



GREEN ERA-HUB
on Agri-Food and Biotechnology

The Green ERA-Hub networks

Challenges, scopes and goals



Green ERA-Hub

The Green ERA-Hub (GEH) brings together networks in the Agri-food and biotechnology sector including all relevant ERA-Nets (Cofunds), and their predecessors, self-sustained networks and EJP. By this the GEH represents most of the relevant national funders in Europe in the Agri-food and biotechnology sectors. The goal of the GEH is to maintain the momentum and experience gained over the last 18 years of trans-national research programming and to use the experience to:

- i.) continue to build on previous achievements and further enhance cross-sector collaborations between Agri-Food and Biotechnology ERA-Nets, through implementation of new joint calls resulting in the funding of transnational collaborative projects;
- ii.) continue valorisation and implementation of other joint activities supporting the market, regulatory or societal uptake of results after the end of individual ERA-Nets;
- iii.) identify common research and innovation priorities, agreed upon by the participating national programmes, and address them via new joint calls;
- iv.) preserve best practice and managerial competences;
- v.) contribute to the planning and complement the implementation of the new HEU Partnerships and Missions;
- vi.) broaden the actions and impact of initiatives towards stakeholders and in terms of geographical coverage;
- vii.) contribute to achieve the strategic goals of the SDGs, in particular zero hunger, industry innovation and infrastructure, responsible consumption and production, life on land, partnership for the goals, the farm2fork strategy and EU's Green Deal.

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A photograph taken from inside a building, looking out through a stone archway. The archway is made of light-colored stone blocks. On either side of the arch are heavy wooden doors with metal hardware, including circular knockers and ornate hinges. The floor in the foreground is made of irregular stone tiles. Outside the arch, a bright, sunny garden is visible. The garden has a dry, yellowish ground in the foreground, a low stone wall, and several trees with pink blossoms. A brick pillar stands on the right side of the garden. The sky is clear and blue.

INTRODUCTION

1.1 Introducing the work

This document brings together the research needs and priorities of all fifteen networks within the Green ERA-Hub (GEH). From each network a profile is presented in which the network is introduced with its background, aims and the challenges that the network is focusing on. This is followed by the scope, goals and relevant research topics identified by each network. This document is a living document, and will be updated when there are new insights and priorities in the networks and on the EU level.

The profiles are built by using and summarizing texts from the networks websites, strategic research agendas, call documents, brochures, and other documents. It was aimed to use the networks own wording and phrasing. Profiles were checked and updated where necessary by the network coordinators.

Additionally the document also gives an overview of the SRA by FACCE-JPI and the SCAR Foresight 5 document, and of a few relevant EU policies and strategies in the thematic areas covered by the Green ERA-Hub.

This document is part of a the wider exercise of roadmapping for the GEH. The diversity of research areas covered by the GEH is a major asset of the project. The roadmapping process aims to bring together the research needs and thematic areas of the fifteen different networks into a strategic plan, and to identify which unique opportunities arise due to the collaboration of the networks. Several activities have been done prior to the making of this document including a kick-off roadmapping workshop, a survey among the networks funders and support to the scoping process of the fist GEH call. These activities and the work on the networks profiles in this document will feed the into the roadmapping process and into the next roadmapping workshop that is planned in November 2023.



BIOEAST

2. BIOEAST

Central-Eastern European Initiative for Knowledge-based Agriculture, Aquaculture and Forestry in the Bioeconomy

2.1 About

BIOEAST is a political initiative started by the Visegrad Group Countries in 2015: Czech Republic, Hungary, Poland, Slovakia, and joined by Bulgaria, Croatia, Latvia, Lithuania, Republic of Estonia, Romania, Slovenia. BIOEAST offers a shared strategic research and innovation framework for working towards the development of a sustainable bioeconomy in the Central and Eastern European countries. The Central and Eastern European countries are strongly committed to keeping the BIOEAST Initiative high on their political agenda. Four political declarations were signed by Agriculture Ministers of the Visegrad Group Countries (CZ, HU, PL, SK) Baltic States (EE, LT, LV) and BG, HR, RO and SI on supporting the Initiative.

2.2 Mission and vision

The mission of the BIOEAST initiative is the development of ‘knowledge and cooperation based circular bioeconomies’ to enhance inclusive growth in the BIOEAST countries and also create new value-added jobs especially in rural areas, maintaining or even strengthening environmental sustainability.

The BIOEAST Initiative’s mission is to assist Central and Eastern European (CEE) countries to operationalise their vision for 2030 drawing on their potential and offering opportunities for:

- A sustainable increase of biomass production, to become competitive and leading, high quality, food and feed producers worldwide;
- A circular (“zero waste”) processing of the available biomass, to become key players in the development of new bio-based value chains;
- Viable rural areas: to develop an innovative, inclusive, climate-ready growth model.

2.2 Challenges

The BIOEAST Initiative has identified five challenges to be addressed:

- Research and Innovation deadlock: the macro-region still suffers the drawbacks of poor R&I infrastructure. The uptake and deployment at full scale of research results into practice and the inputs of practitioners into research need to be improved.
- Stalemate in the bio-based value chains: Neither the traditional nor the innovative value-chains are fully exploited, the opportunities for creating value added processes locally are low or missing. The local rural development model should be based on small-scale investments and on small-scale biomass processing.
- Governance impasse: A more systemic and integrated approach in decision-making is necessary to agree on a set of common principles for sustainable production and consumption.
- Societal indifference: The rural communities of the CEE countries need to be strengthened economically and socially to fully exploit the potential of a knowledge-based, sustainable circular economy.

- Financial barriers: Low access to finance and low level of synergies in public-private funds and investments – CEE countries are characterized by low level of private support to research and innovation and by low level of synergies between public and private funds and investments.

2.3 Scope, goals and research topics

The challenges defined by BIOEAST were used to set the following scope in the areas of Agriculture and Forestry, Freshwater aquaculture, Bio-based waste, Economy and Society, Energy, and Climate and Biodiversity:

- Strategic thinking in bioeconomy:
 - Develop bioeconomy strategies to tackle specific environmental and climatic challenges facing the CEE countries.
 - Facilitate evidence-based policy making by developing bioeconomy-relevant statistical and administrative data.
 - Support stability and socio-economic development in the CEE macro-region, within the framework of a reinforced solidarity between EU Member States and the countries covered by the European Neighbourhood Policy.
- Quality Food and Feed for Europe and for the World: To jointly develop and implement innovative solutions (or reinforce already existing ones) to improve the efficiency and sustainability of biomass production system.
- Industrial boost for rural areas:
 - To facilitate the creation of new value-chains and value-added jobs and competences in the CEE macro-region.
 - To boost knowledge and innovation in rural communities, ensuring that they participate in the knowledge economy and maximize opportunities arising from advances in research.

Within this scope, long-term goals were set by BIOEAST to address the challenges to achieve the overarching mission:

- Productivity: Sustainable increase of biomass production, by becoming competitive and leading high-quality food and feed producers worldwide.
- Sustainability: Developing biodiversity and biosecurity, by maintaining and strengthening natural values and defending the rest of Europe from the transboundary plant and animal diseases.
- Resource efficiency: Circular and value-added use of the available biomass, by becoming key players in the development of new bio-based value chains.
- Rural development: Increasing viability and attractiveness of rural areas and society, by developing an innovative, inclusive, climate-ready and sustainable bioeconomy growth model by 2030.

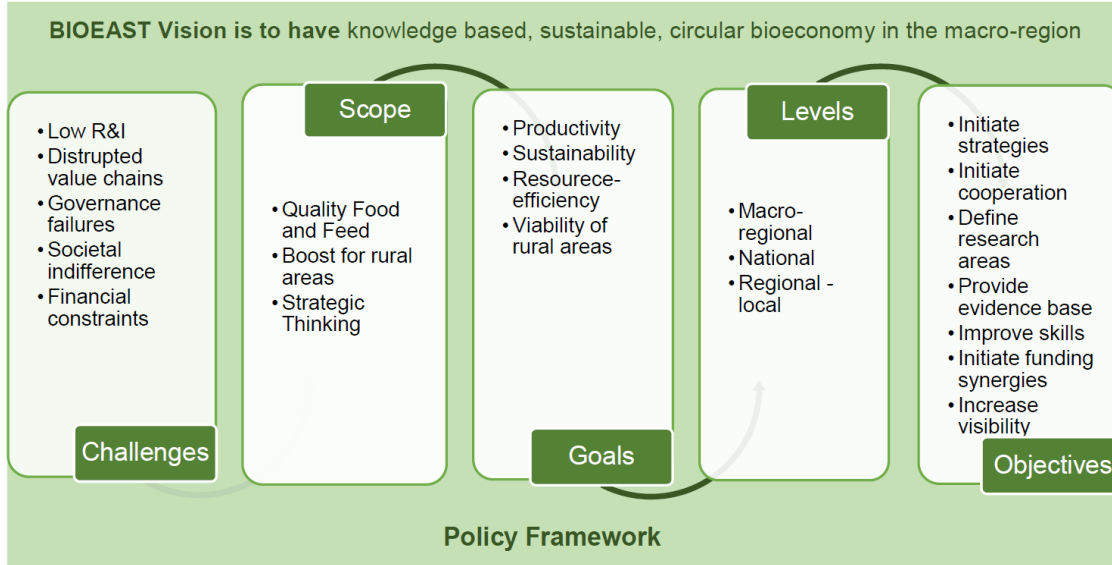


Figure 2.1: The intervention logic of the BIOEAST initiative. *From: BIOEAST vision paper 23-02-2018*



CORE ORGANIC

3. CORE Organic

Coordination of European Transnational Research in Organic Food and Farming Systems

3.1 About

The **CORE Organic** network developed over five different programme periods: CORE Organic I (2004-2007); CORE Organic II (2010-2013); CORE Organic Plus (2013-2018); CORE Organic Cofound (2016-2022), and presently as CORE Organic Pleiades from 1 September 2022 until 2026.

The CO Pleiades network consists of 21 European ministries and research councils funding research in organic food and farming on transnational level since, and 12 stakeholder partners representing the organic sector. The network is encompassing 26 countries/ regions from Europe and Mediterranean. Since its start in 2004, the network is coordinated by the International Centre for Research in Organic Food Systems (ICROFS, DK).

CORE Organic Pleiades aims to ensure policy exchange in the relevant areas for organic food and farming research among the network members. The relevant network objectives are set by European Green Deal (2019) that has specific targets of at least 25% of EU agricultural land to be farmed organically until 2030 and continuous growth of the sector; together with EU Organic Action Plan (2021) supporting coordination of national organic food R&I programmes via Horizon Europe mission in the area of soil health and food, and partnerships on agroecology and food systems. The latter is of particular importance as organic food and farming research should be funding in the future through European Partnerships on Agroecology and Sustainable Food Systems (FutureFoodS).

3.2 Objective and aim

The objective of CORE Organic is to improve the knowledge basis and innovation capacity necessary for supporting further development of organic food and farming as a way to respond to significant societal challenges in Europe's agriculture and food systems.

The main focus of the CORE Organic network is to join forces and fund transnational research projects supporting a focused and coordinated research and innovation effort covering the most important challenges along the organic value chains. The objective of CO is the enhancement of the European research area (ERA) on organic agriculture with a more efficient use of research funds and with a higher impact of research on the organic sector's development.

CORE Organic aims at supporting the development of a larger and more sustainable organic food system, including farming practices, processing and innovative value chains, with the purpose of fulfilling the growing demand for organic products, subsequently supporting health, trade and job creation. In pursuing these objectives, the CO network also contributes to the improvement of the general competitiveness of European agriculture and to the development of innovative solutions for environmentally-friendly agriculture for Europe and the world. Since 2004, CORE Organic supported 8 transnational calls with 62 research projects selected for 61.9 M EUR.

3.3 Challenges

Organic agriculture is considered to be one of the important development pathways towards more sustainable agriculture and food production. This development has been and will be dependent on

continuous research and innovation. The topic of organic research as ERA-Net was proposed by the sector itself. As 'organic' was an under-researched theme, but economically growing sector, it was an opportunity to strengthen its innovation capacity also in terms of job growth policies. .. New information and new technologies are required for the further expansion of the sector, and research on organic farming and processing methods is necessary.

CORE Organic wants to link the national research programmes and to avoid unnecessary duplication of research. Additionally, it aims to reflect the growing market for organic and be a driver for innovation and for knowledge underpinning new regulations. CORE Organic is strong in delivering on sector relevant demands and beyond. Moreover, organic is at the core of the transition towards sustainable food systems, which are climate proofed, healthy nutrition focussed and circular.

3.3 Scope, goals and research topics

The scope of CORE Organic concerns research along the entire organic production and value chain, from producer to consumer.

Specific [topics](#) include:

Circular Bioeconomy

- Sustainable and efficient management of nutrients and use of secondary fertilisers;
- Sustainable and efficient organic cycles and renewable resources;
- Resource-efficient, circular, and zero-waste food system.

The future organic consumer

- Innovative marketing strategies and local markets;
- Supporting the development of organic markets.

Fruit, vegetables and viticulture

- Increased yield of organic fruit, vegetable, and viticulture production;
- Innovative pest and weed management;
- Improved soil fertility in organic fruit, vegetable, and viticulture production.

Mixed farming, food systems and landscapes

- Designing robust and productive cropping systems at field, farm, and landscape levels;
- Diversity in food from field to plate;
- Mixed farming systems and diversification.

Human health

- Quality and safety of organic food along the whole value and processing chains;
- Processing concepts and technologies to ensure food quality and sustainability;
- Mild food processing.

Crop production

- Plant-soil interaction in organic crop production;

- Functional biodiversity to improve management of diseases, weeds, and pests;
- Ecological support in specialised and intensive plant production systems.

Nature and biodiversity

- Improvement of production efficiency and agricultural biodiversity within cropping systems by using eco-compatible breeding techniques;
- Enhanced biodiversity and fertility, and reduced carbon footprint

Pigs

- Management systems to allow natural behaviour and improve welfare
- Animal disease and parasite management, including preventive and health improvement therapies to reduce reliance on antibiotics
- Robust and competitive management and production systems for pigs

Chicken

- Innovative production and management systems to improve animal welfare and reduce environmental impacts
- Eco-efficient production and use of animal feed at the local level

Cattle

- Improved animal welfare regarding feed, barn, pasture and use of medication
 - Eco-efficient production and use of animal feed at the local level
- Appropriate and robust livestock systems

CO's goals in organic research go beyond the mere adoption of effective farming practices and include:

- The development of more sustainable organic processing and value chains
- The capability to effectively fulfil the growing demand for organic products
- The improvement of trade conditions and job creation in the organic sector
- The development of more advanced and tailored organic regulation and support measures
- The wider ecological and social consequences of producing and distributing food and other primary products

Working towards the Code of Practice (CoP) for organic food processors in order to overcome the lack of mandatory standards for organic food processing at the EU level.





EJP SOIL

4. EJP SOIL

Towards climate-smart sustainable management of agricultural soils, European Joint Programme

4.1 About

EJP SOIL is a European Joint Programme on Agricultural Soil Management addressing key societal challenges including climate change and future food supply. EJP SOIL unites a unique group of 26 partners from 24 European countries, > 400 scientists in a 5 year programme (2020 - 2025). The overall goal of the EJP SOIL programme is to build a sustainable European integrated research system and develop and deploy a reference framework on climate-smart, sustainable agricultural soil management.

4.2 Vision and aim

EJP SOIL's vision is to make soils a pivotal resource to enable a transition to a climate-smart, circular society. The long-term aspiration of EJP SOIL is to put soil science knowledge into practise for a productive, sustainable, and climate-smart stewardship of agricultural land and soil resources. To achieve this, EJP SOIL aims to change the perception of the role of farmers among the general public, scientists, and policymakers. Farmers also need to change their perceptions of the potential for climate-smart sustainable farming.

The ambition of EJP SOIL is to pool and align national resources and partner efforts to harmonize methods, indicators, databases, and models on soil across Europe.

4.3 Challenges

Soils have a large role to play in solving the problems of our time. Improved knowledge and farming practices are fundamental when addressing future challenges. The necessary actions require societal, scientific, policy, economic and educational capacities.

