

Multidisciplinary Program on Sustainable Food and Biomass Systems

1. Background

The world faces the enormous challenge of supplying food and biomass in a sustainable manner under the escalating pressures of climate change, environmental degradation and population dynamics. Addressing these challenges requires transformative change and unprecedented innovation¹.

In addition, Covid19 was a stern reminder that the world needs to be better prepared for next pandemics of human, animal and plant diseases as well as other disasters that can disrupt food supplies. Part of that preparedness will be to strengthen resilience in local food supply.

In response to these challenges, there is a growing number of initiatives to develop integrated strategies on sustainable food and biomass systems. On the EU-level these initiatives include the [European Green Deal](#), the [Farm to Fork Strategy](#), the [EU 2030 Biodiversity strategy](#), “[Food 2030](#)” and “[Food 2050](#)”, as well as the July 2020 European Council decision on the [Recovery Plan](#)².

Critical to successful development and implementation of such integrated strategies is that the approaches are multidisciplinary and integrated, based on evidence and impact assessment, developed in a transparent and inclusive manner, and taking into account broader perspectives, such as impacts on developing countries.

2. The VUB Multidisciplinary Program on Sustainable Food and Biomass Systems

In the context described above, the Vrije Universiteit Brussel (VUB) is establishing a program to support the preparation and execution of multi-disciplinary research and education projects on sustainable food and biomass systems³.

While these projects will vary in nature, they will have several common characteristics, such as:

- a. *Multi-disciplinary and integrative*: drawing upon all relevant disciplines (e.g. life sciences, engineering, process-technology, law, economics, social sciences, public policy, spatial planning, history, communication, and ethics) and strengthening where possible the synergy between education and research,
- b. *Collaborative and open*: developed and conducted in collaboration with universities and research institutes in the EU and beyond, in consultation with other relevant national, regional and international organisations, and applying to the extent possible the concept of Open Science.

¹ See for example the FAO [Annual State of Food and Agriculture 2019](#), the [2019 report of the Intergovernmental Panel on Climate Change](#), the [2019 report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services](#), the [2019 report of the World Meteorological Organisation](#), the [2019 report of the Global Commission on Adaptation](#),

² See also: Group of Chief Scientific Advisors: “[Scientific opinion - Sustainable food system](#)” (March 2020) informed by [SAPEA Evidence Review Report](#) (March 2020).

³ Sustainability under this program means aimed at contributing to one or more Sustainable Development Goals (SDGs), and includes environmental, human health, economic, and social aspects. See also the [FAO Strategic Objectives](#)

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- c. *Evidence based and results-oriented*: aimed at providing decisionmakers and other stakeholders with well substantiated, tangible tools to make informed decisions, including decisions that involve 'trade offs' between different aspects of sustainability.
- d. *Serving a broad audience*, including researchers, educators, students, policy makers in national, EU and international organisations, private sector actors, farmers, and the general public.

The program will provide support to the development and execution of the projects by:

1. Bringing together groups at universities and research institutes interested in participating in multi-disciplinary research and education projects on sustainable food and biomass systems. The 59 European groups that have indicated interest are listed in Annex I. In the second half of 2020, other groups in European countries and beyond will be informed of the program.
2. Sharing with the participating groups suggested topics and cross cutting aspects to be addressed in the projects (Annex II) and proposals for multi-disciplinary projects (Annex III).
3. Conducting outreach activities, such as debate events, and collecting suggestions for outreach topics (Annex IV).
4. Sharing with the participating groups input from other organisations. For this purpose, arrangements have been made with national-, EU- and international organisations to share information, views and suggestions relevant to the program and the projects.
5. Assisting, through specialised offices, with the identification of and application for funding.

3. Planning.

The VUB Multidisciplinary Program on Sustainable Food and Biomass System is intended to be operational on 1 January 2021.

