looked into genes that, when mutated in Arabidopsis, display elements of apomictic reproduction. We compared the sequence and structure of those genes between several Boechera species to look for a possible correlation with the mode of reproduction and their evolutionary history. Some of these genes have striking differences that signify the production of completely different versions of the encoded protein. This would have significant implications for the development of the reproductive cells and may sway their path towards one or another reproductive mode.

The next steps will be to assess the functionality of these proteins. Can we change the way a plant reproduces by inserting one version of the corresponding gene into another species? This is yet to be seen. But if it works, we will be one step closer to understanding apomixis, and perhaps one step closer to engineering it in economically valuable crops.

Contribution at the interface of S&P / S& Innovation

When talking about evidence-based decision making, the most immediate thought is of policy decisions based on scientific data. But research itself can (should) be based on evidence and prior knowledge, and funding and project management decisions are made with this information in mind.

In any company, a project that aims to develop a product includes an analysis of the intellectual property surrounding the possible outcome: what are the patents involved in the necessary enabling technologies, who owns them, who can be a competitor or a collaborator. Such a study is called a patent landscape, and millions are spent by companies in establishing these landscapes for each product they intend to develop and market.

In the sciences, such a landscape is a necessary but often overlooked step in developing a project. Too often, an academic research proposal aiming to pursue a promising innovation that could bring benefits to society cares only for the discovery itself and not the future use of it. At most, institutions encourage the patenting of the discovery, and funding organisms are satisfied with that prospect. But no innovation can be used in a vacuum; a marketable product will involve dozens (if not hundreds) of steps in its production that will, themselves, also be under patent protection.

That academic researchers disregard patent landscaping is easily understandable: they might simply be ignorant of the existence of such a thing, or they might know how patents are dense with obscure legal language, and that wading through a sea of patents is cumbersome and time-consuming, when there are experiments to carry through and articles and grant proposals to write, not to mention that there is also very little external encouragement to produce a patent landscape.

But academic researchers, and especially those in plant and agricultural research with clear translational aspects, cannot afford to ignore this task. How then is this to be encouraged into common practice?

The answer lies in sharing.

CAMBIA, the organization at which I worked during the secondment to their offices in Canberra, has been developing and improving free online platforms dedicated to serve whoever wants to research and analyse patent documents. On their main patent platform, the Lens (lens.org), anyone can easily search and read millions of full-text patent documents from around the world, as well as see their legal status. Users are able to browse, collect documents, and perform basic analysis on their groups of patents of interest, all free of charge. The Lens is continually improved via user feedback, and its developing team continues to negotiate access to more full-text documents from as many patent jurisdictions as possible.

During my time with CAMBIA, I worked on drafting a patent landscape for the use of apomixis as a technology, that is, the technological path to producing a plant that has been engineered to reproduce apomictically. I served as well as a benchmarker, by brainstorming and suggesting improvements to the platform based on my user experience. The goal is to develop the Lens to a platform that is as user-friendly as possible, and that helps the users navigate the patent sea even without much previous knowledge. The vision for the future is to expand the Lens into a user-content driven repository of landscapes, where landscapes can be shared and improved upon by the community of users, so that the act of patent landscaping can be just a matter of assembly, improvement, and fact-checking, saving time and making the process easier and less daunting, and ultimately making it an ordinary part of project planning.

PSC Policy Workshop
Science Communication

May 8 and 22, 2017, University of Zurich

Scientists in all fields are expected to perform public outreach occasionally on matters ranging from research funding to assist policymakers in taking decisions. In doing this, they face particular challenges. Challenges range from being clear, convincing, accurate, and, at the same time, engaging. Academic researchers play an essential role in allowing policymakers to develop and properly assess science policy options, speaking to the media, and contributing to the improvement of public's critical thinking. If advised and coached appropriately, they can engage in a true dialogue that enhances mutual understanding between academia and the general public.

Lecturer: Jacopo Pasotti, science journalist, www.jacopopasotti.com

PSC Policy Training Course
System Thinking

13-15 June 2017, University of Zurich

Participants will develop skills in systems thinking in practice using ideas from boundary critique and critical systems heuristics (CSH). Participants effectively design a reference system for their case study based on applying the CSH boundary-setting questions. Through surfacing key inter-relationships, perspectives, and boundaries, participants will explore the possibilities and limitations of making factual judgments, value judgments, and boundary judgments associated with the 'wickedness' of their case study situations. The workshop will be a combination of presentation and mini-lectures centred on a core demonstration case study running throughout the event, group-work sessions based on individuals' choice between two to three other case studies, and plenary reflection and discussion.

