ETH zürich

World Food System Center

Annual Report 2022

Celebrating 10+ Years of Collaboration

World Food System Center

To celebrate 10+ Years of collaboration, the Center curated a public exhibition at the Mühlerama Museum for Food Culture in Zurich. The Science on your Plate exhibition presented how researchers at ETH Zurich are studying the journey of food and exploring new paths forward.

Dear Colleagues, Partners, Alumni, and Friends:

We are pleased to share with you our Annual Report 2022, which highlights various research, education, and outreach activities focused on food system transformation.

Martijn Sonnevelt and Robert Finger

At the World Food System Center, we work together with members from about 50 research groups in various disciplines to develop ideas and find practical answers to key challenges in our food system. There is no one-size-fits-all solution. Over the past ten years, we have come up with several levers and approaches to make our agriculture, food, and diets more sustainable, step-by-step.

Enacting change in the food system is urgent. More and faster steps are needed. Ongoing climate change, soil fertility loss, and conflicts and crises have increased the pressure to the food system. For many key Sustainable Development Goals (SDGs), we are further away from reaching the targets than we were a few years ago. We have about eight years left to achieve the SDGs, or at least to make remarkable progress. It is, hence, time to quickly bring science into practice to accelerate food system transformation.

We are therefore pleased to have successfully laid the groundwork in 2022 to be able to recently open four calls for interdisciplinary research projects. Together with our partners, we want to explore ways to make food systems more sustainable by improving health and nutrition of food products; applying potential novel technologies; better understanding trade-offs in food systems; and addressing environmental and human health risks.

The results generated from these projects will have direct value for society, policy, and industry. They will be used as a basis in educational and outreach formats bringing various actors of the food system together to discuss targeted actions.

Last year, we celebrated 10+ years of collaborative work at the Center with many public events and exchanges. And looking forward, we plan to further stimulate discussions with research we support. We hope to develop, together with you and with all actors sharing different perspectives on the food system, promising pathways for sustainable food systems.

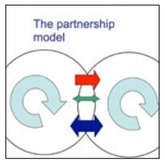
Robert Finger
Chair

Martijn Sonnevelt
Executive Director

10⁺ Years at a Glance

Since its founding in 2011, the World Food System Center has brought together researchers from across ETH Zurich with external partners in collaborative ways. We celebrated these 10⁺ Years of Collaboration throughout 2022.

June 2011
First General Assembly of 25 inaugural members



October 2011
Establishment of Partnership Council and launch of Mercator Research Program

December 2011
Start of Executive Office operations

February 2013
Wood System Film Series course at ETH Zurich

February 2013
REDES Workshop with Swiss Federal Office for Agriculture and Agroscope on food security in Switzerland

June 2013
Start Coop Research Program on Sustainability in Food Value Chains

2011/2012

March 2012
Treffpunkt Science City program on Feeding the World

July 2012
Summer school with ETH Sustainability on Eating Tomorrow

September 2012
Center official public inauguration event

2013

August 2013
First World Food System Summer School on Organic Production Systems

October 2013
Our Common Food: Public lecture and award ceremony at ETH Zurich on World Food Day

November 2013
Launch of ETH Zurich Zukunftsblog including world food system theme

January 2014
Foresight Study on Research for a Sustainable Swiss Food System for Federal Office of Agriculture

February 2014
World Food System Summer School on Organic Production Systems in India

March 2014
Public Lecture: Agricultural Intensification with Pedro Sanchez and Cheryl Palm

April 2015
Public Lecture: Food Systems Resilience in Theory and Practice with Frank Eyhorn

June 2015
Public Event: Science on Your Plate at Expo 2015 in Milan, Italy

June 2015
Conference: Tackling World Food System Challenges Across Disciplines, Sectors, and Scales

March 2016
WFSC Research Programs fund 8 new projects

March 2016
Public Lecture: Sustainable Proteins of the Future with Alexander Mathys

April 2016
Sustainable Campus Catering Workshop

2014

March 2014
Kickoff Workshop: Stellenbosch University Food Security Initiative

April 2014
Master's Course at FAO in Rome on food security and ecosystem services

June 2014
Public Event: Youth in the Driver's Seat with SFIAR

2015

August 2015
Stakeholder Workshop: Resilience of the Tef Value Chain in Ethiopia

September 2015
Public Event: Film Screening and Panel Discussion at Zürich isst

September 2015
Symposium: Reducing Pesticides in Agriculture with Helvetas Intercooperation

2016

May 2016
ETH Meets California Study Tour: Tackling Food System Challenges with IT Innovation

July 2016
Sight and Life Issue on food systems

August 2016
World Food System Summer School on Organic Agriculture and Food Systems in Switzerland

Highlights from the Center's work in its three main activity areas of research, education, and outreach.

10⁺ Years at a Glance

Over the last 10⁺ years, our member groups, networks, programs, and initiatives have grown and evolved, but our vision remains unchanged: A healthy world through sustainable food systems.

May 2017
Stakeholder Workshop: Innovations for Building Resilience in Food Systems

September 2017
Sustainable Nutrition with Bits and Bytes exhibit at Scientifica

September 2017
Public Lecture: Tackling Malnutrition with Biofortification with Maria Andrade

February 2019
Future Food Initiative launched and 4 fellows selected

April 2019
Public Event: Pesticides – What Does Science Say?

May 2019
AgriTech Day: Agriculture of the Future – Digital and Sustainable?

2017/2018

January 2018
Summer School on Food Systems in Transition in Côte d'Ivoire

June 2018
Stakeholder Workshop: Resilience of the Cocoa Value Chain in Ghana

June 2018
Alumni Workshop in Berlin

2019

June 2019
Learning Exchange with Assam Agricultural University

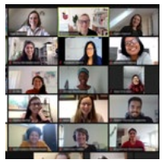
August 2019
Selected as Beacon of Hope for Accelerating Transformations to Sustainable Food Systems

October 2019
Center Research Symposium with 5 presentations and 50 posters

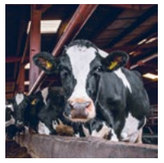
August 2020
Alpine Excursion: Exploring Sustainable Regional Food Networks in the Swiss Mountains

October 2020
Public Webinar: Pathways for Advancing Pesticide Policies

October 2020
Production of films from Center Research Programs projects



February 2021
Professional Short Course: Designing for Food Systems Resilience: A Circular Approach



February 2021
New Agriculture and Food Systems Research Program with Nestlé announced

May 2021
New collaborative project Enhancing Biodiversity & Resilience in Agriculture with Bayer AG & IFPRI

January 2022
Kick off: Urban Microalgae-Based Protein Production project, led by the Singapore-ETH Centre

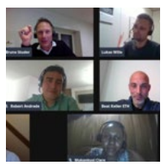
April 2022
Food Security Course at FAO in Rome focused on city-region food systems

May 2022
Exhibition: Science on Your Plate/Forschung zum Aufessen at the Mühlerama Museum for Food Culture in Zurich

2020

October 2020
Visits with Future Food Initiative industry partners Bühler, Givaudan and Nestlé

November 2020
Cook Along Event: Changing the Food System, One Meal at a Time with TasteLab



December 2020
Food Day @ETH: Plant Breeding for Global Food Security Webinar

2021

August 2021
World Food System Summer School in Rheinau, Switzerland

September 2021
ETH/UZH Scientifica Innovations for Sustainable Development exhibit and Fair Chocolate 4All workshop

October 2021
New research collaboration in the field of smart sustainable farming with fenaco announced

2022

August 2022
10th World Food System Summer School in Rheinau, Switzerland

September 2022
Interactive dinner: Science on Your Plate– Fine Dining of the Future at Food Zurich

November 2022
Food Day @ETH: workshops, plenary session, panel discussion & 45 posters

The FAO tracks progress on food and agriculture-related SDG indicators, including those for Zero Hunger (Graphics: UN FAO).

THE CENTER

ETH Zurich established the World Food System Center in 2011 to provide solutions for pressing challenges in our food system concerning food and nutrition security, environmental health, and social well-being. These challenges are larger than ever after the COVID-19 pandemic and demand immediate collaborative efforts.