In the period up to 31 December 2020, the preparatory activities will include: i) updating and further fine-tuning the program⁴, ii) welcoming additional participating groups, iii) expanding collaboration with national, EU and international organisations, iv) establishing work-procedures with offices specialised in identifying and requesting funding, v) conducting outreach activities, and vi) preparing proposals for at least two pilot projects for submission late 2020 or early 2021.

Feedback, and indications of interest in participation can be sent to: Prof. Piet van der Meer, Office of the Vice-rector for Research Policy, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium, pieter.jan.van.der.meer@vub.be.

⁴ Updates of this concept-note will be published on <https://www.vub.be/en/research#excellence>

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Annex I: Participating groups

The overview below lists the European research and education groups that had on the date of this version of this concept note indicated their interest in collaborating in multi-disciplinary projects on sustainable food and biomass systems⁵. In the second half of 2020, other research and education groups from Europe and beyond will be invited to participate.

1.	Laboratory of Plant Genetics, Faculty of Sciences and Bioengineering Sciences, VUB, Belgium.
2.	Brussels Human Robotics Research Center, Vrije Universiteit Brussel (VUB), Belgium.
3.	Centre for Private and Economic Law, Law Faculty, Vrije Universiteit Brussel (VUB), Belgium.
4.	Social and Cultural Food Studies (FOST), Department of History, Vrije Universiteit Brussel (VUB), Belgium.
5.	MOBI research group, Circular food supply chains, Vrije Universiteit Brussel (VUB), Belgium
6.	MOBI research group, Sustainability evaluation, Vrije Universiteit Brussel (VUB), Belgium
7.	MOBI research group, Socio-economic impact assessment, Vrije Universiteit Brussel (VUB), Belgium
8.	Department of Hydrology and Hydraulic Engineering (IR-HYDR), Vrije Universiteit Brussel (VUB), Belgium
9.	Department of Business – Marketing & Consumer Behavior, Faculty of Social Sciences and Solvay Business School, Vrije Universiteit Brussel (VUB), Belgium.
10.	Research group Microbiology - microorganisms for sustainable production. Faculty of Sciences and Bioengineering sciences, Vrije Universiteit Brussel (VUB), Belgium
11.	Research group Microbiology - plant-microbe interactions. Faculty of Sciences and Bioengineering sciences, Vrije Universiteit Brussel (VUB), Belgium
12.	Marine Biology (WE-DBIO), Faculty of Sciences and Bioengineering sciences, VUB, Belgium
13.	Community Ecology (WE-DBIO), Faculty of Sciences and Bioengineering sciences, VUB, Belgium
14.	Biology Department, Faculty of Sciences and Bioengineering Sciences, VUB, Belgium.
15.	Functional Ecology of Plants and Ecosystems (WE-DBIO), Vrije Universiteit Brussel (VUB), Belgium.
16.	TechTransfer VUB, Vrije Universiteit Brussel (VUB), Belgium
17.	Research Group of Industrial Microbiology and Food Biotechnology, Department of Bioengineering Sciences, Faculty of Sciences and Bioengineering Sciences, Vrije Universiteit Brussel (VUB), Belgium
18.	Service Technology Transfer (TTO), Research Department, ULB, Belgium
19.	PhotoBioCatalysis Unit at Crop Production and Biocatalysis Lab (CPBL)-Science, Biomass Transformation Lab (BTL)-EIB, ULB, Belgium
20.	Crop Production and Biostimulation Lab, EIB ULB-Brussels, Belgium
21.	BioMatter – Research group for biomaterials and tissue engineering, Faculty of engineering, ULB, Belgium
22.	LL.M. in International Business Law, ULB, Belgium
23.	Pharmacognosy, Bioanalysis & Drug Discovery (PBDD), Faculty of Pharmacy, ULB, Brussels, Belgium
24.	Plant Physiology and Molecular Genetics Laboratory, Faculty of Sciences, Interfaculty School of Bioengineers, ULB, Belgium
25.	Laboratory on Landscape, Urbanism, Infrastructures and Ecologies (LoUISE), Faculty of Architecture ULB, Brussels, Belgium
26.	Agroecology lab, EIB ULB-Brussels, Belgium
27.	Laboratory of Applied Molecular Genetics, Department of Biotechnology, Faculty of Bioscience Engineering, Ghent University, Belgium
28.	Department of European, Public and International Law, Faculty of Law, Ghent University, Belgium
29.	Laboratory of Biochemistry and Glycobiology, Department of Biotechnology, Faculty of Bioscience Engineering, Ghent University, Belgium