Lecturer: Martin Reynolds, Open University

Registration:
www.registration.ethz.ch/spsw

Mentoring

Problem-Framing Workshop
March 14, 2017

ETH Zurich, CHN Building

The workshop aimed at assuring and strengthen the student's ability to integrate and join the two disciplines - Joint Knowledge Production – which are considered in the PSC-Mercator Fellowship Projects. Moreover, it aimed at supporting the formulations of questions that are of societal relevance, as well as the successful involvement of stakeholders. The PhD students run through TdLab's 10-Steps approach. The approach serves to clarify the roles and contributions of the different disciplines, as well as of the stakeholders.

Lecturer: Dr. Christian Pohl, D-USYS TdLab

Mini symposium: Public engagement with science - relevance and methods
10 April 2017

ETH Zurich, MM C78.1

Alumni-Pavillon

Public engagement with science strengthens the legitimacy of research and will contribute to a more sustainable future. The kind of future researchers want to contribute to is a matter of normative values and of social responsibility. In this one day symposium, relevance, approaches and examples of successful public engagement with science will be presented. In workshops, we will discuss what can be gained for science in general and for research projects of participants.

www.plantsciences.uzh.ch/en/rss-news/2017-04-10.html

PSC Policy Workshop
Stakeholder Engagement

25 - 28 Sep 2017

University of Zurich

Natural scientists may engage in implementing policy programs or may also be invited to participate in stakeholder engagement processes. Communicating and collaborating effectively within the context of different stakeholder groups and engaging constructively with representatives of different sectors of society in multi-stakeholder processes will be key competencies in this context.

Lecturer: Minu Hemmati, Berlin, Germany

PSC launches a new blog and workbook series
Engaging in a science and policy dialogue

https://blogs.ethz.ch/Science_and_Policy

This blog invites you to present your research work at the science and policy interface. It also features special events, training and publications. One section is dedicated to professionals working at the science and policy interface while reflecting on their career paths in government, politics, NGOs or private companies.

With a series of 8 workbooks we would like to share our knowledge and experiences on engaging in the science-policy dialogue. But most important, we are keen to provide a tool and skill set, which enables scientists to generate impact with their research.