Food Systems and the Sustainable Development Goals

Fighting hunger is a central element of the United Nations 2030 Agenda for Sustainable Development to build a better world. The agenda affirms 17 Sustainable Development Goals and 169 targets, which are integrated and indivisible and balance the three dimensions of sustainable development: the economic, social, and environmental. However, despite hopes that the world would emerge from the COVID-19 pandemic in 2021 and food security would begin to improve, world hunger rose further in 2022. Ten times more people worldwide are fighting to survive in famine-like conditions than five years ago.

This increase in global hunger stems from a variety of factors, such as conflicts, climate extremes, and rising fertilizer prices. Unequal patterns of economic recovery and unrecovered income losses from the COVID-19 pandemic further exacerbates inequalities across and within countries and drives growing hunger. The global community is failing to meet its promise to end hunger and malnutrition by 2030.

This alarming rapid increase in food insecurity demands immediate action. Building sustainable food systems is intricately linked to achieving the SDGs. For example, sustainable food systems can provide decent jobs and support the incomes of billions of people, empower and support women, as well as reduce deforestation and support healthy terrestrial ecosystems. Food systems are the enabling source for civilization, and the SDGs provide an opportunity to highlight the contributions of food systems to the global commons.

Since the United Nations Food Summit was held in 2021, hundreds of individuals, governments, organizations, and institutions have joined forces to support the transformation of food systems in line with the ambitions of the summit. Forming coalitions focused on certain interests and priorities emerging from the summit, these actors held dialogues and shared recommendations in 2022. The implementation of such recommendations is now paramount.

We believe a broader adoption of a food systems approach allows building resilient food systems capable of providing food and nutrition security over the long term.

In order to advance food system transformation to achieve the SDGs, effective policies are required that support and coordinate actions by different public and private stakeholders, who often hold different fundamental beliefs. There is a need for incremental steps of change as well as fundamental transformation. Academic institutions through research and education can provide interdisciplinary knowledge as well as methods for collaboration and co-creation involving all actors of the food system, from producers to consumers. Clearly, if the world fails to increase efforts and to implement more targeted measures, the ambitious SDGs will not be achieved.

Sustainable food systems help the world achieve critical progress on all 17 Sustainable Development Goals (Graphic: UN FAO).

The Center and its Approach
Discourse on the global challenge of food security has historically mostly focused on how to grow enough food. This focus, however, overlooks the fact that achieving food and nutrition security requires more than just producing enough calories for all. Access for each individual to a healthy, nutritious and safe diet must also be ensured. Overweight and obesity are widespread while macro- and micronutrient deficiencies affect billions, creating a triple burden of malnutrition in many countries. Only by addressing this grave malnutrition situation can the SDGs be achieved.

In order to play a leading role in addressing the challenges of how to feed the world in a way that ensures human health, environmental sustainability, and social well-being, ETH Zurich established the World Food System Center (WFSC). The Center acts as a coordination and management platform to establish research, education, and outreach initiatives. It brings its members together to collaborate in interdisciplinary ways and with a variety of external partners.

The work of the WFSC is based on the understanding that solutions to food system challenges require collaboration from stakeholders across the entire food value chain. The programs of the Center bring opportunities to students, scientists, and professors who are concerned with food systems in their research and studies. Encouragement of inclusive and creative approaches is key, as is providing interactive platforms to engage with a wide range of local and global stakeholders from different sectors and disciplines.

Values
Seven core values dictate the organizational conduct of the Center. These core values dictate the (1) importance of academic independence and include a commitment to (2) sustainability, (3) transparency, (4) objectivity, (5) inter- and transdisciplinarity, (6) real world impact through partnerships, and (7) addressing global challenges of societal relevance.

Organization Structure
The core of the WFSC is formed by the member groups, which in 2022 comprised 53 professors from eight different departments of ETH Zurich, four groups of Eawag, and one group of Empa (see Appendix). The multi-disciplinary pool of expertise of the member groups is a distinct competence of the Center, and allows for solution innovation across the food system and addressing challenges across disciplines and scales.

This astounding competence spans the food system, from environmental science, agricultural science, food science, nutrition, and immunology, and includes topics such as technology innovation, economics, as well as policy. This body of work continues in parallel with and is supported by the WFSC.

The Steering Committee oversees the strategy and operational functions carried out by the Executive Office. It is formed by a group of maximum ten elected members and led by a Chair.

Our Vision: A healthy world through sustainable food systems.

New Members 2022

Prof. Eva-Marie Meemken leads the Food Systems Economics and Policy Group in the ETH Zurich Department of Environmental Systems Science. Her group conducts applied research that contributes to a better understanding of how to promote sustainability goals in global food systems. A special focus lies on the analysis of policies and institutional arrangements and their role in poverty reduction, decent employment, gender equality, and food and nutrition security in lower-income countries.

Prof. Tom Crowther leads the Global Ecosystem Ecology Group in the ETH Zurich Department of Environmental Systems Science. His group studies ecosystems at a global scale to understand the relationships between biodiversity and climate change. Their work is helping create the scientific foundation for ecosystem restoration and informing and empowering people to protect and restore Earth's biodiversity to fight climate change and improve human well-being.

Celebrating 10+ Years of Collaboration Across the Food System

Science on Your Plate Exhibition
The exhibition Science on Your Plate/Forschung zum Aufessen took visitors on the journey of our food. At the Mühlerama Museum for Food Culture in Zurich, different stops along the way focused on how the cultivation, processing, and consumption of food affects the environment and our health.

The exhibition showcased the Center's systems approach and highlighted supported research from 17 member groups. With an opening celebration, cooking events, and tours with researchers, the exhibition became a place for lively exchange as well as discovery for over 2,200 visitors during six weeks in May and June.

Voices of the World Food System Center
A Jubilee website was launched in April to highlight activities from the Center's 10+ years of work. In addition, many voices of the members groups of the Center came to life in interviews. Professors, researchers, and staff all got the chance to share their stories and hopes for the future of the Center. Founding Chair Nina Buchmann reflected how, at the Center's start, the "concept of a system, a world food system with many interactions instead of linear value chains, was an attractive one and drew a lot of attention."

In a special ETH podcast, members Robert Finger and Kenza Benabderrazik spoke about the many layers of the system that feeds people around the globe.

Food Day @ETH
To celebrate 10+ years of work, the Center's annual research symposium was expanded to a half-day event. Food Day @ETH kicked off with workshops in the afternoon. At the plenary session, Robert Finger reflected on highlights, key achievements, and ways forward for the Center. Keynote speaker Dominique Burgeon, Director of the FAO Liaison Office with the United Nations Office in Geneva, focused on what is needed to build food systems that are resilient and sustainable.

The networking poster session highlighting ongoing research and Center activities offered the over 200 participants the chance to interact together.

RUNRES collaborators at Egnanew Mayet Composting Association in Ethiopia.

«In my opinion, the RUNRES project is a fantastic opportunity for a North-South mutual learning about and implementation of science-based innovations with a transdisciplinary approach that includes scientists and stakeholders from the agricultural, waste, and sanitation sectors.»

Johan Six
Professor of Sustainable Agroecosystems, ETH Zurich
WFSC Member

RUNRES collaborators at Maggot Farm Black Soldier Fly Larvae Facility in Rwanda.

Partnership Approach

The WFSC strives to work together with others in partnerships to achieve together what no partner could achieve on its own. Both strategic and collaborative partnerships are developed, and the WFSC indirectly fosters new partnerships at the project level. This partnership approach has been critical to the Center's success.

In close collaboration with the ETH Zurich Foundation, the Center established a Partnership Council specifically to engage with industry and foundation partners who support our vision and mission through programs and projects. Members include Mercator Foundation Switzerland, Coop, Bühler, fenaco, Nestlé, Givaudan, Bayer, and Syngenta Crop Protection. In November 2022, the Partnership Council met to discuss ideas and priorities. The idea is to further strengthen both formal and informal exchanges between industry, foundations, and academia as well as to explore more possible collaborations.

Collaborative Partnerships

The Center collaborates regularly with organizations who bring important and complementary expertise and networks to the table. Collaborative partnerships allows working together with stakeholders in a way that creates added value for both organizations without engaging in a permanent relationship involving binding commitments. In addition, the WFSC facilitates partnerships at the project level among academia, external partners, and stakeholders from a variety of different sectors.

Collaborations that positively support transformation in food systems require new tools and new ways of thinking and working together.