Soil is the habitat and the supplier of nutrients and water for plants and their roots. Fertile and productive soils are the prerequisite for a stable supply of food, fibre, animal feed, timber and other biomasses. Soils sustain huge biodiversity and contribute to the provision of a wide range of ecosystem services, and as the largest store of carbon on land, soils are also in the nexus of the global climate challenges. Soils are part of the solution to realising the SDGs.

However, soil is a limited resource, and soil degradation including erosion, loss of soil organic matter, soil contamination and soil sealing are threats to soil functions. Intensified production due to rising global demand for food and biomass will only amplify the challenges. Improved knowledge and farming practices are fundamental to address these challenges. Actions in stopping the damages are dependent on societal, scientific, policy, economic and educational capacities.

Climate change projections predict major environmental changes for Europe, which will increase the probability of erosion and landslides, and potentially increase nutrients leaching in northern areas, while exposing other Mediterranean areas to periods of drought and heat waves and increased wind erosion. These changes require European agriculture to adapt to these changes and become more resilient to extreme events.

4.4 Scope, goals and research topics

The long term expected impact of EJP SOIL is that the farming sector becomes a steward of land and soil resources in Europe and farmers contribute to the adaptation of agroecosystems to climate change and to climate change mitigation.

EJP SOIL will address all agricultural soils, i.e. soils under cropland (including bioenergy crops), grasslands, vineyards and orchards, agroforestry systems, hedges and marginal /degraded land, as well as urban agriculture. It will consider mineral as well as organic agricultural soils.

EJP SOIL works towards a sustainable European integrated research system on agricultural soils to develop and deploy a framework on climate-smart, sustainable agricultural soil management. The network will improve understanding of agricultural soil management by targeting:

- Climate change mitigation and adaptation
- Food security and ecosystem services
- Soil education in Europe and capacity building

The expected impact and the targets of EJP SOIL are:

1. Climate change mitigation;
Fostering soil-carbon sequestration that contributes to climate change mitigation in agricultural soils
2. Climate change adaptation;
Fostering understanding of soil management and its influence on climate change adaptation
3. Sustainable production;
Fostering understanding of soil management and its influence on sustainable agricultural production and developing region-specific fertilization practices considering the local soil, water and pedoclimatic conditions.
4. Sustainable environmental management;
Fostering understanding of soil management and its influence on a sustainably used natural environment.
5. Networking and knowledge sharing;
Strengthening scientific cooperation at the European level including training young scientists
6. Harmonising;
Supporting harmonized European soil information, including international reporting
7. Adoption of sustainable soil management;
Fostering the uptake of soil management practices which are conducive to climate change adaptation and mitigation for end-users.
8. Science-policy interface;
Fostering uptake of soil management practices conducive to climate change adaptation and mitigation for the science-policy interface

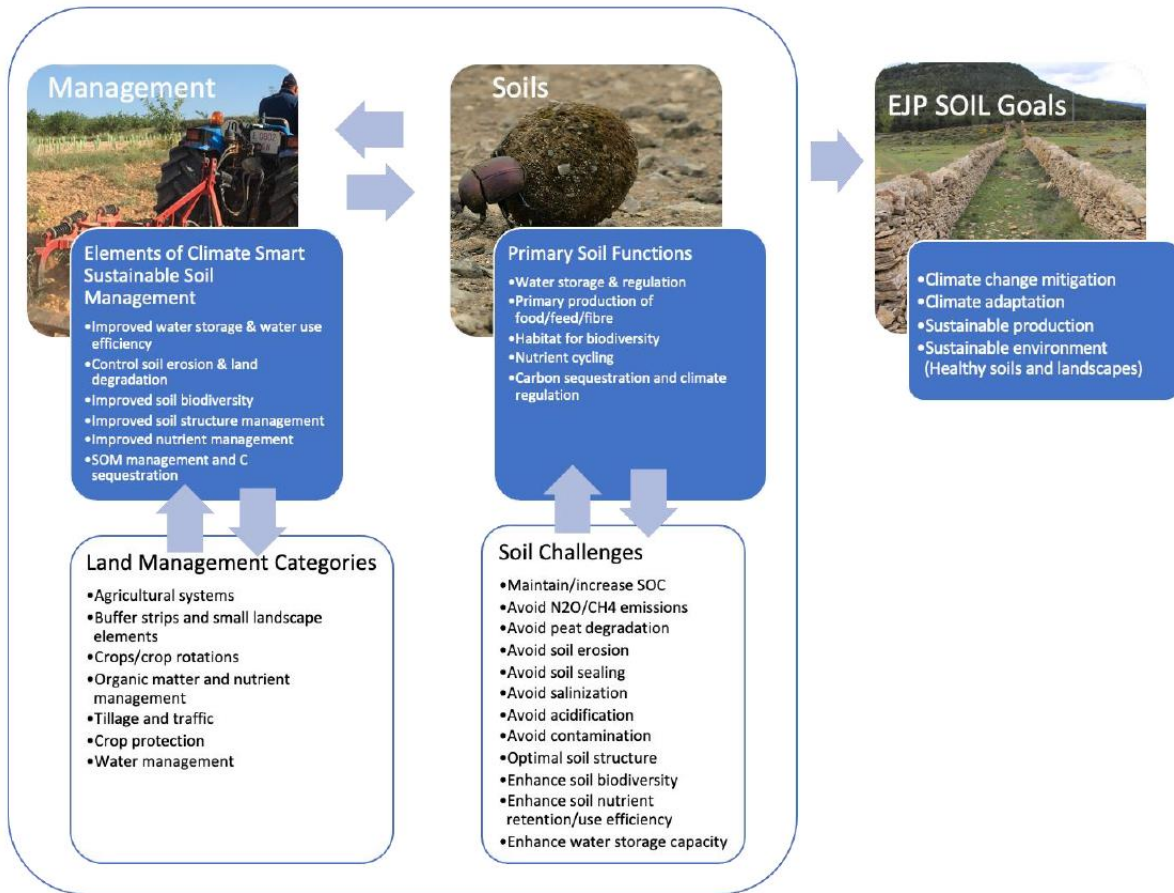


Figure 4.1: Link diagram illustrating i) how local land management choices can influence the elements defining climate-smart sustainable soil management; ii) the link between primary soil functions and soil challenges; and iii) how optimized interactions between soil functions and soil management will lead to achieving EJP SOIL Goals. *From: Roadmap for the European Joint Programme SOIL, 2021.*

A close-up photograph of a tomato cluster on a vine. The tomatoes are in various stages of ripeness, ranging from bright green to deep red. The central text 'ERA CAPS' is overlaid on a white rectangular background.

ERA CAPS

5. ERA-CAPS

Coordinating Action in Plant Sciences; Promoting sustainable collaboration in plant sciences through coordinating and funding excellent transnational research.

5.1 About

ERA-CAPS is the European Research Area Network for Coordinating Action in Plant Sciences. Building on the ERA-CAPS ERA-NET that was supported by the European Commission's 7th Framework Programme until mid-2015, ERA-CAPS has now become a self-sustained network.

5.2 Aim and objectives

Plants are essential to human life. Directly or indirectly, plants produce most of the world's food as well as renewable sources of energy and materials. Past improvements in our knowledge of plant biology and agronomy have underpinned large increases in crop yield and enhanced access to a far greater diversity of food on a global scale.

The ERA-CAPS initiative aims at deepening and enlarging European cooperation in the area of Plant Sciences, which should significantly help plant sciences to address both current and future challenges in food and non-food crop production. ERA-CAPS aims to ensure the scientific understanding to revolutionise agricultural capabilities to deliver higher yields with lower inputs in a changing climate. The networks aims to contribute towards a more sustainable bioeconomy, environment and global food security.

The ERA-CAPS objectives are to foster the development and coordination of Plant Sciences transnationally and to further support a transnational Research Area of Plant Sciences.

5.3 Challenges

With an exponentially growing population our planet is more than ever facing a unique challenge. Indeed, global demand for food is expected to have doubled by 2050, due to population growth and urbanisation. As many as 828 million people were affected by hunger in 2021 and almost 3.1 billion people could not afford a healthy diet (FOA, 2022). Globalisation will continue exposing the food system to novel political and economic pressures. Competition for land, water and energy will increase and the need to adapt and mitigate the effects of climate change will become crucial. In the meantime, crops may play an increasing role in the so called "green chemistry". It becomes therefore essential to ensure reliable production of safe food and renewable carbon supplies for green chemistry, without the use of excess land, energy, water, and chemicals.

High-quality, safe and reliable food and energy supplies demand high-quality, safe and reliable production methods. Current food production methods are utilising excess energy, water, pesticides and chemicals and will not meet the demands of a growing population. To guarantee food security (access to enough safe and nutritious food to ensure a healthy life for all) the world is in need of new ways to produce adequate and stable food supplies in an environmentally sustainable manner. The challenge for plant science is to provide sufficient food for modern society and a clean and safe environment in which to live. Sustainable, high-yielding crops, better use of plants as a renewable source of materials and a transition towards green energy are at the heart of the solution to these problems. Indeed, plants may be the only source of liquid fuels in an oil-free future.

5.4 Scope, goals and research topics

The scope of ERA-CAPS covers all areas of molecular plant science where the research answers fundamental biological questions of relevance to the development of the European and Global Research Area in molecular plant science, and allows maximum engagement of the plant science community. Alignment of the overarching themes with the Joint Programme Initiative for Food Security, Agriculture and Climate Change (FACCE-JPI) are of importance.

ERA-CAPS focuses on research in fundamental molecular plant science for the following themes:

- Food and Nutrition Security: research that contributes to the sustainable and secure supply of safe and nutritious food for an increasing global population. This includes yield optimisation, quality traits and nutrient use efficiency, amongst other research areas.
- Non-food crops: this theme includes research into crops (or appropriate models) where the end-use includes bioenergy or industrial biotechnology.
- Adaptation to a changing climate: research that addresses how plants can adapt, or be adapted, to grow in a changing environment.
- Biotic/abiotic stresses: this theme includes research into plant responses to either biotic or abiotic stress, or how plants contend with a combination of biotic and abiotic stresses.

These thematic areas have been used in the ERA-CAPS calls of 2013, 2014 and 2016 and remain relevant.

The fundamental research performed in ERA-CAPS contributes to the achievement of the practical and relevant goals described below (figure 5.1).

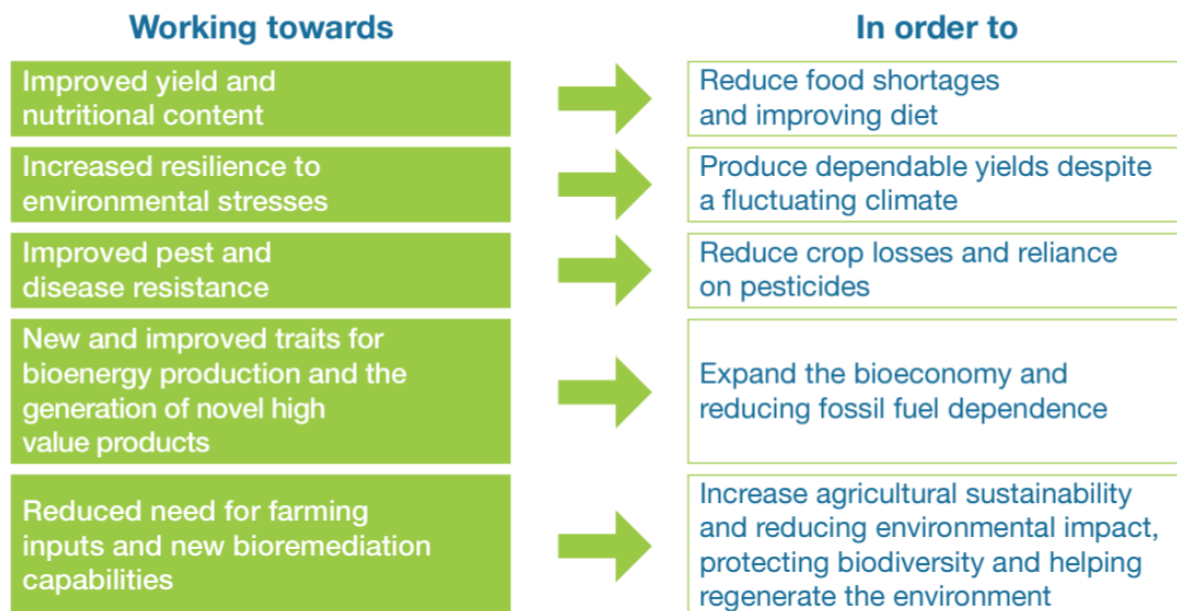


Figure 5.1: ERA-CAPS goals. *From: ERA-CAPS showcase report.*



ERA CO BIOTECH

6. ERA CoBioTech

ERA-Net Cofund on Biotechnologies.

6.1 About

ERA CoBioTech is the ERA-Net Cofund Action on Biotechnology under H2020 with 25 partners. The network aims to strengthen the European Research Area (ERA) in the field of Biotechnology through enhanced cooperation and coordination of different national and regional research programs, promoting systems biology and synthetic biology as technology drivers and to speed up research and innovation in industrial biotechnology.

ERA CoBioTech covers three disciplines within Biotechnology:

- Synthetic biology, a field of science that involves redesigning organisms for useful purposes by engineering them to have new abilities;
- Systems biology, the computational and mathematical analysis and modelling of complex biological systems; and,

Industrial biotechnology, working with nature to maximize and optimize existing biochemical pathways that can be used in manufacturing.

6.2 Aim and objectives

The vision of ERA CoBioTech is to have a direct influence on the transformation of the economy into a sustainable bioeconomy by focussing its research activities in certain biotechnology areas related to the global challenges, and by changing the Research, Development and Innovation (R,D&I) landscape towards a more streamlined and supportive environment.

The ERA CoBioTech partners aim to advance research and innovation in industrial biotechnology, to address innovation needs in conjunction with arising societal needs, and to establish systems and synthetic biology as technology drivers.

Through its strategic work, ERA CoBioTech aims to further support activities targeting the strategic needs of biotechnology in Europe, from targeted technology development to translation of marketable products and services for the bioeconomy.

The key objectives of ERA CoBioTech are to:

- Maximise synergies between current mechanisms of biotechnology research funding in Europe
- Foster the exchange of knowledge across borders
- Demonstrate how a bio-based economy can be beneficial for different groups in society
- Maintain and strengthen Europe's position in biotechnology

6.3 Challenges

The Green Deal states that climate change and environmental degradation are an existential threat to Europe and the world. To overcome these challenges, Europe has to transform into a modern, resource-efficient and competitive economy.

A sustainable bioeconomy is based on both by trying to establish a stable economy while not depleting natural resources. Biotechnology is vital for the bioeconomy and encompasses a wide range of areas which have the potential to contribute significantly to economic growth and addressing global challenges by creating jobs, revitalising existing industries, and fuelling innovative new sectors.

Biotechnology has been named a Key Enabling Technology (KET) for the transformation from a fossil-based to a sustainable bio-based economy as envisaged by the European Union. While Europe is a leader in developing KETs, it is currently lacking in translation of this knowledge into marketable products and services, a problem which is often branded as the “European Valley of Death”. By supporting activities with a strong focus on research, innovation and knowledge translation, the European Commission aims to overcome this obstacle and to expand its leading role in the development of KETs towards translation.

Key Enabling Technologies (KETs) have the potential to help address the societal challenges Europe and the world are facing today, and exploitation of KETs will lead to the creation of advanced and sustainable economies.

6.4 Scope, goals and research topics

‘Biotechnology for a sustainable bioeconomy’ forms the core of ERA CoBioTech. The networks scope aims at biotechnology as a key enabling technology, in the context of the bio-based economy to tackle 21st century societal challenges.