IDP BRIDGES - Final Event

Bridging Science and Policy

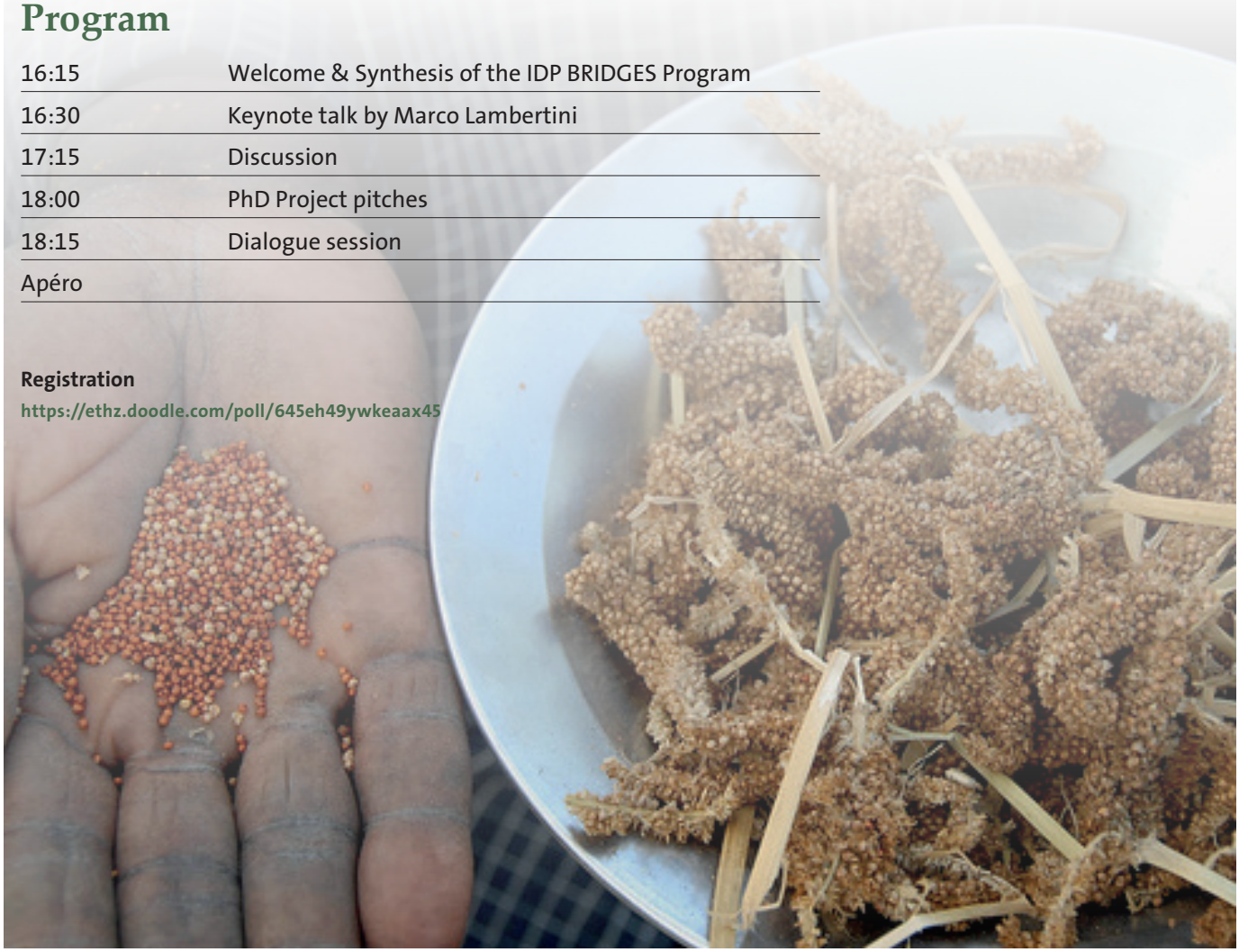
5 April 2017, Aula of the University of Zurich

At the closing ceremony of the IDP BRIDGES Innovative Doctoral Program, 10 PhD students will present their outcomes - for example, key factors influencing the success of biofertilization, assessment of forest policy design to mitigate climate change, the use of RNAi as fungizide, potential of epigenetics for the organic sector, drafting a patent landscape for the use of apomixis as a technology. While participating in the PSC Science and Policy training and mentoring program, the scholars developed skills in evidence-based policy making, participatory processes in policy, evaluation of value judgments, and communicating risks and uncertainties. The research projects were supervised by researchers in the PSC network and by representatives of policy-implementing organizations. During internships the students translate scientific results into outcomes at the science-policy or science-innovation interface.
Dr. Marco Lambertini, Director General at WWF International, will present highlights of the Living Planet Report 2016. He will show how scientific evidence has been integrated in this report and how researchers can actively contribute to the WWF strategy papers. Moreover, he will define the role of WWF International as an NGO at the interface of policy, science and the civic sector.

Program

16:15	Welcome & Synthesis of the IDP BRIDGES Program
16:30	Keynote talk by Marco Lambertini
17:15	Discussion
18:00	PhD Project pitches
18:15	Dialogue session
Apéro	

Registration
https://ethz.doodle.com/poll/645eh49ywkeaax45



Keynote talk

The modern challenges and opportunities for preserving 'our' Living Planet

Marco Lambertini
Director General, WWF International

Marco Lambertini leads a global Network with over 50 years of environmental conservation successes, 7.000 staff, five million supporters, 25 Mio followers on social media and activities in over 100 countries.

he planet was listed on the stock market, 2016 would have been a volatile year for sure. On the one hand, we saw some historic highs with the Paris Agreement coming into force before its first anniversary and four years earlier than expected, , wild tiger populations seeing an increase for the first time in a century and the icon of the conservation movement (and WWF), the panda, moving one step further away from extinction.