⁵ A more detailed overview of these groups with areas of expertise and contact details is available to the participating groups.

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30.	Center for Microbial Ecology and Technology, Department of Biotechnology, Faculty of Bioscience Engineering, Ghent University, Belgium
31.	Centre for Synthetic Biology, Faculty of Bioscience Engineering, Ghent University, Belgium
32.	Alliance of Bioversity International and CIAT, Europe – Belgium, Leuven
33.	Research at the Flanders Research institute for Agriculture, Fisheries and Food (ILVO), Belgium
34.	Living labs of the Flanders Research institute for Agriculture, Fisheries and Food (ILVO), Belgium
35.	Fisheries Biology, Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Belgium
36.	Fisheries technology, Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Belgium
37.	Aquaculture – mariculture, RAS, Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Belgium
38.	Sciensano – group Transversal activities in Applied Genomics, Scientific Directorate Expertise and Service provision, Belgium
39.	Sciensano, Service Biosafety and Biotechnology (SBB), Scientific Directorate Expertise and Service provision, Belgium
40.	Institute for Plant Biotechnology and Cell biology, BOKU University, Vienna, Austria.
41.	Group of Biotic Stress, Plant Virology, Agrobiointitute, Sofia, Bulgaria
42.	Agricultural University of Plovdiv, Bulgaria
43.	Department of Plant physiology, biochemistry and genetics. Agricultural University of Plovdiv, Bulgaria
44.	International Food Economics and Rural Development, Department of Agricultural Economics and Rural Development, University of Goettingen, Goettingen, Germany
45.	Institute of Political Science, Heidelberg University, Heidelberg, Germany
46.	Constitutional and Administrative Law, Public International Law, European and International Economic Law, University of Passau, Passau, Germany.
47.	International and European Law, Faculty of Law, Maastricht University, Netherlands
48.	Maastricht Centre for European Law, Maastricht University, Netherlands.
49.	Food Claims Center Venlo, Maastricht University, Netherlands
50.	Maastricht Working on Europe/Studio Europa, Maastricht University, Netherlands
51.	NTNU Food Forum, NTNU Norwegian University of Science and Technology, Norway
52.	Institute of Field and Vegetable Crops (IFVC), Serbia
53.	Fruit Breeding Group, Instituto Valenciano de Investigaciones Agrarias (IVIA)
54.	Center of Agriculture and Engineering, (IVIA)
55.	Center of Agrobiodiversity, University Polytechnic of Valencia (COMAV), Spain.
56.	Department of Plant Breeding, Swedish University of Agricultural Sciences (SLU), Alnarp, Sweden
57.	Research group Biosafety, Agroscope, Research Division Agroecology and Environment, Zurich, Switzerland
58.	Crop Transformation Group, John Innes Centre, Norwich, UK
59.	Institute of Biological, Environmental & Rural Sciences (IBERS), Aberystwyth University, UK

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Annex II: Suggested topics and cross-cutting aspects

Communications with universities, research institutes and other organisations have confirmed that there is great interest in collaborative research and education projects on sustainable food and biomass systems. In those communications many specific topics as well as broader cross-cutting aspects were suggested to be addressed in such projects.

The suggested specific topics are summarised below in Table II.a. and the suggested cross cutting aspects are summarised in Table II.b.