The 2018 SRA of ERA CoBioTech shows a need to boost efforts on the following topics:

- Decarbonisation of the economy by replacement of fossil raw materials by bio-based products, technologies and processes.
- Sustainable alternatives for animal-based products
- Establishing reliable, sustainable and appropriate supply chains of biomass, by-products and waste streams connected to a respective network of bio-refineries throughout Europe
- Support market development for bio-based products and processes, and take into account associated risks and benefits

ERA CoBioTech’s work can contribute to a variety of sectors, several of those are covered by the Green ERA-Hub. Biotechnological methods can be applied / adapted to many different fields. This makes biotechnology versatile and interesting for very different groups of users and initiatives from different areas. It provides opportunities for research programming to utilise and combine biotechnological research with other sectors. Across Europe the ERA CoBioTech partners identified 11 overarching areas of strategic priorities, which can all be seen as part of the bioeconomy and are potential areas for joint research programming:

- Health & Pharmaceutical
- Food & Food Processing
- Sustainable Agriculture & Food Security
- Aquaculture and Marine Resources
- Forestry
- Natural Resources & Waste Management
- Biomass & Bioenergy
- Fossil Carbon Substitutes



GREEN ERA-HUB
on Agri-Food and Biotechnology

The Green ERA-Hub networks

- Sustainable Industrial Processes
- Industrial Biotechnology
- Biological Data

Through its strategic work, ERA CoBioTech aims to further support activities targeting the strategic needs of biotechnology in Europe, from targeted technology development to translation of marketable products and services for the bioeconomy.





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7. FACCE ERA-GAS

Monitoring & Mitigation of Greenhouse Gases from Agri- and Silvi-Culture

7.1 About

FACCE ERA-GAS is the ERA-NET Cofund for monitoring and mitigation of greenhouse gases (GHGs) from agri- and silvi-culture. The ERA-NET consortium of FACCE ERA-GAS consists of 19 partner organisations from 13 countries.

7.2 Aim and objectives

The aim of FACCE ERA-GAS is to strengthen the transnational coordination of research programmes and provide added value to research and innovation on GHG mitigation in the European Research Area. ERA-GAS organises funding calls for transnational research projects that aim to develop enabling technologies and innovative solutions to improve GHG inventories, increase the GHG efficiency of food, feed and fuel production, enhance carbon sinks and develop circularity in agricultural systems. This is further reinforced by additional activities that support the work of the researchers and research projects (via training, workshops and webinars), and also contribute to better alignment and integration of national research programmes in the area, including internationally.

The expected impact of the ERA-NET Cofund is to provide solutions for the agricultural sector in Europe, which faces significant challenges in curbing GHG emissions while maintaining food security and sustainability in a changing climate. It also seeks to boost climate mitigation in the forestry sector. This transnational effort is urgently required to mitigate climate change, refine GHG reporting mechanisms and design policy instruments necessary to tackle this global environmental challenge.

A key priority of the FACCE ERA-GAS consortium is to ensure that the ERA-NET's activities help to achieve the FACCE–JPI Strategic Research Agenda (SRA) and FACCE–JPI objectives, notably those concerning the agricultural and forestry GHG monitoring and mitigation at present and in the future.

The specific objectives of this ERA-NET are to:

- Design, coordinate and implement a joint co-funded call between Member States/Associated Countries, international third countries and the European Commission aimed at improved monitoring and mitigation of agricultural and forestry GHGs
- Enhance research and innovation capacity in the area of GHG mitigation by promoting cooperation and coordination across nations
- Establish new networking structures and reinforce existing partnerships and initiatives focussed on GHG mitigation in the AFOLU (Agriculture, Forestry and Land Use) sector
- Reduce fragmentation and duplication of research activities and identify international best practices
- Develop enabling technologies and innovative solutions to improve inventories, increase the GHG efficiency of food, feed and fuel production and enhance carbon sinks

Promote the systematic exchange of knowledge between multidisciplinary research and innovation actors and increase engagement with stakeholder communities.

7.3 Challenges

Underpinning the ERA-GAS research agenda are the challenges arising from European climate and land management policies and associated GHG emission targets. In 2015, when the proposal for ERA-GAS was written, the 2030 policy proposals required a 40% reduction in emissions, while primary production was to remain steady or even increase output. In 2019, the European Parliament declared a global “climate and environmental emergency” and the new European Commission President, Ursula von der Leyen, committed to leading the fight against the existential threat posed by climate change. The new Commission set as its headline ambition to become the world’s first climate-neutral continent by 2050 and followed with a suite of proposals to meet this objective under the European Green Deal.

The European Climate Law from 2021 writes into law the goal set out in the European Green Deal for Europe’s economy and society to become climate-neutral by 2050. The law also sets the intermediate target of reducing net GHG emissions by at least 55% by 2030, compared to 1990 levels. Climate neutrality by 2050 means achieving net zero GHG emissions for EU countries as a whole, mainly by cutting emissions, investing in green technologies and protecting the natural environment.

Within this renewed political context, the importance of land-based primary production systems in achieving core European policy objectives has never been so high. According to a study conducted by the European Commission’s Joint Research Centre, food systems are responsible for a third of global anthropogenic GHG emissions, with over 70% of these emissions arising from agriculture and land use/land-use change activities. Agriculture therefore represents a pivotal sector for implementing GHG emission reduction and carbon storage measures. Forestry remains a crucial component of EU climate, energy, bioeconomy and environmental policy and carries a weight of expectation to provide critical carbon sequestration and carbon removals (e.g. storage in long-lived wood products) in order for climate-neutrality to be achieved. Furthermore, sustainable land management can contribute to reducing the negative impacts of multiple stressors, including climate change, on ecosystems and societies.

7.4 Scope, goals and research topics

ERA-GAS covers monitoring and mitigation of GHGs from agriculture and silviculture, including such aspects as reducing uncertainties and improving national GHG inventories, the role of climatic variability and agricultural and forestry practices in regulating GHG emissions, the technical and economic potential of methane and nitrous oxide mitigation options, carbon sequestration and economic and policy measures, including barriers to implementation.

The original scope of ERA-GAS at the start of the network included four main research themes:

1. Improving national GHG inventories and monitoring, reporting and verification of emissions
2. Refining and facilitating the implementation of GHG mitigation technologies
3. State-of-the-art production systems that are profitable and improve food and forest biomass production while reducing GHG emissions
4. Assessment of policy and economic measures to support emissions reductions across the farm-to-fork and forest-to-consumer chain

The 2020 FACCE-JPI SRA provides the framework for further developing the ERA-GAS strategy on agricultural and forestry GHG monitoring and mitigation. The work of ERA-GAS contributes especially to Core Theme 1 “An agricultural sector that contributes to climate neutrality”. The Key Areas in Core Theme 1 “An agricultural sector that contributes to climate neutrality” cover the following:

- KA1. Carbon-neutrality of sustainable food systems
- KA2. Deployment of carbon farming solutions
- KA3. Reducing carbon footprints through circular biomass chains
- KA4. Strategies to reduce GHG emissions based on improving understanding of the microbiome of soils and animals
- KA5. Optimising carbon neutrality through digital technologies
- KA6. Protection and enhancement of landscape carbon stocks

KA 1, 3, 4 and 5 have been addressed comprehensively by ERA-GAS in recent years. The focus in these areas should therefore be on continuing critical work and aligning with and informing other relevant ongoing or planned initiatives. KA 2 and 6 were addressed by the first call in 2016 and are important components of both the European Joint Programme on Agricultural Soil Management (EJP Soil) and the EU Mission ‘A Soil Deal for Europe’. A cross-cutting issue deserving attention is the multi-functionality of land-based systems. A more holistic view of sustainable land management is needed to see the linkages between climate regulation and other land functions, as well as across land uses. Another critical cross-cutting issue is addressing trade-offs and co-benefits, as highlighted by Core Theme 4 of the FACCE-JPI SRA 2020 (Trade-offs and synergies between food production, ecosystems and climate). Achieving climate objectives should not have major detrimental impacts for food and nutrition security or for ecosystems. Therefore, solutions for agriculture and forestry production systems that maximise their contribution to multiple policy objectives, such as creating co-benefits for both climate and biodiversity, could be supported through Member State actions. Continued global cooperation and leadership in the area of GHG mitigation and monitoring is also of paramount importance in addressing such an immense shared challenge.

Some important ‘game changers’ (actors, technologies, trends, events) were identified under Core Theme 1, which could also have relevance to the scope of ERA-GAS:

- Functional biodiversity to sustain high productivity, low external inputs and carbon neutrality
- Manipulation of microbial functions to reduce the level of GHG emissions
- Digital technologies that substantially improve the capacity of monitoring and predicting the behaviour of agricultural systems and provide a foundation for financially rewarding net emission reductions.
- Societal push for less livestock products;
- Bio-refining technologies that reduce waste, save energy and enhance carbon retention of soils
- Co-development and demonstration of technologies and production systems to enhance implementation of carbon-neutral practices by farmers.

EUPHRESKO



8. Euphresco

European Phytosanitary Research and Coordination network

8.1 About

Euphresco is a network of organisations (research funders, policy makers, research organizations and industry) that aim to support the coordination of national research funding and enhance research collaboration in the phytosanitary area. After receiving funding from the FP6 and FP7 EU Framework Programmes (EUPHRESCO I and EUPHRESCO II ERA-Net projects), Euphresco has become a self-sustained network hosted by the European and Mediterranean Plant Protection Organization (EPPO).. As of April 2023, 75 organizations from 5 continents are members of the network.

Phytosanitary measures refer to ‘any legislation, regulation or official procedure having the purpose to prevent the introduction or spread of quarantine pests, or to limit the economic impact of regulated non-quarantine pests’.

8.2 Aim and objectives

The need to revive the scientific basis of the phytosanitary field has been a priority since the EPPO Madeira Declaration. Research coordination through Euphresco aims to develop and take advantage of synergies amongst national research programmes and activities and to maintain and develop scientific expertise and infrastructure that support plant health.

The specific objectives of Euphresco are:

- To coordinate transnational research programmes, by developing a common strategic research agenda
- To coordinate research funding of in the phytosanitary area, through annual rounds of calls
- To facilitate the dissemination of research outputs and adoption by the end-users, in particular the policymakers

8.3 Challenges

All plants encounter different enemies in their natural habitat, from pests like aphids or beetles, to diseases caused by fungi, bacteria or viruses. While plant pest and diseases relied on natural mechanisms for dispersal in the past, human trade and transport have opened new opportunities for rapid global dispersal. Biological invasions are as costly as natural hazards. To avoid extensive damage to society, the economy and the environment, we need measures to prevent entry, establishment and spread of pests.

The rate of entry and establishment of new damaging plant pests, diseases and invasive species is constantly increasing worldwide as trade of plants and plant products becomes more global. Climate change may also favour the movement of pests over long distances and facilitate their survival in previously unfavourable environments.

The success of Euphresco as a primarily European network for phytosanitary research coordination has set the ground for discussions on the development of initiative(s) to address the needs of other regions of the world and global phytosanitary research coordination. In the context of global trade,

phytosanitary research should be global too. Countries around the world may deal with the same harmful organisms, either as native plant pests or as non-native new pests. Joining resources can accelerate the development of solutions without increasing the costs supported by each individual country. It is not possible to avoid all the challenges to plant health posed by global trade, increasing travel activities and climate change. However, it is possible to optimise strategies to address these challenges with effective cooperation and coordination.

8.4 Scope, goals and research topics

Research activities commissioned through Euphresco focus on regulated and emerging plant pests. Small to medium-size projects are commissioned to provide evidence to specific questions. The projects are not necessarily intended to deliver break-through science and innovation, but fall into the category of explorative and applied science needed to support policy.

Interdisciplinary research is necessary to identify those pests on which transnational research efforts should focus. There is also a need to identify changes to existing and emerging trade routes, to collect information regarding growing and production practices in exporting countries and to develop knowledge on the pest biology in different production conditions in order to guide investigations on possible epidemics and to identify those pathways presenting the greatest phytosanitary risks.

Euphresco identified 8 priorities for phytosanitary research:

Know your enemy - epidemiology and taxonomy

- To improve knowledge on the biology, epidemiology and ecology of priority invasive and (re)emerging pests
- To support taxonomic research for the unambiguous identification of pests

Know your enemy - trade impact

- To improve knowledge on emerging pathways of entry and means of spread for pests
- To expand knowledge on transmission of disease and pathogens for healthy planting material

Know your enemy - assessing impact

Quantification of the likelihood and magnitude of risks posed by entry, establishment and spread of pests, their potential economic, social and environmental impacts and identification and evaluation of risk management options.

- To identify and evaluate (horizontal) risk reduction options (effectiveness, feasibility and cost)
- To develop models to summarise the understanding of the spread, establishment and impact of pests

Find your enemy - improved inspection and surveillance

- To validate risk-based sampling methodologies for phytosanitary inspections.
- To explore the use of remote sensing technologies to support surveillance and detection activities
- To test and validate the use of volatile organic compounds for early detection and pest management

- To test and validate the use of environmental DNA (eDNA) analysis in inspection and surveillance activities

Find your enemy - new diagnostic technologies in plant health

- To understand the biological significance of a positive molecular diagnosis
- To develop and validate high-throughput DNA extraction methods
- To understand mixed infections through metagenomic analysis
- To test and validate the use NGS (e.g. whole genome sequencing, metagenomics, deep sequencing, typing by sequencing) for routine diagnostics

Find your enemy - on site detection and identification of diseases and pests

- To test and validate methods for in situ detection and identification of pests

Deal with the enemy - phytosanitary measures

- To validate cost-effective and socially acceptable phytosanitary measures for consignments (pre-border and at border)
- To validate cost-effective and socially acceptable phytosanitary measures at the place of production (inland) for plants, plant products, water and soil
- To identify and validate strategies for control of pests resistant to pesticides and understand the genetics and epidemiological behaviour of resistant forms

Eupresco identified 6 priorities considering available infrastructures and collaborations.