But on the other hand, 2016 was the hottest year on record, the Arctic warmed much faster than anyone predicted and the latest edition of WWF's Living Planet Report showed us that in just over 40 years, the world witnessed a nearly 60 per cent decline in wildlife across land, sea and freshwater and is heading towards a shocking two third decline by 2020. This is in less than a generation! Indeed if the biodiversity index is considered akin to the stock market index for tracking a company's health and prospects, our planet may well be heading for a crash unless something is done about it. And a crash of natural systems is not something any central bank can easily fix.

The undeniable truth is that we continue to do great damage to the planet and we haven't learnt how to grow our economy without harming nature. In the past fifty years, truly a blink of an eye compared to the over two million years of our species' history, we have seen an exponential acceleration of the unsustainable and wasteful use of natural resources. If we continue to produce, consume and power our lives the way we do right now, forests, oceans and weather systems could be overwhelmed and irreversibly damaged.

Biodiversity – the complex web of life made of millions of species, plants, bacteria and fungi–underpins the many Earth systems we take for granted, providing us with the air we breathe and the food and water we consume. It maintains the ecosystems that society and its various enterprises need to thrive, ensuring access to essential raw materials, commodities and services.
Yet, for the first time in Earth's history, people and businesses are overpowering the planet using resources faster than they can be regenerated. Unsustainable agriculture, fisheries, infrastructures, mining and energy are leading to unprecedented habitat loss and degradation, overexploitation, pollution and climate change and while their impacts are increasingly evident in the natural world, the consequences on people and businesses are real too. From food and water scarcity to growing evidence of climate-related risks faced by individuals, businesses and countries, the evidence has never been clearer.

A planet being pushed to the edge will eventually turn on us. We are already seeing an increase in the frequency and intensity of extreme weather events disrupting lives and livelihoods across the region.

Climate instability, extreme weather events and water scarcity feature at the top of the World Economic Forum's list of risks for businesses and as the planet finds itself at a crossroads, the challenge for governments and businesses is to balance ecologically sustainable development with economic growth. The equation is a simple one: we will not build a stable, prosperous and equitable future for humanity on a degraded planet. Particularly when in three decades, the Earth's population is expected to reach 10 billion.

Producing better and consuming more wisely is key to establishing resilient markets that stay within our planet's safe operating space, safeguard our natural wealth, and contribute to overall economic and social well-being. Increasingly companies are expected to address, not to worsen, environmental degradation – it is becoming part of their social license to operate.
Right now the state of the planet is getting worse and the pressures on natural systems are deepening but, for the first time perhaps, we are also seeing an increase in response. Whether it's halting deforestation, shifting to renewable energy or fishing sustainably, there are many positive signs too.

We have undoubtedly begun a great transition towards sustainable living. Now, we need to focus on the scale and speed of this transition if we are going to decouple economic development from environmental degradation. There is no time to waste and that is the bottom line.

March 2017

PSC Summer School 2017

Understanding Risks and Resilience in Plant Systems

29 May - 2 June 2017, Einsiedeln

With humankind leaving the planetary boundaries and the safe operating space, systemic risks have become frequent: our climate system is approaching a new state. Biodiversity losses are endangering ecosystem services; pests are globally spreading and threatening our food security. Complex systems are characterized by inter-connections between species, agents, individuals and multiple stable states whereas regime shifts can be triggered after periods of stability towards non-linear behavior, i.e., path dependance, sustained oscillation, contagion and synchrony. Systemic risks arise from the potential for unpredictable changes of the system to another state. While we cannot predict the tipping point, we can stabilize the system in the current state through increasing or restoring resilience and diversity.

In this Summer School, we will discuss modeling of variable to be considered in complex systems and their threshold effects as well as some interaction at the socio-ecological interface, the so-called complex adaptive systems. The range of topics spans from plant sciences to economy with a focus on modeling from the mathematical background to complex ecological models. Research and case studies are from climate change, ecosystem research, epidemiology, agriculture and economics with strong links to plant sciences.

Invited speakers will present state-of-the-art tools, conduct interactive workshops and take part in plenary discussions. They will act as mentors in the case studies group work. The outcome of the group work will be available in the proceedings.