For example, the Center is part of the Nutrition in City Ecosystems (NICE) project. The project aims to improve urban diets in low- and middle-income countries. NICE promotes women and youth leadership and places a strong emphasis on public-private engagement and income generation. The consortium includes the Swiss Tropical and Public Health Institute, Sight and Life, ETH Zurich, and the Syngenta Foundation for Sustainable Agriculture.

In 2022, Center staff, along with colleagues from the consortium, coordinated a peer-to-peer learning process within the framework of the project. Workshops throughout 2022 culminated in a 3-day learning journey for representatives from cities in Rwanda, Kenya, and Bangladesh. The process allowed for an exchange of experiences and knowledge on urban food systems and how to improve food and nutrition security.

Research to Practice

Research supported by the Center often takes place abroad, with co-creation of solutions with local stakeholders an important component. For example, the RUNRES (Rural-Urban Nexus: Establishing a nutrient loop to improve city-region food system resilience) project is coordinated by a steering committee based at ETH Zurich, with country project teams working with local communities in several African countries. Led by Center member Johan Six, the project aims to improve city region food system resilience by capturing waste streams and retrieving nutrients using various technologies. The whole team met for a workshop in Naivasha, Kenya in December 2022 to finalize the framework for Phase II of the project (2023-2027 with a budget of 4.4 million Swiss Francs from the Swiss Development Cooperation).

Years of field research in Ghana is showing the potential of dynamic agroforestry systems to help create diverse, healthy cocoa farms. To increase the feasibility of these practices, ETH researcher Christian Andres brought together local farmers with NGOs, extension specialists, and license buying companies at a workshop in May 2022. These stakeholders co-created a set of proposed solutions to increase adoption of agroforestry.

The project Enhancing Biodiversity & Resilience in Crop Production, published several project briefs in 2022. The collaboration among ETH Zurich researchers, the WFSC, Bayer AG, and the International Food Policy Research Institute (IFPRI) aimed to explore scenarios with farmers for biodiversity-oriented outcomes and develop the basis for decision-making and value-generation tools. The briefs focused on biodiversity and resilience interventions as well as indicators in several countries.

Representation at Food Sector Events and Forums

WFSC members and Executive Office staff regularly represent the Center at food system-themed events and forums organized by Swiss and international groups. This engagement in diverse forums and bodies allows the Center to bring a food system perspective to the respective tables. For example, Executive Director Martijn Sonnevelt represents ETH Zurich in the Swiss National Committee of the UN FAO (CNS-FAO), a position nominated by the federal council. He was elected as President of the committee in January 2020.

In 2022, the CNS-FAO released the input paper Priorities and recommendations of CNS-FAO in support of food systems transformation. The recommendations included strengthening cooperation for sustainable agri-food systems to overcome the current polarization and promote the participation of all stakeholders and providing more funding for initiatives that focus on young farmers and entrepreneurs. The committee also took part in Agroecology Dialogue Series, an initiative of the FAO and Biovision Foundation in support of the Coalition for Food Systems Transformation through Agroecology.

The Center represents ETH Zurich in the Swiss Food and Nutrition Valley, a networking platform of Swiss food innovators. ETH Zurich is an academic partner of the network, and in 2022, Martijn Sonnvelt was part of the Executive Committee. Further, the WFSC is also part of the Swiss Forum for International Agricultural Research (SFIAR), a multi-stakeholder platform that includes the Swiss Federal Office for Agriculture (FOAG), Swiss Development Cooperation (SDC), major Swiss agricultural research institutions, and NGOs.

Researchers at ETH are studying the effects of various dietary fibers so that food manufacturers can use them optimally to benefit our health.

RESEARCH

The Center aims to generate new scientific knowledge with societal, political, and industrial relevance in a manner that supports real-world impact. We support innovations from the laboratory as well as through dialogue to create lasting positive change.

The World Food System Center (WFSC) enables novel interdisciplinary research that contributes knowledge and solutions to key food system challenges. The Center's core research activities also strive to provide leadership and foresight on issues connected to food and nutrition security based on innovative solutions. In order to do so, the Executive Office fosters and manages competitive research programs, develops and supports Flagship projects, and engages in special collaborations. These activities connect researchers from different disciplines with one another and with external partners and local stakeholders.

Research promotion and support builds directly on the strengths of our over 50 members. Various activities are planned to raise awareness of inter- and transdisciplinary research projects. The Center also seeks to find funding opportunities from various foundations interested in supporting food system transformation. Furthermore, the Center supports targeted coordination among members and partners for successful application for research funding.

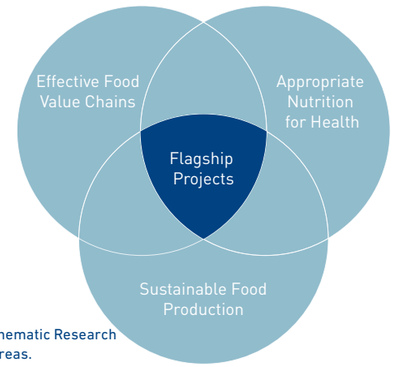
Research results are incorporated in various education and outreach projects to ensure highlighting of promising pathways to support sustainable transformation of food systems. Our members also work directly with local stakeholders around the world to implement solutions for change.

Thematic Research Focus Areas

The Center adopts a systems perspective to its research that takes place within interlinked thematic focus areas: *Effective Food Value Chains*, *Appropriate Nutrition for Health*, and *Sustainable Food Production*. These areas guide the Center's research initiatives and connect them to food system challenges of societal relevance. Resilience and resource efficiency are core concepts for the Center's work on food value chains and production systems. Diversity and safety are underlying principles for our work on food production and appropriate nutrition.

We strive to provide leadership and foresight on issues connected to food and nutrition security.

Flagship research projects showcase a food systems approach and tackle large questions at the intersection of the focus areas, where ETH Zurich is uniquely positioned to contribute to solutions for the world's pressing challenges.



WFSC Thematic Research Focus Areas.

Flagship Projects
Flagship projects supported by the Center should be visionary and potentially high risk; take a food systems or whole of value chain approach; involve at least three investigators from different disciplines; and involve key stakeholders from industry, government, and NGOs, in non-competitive roles.

In 2022, the Center supported the work of two Flagship projects. Enhancing Resilience in Food Systems is an initiative of the Sustainable Agroecosystems Group and the TdLab. Initiated in 2013 and led by Center member Johan Six, it addresses how food systems can be made more sustainable under multiple, unpredictable drivers of change. Support for the multiple subprojects comes from a wide range of food system actors, such as the Swiss Federal Office for Agriculture (FOAG), the UN FAO, multi-national companies and organizations, and academic partners.

The Flagship Novel Proteins for Food and Feed involves many member groups, with Center member Alexander Mathys as Principal Investigator. This project aims to develop food innovations to provide new sources of sustainable and nutritious protein for a growing world population. The project enables the broad exploration of microalgae and insect proteins for more sustainable food and feed. In 2022, the Stellar Gemini system was deployed at the Singapore-ETH Centre's Urban Microalgae Protein project laboratory to increase the efficiency of microalgae processing. Based on research at ETH Zurich on focused nanosecond pulsed electric fields and developed by Bühler, this device is an outstanding example of technology transfer from academia into industry.

Learn more at **https://worldfoodsystem.ethz.ch/research/flagship-projects**.

Future Food Initiative
ETH Zurich and EPFL launched Future Food – A Swiss Research Initiative (Future Food Initiative) in 2018 together with Swiss food industry leaders Bühler, Givaudan, and Nestlé. The goal of this initiative is to expand research and education in the area of food and nutrition sciences. The fellowship program within the initiative aims at bringing together competences from academic and industrial research in this field. The program is co-managed by the WFSC and the Integrative Food Science and Nutrition Center at EPFL.

The fellowship provides personal research funds for three years that enable postdoctoral fellows to work on their projects in a research laboratory with a host professor at ETH Zurich or EPFL. In total, nine fellows have started novel research projects. The initiative provides these fellows, host professors, and the Center a great opportunity to further develop collaborations with industry and EPFL. Together, all partners of the initiative are building a strong Swiss food science ecosystem.