Research infrastructures – Collections; to support taxonomy, diagnostics, surveillance and archives on pests

- To support knowledge exchange for efficient management and maintenance of collections
- To improve access to collections of phytosanitary importance
- To build a network of collections that fulfil minimum quality standards

Research infrastructures - Information technology to support plant health activities

- To support data exchange, data use and re-use for the benefit of plant health research activities
- To contribute to databases for plant pests identification and diagnostics
- To develop databases on (i) distribution of economically important crops, and (ii) cultural practices/control measures applied by the various countries
- To use information technology in pest/pathogen surveillance programmes

Cooperation - Disciplines

- To address plant health challenges through integrative approaches and support collaboration among disciplines

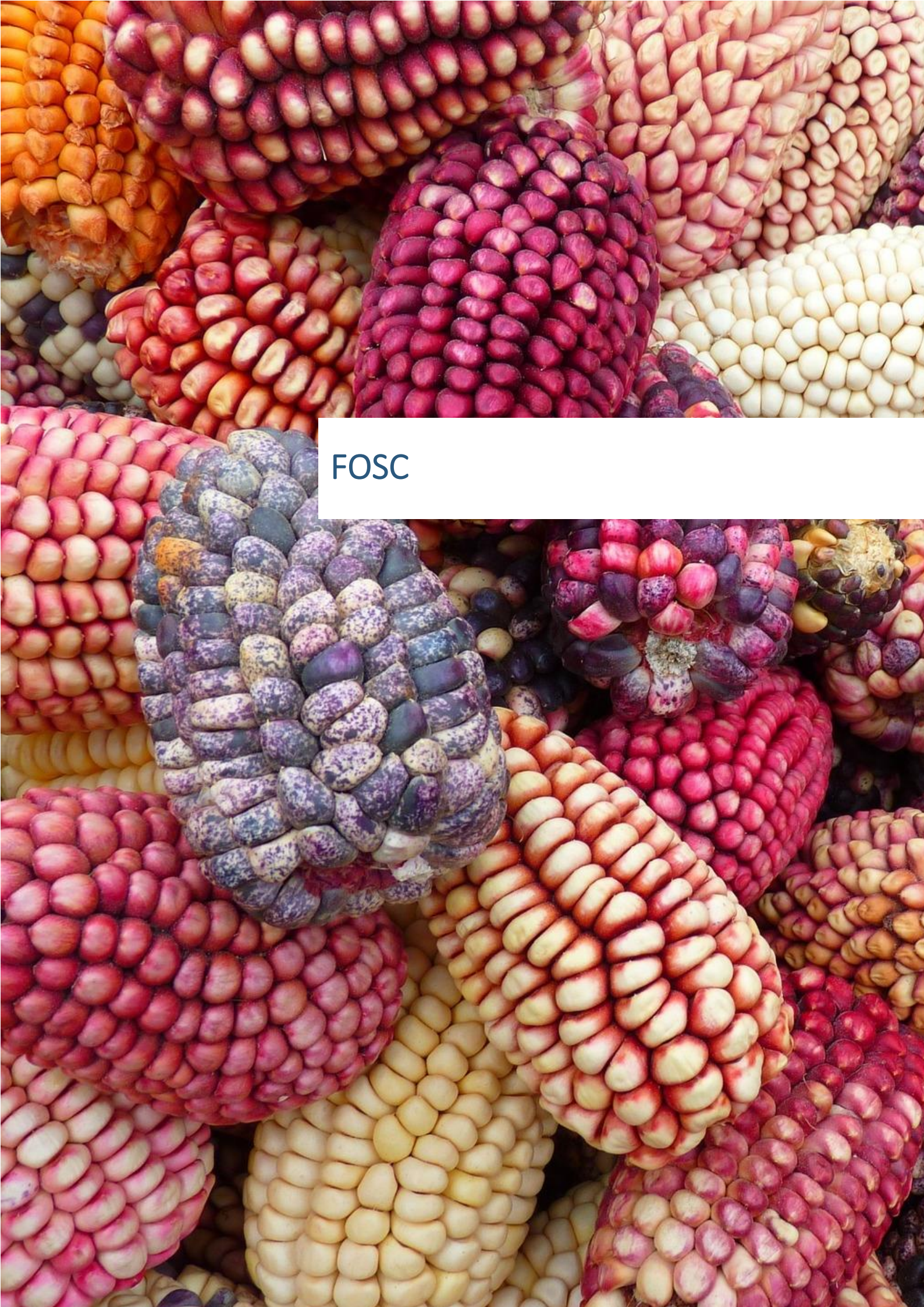
Cooperation - Players

- To address plant health challenges through whole-chain, multi-actor approaches

Cooperation - Initiatives

- To favour knowledge exchange and support common initiatives with relevant players





FOSC

9. FOSC

ERA-NET on Food Systems and Climate

9.1 About

FOSC, the ERA-NET Cofund on Food Systems and Climate, is dedicated to fostering collaborative R&I&D between AU and EU in order to address this global challenge. FOSC started in October 2019 for a duration of five years under the umbrella of FACCE-JPI. The FOSC Consortium consists of 28 international partners from Europe, Africa, and Latin America. The work of FOSC focuses on one of the most complex global challenges: how to achieve food and nutrition security and sustainable agriculture under a changing climate.

9.2 Aim and activities

The ambition of FOSC is to contribute to strong and effective trans-national research and innovation between Europe, Africa, and Latin America for food security under climate change. FOSC aims as well to contribute to the coordination and synergism between national and international research programmes on these topics.

The challenge of achieving food and nutrition security within the context of sustainable food systems calls for increased investment and collaboration with a shift towards a more inclusive approach to thinking and working. It is aspired that FOSC will increase investments in R&D&I through a coordinated regional mechanism aimed at reducing fragmentation.

For reaching its targets, FOSC initiates and organises additional activities to foster collaborations into existing networks and enhance impact of research on food systems and climate at the bicontinental AU-EU level and beyond:

- the preparation and implementation of a joint call for proposals (FOSC call 2019) resulting in 17 funded projects;
- the deployment of innovative instruments for alignment and collaboration in R&D&I;
- a second call or alternative research funding activity for multi-actor research projects (joint call of FOSC and SUSFOOD2 2021) resulting in 5 funded projects;
- capacity strengthening (workshops, trainings,...);
- stakeholder engagement;
- support to policy making;
- developing a Knowledge Platform; and
- communication and dissemination of results emerging from activities.

9.3 Challenges

The world today faces one of the biggest challenges of the 21st century: how to feed 10 billion people in 2050. Current patterns of food consumption and production will increase pressure on already scarce natural resources. Climate change represents an additional threat, already undermining agriculture and food systems in many regions, making it more difficult to achieve food security and nutritional goals and reduce poverty. Ensuring food and nutrition security in the long-term while containing global warming within 1.5 or 2°C, will require both changes on a societal-level and a systemic transformation of food

systems. This transformation will require a change in the current predominantly short term vision of food systems, as well as a change in culture, education and training and an overall change in consumption patterns and citizen's behaviour.

Impact of climate change is expected to alter crop yields, livestock productivity, and food quality, with cascading impacts on agricultural land use, soil, water and biodiversity, as well as food systems through changes in availabilities and prices of agricultural commodities and in international trade. The four pillars of food security (availability, access, stability and utilization) are threatened by climate change especially in developing countries and this may contribute to population displacements, conflicts and migration.

Food is essential for all human beings. Global peace and stability are largely underpinned by the ability to provide healthy diets for all. The projected need for a 60 percent increase in food to feed a global population approaching 10 billion by 2050, coupled with an increased demand for animal-sourced protein and higher caloric diets, will dramatically increase pressure on natural resources on which our food security depends and worsen the climate challenges which we currently face.

9.4 Scope, goals and research topics

The scope of FOSC covers all topics that contribute to the achievement of food and nutrition security under climate change within the context of sustainable food systems, considering the three dimensions of sustainability (social, environmental, and economic). This scope covers the food system as a whole, from soil and agriculture to food processing, logistics, economics, consumers and waste.

The work of FOSC is embedded in the EU-Africa High Level Policy Dialogue on science, technology, and innovation and all initiatives within the ERA-Net associate transcontinental participants.

FOSC aims to have impact on:

- Effective trans-national, research, innovation and collaboration on food and nutrition security and sustainable agriculture under climate change;
- Effective networking, better coordination and synergy between national, international and EU research programmes relevant to foods systems under climate change;
- New insights on the reduction of the environmental footprint of the sector, and more specifically on the reduction of both inputs and waste;
- Carbon neutral agriculture and food chain;
- Enhanced understanding and awareness about the effects of climate change on global food value chains, and understanding the consequences on the social and economic components of society;
- Development of innovative solutions to cope with the multiple risks and challenges to the food systems posed by global environmental changes.

The following research topics were prioritized during the first three years of FOSC and are still considered relevant:

- Assessment of climate change-related risks for food value chains, including impacts on producers, prices, availability, quality, international trade and food security, and resulting changes in consumer behaviours;

- Promotion of innovative technology deployment to build sustainable and resilient food value chains influenced by changing food needs and patterns, and to develop better efficiency of the inputs and outputs of food systems;
- Improvement of resilience and reducing volatility in agri-food production and food markets to sustainably improve food security in the context of climatic variation;
- Reducing food losses under climate change, including novel approaches to valorise side streams and reduce food waste;
- Food Systems adaptation and resilience to system shocks;
- Energy use and efficiency in food and feed production systems.

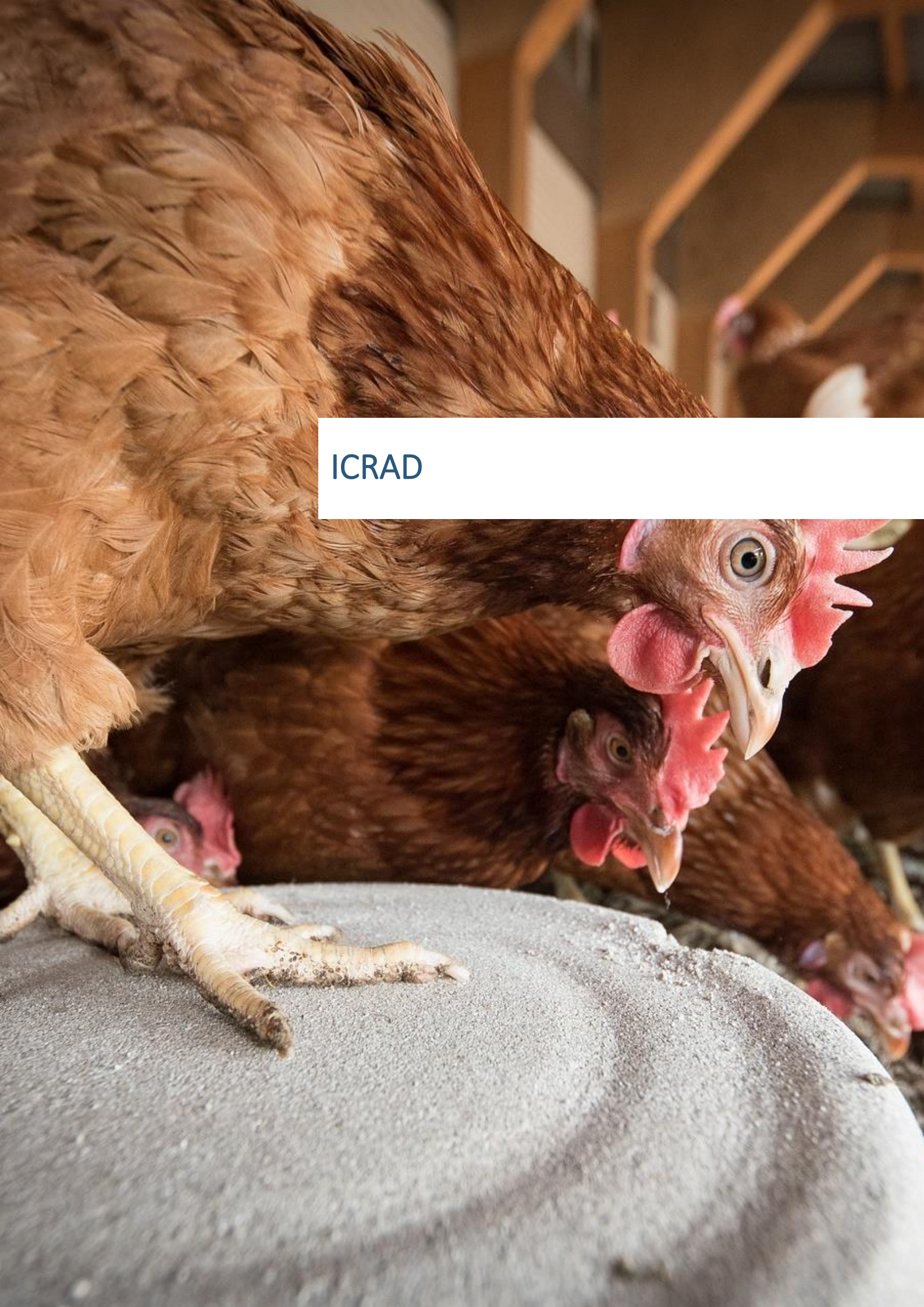
Important cross-cutting aspects welcomed in the work of FOSC are:

- Addressing different scales in research:
 - Spatial scales (local case studies and projections at regional level / comparisons between different regions and global assessments);
 - Time scales with the 2050 time horizon. Transitions between current conditions and 2050. Scenarios, trends, drivers, climatic trends and climatic variability in time;
- Multidisciplinary and transdisciplinary work;
- A system approach.

Other relevant topics identified by FOSC are:

- To clarify patterns regarding the economical and societal impacts of climate change at regional and at global levels;
- Risk assessment and risk management approaches for the extreme events;
- Mitigation and adaptation solutions fostering resilience of food systems;
- To protect human health through the provision of enough safe foods;
- Safeguard food production while preserving environment and climate.





ICRAD

10. ICRAD

International Coordination of Research on infectious Animal Diseases

10.1 About

ICRAD is the ERA-Net for International Coordination of Research on infectious Animal Diseases. The network was launched in 2019 for a period of five years. The EU-funded consortium of 28 partners from 19 countries will address the global threats of infectious animal diseases through joint efforts via multi-disciplinary research on mechanisms of host/vector/pathogen interactions, epidemiology, diagnostics and vaccination strategy. ICRAD will build on the work of the two previous ERA-NET programmes with successful outcomes that were dedicated to ensuring sustainable livestock production along with safety in international trade.

10.2 Aim

ICRAD aims to:

- Support cross-cutting research to improve public health, and animal health and welfare, with associated benefits towards the environment and the economy.

Connect research partners with different but complementary scientific and technological expertise to maximise resources and share risks, costs and skills. The partnership between industrial and academic researchers, where appropriate, will improve and accelerate the development of technological solutions for the benefit of animal health and welfare.

10.3 Challenges

Animal diseases cause severe social, economic and environmental damage and in some cases threaten human health as well. Animal health is a key and a fundamental pre-requisite to ensure and enable global food safety and security, public health, international trade, and contribute to high standards of animal welfare.

The World Organisation of Animal Health (OIE) estimates that morbidity and mortality due to animal diseases cause the loss of at least 20% of livestock production globally. This represents at least 60 million tonnes of meat and 150 million tonnes of milk with an estimated value of \$300 billion per year.

Moreover, five influenza pandemics, starting with the Spanish flu, have killed millions of people, and the outbreak of ASF in Europe and Asia has killed thousands of animals, resulting in serious economic impacts on the livestock industry.

The disease threats to the livestock industry have increased steadily over the past decades due to globalisation, increased farming intensification with changed husbandry and management structure, climate changes, changes in the weather conditions and changes in wildlife management. These factors contribute to the risk of spread and evolution of pathogens. African Swine Fever (ASF) for instance, has been spreading steadily in Europe since its introduction into Georgia in June 2007, and has had outbreaks in Asia, Haiti and the Dominican Republic.

Another example is the poultry industry, which has suffered from multiple avian influenza outbreaks over the past decade. Avian influenza poses a major threat to public health and continuously new

human cases reported regularly by Chinese authorities. Since February 2013, there have been 1568 confirmed human cases and 616 deaths.

Antimicrobial resistance (AMR) is a major threat to the livestock industry and public health. In May 2015, the World Health Organisation (WHO) agreed on a global plan to combat resistance to antibiotics in the framework of the “One World, One Health” concept.

Furthermore, there is currently no prophylaxis and/or therapies for some diseases like paratuberculosis in cattle, avian influenza and ASF in pigs, and for a number of other diseases the efficacy of existing vaccines is insufficient and new/improved vaccines would increase animal health and welfare and reduce the need for antibiotic use.

Globally, the EU Member States and the partners of the International Research Consortium on Animal Health (global network STAR-IDAZ IRC) invest significant amounts in the development of new or improved control strategies for a range of diseases. However, more could be achieved through increased coordination of the research efforts, joint funding of activities and sharing of results. These efforts would be greatly facilitated by a coordinated international funding initiative focused on some of the critical challenges affecting the public health, environment and livestock industries. For some of the emerging diseases including ASF, there is an urgent need for R&D cooperation between European and other countries to avoid knowledge gaps and increase the level of expertise.

10.4 Scope, goals and research topics

Research and innovation co-funded through ICRAD would seek a concerted approach towards the development of novel and improved instruments to address and control infectious diseases, particularly regarding novel detection, intervention and prevention strategies to:

- Increase preparedness and ability to respond to emerging and endemic livestock threats
 - Control: by improving control of specific infectious animal diseases, in particular those where the role of wildlife and vectors are prominent, by further understanding the epidemiology, ecology and means of surveillance and control
 - New generic tools: by providing new generic tools, systems for better prevention and improved preparedness to react to infectious animal disease outbreaks, in particular by designing and developing new or improved vaccines, diagnostic and surveillance tools and vaccination/immuno-stimulation strategies
 - Translation: by improved translation of key knowledge on host and pathogen interaction and pathogen transmission into pathways for means of prevention, detection and control of animal infectious diseases
- Contribute to the reduction of antimicrobial and antiparasitic use in livestock and to minimising the development of resistance for the benefit of animal and public health
- Contribute to animal welfare by better prevention of diseases and renewed animal management and farming systems
- On a larger scale, contribute to food security and competitive and sustainable livestock systems, by reducing the burden of disease and reducing impact on international animal trade

ICRAD contributed significantly to the Strategic Research and Innovation Agenda for the European Partnership on Animal Health and Welfare, 2023. The SRIA lists the main research needs and priorities in animal health and welfare which are fully in line with the scope and goals of ICRAD.