Registration: https://www.registration.ethz.ch/spsw

Program and Invited Speakers

Systemic Risks: Overview
- Dr. Pia-Johanna Schweizer, Institute for Advanced Sustainability Studies, Berlin, Germany

Understanding resilience
- Dr. Andrea Downing, Stockholm Resilience Center

Modeling of variable to be considered in complex systems
- Prof. Mary Lou Zeeman, Bowdoin College, Brunswick, ME, USA
- Adam Clark, MSc, University of Minnesota, USA

Examples for systemic risks from plant epidemology and from plant ecology
- Prof. Chris Gilligan, University of Cambridge, United Kingdom
- Dr. Christophe Randin, University of Lausanne, Switzerland
- Dr. Matthew Barbour, University of Zurich, Switzerland

Examples for systemic risks from economy
- Prof. Robert Finger, ETH Zurich, Switzerland

Consortium: ETH Zurich, University of Zurich, University of Basel
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Project Management: Dr. Melanie Paschke, Zurich-Basel Plant Science Center
Project Officer: Dr. Luisa Last, Zurich-Basel Plant Science Center
Financial Administration: Romy Kohlmann, Zurich-Basel Plant Science Center

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ETH Zurich: Dr. Eduardo Perez, Prof. Hervé Vanderschuren, Prof. Achim Walter, Prof. Samuel Zeeman, Prof. Bruno Studer, Prof. Jaboury Ghazoul
University of Basel: PD Dr. Mikhail Pooggin, Prof. Thomas Boller, Prof. Ansgar Kahmen, Prof. Jürg Stöcklin
University of Zurich: PD Dr. Diana Santelia, Prof. Bernhard Schmid, Prof. Pascal Niklaus, Prof. Ueli Grossniklaus

Fellows

ETH Zurich: Guillaume Lacavé, Devang Mehta, Wuyan Wang, Timothy Sykes, Lisa King, Charlotte Pavageau
University of Basel: Silvia Turco, Claudia Hahn, Michael Thieme, Lukas Schütz
University of Zurich: Arianna Nigro, Yuanyuan Huang, Margarida Sofia Nobre

Associated Partners

Dr. María Elvira Zúñiga - Centro Regional de Estudios en Alimentos Saludables, Chile
Prof. Maria Emma Christine Rey - University of Witwatersrand, South Africa
Dr. Monika Messmer, Dr. Lucius Tamm and Dr. Paul Mäder - Research Institute of Organic Agriculture, FiBL, Switzerland
Dr. Willy Kessler, Dr. Andreas Lüscher and Dr. Olivier Schumpp - Agroscope Reckenholz, Switzerland
Dr. Klára Panzarova - PSI, Czech Republic
Dr. Kebebew Assefa - Ethiopian Institute of Agricultural Research, Ethiopia
Dr. Zerihun Tadele - University of Bern, Switzerland
Dr. Torben Asp - Arhus University, Denmark
Dr. Uma Shaanker - University of Agricultural Sciences, Bangalore, India
Prof. Ma Keping - Chinese Academy of Sciences, China
Dr. Richard Jefferson - CAMBIA, Australia
Prof. Lian Pin Koh - University of Adelaide, Australia
Dr. Etienne Bucher - Institut de Recherche en Horticulture et Semences, France

Mentors

Dr. Gerlind Wallon - EMBO Deputy Director, Manager for Women in Science Activities, EMBO Young Investigator Program
Dr. Michele Garfinkel - EMBO Science Policy Program
Regina Ammann - Head of Public Policy, Syngenta International AG
Dr. Gunter Festel - FESTEL CAPITAL
Dr. Eva Spehn - Swiss Biodiversity Forum SCNAT, Global Mountain Biodiversity Assessment of DIVERSITAS, University of Basel

Work Package MANAGEMENT

Lead: Dr. Melanie Paschke

Work Package RESEARCH

Lead: Prof. Samuel C. Zeeman

Work Package TRAINING

Lead: Dr. Melanie Paschke

Work Package EXPLOITATION

Lead: Dr. Manuela Dahinden

Work Package OUTREACH

Lead: Dr. Manuela Dahinden

IDP BRIDGES is an Innovative Doctoral Program supporting 14 PhD students' work in the most challenging areas of the plant sciences and policy. This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no PITN-GA-2013-608422 – IDP BRIDGES. The project is coordinated by the Zurich-Basel Plant Science Center - a competence center linking and serving the plant science research community of the University of Zurich, ETH Zurich and University of Basel.

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