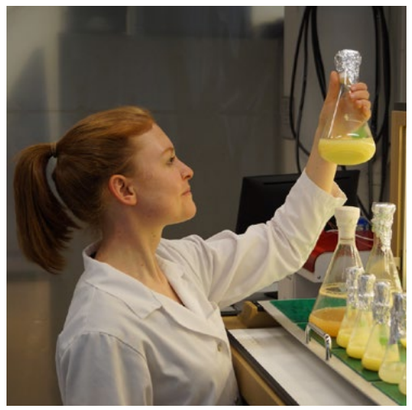
We fund research projects that support education and training of early career scientists.

Future Food Fellows investigate plant-based proteins and beverages, computer vision for use in food science, beneficial impacts of lactate on muscular health, and dietary disease prevention.

Flagship Project Updates

Enhancing Resilience in Food Systems
This Flagship Project seeks to directly contribute to food systems resilience by supporting decision-making in practice through stakeholder participation in case studies and academic education.

Highlights in 2022 include approval of another phase of the RUNRES (Rural-Urban Nexus: Establishing a nutrient loop to improve city-region food system Resilience) project. In Rwanda, the on-going research of doctoral student Mélanie Surchat led to a Photovoice Exhibition at the Swiss Development Cooperation in Bern. In this context, RUNRES seeks to support companies that are trying to recycle organic waste into fertilizers and animal feeds. The research focuses on the social sustainability of these innovations, by adopting the viewpoint of those who are working in the circular bioeconomy. Furthermore, several projects studied local value chains around the world, including tomatoes in Morocco and cocoa in Ghana.



Novel Proteins for Food and Feed
Components of this multifaceted Flagship Project include defining target properties and functionalities of the envisioned novel proteins, gaining insights from a consumer perspective, and using a system-oriented approach to assess sustainability.

In January 2022, the 'Urban Microalgae-Based Protein Production' project, led by the Singapore-ETH Centre, kicked off. ETH Zurich Senior Scientist Iris Haberkorn relocated to Singapore to help lead the project. A meeting of the consortium in November brought together universities, industry, and food agencies in Singapore.

In addition, several publications in 2022 highlight the productivity of the Flagship, focusing on innovations in microalgae cultivation as well as examining the role of future foods in sustainable flexitarian diets.

The Novel Proteins for Food and Feed Flagship project develops food innovations to provide new sources of sustainable and nutritious protein.

«It might seem like a trivial detail, but only if consumers hold a positive impression of meat substitute products will they replace meat in their diet. Therefore, it is important to examine consumer acceptance at an early stage of product development here in Switzerland as well as in other food cultures around the world.»

Michael Siegrist
Professor of Consumer Behavior, ETH Zurich
WFSC member

Researchers as well as representatives from industry and food agencies at kick-off meeting of 'Urban Microalgae-Based Protein Production' project in Singapore.

Research Programs

The Center's Research Programs support new cross-disciplinary and solution-oriented research to address food system challenges. All projects are subject to a rigorous evaluation and an assessment process that takes into account scientific excellence and relevance to the programs. These programs produce scientific publications and briefs for practice (see Appendix). To date, the Center's programs have supplied over 16 million Swiss Francs to research project funding at ETH Zurich.

Learn more about all the programs at **https://world-foodsystem.ethz.ch/research/research-programs**.

Agriculture and Food Systems

The Agriculture and Food Systems Research Program aims to improve sustainability of agriculture and food systems. Nestlé provided ETH Zurich with 2.8 million Swiss Francs of research funding in 2021 to support several interdisciplinary projects. Current research projects focus on dietary strategies for mitigation of greenhouse gas emissions in dairy cows as well as identification of the best nitrogen management options for climate-smart agriculture.

Smart Sustainable Farming

The Smart Sustainable Farming Research Program aims to contribute to sustainable, innovative, and competitive agricultural production and increase transparency from agricultural production to consumers.

We strive to create actionable knowledge to be shared in dialogue with a wide audience.

With this initiative, fenaco is supporting the establishment of the Smart Sustainable Farming Research Cluster at the World Food System Center with a total of 1.2 million Swiss Francs, starting in 2021. This funding enables several interdisciplinary projects at the interface of agriculture, sustainable production systems, robotics, and artificial intelligence.

The first project to be funded in 2022 will focus on the use of smartphone imaging to increase sustainability of crop production. Management decisions in crop fields are based on both crop and field traits. The goal of the new project will be to improve decision support of farmers, based on high-quality visual representations of the past, current, and projected future status of the crop field. The core outcome is to improve decision support for farmers.

Improving Sustainability of Agricultural and Food Systems

The Improving Sustainability of Agricultural and Food Systems across Key Environmental Metrics Research Program enables new interdisciplinary research projects that will specifically aim to identify sustainable production practices and agricultural systems covering all sustainability dimensions, explore them along key metrics, and further improve their sustainability by minimizing tradeoffs with special focus on the environmental footprint and risks of production.

In the frame of this program, Bayer AG supports several interdisciplinary research projects of the World Food System Center with a total donation of 1.1 million Swiss Francs, starting in 2022. The funded projects are expected to yield insights on pathways to reduce the environmental impact of food systems using a holistic perspective. Research results will be shared with the agriculture sector, other research institutions, companies, and the public.

Detlef Günter, former Vice President Research at ETH Zurich, commented, "New solutions are needed to produce sufficient food of good quality, making it accessible for all while greatly reducing environmental risks. This new partnership supports interdisciplinary research to identify solutions that consider relevant tradeoffs for farmers, industry, and consumers."

Special Collaborations

The Center engages in practice-oriented research via special projects with partners to support real-world agenda setting and decision-making. The role of the WFSC in these projects is not necessarily to conduct research but rather to support the project teams by providing the Center's expertise in education and outreach. Examples of such activities include being an education partner for the ETH Domain funded project 'Engage - Evidence-based dialogue on trade-offs in wicked societal problems'. The Center was also an outreach partner for the EIT Food Phenoliva Project 'Treatment and valorisation of olive mill wastes', led by member Laura Nyström as well as the 'Towards pesticide free agricultural production systems' project with member Robert Finger.

Sharing interdisciplinary research on sustainable food production with the public at Farming Days at the Swiss Museum of Transport in Luzern, Switzerland in September 2022.

The 2022 World Food System Summer School again took place in Rheinau, Switzerland.

EDUCATION

The education activities of the Center focus on building capacity in the next generation of decision makers to provide leadership for sustainable food systems issues.

The World Food System Center aims to support young talents from ETH Zurich and the world to become the next generation of leaders to tackle complex food system challenges. The Center focuses, therefore, on supplementing ETH Zurich curricula with innovative approaches to education that teach participants to navigate complexity and build sustainable food systems.

The Center organizes a range of education activities including intensive summer schools and extra-curricular courses and excursions. All of these activities are built on an interdisciplinary, critical thinking approach that emphasizes a food systems perspective and involves innovative teaching methods. From these activities, we create and foster a global, interdisciplinary community of WFSC alumni.

Summer Schools

The educational programs of the Center are developed for students and young professionals and designed to explore all aspects of the food system. Since 2013, the cornerstone of the Center's educational activities is the World Food System (WFS) Summer School program that brings together 20-25 students and young professionals from ETH Zurich and universities from around the world for a two-week intensive course. The course has been hosted in Switzerland, India, South Africa, and Côte d'Ivoire.

Our education courses teach participants to navigate complexity and build sustainable food systems.

Participants explore food system challenges and solutions first-hand and learn to better understand their own role in driving a sustainable transformation. The course incorporates a diversity of interactive teaching methods, such as first-hand exchanges with stakeholders and practitioners, group work, concept mapping, policy impact analysis, role playing, panels, and hands-on practical applications. Instructors include ETH Zurich faculty, international researchers, and practitioners from industry, public, and non-profit sectors. This ensures the courses balance academic content and rigor with an immersion and experiential learning context.

Find out more: https://worldfoodsystem.ethz.ch/education/summer-schools.

Professional Short Course
In March 2022, the World Food System Center collaborated with the Sustainable Agroecosystems and the Agroecological Transitions research groups to host the second short course for food systems professionals on designing for food systems resilience using a circular approach. The program aimed to connect practitioners working in the fields of agriculture, food, and nutrition to the knowledge and methods that have emerged from research at ETH Zurich.

The first two days of the course focused on concepts of agroecology, resilience, circularity, systems thinking, power dynamics, and solidarity economy. After a weekend break, the next days had participants delve into the design thinking process. Throughout the program, the participants actively interacted and collaborated, making intensive use of the online tools.