Table II.a: Specific topics

The specific topics suggested to be addressed in the projects are for the time being grouped along the components: 1) Production, 2) Distribution, 3) Consumption, 4) Post consumption⁶.

The table below reflects the suggestions received and are intended to be a source of inspiration, rather than a delineation or limitation of any project. The tables nor the groupings pretend to be comprehensive or fixed. Suggestions for additions, updates and/or fine tuning of the tables are most welcome.

AREA	FOCUS
1. Production	
General – baseline	Long term trends in food production and population dynamics
	Comparative impact of various systems
	Energy and natural resources use
	Economic and trade aspects
Strengthening current agricultural systems	
<i>Strengthening farming practices</i>	Agro-ecology
	Digitalisation in agriculture and fisheries
	Precision farming
	Agro-forestry
	Robotics in agriculture and food production
	Phototonics in agriculture and food production
	Plant-microbe partnerships
	Soil quality
	Restoration agriculture
	Intensification
<i>Improving seed/ planting material</i>	Seed security and diversity
	Long term trends in crop improvements
	Improving agronomic characteristics in plants
	Improving food quality characteristics in plants
	Improving processing characteristics in plants

⁶ A more detailed overview with further elaborations, references and background information is available to the groups listed in Annex I.

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AREA	FOCUS
	Long term trends in animal breeding
<i>Improving fisheries and aquaculture</i>	Comparative carbon footprint farmed fish and seafood
	Safeguarding aquatic genetic resources
	Sustainable fishery through new technological approaches
	Strengthening sustainable aqua-culture
<i>Improving food-handling and processing</i>	Improving food curing
	Improving food preparation techniques
	Sustainable seafood handling and processing
Alternatives for current agricultural systems	
<i>Agriculture on marginal soils</i>	Breeding crops for saline soils.
	Beneficial plant-microbe interactions
<i>Urban and peri-urban agriculture</i>	City Region Food Systems
	Indoor-Vertical farming
<i>Floating farms</i>	
<i>Fermentation processes</i>	Fermentation to contribute to climate neutral economy
	Fermentation to address EU protein deficiency
	Cellular agriculture
2. Distribution	
Strengthening current distribution systems	Shortening supply chains and improving distribution logistics
Alternatives for current distribution systems	weekly markets, web services, Local retailers, Farmgate sales
	Reverse logistics
3. Consumption	
General	Long term trends in food consumption
<i>Improving current consumption patterns</i>	Reducing over-consumption of protein and calories
Alternatives for current meat consumption	insects, weeds, and commercial fishing bycatch
	Cultured meat
4. Post consumption	Reducing food waste
	Improving waste treatment
	Reverse logistics

Table II.b - Cross cutting aspects.

The cross-cutting aspects suggested to be addressed in the projects are for the time being grouped as: Sustainability, Governance, Research and Innovation, and Project Methodology.

The table below reflects the suggestions received and are intended to be a source of inspiration, rather than a delineation or limitation of any project. The table nor the groupings pretend to be comprehensive or fixed. Suggestions for additions, updates and/or fine tuning of the tables are warmly welcome.

Cross cutting aspects	Related topics
Sustainability	Sustainable Development Goals (SDGs)
	FAO strategic objectives (Link)
	Circular bioeconomy ⁷

⁷ See also: FAO: Indicators to Monitor and Evaluate the Sustainability of Bioeconomy ([link](#))