The AH&W Partnership addresses these challenges:

- Control of contagious and zoonotic animal diseases and assess and improvement of animal welfare.
- Prevention strategies, control measures, diagnostic and alternatives to the use of antibiotics and other substances/techniques to tackle antimicrobial resistance and threats from biological hazards.
- Tackling the links between plant, animal, ecosystems and public health from One Health-One Welfare and Sustainable Development Goals/Global-Health perspectives.

Priority Area: Surveillance / monitoring systems and risk assessment for animal health and welfare

- Contribute to design and harmonize surveillance and monitoring systems for animal health and welfare
- Contribute to adapt risk assessment and alert communication to the new needs in animal health and welfare

Priority Area: Procedures, methodologies and tools to analyse animal health and welfare

- To develop diagnostic procedures, methodologies and tools to support the surveillance of animal health
- To develop procedures, methodologies and tools to support the monitoring of animal welfare

Priority Area: Management and husbandry guidelines on farm including aquaculture, during transport and at slaughter

- To develop guidelines and preventive tools to fight against animal infectious diseases on farm and during transport
- To develop guidelines and prototype solutions that advance animal welfare on farm, during transport and at the end of life

Priority Area: Treatments & vaccines

- To develop new interventions and treatments, or improve existing ones, against specific priority animal infectious disease
- To develop new vaccines or improve existing vaccines, including adjuvants and immunomodulators

Transversal Priority Area: Integrated approach, including socio-economic aspects of animal health & welfare

- To develop an integrated approach on animal health and welfare including socioeconomic aspects

ICT AGRI FOOD



11. ICT-AGRI-FOOD

ERA-NET Cofund on ICT-enabled agri-food systems

11.1 About

ICT-AGRI-FOOD is an ERA-NET Co-fund with 34 partners from 22 countries/regions. The network started in 2019 under Horizon 2020 and will run for five years. It is the successor of ICT-AGRI (2009, FP7) and ICT-AGRI2 (2014, FP7). ICT-AGRI-FOOD wants to underpin the transition towards more sustainable and resilient agri-food systems with digital technology. It started in 2009 as ICT-AGRI under FP7. Data from the entire food chain is used for this purpose. All stakeholders benefit, but ultimately it is the consumer who will be able to make smarter, healthier and more appropriate choices based on information about environmental impact, origin, nutritional value, safety and integrity.

11.2 Vision and aim

The vision for ICT-AGRI-FOOD is to bring together actors from across the entire agri-food system including primary producers (comprising both conventional and organic), SMEs, food processors, food retailers, consumers and the public sector (e.g. Ministries, funding agencies and regulatory bodies) in a multi-actor approach, to enable digital technology solutions for a transformation and transition towards sustainable and resilient agri-food systems. The vision for the ERA-NET Cofund ICT-AGRI-FOOD is to bring together actors from across the entire agri-food systems including primary producers, advisors, SMEs, food processors, food retailers, consumers and the public sector with researchers in a multi-actor approach, to enable digital technology solutions for a transition towards sustainable and resilient agri-food systems.

The aim of the ERA-NET Cofund ICT-AGRI-FOOD is consequently to foster, in a verifiable and perceptible manner, the use of smart digital technologies and to remove the barriers to their adoption to drive the transformation of European food systems making them more sustain-able, resilient, fair, responsible, responsive, adaptive, circular, transparent, safe and secure. This is addressed by strengthening the transnational coordination of research programmes and by providing added value to research and innovation by funding and supporting RDI on enabling digital technologies in the European Research Area and beyond. The overarching ambition for ICT-AGRI-FOOD is to join forces among public organisations (Ministries, funding agencies, programme managers) from interested EU countries and beyond. Furthermore, to connect related initiatives (such as JPIs, ERA-NETs, EIP-AGRI, the ESA, EIP Food, the S3 High Tech Farming partnership (S3HTFP) etc.) to support the digital transformation in the agri-food system through research development and innovation (RDI).

11.3 Challenges

The agri-food sector in Europe faces significant challenges in balancing the increasing demand for food (especially for resource intensive foodstuffs) and other outputs of the bio-economy with society's increasing demand for an agri-food system with less damaging impacts on the environment, and positive social and societal effects. Structural changes in the European agri-food sector are accelerating under the influence of societal demands, increasing competitive pressure, changing diets, demographic change, volatile national and global markets, diverging wages and new technologies. Adaptation to climate change will force significant changes to the agri-food system. In order to keep pace with these

increasingly complex relationships, the sector is more than ever forced to find innovative solutions for adaptation.

To tackle the challenges the agri-food sector is facing today and tomorrow, ICT-AGRI-FOOD is bringing together, joining and aligning forces with all relevant actors and stakeholders. In the consequence, ICT-AGRI-FOOD has the ambition to be a pivotal point where Member States can have an overview of relevant projects and initiatives all over Europe, and to connect the many projects and initiatives on a durable platform to ensure RDI funding policy for the future of food systems. With ICT-AGRI-FOOD's anticipated structuring effect, it is aimed to spread the uptake of digital innovations in MSs and the entire agri-food sector to make the transformation a reality.


11.4 Scope, goals and research topics

The digital technologies supported by ICT-AGRI-FOOD build on the standardisation efforts and platform developments from existing funded projects and integrate with existing major digital platforms from food actors, ICT solution providers and consumers. Collaborative research projects and networking structures aim to trigger dialogue between participating countries and create a common vision to improve coordination between national and EU funding and ensure better use of resources.

Important thematic areas within the scope of ICT-AGRI-FOOD are:

- Foster agri-food systems enabled by interconnected digital technologies that are more transparent to consumers, farmers and other stakeholders along the agri-food value chain.
- Identification of barriers, addressing and removing barriers for adoption of ICT technologies in the agri-food systems.
- Development and impact estimation of data-driven reward and incentive systems to support sustainable and resilient farm management practices.
- Digital solutions for sustainable agriculture: this includes technology that contributes to precision farming, sustainability of agriculture, digital tools for efficient use of resources such as water and fertilizers and to mitigate the impact of climate change.
- Digitalization of supply chains: this involves using digital technologies to optimize supply chains, reduce waste and improve traceability and transparency.
- Farm management systems: this includes research on the development and use of integrated farm management systems that use ICT tools to improve the efficiency and sustainability of agricultural production.
- Data analytics and decision support systems: this includes research on the development of data analytics tools, remote sensing, and decision support systems that leverage big data and machine learning to improve the efficiency and sustainability of agricultural production.
- Robotics, sensors and automation: this includes research on the use of robotics and automation in agriculture to reduce labour costs, increase efficiency, and improve crop quality.
- Cross cutting solutions: this includes interdisciplinary research, addressing barriers, knowledge exchange, capacity building, and working with the industry, retail, consumers, policy makers and other stakeholders in the sector.

Overall, these areas are crucial for the development of a more sustainable and efficient agriculture sector that can meet the challenges of the future.



CHALLENGES	GOALS	STATE OF ART AND TRENDS IN ICT	CHALLENGES RELATED TO ITC AND ITS ADOPTION
Global food security	Increase productivity	More sensors and UAVs	Compatible software systems
Sustainable resource management	Reduce waste in the food chain	More robotics	Data ownership
Energy consumption	Optimize fertilizer and pesticide use	Network connectivity	Training of farmers
Food quality and safety	Optimize water management	Big Data	Directly usable
Climate change	Maintain soil quality	Open/FAIR data	Change of farmers' way of life
Social aspects and demands	Protect and promote biodiversity	Apps everywhere	Bandwidth
	Minimize air pollution	Farm to fork integration/standards	Change of business model
	Increase energy efficiency	Explosion of start-ups	Society's (consumers) support
	Ensure food quality and safety	Consolidation and market dominance	Financial investment
	Food traceability and information		
	Reduce greenhouse gas emissions		
	Increase animal welfare and health		
	Less tedious and hazardous work		

Figure 11.1: Challenges, goals and trends related to ICT and its adoption as identified by ICT-AGRI2. *From: ICT-AGRI2, Digital Technologies for a sustainable Agrifood System: A Strategic Research and Innovation Agenda, 2019.*

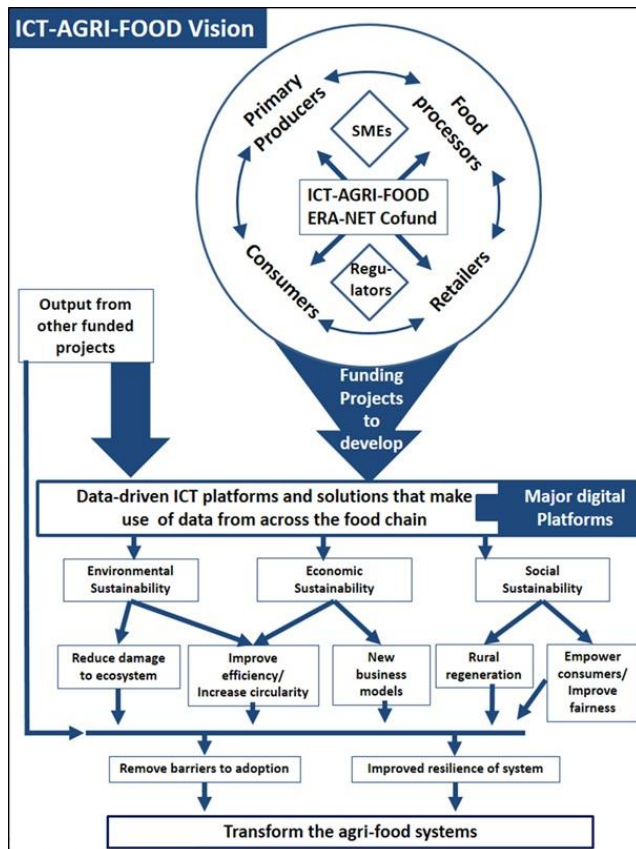


Figure 11.2: ICT-AGRI-FOOD Vision: Enabling digital technology solutions for a transformation towards sustainable and resilient agri-food-systems.



LEAP AGRI

12. LEAP AGRI

A Long term EU-Africa research and innovation Partnership on food and nutrition security and sustainable Agriculture

12.1 About

The [LEAP-Agri programme](#) (2016-2022) is an African Union-European Union partnership aimed at research and innovation for food and nutrition security and sustainable agriculture. This long-term, jointly funded Research & Innovation (R&I) Partnership was built on the roadmap of the AU-EU High Level Policy Dialogue on Science, Technology and Innovation (HLPD). The consortium exists out 19 partners from Europe, 10 partners from Africa and one international organisation.

12.2 Aim and objectives

The aim was to contribute to the United Nations Agenda 2030 and the Sustainable Development Goals on the priority topic of ‘Food and Nutrition Security and Sustainable Agriculture’ (FNSSA). In this frame, 27 research and innovation (R&I) projects were funded with participants from the two continents. LEAP-Agri demonstrated that the capability of 24 funding bodies from 18 EU and AU countries to commit national budget for FNSSA R&I research in addition to EC top up funds.

A complementary aim of LEAP-Agri was to propose a flagship programme in the light of this cofounded call experience.

12.3 Challenges

Africa and Europe share global challenges to improve food systems on sustainable development pathways in line with the targets of the SDGs and more specifically SDG2 sustainable development goal “Zero hunger”. The first of these challenges is to end hunger and ensure access to safe and sufficient food for all, especially people in vulnerable situations including children throughout the year. According to the World Food Programme, 135 million people suffer from acute hunger largely due to man-made conflicts, climate change and economic downturns and more than 800 million suffer from malnutrition.

A profound change in the global food and agriculture system is needed if we are to feed the 690 million people who suffer from hunger today and the additional 2 billion people the world will have by 2050. Increasing agricultural productivity capacities and strengthening sustainable food production systems are necessary to help reduce the problem of hunger, including agricultural products and food waste decrease. At the same time, it is needed to implement resilient agricultural practices that increase productivity and production, contribute to the preservation of ecosystems, strengthen the capacity to adapt to climate change, extreme weather events, drought, floods and other disasters, and progressively improve land and soil quality, conserve water resources and biodiversity.

It is challenging to ensure the proper functioning of food and derivatives markets and to facilitate rapid access to market information, including food reserves, in order to help limit extreme food price volatility. Moreover, it is important to prevent trade restrictions and distortions in global agricultural markets.

In this context, Africa and Europe have decided to increase investment in rural infrastructure, agricultural research and extension services and the development of new technologies to strengthen their agricultural productive capacities while protecting the environment, managing renewable

resources, decreasing waste and providing healthy food for their people. The two continents are seeking to improve trade to ensure a supply of essential foodstuffs for each other even when they cannot be produced locally (e.g. tea, coffee, cocoa for Europe, wheat, durum wheat in tropical Africa).

Sustainable food systems' transformation needs to build on the right to food and scaling of a systems approach. For evidence-based decision-making, investment into research and innovation plays a critical role. However, for it to be effective, research needs to be actor-oriented and despite the problems being of concern to both continents, solutions need to be context-specific and co-developed, including multiple stakeholder groups. To reach these goals, research programming, implementation capacities and knowledge management and communication mechanisms need to be strengthened across the AU-EU region through the development of a joint AU-EU R&I agenda on FNSSA. Moreover, understanding funding constraints and adjusting current funding mechanisms to facilitate equal partnership development is a crucial step towards consolidating the long-term AU-EU Partnership and the HLPD.

12.4 Scope, goals and research topics

Four priority areas were identified in the roadmap of the HLPD, as being of common interest for Europe and for Africa. LEAP-Agri built on these four priorities for its first co-funded call and these areas remain a priority over the coming years, and should be illustrated but not restricted to the following topics :

- Sustainable intensification,
 - The improvement of the production of food/fibre/biomass and of services (social, economic and environmental);
 - Reduction of the environmental impact of such production and the depletion of natural resources;
 - Ecological intensification approaches;
 - Breeding of crops and animals;
 - Nutrient management.
- Agriculture and food systems for nutrition,
 - The reduction of food waste;
 - Improvement of diets (including through development of aquaculture and coastal fisheries);
 - Solving under-nutrition, obesity and micronutrient deficiency;
 - The role on diets of urban agriculture and better rural-urban linkages;
 - Understanding of consumer behaviour in relation to diets; and
 - Role of regulations, education and incentives.
 - Pest and disease control;
- Expansion and improvement of agricultural markets and trade,
 - Local and global value chains and markets;
 - Linking smallholder farmers/fishers & rural communities to markets;
 - Impact of urbanisation;
 - IT and communication technologies;
 - Price stability;
 - Market logistics;
 - Innovative and multiscale approaches to global food system policies;
 - Organisational innovations;

- Facilitating uptake of innovations across farms and rural communities;
- Cross cutting approaches for FNSSA.

LEAP-Agri highlighted in its 'Development of a medium to long-term joint research and innovation agenda (2020)' new cross-cutting R&I topics in addition to the HLPD roadmap on FNSSA:

- Climate resilient agriculture, and
- Global issues of antimicrobial resistance.

LEAP-Agri proposed a new flagship programme on FNSSA in the light of the co-funded call experience. It is published in the 'Draft proposal for a long-term EU-Africa Research and Innovation Flagship Programme on FNSSA (2022)'. Agroecology is identified as main topic for EU-AU research and innovation. The document also proposed ways for improving and maintaining the AU-EU collaboration for FNSSA R&I.

LEAP-AGRI highlighted during their final conference in Senegal (2022) the importance of funding projects following consolidation of results: It is essential that there are dedicated calls or part of the calls targeted to projects following promising projects. This will allow for a perpetuation of achievements or a transfer of achievements.



An aerial photograph showing a large green field on the left and a large yellow field on the right, separated by a curved boundary. The background is a dense forest of green trees. A white rectangular box is overlaid on the image, containing the text "FACCE SURPLUS" in blue capital letters.

FACCE SURPLUS

13. FACCE SURPLUS

Sustainable and Resilient Agriculture for Food and Non-Food Systems

13.1 About

FACCE SURPLUS is an ERA-NET Cofund, formed in 2015 in collaboration between the European Commission and a partnership of 15 countries in the frame of the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI).