Learn more at https://worldfoodsystem.ethz.ch/education/wfsc-courses.html.

Food Security and Resilient Food Systems at FAO
Since 2014, the WFSC has collaborated with the Food and Agriculture Organization of the United Nations (FAO) and the Sustainable Agroecosystems Group to offer a three-day course for ETH Zurich Master's students at the FAO headquarters in Rome.

The course in April 2022 explored the role of agroecology for improved nutrition in city ecosystems. The students studied how farmers (cooperatives), business models, or local governance systems can potentially increase the production and demand for foods produced locally and based on agroecological principles. In a visit to Rome, the students discussed different aspects of sustainable city region food systems with experts from FAO and other international organizations. The students then presented their ideas for possible pathways towards better and more sustainable local food systems.

Our courses motivate life-long learning and engagement in creating change.

Students and instructors of the Food Security and Resilient Food Systems course during the study trip to Rome in April 2022.

10 Years of World Food System Summer Schools

The Design
The course was built on the philosophy that learning is not only an individual process, but a social process and that an educational environment is most effective when it is enjoyable, sparks curiosity, and motivates the participants to direct their own life-long learning. The beginning of the course always focused on building a learning community between participants, where they appreciate and respect their different backgrounds and what they can learn from one another. Setting such an inclusive learning environment is very important in ensuring that the program builds both hard and soft skills for participants and places effective collaboration amid disciplinary, socio-economic, and cultural diversity at the center of the experience.

The Locations
The summer school was launched in 2013 with the aim to create a network of inspired participants from around the world who continue to collaborate and create impact after the course ends. Each course lasted for two weeks and brought on average 24 students from diverse backgrounds to live and work together in an intensive program setting in a location chosen for its relevance to the course content. The majority of the courses have been hosted in Switzerland at the Gut Rheinau, the largest organic farm in the country. Courses were also held in India, South Africa, and Côte d'Ivoire.

The Shared Meals
The Center saw a need for an education program that would build the next generation of decision makers who could tackle complexity and have the knowledge, skills, network, and motivation needed to create change. Over the 10 years, the 235 participants of 56 nationalities shared 14,400 meals together. The alumni continued to contribute to the summer school. As they stepped into their careers, they were invited back to the course to share their practical experience. In 2019, this included training the students on the organic certification process in Switzerland and sharing how social innovation as well as entrepreneurship can be a tool to tackle food system challenges.

Alumni in Quindio, Colombia, helping to build a community garden.

«As educators, we have to ask ourselves if we teach our students to accept and to adapt to the currently dominant food system that is so obviously unsustainable and unjust. Or if we co-create, explore, test, and enhance alternatives? The latter means a lot of new learning, but also un-learning - for instance the narrative that industrial agriculture "feeds the world". This also means to do critical research on power and interests in food systems and related knowledge systems, but even more importantly, to acknowledge that everyone has valuable knowledge.»

Johanna Jacobi
Professor of Agroecological Transitions, ETH Zurich
WFSC member

Participants of the World Food System Summer School 2022, now members of the World Food System Network.

Agroecology and the Transition to Sustainable Food Systems
This public lecture series, started in 2021, continued with five lectures in 2022. This series was part of the ETH Zurich Department of Environmental Systems Science course of the same name, which was developed in collaboration with the Grasslands Science Group at ETH Zurich.

The lectures provided a variety of perspectives on the topic of agroecology. Experts on various elements provided inputs and share state-of-the-art knowledge. They discussed benefits and the potential of agroecology to contribute to sustainable food system transformation but also challenges and limitations.

In Fall of 2022, the series was thematically structured along the 13 principles of agroecology, proposed by the High-Level Panel of Experts for Food Security and Nutrition of the Committee on World Food Security. The principles highlighted included biodiversity, animal health, social values, participation, and land and natural resource use governance.

World Food System Center Alumni
Through the Center's educational activities, a growing interdisciplinary and global community of alumni has been created. In 2022, this community boasted more than 350 alumni from over 50 countries.

In 2019, the WFSC alumni community founded the World Food System Network. The vision of the organization is to cultivate a collaborative international network that inspires and leads change towards sustainable food systems. The mission is to support alumni-driven initiatives that encourage connecting, learning, and contributing.

Three board members run the organization and coordinate learning experiences, events, and workshops as well as an online platform. The World Food System Network links individual alumni to all participants, expanding the network of food system change makers. On the platform, alumni can discuss ideas, look for collaborators, and post opportunities and events.

Alumni connect at https://wfscalumni.com.

We create and foster a global, interdisciplinary community of WFSC alumni.

Alumni activities in 2022 included a 5-day field trip to Sicily to visit and talk with different producers from a cooperative of organic farmers called Valdibella. The group had the chance to hear the producers' motivations to work in organic agriculture, the social and climate change challenges in their area, try some of the products that they grow, and to hear their stories. Overall, many of the alumni were inspired by the magnitude of the agricultural system being implemented in Sicily and expressed a desire to apply some of the concepts they had learned in their own contexts.

Another alumni workshop took place in Colombia. The focus was on agroecological practices, specifically the management of organic waste and community gardening. The participants traveled through the western regions of Quindío and Antioquia, seeking to understand how to involve the community in agroecological projects through collaboration with various partners.

Food System Stories Blog
The Center's **Food System Stories blog** features the voices and perspectives of the WFSC alumni network and showcases outputs and lessons learned from the Center's Enabling Grants.

This creative space offers them a platform to share short stories and communicate their observations, experiences, and food system interests in an informal way. In 2022, 16 new stories were published.

Read the stories at www.foodsystemstories.org.

Alumni together in Sicily for a learning experience about sustainable agriculture.

The Science on your Plate exhibition at the Mühlerama Museum for Food Culture highlighted research from 17 WFSC member groups.

OUTREACH

The Center engages with a broad audience to disseminate and discuss new knowledge and innovations that support the achievement of the Sustainable Development Goals.

The World Food System Center (WFSC) aims to increase awareness and enact action to help the transformation of food systems and thereby support the achievement of the UN Agenda 2030 for Sustainable Development. In order to do so, the Center organizes numerous outreach events and creates materials for communication to assist in dialogue with various stakeholders.

These activities are crucial, as the way the world produces, consumes, and wastes food is far from sustainable. Food system transformation requires a complete change in the way we produce but to a large extent the way we consume food. Long-term sustainability and resilience of the entire food system requires not only technological innovations but also innovations in terms of governance and regulations to support the shift in consumption needed to reduce the environmental impact of the food system.

Diverse stakeholders are engaged by using varied platforms and venues, ranging from public events and lectures, exhibitions and guided tours, webinars, and direct discussions. Such activities have reached thousands. Along with the Center's communication materials and channels, outreach activities make visible the expertise at ETH Zurich and its contribution to global challenges.

By allowing a broad scope for outreach, the Center is able to explore the breadth of the food system in its activities. The expertise of its members is often complemented with the experience of colleagues and peers from outside ETH Zurich.

Outreach increases awareness of challenges in the world food system and promising approaches to create solutions.

Public Events and Research Symposium
The Center organizes numerous scientific events aimed at increasing awareness of the informed public about both the challenges of the world food system and system-based approaches to addressing them. In 2022, the Center organized 20 events plus a public lecture series consisting of 5 webinars, reaching a total of over 4600 people (see Appendix). Many events were jointly organized with WFSC members and partner centers and institutions.

Every year, the Center organizes Food Day @ETH. This symposium highlights research supported by the Center as well as showcasing other food system related research at ETH Zurich. The plenary session and networking poster session brings together a diverse audience from academia, industry, government and international organizations.