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	World Population Prospects, population dynamics
	Nature-based Solutions for climate change (IUCN/WWF), OECD-WWF: "Nature-Based Solutions as a Force for a Green and Resilient Recovery".
	The One Health Initiative.
	The 2020 report 'Environment at a Glance'.
	Synergies and 'Trade offs' between different aspects of sustainability.
	Knowledge sharing and extension services.
	Balancing agricultural productivity as well as sustainability pathways
	The role of food as a common good - Nutrition Equity
	UNEP: How to feed 10 billion people? (link)
	Sustainable Use of biodiversity
Governance	Research strategies targeted at sustainable food and biomass systems
	Communication
	Public awareness and involvement/participation
	Ethical considerations
	Developing country perspectives
	Governance of new technologies: bringing technologies to the farmers.
	Invasive species, pests and diseases: a threat to biodiversity and agricultural production
	Access and Benefit Sharing (Nagoya Protocol); Farmers' rights; Variety registration
	Better Governance and Better Regulation
	The Precautionary principle and the Innovation Principle
	Impact assessments: environmental and socio-economic
	Rural development, young farmers, farm income development
	Traditional/ethnographic knowledge and practices
	Evidence governance
Research and Innovation	Research and innovation are key drivers in accelerating the transition to sustainable, healthy and inclusive food systems from primary production to consumption. (F2F)
	Plant breeding and pre-breeding, Plant genomics, Plant phenomics, Plant gene editing
	Responsible innovation /Open Science
	Bioengineering Horizon scan 2020 (link)
Project Methodology	Multi-disciplinary study-design
	Open Science; Data sharing. Elixir .

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Annex III – Proposed multidisciplinary projects

Title	Outline	Contributing Disciplines
1. Training network for multidisciplinary, integrative PhD projects in Life Sciences.	The proposed project aims to establish a training program and network that assists prospective PhD students in Life Sciences in including a broader perspective to their PhD work. This broader perspective addresses questions related to the future use of the result of their research, such as contribution to the SDGs, safety/regulatory, economic/marketing, patenting/ABS, social acceptability, and communicating the research to stakeholders and society. The project aims to obtain for the period 2021-2025 funding for 10-20 PhD students.	<ul style="list-style-type: none"> - Life Sciences - Public Law/Regulatory - Law/ IPR, ABS - Economics - Sociology - Communication, - Food and agricultural history -Archaeobotany
2. Crop improvement database	The proposed project aims to develop a database to assist national agricultural research strategies. Starting point is the identification of challenges in the agricultural production of crop plants, whereby per country the following information is collected: 1) Key crops in the country; Main challenges in the production of those crops (e.g.: diseases, pest, drought); 3) Consequences of those challenges, e.g. % yield loss; 4) Current approaches to address these challenges (e.g. irrigation, crop rotation, pesticides) and their impacts 5) Ongoing and/or planned research on crop improvement, including conventional breeding, and modern biotechnological methods. (NB: The approach is solution-oriented and does not focus on any particular technology.). The information will be collected with the participation of relevant stakeholders in the countries, including farmers and farmer organisations, extension services, policy and decision-makers, non-governmental organisations, private sector actors. The aim is to share the collected information with the international agricultural research community through a web-based database.	<ul style="list-style-type: none"> - Agronomy - Environmental toxicology - consumer preferences - plant breeding - Life Sciences - Archaeobotany and food and agricultural history - Environmental and health safety assessment - Consumer perception
3. LCA based study on sustainable food.	Combine the impact of food production, distribution and recovery and compare with more traditional food supply chains.	
4. Circular Hackathon	An education project to develop business cases that can capture value from food waste streams, e.g. add valorisation of by-catch and by-products from fisheries unwanted catches.	
5. Monitoring the implementation of the EU F2F and the Biodiversity Strategies		

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Annex IV - Suggested topics for debate events.