FACCE SURPLUS is committed to improve collaboration across the European Research Area in the range of diverse, but integrated, food and non-food biomass production and transformation systems, including biorefining.

13.2 Aim and objectives

The overall objectives of FACCE SURPLUS are:

- To improve collaboration and cooperation across the European Research Area in the fields of diverse, but integrated, food and non-food biomass production and transformation systems, including biorefining.
- To link up and create a network of research platforms, enterprises and clusters of enterprises (as associations of family farms, SME's etc.) and facilities/research infrastructures across Europe working on the sustainable intensification of agriculture as well as focusing on innovation for increased, resilient and sustainable biomass production and product transformation processes for added value creation.
- To support innovation and value creation from biomass and biorefineries in synergy with the environmentally sustainable intensification of agricultural and other biomass production taking into account the required economic, environmental and social conditions.
- To fund and organise a joint call between funding bodies from Member States and the European Commission.

Furthermore, FACCE SURPLUS also aims at:

- Organising further joint calls without EU funding in the scope of the ERA-NET Cofund,
- Supporting the environmental innovation and value creation from biomass and biorefineries in synergy with environmentally sustainable intensification of agricultural production and
- Overcoming fragmentation & duplication, closing gaps on national level and generating maximal synergies for all funders and research providers in Europe in the field.

These objectives contribute to the strategic objective of FACCE-JPI to build a European Research Area in the domain of agriculture, food security and climate change as well as to the scientific objective of enhancing resilience in agricultural production systems. In turn, this contributes to tackling the Grand Challenge of ensuring food security and agricultural production in the face of climate change.

13.3 Challenges

Global food security, the use of renewable raw materials and production of energy from biomass are three of the “Great Challenges” for the 21st century. In line with the European Bioeconomy Strategy,

better use of biomass and waste from plant and animal terrestrial and aquatic production systems is a fundamental aim to fulfil human needs while preserving natural resources and biodiversity. All economic actors that produce, manage and otherwise exploit biological resources, including agricultural and other land based activity in its widest sense, such as in the food, animal feed, farmed fish and forest-based chains, as well as parts of the chemical, biotechnological and energy industries, should be considered as a whole in the bioeconomy. The concept extends beyond technological innovation to present new opportunities for organisational innovation in the development of novel production chains that will contribute to improving life for all. In this way, rural and coastal communities will be given greater opportunities for diversification at different spatial scales in line with local and regional development plans.

The current food system was created in response to meeting food production targets in the post-war era. It represents decades of investment in infrastructure and the creation of institutional arrangements that reflect the political and economic priorities of recent decades, up to and including the globalisation of food systems. However, in the past years it has become clear that a managed transition towards radically improved food and non-food systems by 2050 will be needed to make the most efficient and sustainable use of land and other natural resources across the EU.

New bio-technologies and industrial processes need to be developed and traditional relationships between actors in the various food and non-food production chains will need to change to accommodate innovations leading to a radical reorganisation of the agri-industrial sector and the emergence of a reformed bioeconomy. Industrial reorganisation is an ongoing process driven by the market and the growing demand for bio-based products.

A holistic view across research disciplines is a prerequisite of any research into the relationship between food and non-food systems: the interconnections between them lead to a weakening of the boundaries between production and product transformation. Alongside the increased demand for biomass for a variety of products, the world's available agricultural land area is steadily decreasing as a result of soil degradation and expansion of residential areas. Furthermore, climate change will increasingly affect agricultural productivity. All this impacts the resilience of agricultural food and non-food systems and their ability to tolerate and adapt to external disturbances. A resilient system should be able to speedily recover from climatic shocks and biological stress and should provide alternative means for satisfying services and needs in the event of changed external circumstances. Only resilient agricultural systems allowing growth and intensification of agriculture under the increasing stress of climate change, new pests and disease outbreaks and other environmental pressures will address these challenges adequately.

Transitions in farming systems towards sustainable intensification, and/or high nature value need to be integrated into the broader perspective of a bioeconomy that will combine the simultaneous production of food, fibres, feed, bio-chemicals, raw materials and bio-energy from biomass over a territory, the recycling of wastes and the utilisation of by-products and co-products. Holistic value chains need to be developed through the integration of industries across rural regions and cities. Alternative agricultural systems which are currently being developed and studied in (and outside) Europe should be compared with each other and networks of study sites developed to test holistic sustainable intensification metrics at farm, landscape and national scales.

13.4 Scope, goals and research topics

The scope of FACCE SURPLUS covers the thematic area of sustainable intensification of agriculture and focuses on innovation for increased, resilient and sustainable biomass production and product transformation processes for added value creation, including biorefinery. The network has launched 3 calls for proposals since 2015. The topics of the second and third call built further on the work done under the first call for proposals. All the topics remain relevant.

- Spatial targeting of land use to increase biomass production and transformation
 - Optimising the yield of green (plant-based) biomass per unit area of land
 - Innovations in the design and siting of environmentally advanced, minimum waste biorefineries
 - Integrated approaches for the primary production of green biomass as part of the whole biomass production and processing chain
 - Demonstrating how the resilience of agriculture and agro-forestry results from a range of spatial and temporal solutions across the same land area
 - How can biomass, including wastes and losses, and product expectations best be evaluated and modelled, using a systemic approach
 - Evaluating the synergy between ecosystem services and biomass harvesting from locally specialised crops, including the role of biorefining
- Developing markets
 - Designing new business models for biomass production and its transformation
 - Conducting foresight exercises on the regulatory framework for integrated food and non-food agricultural systems associated with the sustainable intensification of green biomass production.
- The sustainable intensification of integrated food and non-food systems of agriculture
 - Development of system-based approaches for the integration and improvement of food and non-food agricultural production systems
 - Evaluation of the synergies and trade-offs between increasing yields and biomass production for food and non-food uses and the impacts on the environment
 - Development of new agricultural systems in crop rotations to exploit seasonal growth cycles through intercropping, at farm level and at landscape scale
 - How may the use of biomass for biorefining in marginal agricultural areas and grasslands create synergy between economic value addition nature values
 - How can the integrated modelling of water, biomass, bioenergy, food, and chemicals in the production and transformation of biomass follow the requirements of environmental sustainability
 - Systems approaches assessing novel utilisation of agricultural products and exploring their potential for value
 - Economic and environmental assessment of integrated food and biomass systems under different agro-ecological conditions
- Small-scale biorefinery concepts and their potential role in enhancing the sustainability and productivity of EU agriculture, as well as their scope to benefit the rural economy

- Supporting innovation, value creation and sustainable intensification of biomass production, taking into account the required economic, environmental and social conditions and resilience to climate change
- Resilient agricultural systems allowing growth and intensification of agriculture under the increasing stress of climate change, new pests and disease outbreaks and other environmental pressures and preserving biodiversity and ecosystem services.



Figure 13.1: Products developed within FACCE SURPLUS projects.

A close-up photograph of a pig's snout, showing its two nostrils and the texture of its pinkish skin. The snout is positioned between two horizontal wooden beams. A white rectangular text box is overlaid on the left side of the image, containing the name 'SUSAN' in blue capital letters.

SUSAN

14. SUSAN

European research area network on Sustainable Animal Production Systems

14.1 About

The longstanding activity of SusAn partners in a very wide and diverse community is one of the key features of the network and a pillar of its success. The SusAn consortium consists of 37 entities from 23 countries, representing the leading national funding bodies for research in the thematic field of this ERA-Net Cofund activity in the EU. The scope for this ERA-NET has been developed under the SCAR Collaborative Working Group on Sustainable Animal Production (CWG-SAP). Funding organisations from 23 European countries initially sought to support one co-funded call followed by other joint activities including the development of a Common Strategic Research and Innovation Agenda on Sustainable Animal Production.

14.2 Aims

SusAn aims to meet the challenges and complexities in sustainable animal production. These are to be addressed effectively through joint European research within a framework which supports the three pillars of sustainability - economy, environment and society - and targets opportunities for innovative research spanning all areas of animal production such as feeding and nutrition, reproduction, breeding and genetics, housing, nutrient management, health and welfare and economics. Partners in ERA-NET SusAn endorse scientific excellence and recommend an integrated, interdisciplinary, cross-cutting and multi-actor approach to research and knowledge exchange which reflects the complexity of the research requirements for sustainable European animal production.

14.3 Challenges

SusAn's view on the present status of European livestock production is as follows:

» Achieving global food and nutrition security has become a more complex and multifaceted challenge than in the first decades after World War II. The complexity of the European agri-food system means that livestock production is seen as a sub-system in a larger context.

» A significant part of present European livestock production systems compete for land and resources that can alternatively be used for e.g. growing plant based food or for nature conservation. Strategies for sustainable livestock farming must take existing trade-offs into account, for instance, food versus feed.

» Current overconsumption and food waste in Europe considerably contribute to excessive resource use, public health costs and environmental costs. These costs could alternatively be used to support sustainable practices, and as long as they are unaccounted for, they distort prices and interfere with market mechanisms. Sustainable production can only be achieved in a framework of sustainable consumption.

» Excessive intensification beyond nature's capacity leads to an unbalanced concentration and specialisation of livestock production, and to overconsumption of animal-source food. This has detrimental effects on farms, the environment and society. There is no universal solution that fits all

livestock production systems in Europe. Diversity of production and adaptation to local conditions should be increased rather than decreased, also to benefit resilience.

» Societal expectations about agriculture and food systems are high in Europe. The consumption of animal based food is high per capita and currently has a decreasing trend while consumption is increasing in other parts of the world (e.g. China, South East Asia). From this point of view, the European livestock sector may start development processes that could later also take place in other regions of the world.

» A shared vision of European livestock production is lacking, including its role for global health, and food and nutrition security. Furthermore, there is a need for concrete targets and corresponding evaluation methods (indicators, metrics).

» Strategies for future global food and nutrition security should not only look at increasing crop and livestock production in Europe. They should also take other aspects into account, for instance consumer behaviour, food loss and waste, inequalities in global food distribution, and the food sovereignty of developing economies.

» The European agri-food system as a whole, including livestock production, is currently not sustainable. Therefore, a fundamental change of the system is required. The next ten years are decisive for this necessary development.

SusAn selected the main challenges for European livestock production on the basis of the UN Sustainable Development Goals. Priority was given to the relevance for European livestock production systems. However, any effects outside Europe must be considered as well. This includes, for instance, GHG emissions, deforestation in countries exporting animal feed to Europe, as well as the effect of European exports on local markets of developing economies. Major challenges for European livestock production systems are:

- To achieve food and nutrition security
- To restrict emissions and nutrient losses
- To keep resource use within planetary boundaries
- To preserve and enhance biodiversity
- To support rural livelihoods
- To provide high standards of animal health and welfare

Key-messages regarding these challenges are that all challenges must be met simultaneously and in accordance with set targets, and that the challenges are interdependent and need to be tackled within a systems based approach in order to account for potential synergies and trade-offs.

14.4 Scope, goals and research topics

SusAn published a Common Strategic Research and Innovation Agenda in 2022. The strategic approach comprises five area's that can be used together as a strategy for R&I on livestock production systems.

Area 1: Develop a shared vision of European livestock production

A shared vision of a future food system (and the role of European livestock within it) is a prerequisite to efficiently redesign livestock production systems, develop a socio-economic framework to support them and to evaluate the system's performance.

Area 2: Design livestock production systems

The design of livestock production systems involves combinations of its basic components like animal health, animal nutrition, genetics, housing and manure management, to tackle the challenges. Livestock production must tackle several challenges, from local to global level, and it needs to use synergies and avoid trade-offs between them

Area 3: Support implementation of sustainable systems

Without societal facilitation, sustainable livestock production cannot be viable in practice. In order to enable Europe's food system to become sustainable, the existing political and socio-economic framework needs to be developed further, in line with the European Green Deal.

Area 4: Evaluate system performance

If a system is more than the sum of its components, the evaluation of a system must take an approach that is able to catch the system's essential properties beyond its components.

Area 5: Facilitate collective action

There seems to be agreement that a fundamental change of the European agri-food system will require concerted action of all stakeholders, in different fields and at different levels.

From a scientific perspective, priority should be given to:

1. Develop a shared vision of future European livestock production systems, based on scientific opinion and balanced stakeholder participation.
2. Establish science-based methods (metrics) to evaluate the performance of livestock production systems with regard to their sustainability.
3. Consider the notion that a coherent political and socio-economic framework that supports the implementation of sustainable livestock farming is at least as important for a transformation of the livestock sector as redesigning agricultural/technical system components.



A close-up photograph of two green wheat stalks. The stalks are in sharp focus, showing the individual grains and the long, thin awns. The background is a soft, out-of-focus green field with a bright, glowing sun or light source in the distance, creating a warm, golden light. A white horizontal bar is overlaid on the image, containing the text 'SUSCROP' in blue capital letters.

SUSCROP

15. SUSCROP

ERA-NET Cofund on Sustainable Crop Production

15.1 About

SusCrop was an ERA-Net Cofund Action under H2020, which aimed to strengthen the European Research Area (ERA) in the field of Sustainable Crop Production through enhanced cooperation and coordination of different national and regional research programmes. In this regard, *SusCrop* brought together 34 owners and managers from 19 different countries from national and regional R&D&I programmes of EU Member States, EU-associated States and Third countries with significant experience in research funding and coordination.

15.2 Aim and objectives

SusCrop had four major strategic objectives:

- Enhancement of predictive breeding technologies and development of new genotypes leading to new phenotypes and crop varieties
- Development and exploitation of novel integrated pest and crop management methods and practices
- Improvement of resource-use efficiency of crops and cropping systems
- Systemic research on agricultural crops as part of an ecosystem (“plant as a meta-organism”)

15.3 Challenges

One of the Grand Societal Challenges of the 21st century is to ensure food and nutrient security for a growing population under climate change and pressure on natural resources.

To do this, sustainable crop production needs to be secured and enhanced. Current food production methods utilise excess energy, water, pesticides and chemicals. New ways of sustainable crop production are necessary to increase productivity, reduce the amount of chemical inputs and/or improve the quality of the crops. This will be crucial to maintain access to affordable, safe and nutritious food for a healthy life, and to serve the increasing demand for industrially used biomass whilst keeping and improving a healthy environment, natural habitats and increasing biodiversity. Modern crop production must be addressed by taking into account the whole food value chain, crop diversity and resilience, resource use efficiency, nutrient recycling, ecosystem services, environmental impacts, integrated pest management and waste reduction and use in order to achieve food and nutrition security.

Widespread use of simplified cropping systems with large fields cultivated in standardized operations with large-scale machinery strongly influence agricultural habitats, soil structure and soil organisms. Monocultures tend to reduce the variety of cultivated species, contribute to overexploiting soils and also render crops more vulnerable to pests and climate extremes. Wild habitats disappear when field margins and hedges are cleared to combine smaller fields, fertilisation modifies plant community composition in field margins and pesticides have direct and indirect lethal or sublethal effects on survival or reproduction of plants, invertebrates, mammals, and birds. The simplification of cropping systems leads to erosion of the heritage of species and varietal diversity from European farmland and the ability

to adjust crops and cultivation practices to differences in soil quality and other landscape characteristics. Thus, reduced biodiversity will eventually result in a decrease of agricultural productivity.

With the Green Deal, the European Union has pledged to foster the ecological transition and has set stringent goals for reduction of chemical pesticides, fertilisers and antibiotics, and has pledged to reverse the trend of biodiversity degradation by 2030. According to the European Environment Agency, compared to 2015, agricultural habitats show an overall deterioration in conservation status: good status decreased from 14% to 12% and bad status increased from 39% to 45%. Only 8% of agricultural habitats show an improving trend, whereas 45% are deteriorating.