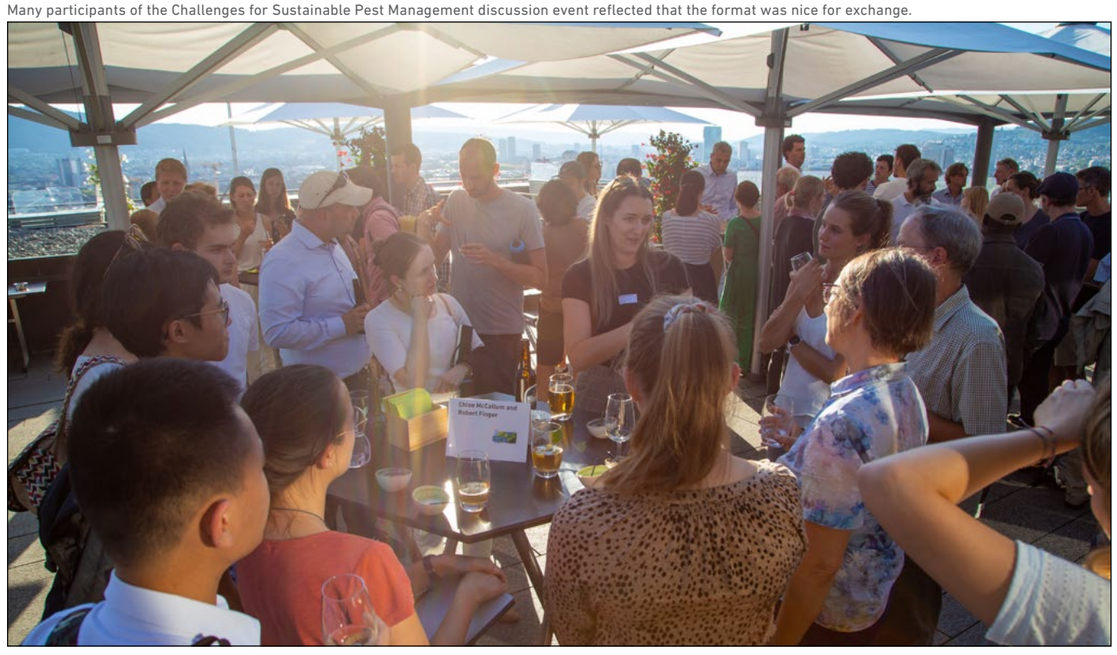
Treffpunkt Science City: At the table
The Spring 2022 Program of the ETH Zurich public science event focused on how what we eat every day impacts our own health as well as the environment around us. Many Center members were on hand to share their expertise and personal reflections at lectures, guided tours, and panel discussions. For example, Executive Director Martijn Sonnevelt gave a lecture on food that is "Healthy for us and the planet'.

Food Security Strategies for a Changing World
Food system economist Chris Barrett joined guests at ETH Zurich and online to share his research and insight into food security challenges. He focused on how successful transformation of our food system will require the combination of accelerated technological change with a range of policy, institutional, and cultural innovations. He also stressed the importance of investing in agri-food innovations that bring societal return. This seminar was co-organized with ETH4D.

Challenges for Sustainable Pest Management
At the discussion event co-organized with the Agricultural Economics and Policy Group at ETH Zurich, over 50 guests joined a consortium of interdisciplinary experts from agronomy, agroecology, human toxicology, ecotoxicology, and agricultural economics and policy. Each researcher presented their views on current challenges in pest management and their ideas for paths forward. The floor was then open for discussion with all experts.

We create enabling environments for science-society dialogue by providing venues for discussions and exchanges.

Many participants of the Challenges for Sustainable Pest Management discussion event reflected that the format was nice for exchange.



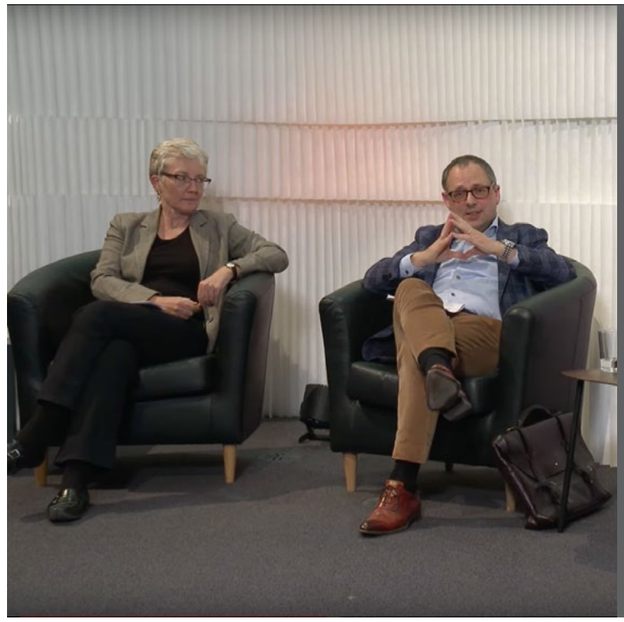
Food Day @ETH

Workshops
Food Day @ETH 2022 kicked off with workshops in the afternoon, focusing on scientific topics as well as the role of education and communication in building future food systems. ETH Zurich scientists and start-ups shared new innovative approaches at the 'Future proteins for sustainable food systems' workshop. The 'Community building for food system leaders' attracted researchers, educators, and students interested in fostering an active community. And the 'Science communication for #changemakers' workshop was created for researchers interested in sharing their work with the public in order to drive change.

Plenary Session
At the plenary session, Robert Finger took the opportunity to look back on more than 10 years of food system research, education, and dialogue facilitated by the WFSC. Vanessa Wood, Vice President Knowledge Transfer and Corporate Relations at ETH Zurich, then spoke about the role of competence centers at ETH Zurich and beyond. Keynote speaker Dominique Burgeon, Director of the FAO Liaison Office with the United Nations Office in Geneva, focused on what is needed to build food systems that are resilient and sustainable. Lastly, a panel discussion focused on what transformation is needed to make our food system fit for the future, with academic, industry, governmental, and NGO perspectives represented.

Networking Poster Session
The networking poster session showcased 45 posters displaying ongoing food system research and Center initiatives and offered the over 200 participants the chance to interact.

The audience selected three poster awards during the session. The winning posters focused on ' Biosphere monitoring in agricultural ecosystems with drone-based eDNA surveys', 'Boosting legume breeding in Switzerland', and 'Modeling nutritional and environmental effects of the Swiss food system'.



Nina Buchmann and Michael Siegrist, Center members, joined the panel discussion 'Eating without harming the planet' at Treffpunkt Science City.

«Science can and should play a fundamental role in informing society, policy, and industry as well as in supporting decision making by providing the evidence on food systems challenges and possible solutions. Moreover, engaging in such intense science-society dialogue is crucial to frame and create solutions to real-world problems together with stakeholders.»

Robert Finger
Professor of Agricultural Economics and Policy,
ETH Zurich
WFSC member and Chair

Fabienne Michel, Corina Sägesser, Fabian Hess, and Corina Oppliger shared their research with guests at Food Zurich dinner event.

The Center also provides outreach opportunities to ETH researchers at venues away from the campus to engage with a public audience.

Science on Your Plate/Forschung zum Aufessen

This curated exhibition took place at the Mühlerama Museum for Food Culture for six weeks in May and June. The many components of the exhibition focused on how the cultivation, processing, and consumption of food affects the environment and our health. With an opening celebration, cooking events, and tours with researchers, the exhibition became a place for lively exchange as well as discovery for over 2,200 visitors. With a visit from a high-level delegation from Germany, organized by the Swiss Embassy in Germany, the exhibition also was a space for exchange between science and policy.

Science on Your Plate at Food Zurich

At the annual local food festival, Food Zurich, four scientists from Center member groups shared findings from their work. The interactive dinner 'Science on Your Plate – Fine Dining of the Future' served portions of science with each course. The guests enjoyed a vegan meal while hearing about research on breeding, cultivation, and processing of plant-based proteins.

Research Dissemination and Dialogue

The Center prepares content, discovers opportunities for dissemination, and ensures that the Center with all its activities and projects communicates strategically and in coordination with ETH Corporate Communications efforts. The Center has established and manages its own communication platforms to further support these efforts.

The Center aims to be a point of reference for food system research at ETH Zurich. The Center's website is a venue to communicate news and findings. The Center also produces a quarterly newsletter, bringing news highlights and member updates to a network of over 1850 interested subscribers. In 2022, the Center's social media presence included several growing platforms. Six new short films, based on outcomes from Center supported projects, premiered in May 2022.

@ethzwfsc

World Food System Center, ETH Zurich

World Food System Center ETH Zurich

We invite all to reach out to us with ideas for outreach, dialogue, or dissemination for food systems transformation.