Open Science	The European Commission website refers to Open Science as “a transition in how research is performed and how knowledge is shared”. The proposed debate will provide further background on Open Science, and the related concepts of Open Data and Open Scholarship, and discuss to what extent these concepts can make science more efficient, reliable, and responsive to societal challenges.
The impacts of food processing and fermentation on SDGs.	Food processing has been considered both as an important factor in contributing to sustainable food systems (e.g. by extending the ‘shelf life’ of products), and as a cause of health impacts. The proposed debate event will discuss the potential health, environmental, economic and food security impacts of various forms of food processing and fermentation.
The impact of food and biomass systems on the development of pandemics.	Practices such as ‘wet markets’, deforestation , irrigation dams, and intensive animal husbandry can result in an increase of such so called zoonotic diseases. As the Executive Secretary of the Convention on Biological Diversity stated at the occasion of World Health Day: “The lessons learned from COVID 19 and other epidemics tell us that we need to fundamentally transform our collective relationship with the natural world to prevent, insofar as possible, future pandemic outbreaks”. The proposed debate event will discuss this multifaceted challenge.
EU Protein deficiency	The EU has had a protein deficiency for decades, for which it needs to import large amounts of proteins (e.g. soy) from outside the EU. Over the years there have been attempts to find alternative protein sources (e.g. growing lupines, process technology using micro-organisms). The proposed debate will discuss the various proposed alternative from various perspectives, such as self-sufficiency, agronomic, environmental and political impacts.
Effect of changes in agricultural practices on nutritional profiles.	Changes in agricultural practices and alterations to our crops from the early 20 th century onwards have also profoundly changed the nutritional profiles of our food (as analyses of herbarium and archaeological specimens in one of the FOST projects indicates) – this longer term trend should be included in the debate.
Intellectual property in food and farm law – Transparency v. innovation	IPRs range from the seed planted to the food consumed. “Patents on life” is a highly controversial topic as well as plant breeders’ rights, the handling of trade secrets and geographical indications. Data protection in food law has a whole different meaning than otherwise perceived. Unresolved is the question as to who owns and is able to exploit “big data” gathered on farmland and increasingly digitalised agricultural operations. Related to food and farm, IPRs become subject to passionate, but often ill-informed debate. Europe is challenged to find a suitable approach balancing inventors’ interests and citizens expectations.
Farmland in the TFEU – National wealth or market commodity?	The real estate corollary to IPRs in the agro-food chain is ownership of farmland, investment in land and restrictions imposed by the regulator. Arable land and healthy soil is a much sought after commodity and increasingly subject to concentration and speculation. The ECJ/CJEU was on several occasions requested to reconcile the Treaty with national law. UNIDROIT is looking into the law of the farmland.

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Food private law	Unfair trading practices and contractual relationship in the food chain have recently become subject to EU legislation but food private law ranges much further and includes private standards, certification and audits establishing de facto global rules. So far, legal doctrine has not sufficiently looked into the complex legal structures thereby created and how it impacts back on food public law.
Sustainable food 2023	Features for the legislative framework for sustainable food systems the European Commission wants to present 2023
Peer review	Peer review: What is it and what is it not?
Evidence based policy making	Evidence based policy making: what does it mean in practice. The 'weight of evidence' approach.
Food safety	To ensure quality, food is subject to continuous monitoring in order to verify the quality of the food, to identify and control outbreak or ensure the freedom of choice of the consumer (ex GMO). Transversal/multidisciplinary approaches crossing all sectors (one health) is necessary for an efficient approaches as well the use of new tools like high throughput sequencing and bioinformatics .
Chronic diseases	Chronic diseases (cancer, diabetes, obesity, allergy, asthma...) are increasingly prevalent in developing nations. Searching the factors influencing these diseases in link with alimentation, pathogen infection or environmental exposure , genetics and epigenetic as well biomarkers of exposures is crucial. Transversal/multidisciplinary approaches crossing all sectors (one health) is necessary for an efficient approaches as well the use of new tools like high throughput sequencing and bioinformatics is necessary for an efficient approaches.
Infectious diseases	Monitoring infectious diseases which are still widespread and may cause major epidemic crisis was demonstrate to be of high importance. In it important to develop efficient strategy to monitor infectious diseases transmissible from one person to another, from an animal to a person, infectious diseases related to food as well in the environment. Transversal/multidisciplinary approaches crossing all sectors (one health) is necessary for an efficient approaches as well the use of new tools like high throughput sequencing and bioinformatics is necessary for an efficient approaches.