The EU biodiversity strategy for 2030 pledges to "Bringing nature back to agricultural land" and demands solutions to substantially improve agrobiodiversity in European agricultural systems, including innovative agro-ecological practices building on knowledge of beneficial and manageable variation in species and varieties within and between fields. In its 2020 Strategic Research Agenda (SRA), FACCE-JPI has stated the need to adopt research and farming approaches such as agro-ecology, agrobiodiversity, conservation farming/regenerative agriculture, circular farming, organic farming... that can have a transformative role at the farming system level but also at the level of the broader bioeconomy, as they can inspire new products, new business models, supply chain configurations, cooperation among firms, trade relations, responsible business and marketing conduct. Moreover, the SRA notes the importance of improving and adapting these practices to the specific contexts, particularly in relation to weather volatility due to climate change.

The SusCrop ERA-NET has also flagged sustainable crop production, particularly (agro-)biodiversity as a key topic. Therefore, research is needed that:

- (a) leads to the production of new and/or improved crop varieties to cope with the consequences of climate change,
- (b) enhances biodiversity of crops and in cropping systems contributing to nutritional and food security for a balanced and diverse human diet.

15.4 Scope, goals and research topics

SusCrop focuses on the core research theme "Environmentally sustainable intensification of agricultural systems." The network contributes to sustainable crop production, particularly agro-diversification strategies tailored to different European agricultural systems, and targeting landscapes and cropping systems with low and/or moderate agro-biodiversity, higher negative impact on agrobiodiversity, or most at risk due to low resilience. In this context, SusCrop and FACCE-JPI have joint forces and launched a Joint Call on Agrobiodiversity in 2022.

During the final period of the ERA-Net Cofund action, SusCrop published in August 2023 a White Paper on 'Future Research Needs in Sustainable Crop Production'. In this document, the four most relevant research needs are presented. Work in SusCrop highlighted both research needs and a methodology for working. The initial focus concerned protein crops, primarily for food but also including feed. Here the term protein refers to proteins coming from plants (but not algae) and therefore including e.g. grasses. Further, the focus was on production (crop improvement and cultivation) but taking into account the value chain. More generally, there was a focus on "niche crops", which have huge potential in the future, given that there is sufficient investment in research and a step-by-step approach to developing and

sharing knowledge on such crops. In this context, the following four relevant research areas/topics in the field of sustainable crop production were elaborated and are defined as:

Topic 1. Knowledge generation in relation to nutritional value and health benefits of protein/niche crops

This gap concerns the nutritional quality of protein/niche crop species for human health by increasing micronutrients (phytochemicals,(pro)-vitamins, trace minerals), decreasing anti-nutrients, optimising bioavailability, improving amino acids as well as the associated processing techniques to safeguard the beneficial plant compounds.

Topic 2. Knowledge generation and transfer on multi-stress resistance for stable yield

Further research is needed on the links between yield and biotic (pests, diseases etc.) and abiotic stress (drought, salinity due to climate change, CO₂, temperature). In addition to investigation of resistance to individual and combined stresses, better linking genetics and genomics, and making more use of bridge species.

Topics 1 and 2 should be supported by the following items:

- A toolbox for researchers investigating protein/niche crops, including:
 - Development of fundamental tools at the research level for protein/niche crops: genomes, markers + mapping populations + seeds/seedbanks especially with vouchers of sequenced accessions as well as transformation methods;
 - Efficient pathways to move from lab models to real life production (including microbiome);
 - Understanding the value chain for protein/niche crops beyond the farm gate, including policy and society (feeding back into a and b).
- Concrete information for farmers on a particular species for decision-making on cultivation practices
 - Better understanding of growth and biology/genetics;
 - Better understanding of crop management.

Topic 3. Innovation pipeline: Protein/niche crops for food and feed value chains: How to build up a value chain for uncultivated protein/niche crops

To support the development of the protein/niche crop food value chain, research is needed as efforts so far have supported mainly the feed value chain.



Topic 4. **Impact assessment and trade-offs**

Research needs concern the impacts of switching our current land use and production to protein/niche crops with emphasis on the shift to systemic approaches and on resulting consequences with regard to climate change. Socio-economic research is also needed to identify and demonstrate the value of protein/niche crops and to develop better understanding of both global environmental impact and of the potential for protein/niche crop value chains for food at local, national and international levels.



SusCrop – ERA-NET

Cofund on Sustainable Crop Production

FACCEJPI

A close-up photograph of two ripe red apples hanging from a branch. The apples have a mix of red and yellow-green skin. Green leaves are visible in the background and foreground, some showing signs of insect damage. A white rectangular box is overlaid on the image, containing the text 'SUSFOOD' in a dark blue, sans-serif font.

SUSFOOD

16. SUSFOOD

ERA-Net on Sustainable Food production and consumption

16.1 About

The [SUSFOOD2](#) ERA-Net Cofund started in January 2017 and ended in June 2022. The network has 26 partners from 15 EU member states and third countries and is coordinated by PTJ Juelich. SUSFOOD2 is the successor of the first SUSFOOD ERA-NET that was launched in 2011 under the EU 7th Framework programme. The first SUSFOOD ERA-Net was built on and accelerated the work of the SCAR (Standing Committee on Agricultural Research) Collaborative Working Group that was launched in Denmark in 2010.

SUSFOOD2 promotes a cross-sectoral and multi-disciplinary approach of food systems from biology to food engineering, social science, economics and humanities. The network focuses on the food chain beyond the farm gate, covering processing, packaging, transport, retailing, food services, storage and consumer activities.

16.2 Vision and aim

SUSFOOD2 has the vision:

All food chain partners contribute to achieving sustainable, secure and resilient food systems which feed the world and make sustainable choices the easy and preferable choices for consumers.

SUSFOOD2 aims:

- Responding to the increasing demand for food by increasing food production sustainably (reducing CO₂ emissions, energy consumption and water use, and taking account of ecosystem/bio-diversity impacts) and reducing losses and waste in the food supply chain;
- Improvement of the quality, traceability and safety of food in a sustainable way;
- Improve the quality of life through better availability and improved access to food and healthy diets;
- Improvement of the resilience of the food chain;
- Encourage more sustainable consumption behaviour;
- Improvement of the European agri-business competitiveness and green economic growth with additional focus on SMEs and job creation.

16.3 Challenges

SUSFOOD defines sustainability in the food area as “A food system that supports food security, makes optimal use of natural and human resources, and respects biodiversity and ecosystems for present and future generations, and which is culturally acceptable and accessible, environmentally sound and economically fair and viable, and provides the consumer with nutritionally adequate, safe, healthy and affordable food.”

The global food system will experience unprecedented pressures over the coming years. Global challenges in the food sector are numerous: climate change, the growing and ageing population,

urbanization, excessive use of natural resources, and loss of biodiversity. All forms of malnutrition (hunger and undernutrition, micronutrient deficiencies, but also overweight and obesity) threaten the health of billions.

Set against the context of the global challenges on food security, resource constraints and food waste, and taking into account the other EU initiatives in this field, SUSFOOD has identified a number of core challenges for research relevant for the SUSFOOD ERANET. These challenges reflect environmental, technological, socio-demographic, economic and political dimensions:

1. Food security for providing enough food for the world's growing population with a sustainable and secure supply of safe, nutritious and affordable high-quality food which takes account of resource constraints and the need to adapt to climate change – set within a global context.
2. Pressures on supplies of energy, water, natural resources and adapting to climate change. This requires more effective use and re-use/recycling of resources, and mitigation of and adaptation to climate change.
3. Innovation in development of smart technology and infrastructure across the food chain. Knowledge transfer between all stakeholders to support uptake and use of innovative approaches into practice, tool sets and infrastructure are needed to support sustainable development in the food system. Indicators of change need to be defined to support monitoring and evaluation of progress.
4. Food and health to improve and ensure quality of life of an ageing society will be a leading issue in terms of demographic and social challenges.
5. Change of markets and approaches to a new economy, including value creation, are challenges that have to be taken into consideration to ensure a more resilient and sustainable food economy. Markets have to reflect integrated policies, new governance and innovative institutionalisation. Other specific issues in this area include new approaches to employment and a new understanding of real and equitable prosperity. As far as economic growth and competitiveness are concerned, SUSFOOD has the crucial role of promoting incentives for innovation in order to explore sustainability-oriented business models and value creation in the food supply chain.
6. Contribution to food security by understanding how food demand can be managed. This is a challenge for the whole food system and not only for the end consumer. Indeed, changing consumer patterns can not only be dealt with by more consumer awareness; the whole design of processes, markets and products has to be redesigned.

16.4 Scope, goals and research topics

The strategic goal of SUSFOOD ERA-NET is to reinforce the scientific cooperation between EU Member States and associated states in order to maximise the contribution of research to the development of more sustainable food systems.

The research funded under SUSFOOD can be clustered into four main research areas (including some topic examples):

- 1) Resource Efficiency and Valorisation

- Redesign input, waste and side flow strategies to increase resource efficiency and provide added value in food products and processing, manufacture etc.; In order to achieve more sustainable and resilient food production, there is a strong need for research supporting redesign of the supply chain and the whole production chain from raw material to consumption.
- 2) Processing Technologies
- Innovation in food processing technologies; There is a need for flexible, innovative food manufacturing, and resilient processes and systems.
 - Interdisciplinary research approach to develop innovative food products and use of new raw materials for food products; There is a need for research into the use of new raw materials for production of ingredients or foods based on side streams or by-products, which are important sources for a sustainable food production.
- 3) Sustainable & Diverse Food Systems
- Connection between stakeholders and food systems; There is a need for a multi-stakeholder approach to redesign and optimize food systems for more sustainable food production that meets consumer demand.
 - Diversity in food from field to plate; to ensure a healthy and sustainable diet and increase resilience within the food system
 - Food systems adaptation and resilience to system shocks; research is needed to make food systems more resilient and resistant towards stresses and shocks
 - Harmonization of the methods and metrics for integrated assessment of sustainability of food products and food patterns; For stakeholders to be able to assess and value the sustainability of food products in a chain perspective there is the need to develop harmonised and transparent methods and metrics to measure, monitor and assess sustainability of food production and consumption.
 - Public policy coherence; In order to achieve sustainable food systems, public policies need to be coherent and transparent throughout the system.
- 4) Consumer Behaviour
- Understanding of consumer behaviour and food choices; To facilitate sustainable consumer behaviour, insight is needed into the factors that determine consumer behaviours and choice.
 - Integration of information systems for personalized and sustainable choices; Based on existing information systems, research is needed to identify which type of information and in which mode of expression information has an impact on consumer behaviour inside and outside the home, why and how it has an effect on sustainability, safety and nutrition.

Next to the research areas/ topics, SUSFOOD projects have to consider and adapt cross-cutting issues, such as multi-actor approach, multi-disciplinary approach and systems approach in order to increase impact.



Figure 16.1: SUSFOOD, 10 years of sustainable food systems research for a better future.



FACCE-JPI SRA and SCAR Foresight 5

17.1 Relevant foresight and strategic documents

There are many documents that give insight in the societal challenges, research needs and give foresight in future possibilities and challenges. For this stage of the roadmapping process we selected two relevant documents to feed into the process. The first is the Strategic Research Agenda 2020 from FACCE-JPI, the Joint Programming Initiative on Agriculture, Food Security and Climate Change. The second is the SCAR Foresight 5 report, 2020.

17.2 FACCE-JPI SRI 2020

About

The [Joint Programming Initiative](#) on Agriculture, Food Security and Climate Change (FACCE-JPI) FACCE-JPI brings together 20 countries comprised of European Countries and New Zealand who are committed to building an integrated European Research Area addressing the interconnected challenges of sustainable agriculture, food security and impacts of climate change.

By providing and steering research FACCE-JPI supports sustainable agricultural production and economic growth, to contribute to a European bio-based economy, while maintaining and restoring ecosystem services under current and future climate change.

The aim is to do so with a strong transdisciplinary research base, encompassing economic and social aspects in addition to scientific ones, and with a creative approach towards the alignment of national programmes and the input of multiple actors and stakeholders.

The Council of the European Union launched the Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI) in 2010 to stimulate collaboration between member states, and to provide coherence in research programming across Europe to meet the societal challenges of jointly ensuring food security, adaptation to climate change impacts, and mitigation of greenhouse gases emissions.

FACCE-JPI strives to contribute to the strengthening of the European Research Area (ERA) by mobilising European researchers, funders and other stakeholders. The work of FACCE-JPI helped build and supported several of the GEH networks.

FACCE-JPI Strategic Research agenda 2020

In 2020 FACCE-JPI launched its renewed Strategic Research Agenda. The updated SRA outlines how FACCE-JPI will continue to align and co-design research and deliver knowledge for addressing the challenges of sustainable and resilient agricultural production systems integrating the interdependent climate system, food system and ecosystem.

The SRA uses four core themes to outline a path towards an agricultural sector that respects the planetary boundaries, preserves and encourages biodiversity, reduces emissions and inputs, embraces new approaches such as agroecology, and at the same time provides a sufficient and healthy diet.

Core Theme 1

An agricultural sector that contributes to climate neutrality - investigates the changes needed to reduce the agricultural contributions to climate change. This includes the reduction of greenhouse gas (GHG)

emissions, and the improvement and conservation of carbon storage, driven by technology development and changes in agricultural practices and dietary habits.

Core Theme 2

Sustainable & resilient agriculture - focusses on the need to transition to more resilient farming practices, better adapted to the impacts of climate change. For this, major changes to adapt to societal and economic developments are needed and the value of ecosystem services has to be recognised. The associated risks require careful management in order to establish successful resilient farming enterprises fulfilling all dimensions of sustainability.

Core Theme 3

Nutrition-sensitive agricultural production for food security - addresses the need to provide sufficient, healthy and nutritious food for all. It highlights the changes necessary to get away from a diet mainly based on available calories and to go towards diverse diets based on nutritional quality. Dietary diversification and a focus on nutritional quality will not only help to increase the diversification of production systems but also support attempts to tackle serious issues such as malnutrition and obesity.

Core Theme 4

Trade-offs and synergies between food production, ecosystems and climate - will enhance our understanding of the trade-offs and synergies between food security, biodiversity, ecosystems and climate and create support to take decisions for end users. For this, better attention to ethical issues is needed as well as closer connection between science and policy, and the improvement of methodology to establish the economic value of ecosystem services.

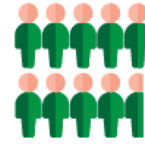
These core themes are not only closely related but also further connected through cross-cutting topics such as:

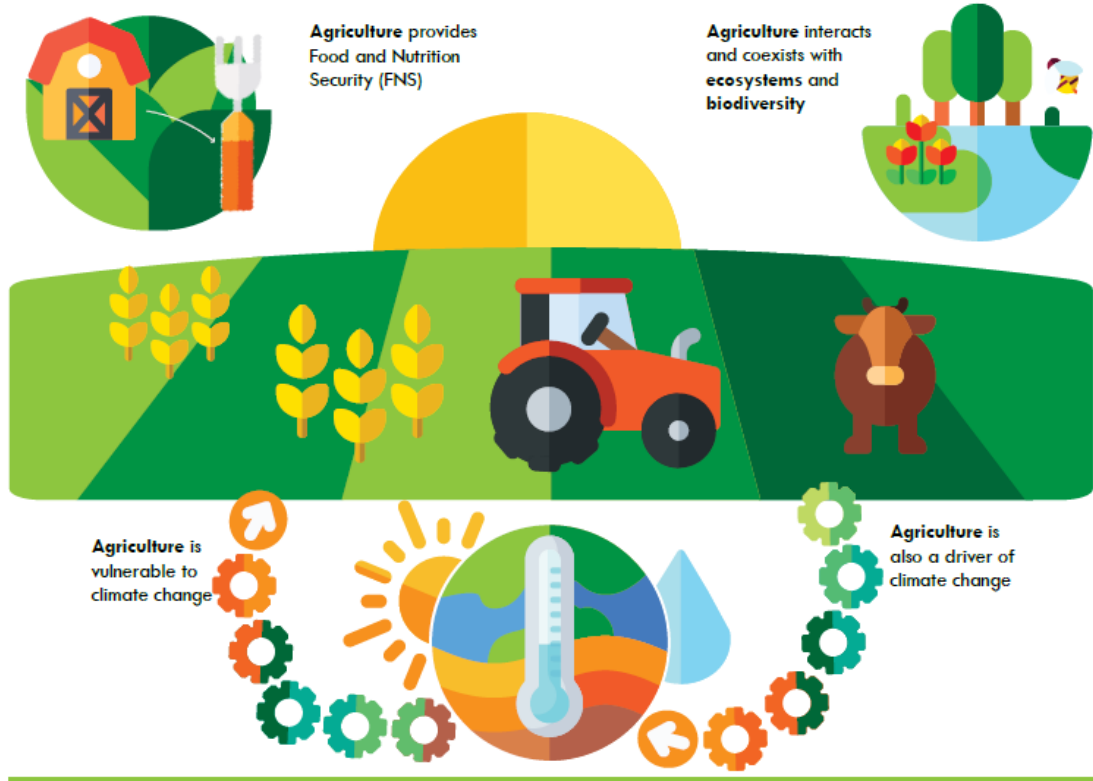
- life science generating innovation with radical transformation potential for the primary production sector,
- the increasing need to better include Responsible Research and Innovation approaches,
- digitalisation and its impacts,
- the awareness of societal change,
- the use of context-specific approaches, and
- the importance of research to inform policy.