Additionally, Center members and Executive Office staff regularly contribute to food system-themed events and exhibits. This participation allows for an increased inclusion of science into the societal dialogue on food system challenges.

Highlights in 2022 included Chair Robert Finger joining a panel discussion with Nestlé CEO Mark Schneider, IP Suisse President Andreas Stalder, and Coop Head of Sustainability Salome Hofer on sustainable agriculture in Switzerland. He also met with the Swiss Farmers' Association and presented at Brennpunkt Nahrung, a conference in Luzern focused on connecting management-level players in agricultural and food industries. In addition, Executive Director Martijn Sonnevelt was a guest on the 'Planet Wissen' television program focused on changes needed in food production and consumption.

Robert Finger presenting at Brennpunkt Nahrung in Luzern in November 2022.

Enabling Grants

Through targeted Enabling Grants, the WFSC supports early-career scientists and students to engage in auxiliary education and research activities. These programs opened new doors and enabled grantees to pursue opportunities that would have otherwise been unattainable.

These grants were available to WFSC member groups and alumni of the World Food System Summer School program. The WFS Fund supported education and research at the ETH Zurich in fields relevant to the world food system. From 2012 to 2021, 38 projects were funded through this program.

The Ambassadors Program, which was a core outreach activity for the Mercator Program since 2014, supported small projects and short-term educational or professional development activities. From 2014 to 2022, 49 projects were funded.

Appendix

World Food System Center Members

Members
* Indicates Member of Steering Committee
** Indicates Chair of Steering Committee

Appendix

Executive Office Staff

The Executive Office is responsible for the management and operation of the Center and its research, education, outreach, and communication activities. Together with the Steering Committee, the Executive Office develops and implements the strategy of the Center and builds strategic partnerships and collaborations. It is the central hub for facilitating exchange between members and external partners from academia, industry, government, and the not-for-profit sector.

Dr. Martijn Sonnevelt
Executive Director

Toya Bezzola
Project Manager Education and Research (left in 2022)

Dr. Ivonne Blossfeld
Project Manager Outreach

Michelle Grant
Lecturer and Advisor (left in 2022)

Monika Piessens
Education Manager

Dr. Jeanne Tomaszewski
Communications Manager

Selina Hess, Jan Streit
Student Project Staff
Gina Tüfer
Education Intern

Summary of Consolidated Financials (Infrastructure and Program)

TOTAL INCOME	2'071'220
ETH Zurich Infrastructure Funding	200'000
Member Fees	2'000
Management Support Funding from ETH Sources	250'000
Management Support Funding from Third Party Sources	102'117
Donations through ETH Foundation	1'496'602
Educational Offerings	18'002
Miscellaneous	2'500
TOTAL EXPENSES	**2'221'019**
Programs and Projects	
- Research	1'393'602
- Education	84'270
- Outreach	79'650
Management and Infrastructure	
- Personnel (including social benefits)	611'849
- Office and Administration	5'022
- Travel	1'735
- Communications	41'393
- Miscellaneous	3'498

Goodbye, Michelle
Michelle Grant joined the World Food System Center in December 2011 as the founding Executive Director. She led the establishment and growth of the Center, including securing funding and broad stakeholder support to expand into a second phase of work from 2016-2020. Michelle continued her work at the Center as the Education Director (Nov 2017-2021) and then as a Lecturer and Advisor (2022).

Thanks to her work, we continue to build the future of the Center on strong fundamentals. And we look forward to collaborate with her on new endeavors.

Appendix

Selected Publications from WFSC Research Programs and Flagship Projects 2022

Alvarez, A.R.G.; Narciso, J.O.: Manning, S.; Hizola, K.L.; Ruelas, T.D.; Chung, Y., Havill, T.; Santos, M.; Ara, O.; Community Advisory Board. (2022) Ang Pagtanom ug Binhi ("The Planting of Seed"): Health implications of food sovereignty movements in the Philippines. *Journal of Indigenous Social Development*, 11(1):120-144.

Ashley Green, A.; Blattmann, C.; Chen, C.; Mathys, A. (2022) The role of alternative proteins and future foods in sustainable and contextually-adapted flexitarian diets. *Trends in Food Science & Technology*, 124:250-258.

Benabderrazik, K.; Jeangros, L.; Kopainsky, B.; Dawoe, E.; Joerin, J.; Six, J. (2022) Addressing the resilience of tomato farmers in Ghana facing a double exposure from climate and market. *Ecology and Society*, 27(3):26.

Benabderrazik, K.; Kopainsky, B.; Monastyrnaya, E.; Thompson, W.; Tazi, L.; Joerin, J.; Six, J. (2022) Climate resilience and the human-water dynamics. The case of tomato production in Morocco. *Science of The Total Environment*, 849:157597.

Canelli, G.; Tevere, S.; Jaquenod, L.; Dionisi, F.; Rohfritsch, Z.; Bolten, C.J.; Neutsch, L.; Mathys, A. (2022) A novel strategy to simultaneously enhance bioaccessible lipids and antioxidants in hetero/mixotrophic *Chlorella vulgaris* as functional ingredient. *Bioresource Technology*, 147:126744.

Chen C.; Chaudhary, A.; Mathys, A. (2022) Dietary change and global sustainable development goals. *Frontiers in Sustainable Food Systems*, 6.

Fenzi M.; Rogé P.; Cruz-Estrada A.; Tuxill J.; Jarvis D.I. (2022) Community seed network in an era of climate change: dynamics of maize diversity in Yucatan, Mexico. *Agriculture and Human Values*, 39:339-356.

Fuhrmann, A.; Wilde, B.; Conz, R.F.; Speciose, K.; Konlambigue, M.; Masengesho, B.; Kintche, K.K.;, Kassa, K.; Musazura, W.; Späth, L.; Gold, M.; Mathys, A.; Six, J.; Hartmann, M. (2022) Residues from black soldier fly (*Hermetia illucens*) larvae rearing influence the plant-associated soil microbiome in the short term. *Frontiers in Microbiology*, 13.

Galle, E.; Wong, CW.; Ghosh, A.; Desgeorges, T.; Melrose, K.; Hinte, L.C.; Castellano Castillo, D.; Engl, M.; Agostinho de Sousa, J.; Ruiz Ojeda, F.J.; De Bock, K.; Ruiz, J.R.; von Meyenn, F. (2022) H3K18 lactylation marks tissue-specific active enhancers. *Genome Biology*, 23:207.

Green, A.; Nemecek, T.; Walther, B.; Mathys, A. (2022) Environmental impact, micronutrient adequacy, protein quality, and fatty acid profiles of plant-based beverages compared with cow's milk: a sustainability assessment. *The Lancet Planetary Health*, 6(1):S8.

Heuel, M.; Kreuzer, M.; Sandrock, C.; Leiber, F.; Mathys, A.; Guggenbühl, B.; Gangnat, I.D.M.; Terranova, M. (2022) Feeding value of black soldier fly larvae compared to soybean in methionine- and lysine-deficient laying hen diets. *Journal of Insects as Food and Feed*, 8(9):1-12.

Hilaj, N.; Zimmermann, M.B.; Galetti, V.; Zeder, C.; Lima, R.M.; Hammer, L.; Krzystek, A.; Andlauer, W.; Moretti, D. (2022) The effect of dechitinization on iron absorption from mealworm larvae (*Tenebrio molitor*) flour added to maize meals: stable-isotope studies in young females with low iron stores. *American Journal of Clinical Nutrition*, 116:1135–1145.

Keller, B.; Ariza-Suarez, D.; Portilla-Benavides, A.E.; Buendia, H.F.; Aparicio, J.S.; Amongi, W.; Mbiu, J.; Nchimbi Msolla, S.; Miklas, P.; Porch, T.G.; Burridge, J.; Mukankusi, C.; Studer, B.; Raatz, B. (2022) Improving association studies and genomic predictions for climbing beans with data from bush bean populations. *Frontiers in Plant Science*, 13:830896.

Keller, M.; Kreuzer, M.; Reidy, B.; Scheurer, A.; Guggenbühl, B.; Luder, M.; Frank, J.; Giller, K. (2022) Effects on performance, carcass and meat quality of replacing maize silage and concentrate by grass silage and corn-cob mix in the diet of growing bulls. *Meat Science*, 188:108795.

Liu, Y.; Bachofen, C.; Wittwer, R.; Silva Duarte, G.; Sun, Q.; Klaus, V. H.; Buchmann, N. (2022) Using PhenoCams to track crop phenology and explain the effects of different cropping systems on yield. *Agricultural Systems*, 195:103306.

Liu, Y.; Duarte, G.S.; Sun, Q.; Gilgen, A.K.; Wittwer, R.; van der Heijden, M.G.A.; Buchmann, N; Klaus, V.H. (2022) Severe drought rather than cropping system determines litter decomposition in arable systems. *Agriculture, Ecosystems & Environment*, 338:108078.

Muntwyler, A.; Braunschweig, A.E.; Rosa, F. (2022) Collaboration within and beyond the LCA community: success stories, obstacles, and solutions-79th LCA Discussion Forum on Life Cycle Assessment, 18 November 2021. *International Journal of Life Cycle Assessment*, 274: 623-626.

Panagos, P.; Muntwyler, A.; Liakos, L.; Borrelli, P.; Biavetti, I.; Bogonos, M.; Lugato, E. (2022) Phosphorus plant removal from European agricultural land. *Journal of Consumer Protection and Food Safety*, 17:5-20.

Peguero, D.A.; Gold, M.; Vandeweyer, D.; Zurbrügg, C.; Mathys, A. (2022) A review of pretreatment methods to improve agri-food waste bioconversion by black soldier fly larvae. *Frontiers in Sustainable Food Systems*, 5.

Pool, S.; Francés, F.; Garcia-Prats, A.; Puertes, C.; Pulido-Velazquez, M.; Sanchis-Ibor, C.; Schirmer, M.; Yang, H.; Jiménez-Martínez, J. (2022) Impact of a transformation from flood to drip irrigation on groundwater recharge and nitrogen leaching under variable climatic conditions. *Science of the Total Environment*, 825:153805.

Pool, S.; Jimenez-Martinez, J.; Schirmer, M. (2022) To drip or not to drip? Understanding nitrogen leaching in semi-arid Spain. *Water Science Policy*.

Rentsch, N.; Nyström, L.; & Narciso, J. O. (2022) Extraction of Pectin from Orange Peel Wastes as an Ingredient for Edible Films Containing Kabog Millet Flour. In Ahmed, M. (Ed.). *Pectin - Extraction, Processing, and Uses in the Food and Pharmaceutical Industries*. IntechOpen.

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Sekabira, H.; Nijman, E.; Späth, L.; Krütli, P.; Schut, M.; Vanlauwe, B.; Wilde, B.; Kintche, K.; Kantengwa, S.; Feyso, A.; Kigangu, B.; Six, J. (2022) Circular bioeconomy in African food systems: What is the status quo? Insights from Rwanda, DRC, and Ethiopia. *PLoS ONE*, 17(10).

Singh, A.; Lehner, I.; Schöb, C. (2022) Effect of Drought on Bean Yield Is Mediated by Intraspecific Variation in Crop Mixtures. *Frontiers in Plant Science*. 13:813417.

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Thompson W., Blaser-Hart W.J.; Joerin J.; Krütli, P.; Dawoe, E.; Kopainsky, B.; Chavez, E.; Garrett, R.D.; Six, J. (2022) Can sustainability certification enhance the climate resilience of smallholder farmers? The case of Ghanaian cocoa. *Journal of Land Use Science*, 17(1):407-428.

Public and Specialist Events Organized by WFSC and Partners 2022

Event	Date	Location	Participants	Speakers	Organizers
Exhibition: Together for the Sustainable Development Goals	Mar 2022	ETH Zurich	30		ETH4D, Sustainability Week Zurich, WFSC
Workshop: In the beginning was the cocoa bean	Mar 2022	ETH Zurich	28	Ivonne Blossfeld, Jan Streit, Martijn Sonnevelt	Treffpunkt Science City, WFSC
Public Lecture: Healthy for us and the planet	Mar 2022	ETH Zurich & online	240	Martijn Sonnevelt	Treffpunkt Science City, WFSC
Meet the Scientists at the Messe Food4Thought	Mar 2022	ETH Zurich	30	Julia Baumgartner, Lukas Böcker, Daniela Peguero, Anna Spescha, Francesca Zuffa	ETH Sustainability, WFSC
Networking Event Series: Climate-friendly farming	Apr 2022	Zurich	60	Ursina Hutter, Cordelia Kreft, David Schuppisser, Tilmann Silber	GreenBuzz Zurich, WFSC
Exhibition: Science on your plate (Forschung zum Aufessen) at Mühlerama Museum of Food Culture	May-Jun 2022	Zurich	2'200	17 WFSC member groups contributed	WFSC
Vernissage Event: Science on your plate (Forschung zum Aufessen) at Mühlerama Museum of Food Culture	May 2022	Zurich	60		WFSC
Seminar: Sustainable dairy and agriculture, a Swiss perspective	May 2022	Online	60	Melissa Terranova, Mutian Niu, Cordelia Kreft, Jeanne Tomaszewski	US Dairy Education and Training Consortium, WFSC
Cooking Workshop: The colorful plate – a healthy and diverse dinner at Mühlerama Museum	May 2022	Zurich	10		FooDi Cooking Hub, WFSC
Public Lecture: Food security strategies for a changing world	Jun 2022	ETH Zurich & online	155	Christopher Barrett	WFSC, ETH4D
Cooking Workshop: Budbud kabog – a Filipino specialty at Mühlerama Museum	Jun 2022	Zurich	7	Ivonne Blossfeld, Joan Narciso	WFSC
Meet the Scientist: Special tours of Science on your plate exhibition at Mühlerama Museum	Jun 2022	Zurich	53	13 WFSC members	WFSC
Special tour of Science on your plate exhibition with students from Nanyang Technological University Singapore	Jun 2022	Zurich	20		WFSC
Discussion Event: Challenges for sustainable pest management	Aug 2022	ETH Zurich	52	Robert Fingerr, Chloe McCallum, Per Kudsk Niklas Möhring, Matin Qaim, Robin Mesnage, Urs Niggli, Christian Stamm	AECP, WFSC
Interactive dinner: Science on your plate – Fine dining of the future at Food Zurich	Sep 2022	Zurich	45	Fabian Hess, Fabienne Michel, Corina Oppliger, Corina Sägesser	Food Zurich, WFSC
Exhibition: Future of food at Farming Days at Swiss Museum of Transport	Sep 2022	Luzern	1000		fenaco, WFSC
Public Webinar: Agroecology and the transition to sustainable food systems Biodiversity Animal Health Social values Participation Land and Natural Resource Use	Sep-Oct 2022	Online	178 (whole series)	Jaboury Ghazoul, Marianna Fenzi Anne Mottet, Anna Reiche Yodit Kebede, Toya Bezzola Shruti Patel, Lili Balogh Will Thompson, Fergus Sinclair	WFSC
Teacher Workshop: Bittersweet stories of chocolate	Oct 2022	Zurich	18	Monika Piessens, Toya Bezzola	Life Science Zurich, WFSC
Food Day @ETH Future proteins workshop Community building workshop Science communiation workshop Plenary session and posters	Nov 2022	ETH Zurich	38 34 36 200	Vanessa Wood, Dominique Burgeon, Erika S. Georget, Christian Hofer, Eva-Marie Meemken, Denise Rotondo, Emma Wetter-Slack	SFNV, WFSC WFSN, WFSC AI Center, WFSC WFSC
Public Webinar: Social sustainability in today's food system - desired or indispensable?	Dec 2022	Online	90	Janina Grabs, Noah Ramos, Eva-Marie Meemken	Swiss Society for Agricultural Economics and Agricultural Sociology, WFSC
SFIAR Award Ceremony	Dec 2022	ETH Zurich	50	Felix Dubach, Patrick Fallet, Adrian Fuhrmann	SFIAR, WFSC
Total: 25 events			**4'694**		

ETH Zurich
World Food System Center
Weinbergstrasse 11
8092 Zurich

www.worldfoodsystem.ethz.ch

World Food System Center

Content Jeanne E. Tomaszewski
Design & Layout Jeanne E. Tomaszewski
Cover Visitors at Science on Your Plate exhibition at the Mühlerama Museum for Food Culture interact with a circular economy model from the Sustainable Agroecosystems Group. Image: Alessandro Della Bella.

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