FACCE-JPI addresses challenges in food security, agriculture and climate change

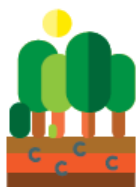
A key global challenge is to sustainably increase the supply of healthy and nutritious food and other ecosystem services for 9.7 billion inhabitants by 2050, while maintaining economic and social development from limited resources under the pressures imposed by the effects of climate and environmental change.

 **9.7 billion inhabitants by 2050**



Science must be mobilised. Cross-border collaboration offers the opportunity for a more efficient use of scarce resources. FACCE-JPI has been working successfully for the last 10 years to define the critical research elements needed for a European response.

Mitigation efforts are crucial in a path towards carbon neutrality



Increase carbon sequestration



Reduce GHG production

Adaptation measures reduce damage and increase resilience of agri-food systems



Icons Freepik from www.flaticon.com

Figure 17.1: Challenges in food security, agriculture and climate change. From: FACCE-JPI Strategic Research Agenda 2020

17.3 SCAR Foresight

About

Since its re-launch in 2004, the [Standing Committee on Agricultural Research](#) (SCAR) has provided the European Commission (EC), Member States and Associated Countries with independent policy advice on better cooperation and alignment of research activities in agriculture and the wider bioeconomy in Europe. SCAR has been a major catalyst for the coordination of national research programmes, where it has helped shape the beginnings of an integrated European Research Area. The Committee plays an important role in coupling research and innovation and in removing barriers to innovation, and aims to make it easier for public-public and public-private sectors to work together in delivering innovation that tackles the challenges faced in the bioeconomy area.

SCAR currently represents 37 different countries, the members being ministries (or other organisations such as research councils) from all EU Member States, with Candidate and Associated Countries as observers.

One of SCAR's main activities is horizon scanning and foresight. The SCAR Foresight Group oversees the execution of relevant studies, once this has been agreed at the SCAR plenary meeting.

SCAR Foresight 5, 2020

To make change happen, what knowledge do we need and how to use it? That is the subject of the SCAR Foresight 2020 report. The aim is to show, to the European Commission, the EU member states and associated countries, where current trends are pointing on diet, farming, environment and related domains. From there, it is analysed how to move to a better world, focusing on three main routes, or transitions: 1) improving diet and nutrition, 2) increasing circularity in the food system, and 3) restoring lost biodiversity. In broad terms, the report shows how research and innovation can help devise better policies, and help to “build back better” after the pandemic.

Foresight has devised a list of targets related directly or indirectly to food and agriculture and to the Sustainable Development Goals. Foresight believes that these targets must be met by Europe by 2050 to sustain human and other life indefinitely, and maintain a fair and safe society.

Targets EU+ 2050:

- Zero CO₂-equivalent net emissions by 2050
- Restore the level of biodiversity extant in 2000
- 2/3 of Europe's land needs ecosystem restoration
- Keep freshwater use at recent level
- Reduce phosphorous by 81% in 2050, and nitrogen by 86%
- Reduce pesticides by 75% in 2050
- Health, normal body weight
- No gender discrimination
- All animals treated according to stringent welfare standards
- Fair income for farmers
- Access to Internet for all in rural areas

Getting there (1): **Healthy, Sustainable Diets for All**

Research topics for Sustainable and Healthy Diets for All – A social imperative

- Developing agriculture, fishery and forestry methods that result in more diverse and nutritious diets
- Developing new, sustainable foods, food production and processing models, and food quality criteria
- Analysing and monitoring the environmental and social impact of what we eat
- Designing better urban food environments for choosing and buying healthier, sustainable foods
- Education, communication, ‘nudging’ consumers to eat sustainably and healthily

Getting There (2): **Towards a ‘Circular’ Food Supply**

Research topics for a Circular Bioeconomy – A Road to Sustainability

‘Strong sustainability’ in farming

- Developing methods to ‘close the loop’ in agriculture, forestry and aquaculture, so waste is reduced and circularity achieved
- ‘Regenerative’ agriculture, harnessing natural methods to improve soil health, sustainability, diversity and productivity
- Strategies for radical reduction of antibiotics and synthetic pesticide and fertiliser in farming
- Ways to make farming, fishing and forestry more viable economically – and resilient
- New services for rural and agricultural communities that enhance their well-being

Shaping a bio-based circular economy

- New logistic and digital infrastructures for circularity
- New ways to get industries or regions working together for circularity
- Carbon-neutral technologies for biorefineries
- New materials, bioplastics, waste conversion techniques and other basic tools
- New ways to govern a circular economy, and the trade-offs required
- Devising new business models to get people to use and support circular food practices
- Identifying and managing competing values and visions among stakeholders

Getting There (3): **Towards Greater Diversity**

Research topics for diversifying agriculture and food systems – a key to resilience

- Diverse farming and food production systems, sustainable food processing models
- Diversifying food retail channels, for a greener, resilient system
- Supporting the role of small farms and fishers in a diversified food system
- Interdisciplinary research to boost resilience and long-term stability in agriculture and food systems, and to reduce vulnerability to shocks.
- Monitoring, measuring and disseminating knowledge about ecosystem services. This would include digital tools that encourage citizen science

Cross-Cutting Research Themes

The SCAR Foresight 5 report also looks across the wide range of inter-related problems of food and agriculture and has identified some cross-cutting research themes that need special attention in designing EU or national programmes. Research and innovation that can provide solutions to these cross-cutting issues will have broad impact:

- Food, well-being and society. How what we eat and how we grow it shapes our identities and well-being – and can speed or block change
- Social innovation. New businesses, partnerships and services to help change happen.
- Agro-ecology. How farming methods interact with the environment, and how to get a better, greener outcome.
- Digital transformation of the bioeconomy. New tools, services and policies in digital technologies that can support change and speed up some of the processes.
- Foresight. New study methods to track and understand how major trends and technologies could shape our future – how to prepare for different futures in an uncertain world.
- Coping with disaster. Understanding how shocks hit some people and regions worse than others, and how best to prepare for the unknown.
- Finance for transition. How financial markets, debt, subsidies and investment shape the way we produce and consume food, and how to bend those factors to support rather than block change.

3 pathways to a 'safe and just operating space'



Figure 17.2: Three pathways to a 'safe and just operating space'. *From: Resilience and transformation. Report of the 5th SCAR Foresight Exercise Expert Group Natural resources and food systems: Transitions towards a 'safe and just' operating space, 2020.*

A close-up photograph of several golden wheat stalks with long, thin awns, set against a clear blue sky. The wheat is in sharp focus, showing the texture of the grains and the delicate structure of the awns. A white rectangular box is overlaid on the image, containing the text "Relevant EU policies and strategies".

Relevant EU policies and strategies

This chapter gives a selection of EU policies, strategies, missions and other documents that are considered relevant to the scope and the work of the Green ERA-Hub.

18.1 The European Green Deal

Based on consilium.europa.eu, September 2023

The European Commission acknowledges climate change and environmental degradation as an existential threat to Europe and the world. To overcome these challenges, the European Commission launched the Green Deal in 2019. The Green Deal is the strategy that will transform the EU into a modern, resource-efficient and competitive economy, ensuring:

- No net emissions of greenhouse gases by 2050
- Economic growth decoupled from resource use
- No person and no place left behind

The European Green Deal is a package of policy initiatives, which aims to set the EU on the path to a green transition, with the ultimate goal of reaching climate neutrality by 2050. It supports the transformation of the EU into a fair and prosperous society with a modern and competitive economy. It underlines the need for a holistic and cross-sectoral approach in which all relevant policy areas contribute to the ultimate climate-related goal. The package includes initiatives covering the climate, the environment, energy, transport, industry, agriculture and sustainable finance – all of which are strongly interlinked.

The [initiatives](#) included in the Green Deal are:

Fit for 55

The Fit for 55 package aims to translate the climate ambitions of the Green Deal into law. The package is a set of proposals to revise climate-, energy- and transport-related legislation and put in place new legislative initiatives to align EU laws with the EU's climate goals. The package of proposals aims at providing a coherent and balanced framework for reaching the EU's climate objectives, which:

- ensures a just and socially fair transition
- maintains and strengthens innovation and competitiveness of EU industry while ensuring a level playing field vis-à-vis third country economic operators
- underpins the EU's position as leading the way in the global fight against climate change

European climate law

The European climate law regulation turns the political ambition of reaching climate neutrality by 2050 into a legal obligation for the EU. By adopting it, the EU and its member states committed to cutting net greenhouse gas emissions in the EU by at least 55% by 2030, compared to 1990 levels. This target is legally binding and based on an impact assessment carried out by the Commission.

The main actions included in the regulation are:

- mapping out the pace of emission reductions until 2050 to give predictability to businesses, stakeholders and citizens

- developing a system to monitor and report on the progress made towards the goal
- ensuring a cost-efficient and socially-fair green transition

EU strategy on adaptation to climate change

The strategy outlines a long-term vision for the EU to become a climate-resilient society that is fully adapted to the unavoidable impacts of climate change by 2050.

The measures set out in the strategy include:

- better gathering and sharing of data to improve access to and exchange of knowledge on climate impacts
- nature-based solutions to help build climate resilience and protect ecosystems
- integration of adaptation in macro-fiscal policies

The conclusions give political guidance to the Commission on the implementation of the strategy.

In March 2022, the Council adopted conclusions calling for the adaptation of civil protection to extreme weather events resulting from climate change. Ministers called for the adaptation of civil protection systems with a focus on:

- prevention
- preparedness
- response
- recovery

EU biodiversity strategy for 2030

The EU biodiversity strategy for 2030 aims to help recover Europe's biodiversity by 2030. This would bring benefits for people, the climate and the planet.

The actions set out in the strategy include:

- extending protected land and sea areas in Europe
- restoring degraded ecosystems by reducing the use and harmfulness of pesticides
- increasing funding of actions and better monitoring of progress

In June 2023, the Council agreed on a negotiating position on the proposed nature restoration law which aims to put into legislation some of the goals of the biodiversity strategy. The rules would set a binding target at EU level, which would require member states to put in place effective restoration measures to cover at least 20% of the EU's land and sea areas by 2030.

Farm to fork strategy

The Commission's farm to fork strategy aims to help the EU achieve climate neutrality by 2050, by shifting the current EU food system towards a sustainable model.

In addition to food security and safety, the strategy's main goals are to:

- ensure sufficient, affordable and nutritious food within planetary limits
- support sustainable food production

- promote more sustainable food consumption and healthy diets

European industrial strategy

The aim of the EU's industrial strategy is to support the industry in its role as an accelerator and enabler of change, innovation and growth. An update to the industrial strategy, published by the Commission in May 2021, is aimed at strengthening resilience and advancing Europe's competitiveness. It strives to enable Europe's industry to lead the green and digital transformation and become the global driving force in the shift towards climate neutrality and digitalisation.

Circular economy action plan

Decoupling economic growth from resource use and shifting to circular systems in production and consumption is key to achieving EU climate neutrality by 2050. The action plan envisages over 30 action points on designing of sustainable products, circularity in production processes and empowering consumers and public buyers. It targets sectors such as electronics and ICT, batteries, packaging, plastics, textiles, construction and buildings, and food.

Batteries and waste batteries

Demand for batteries is expected to grow by more than ten-fold by 2030. The EU has adopted a regulation on batteries to create a circular economy for the sector by targeting all stages of the life cycle of batteries, from design to waste treatment. This initiative is of major importance, particularly in view of the massive development of electric mobility.

A just transition

The EU has introduced a just transition mechanism to provide financial and technical support to the regions most affected by the move towards a low-carbon economy. It will help mobilise at least €55 billion over the period 2021-2027 for:

- people and communities – facilitating employment opportunities and reskilling, improving energy-efficient housing and fighting energy poverty
- companies – making the transition to low-carbon technology attractive for investment, providing financial support for and investment in research and innovation
- member states or regions – investing in new green jobs, sustainable public transport, digital connectivity and clean energy infrastructure

Clean, affordable and secure energy

As 75% of EU greenhouse gas emissions come from energy use and production, the decarbonisation of the energy sector is a crucial step towards a climate-neutral EU.

The EU is working at several levels to achieve these objectives:

- supporting the development and uptake of cleaner energy sources, such a renewable offshore energy and hydrogen
- fostering integration of energy systems throughout the EU
- developing interconnected energy infrastructure via EU energy corridors

- revising the current legislation on energy efficiency and renewable energy, including their 2030 targets

The buildings sector is one of the largest energy consumers in Europe and is responsible for more than one third of the EU's greenhouse gas emissions. In June 2021, EU ministers approved conclusions on the Commission's renovation wave strategy emphasising the aspects of social inclusion, economic recovery and green transition.

EU chemicals strategy for sustainability

The strategy sets out a long-term vision for the EU chemicals policy, wherein the EU and member states want to:

- better protect human health
- strengthen the industry's competitiveness
- support a toxic-free environment

The strategy is an essential part of the European Green Deal and its zero-pollution ambition.

EU forest strategy for 2030

As one of the flagship elements of the European Green Deal, the EU forest strategy for 2030, presented by the Commission in July 2021, builds on the EU's biodiversity strategy and forms a key part of efforts to reduce greenhouse gas emissions by at least 55% by 2030.

The proposed measures include:

- promoting sustainable forest management
- providing financial incentives for forest owners and managers to adopt environmentally friendly practices
- improving the size and biodiversity of forests, including by planting 3 billion new trees by 2030

The EU has adopted rules to reduce the EU's impact on global deforestation. The regulation, adopted in May 2023, will ensure that products purchased, used and consumed by citizens on the EU market do not contribute to deforestation and forest degradation worldwide.

18.2 Farm to Fork strategy

Based on consilium.europa.eu, September 2023

The EU is transforming the way food is produced and consumed in Europe to:

- reduce the environmental footprint of food systems
- strengthen resilience against crises
- keep on ensuring healthy and affordable food also for future generations

The *farm to fork* strategy is:

The Commission presented the farm to fork strategy in May 2020, as one of the key actions under the European Green Deal. Contributing to achieving climate neutrality by 2050, the strategy intends to shift the current EU food system towards a sustainable model.

While recalling food security and safety as priorities, the strategy's main goals are to:

- ensure sufficient, affordable and nutritious food within planetary limits
- halve the use of pesticides and fertilisers and sales of antimicrobials
- increase the amount of land devoted to organic farming
- promote more sustainable food consumption and healthy diets
- reduce food loss and waste
- combat food fraud in the supply chain
- improve animal welfare

The transition to a more environmentally-friendly food system aims to generate new business opportunities which have a positive impact on the revenues of agri-food operators.

In October 2020, the Council adopted conclusions on the strategy, endorsing the goal of developing a European sustainable food system, from production to consumption. Member states stressed the need to ensure:

- sufficient and affordable food while contributing to EU climate neutrality by 2050
- a fair income and strong support for primary producers
- competitiveness of the EU agriculture at global level

The farm to fork strategy is aligned with the 2030 EU biodiversity strategy — the two proposals being presented as complementary.

The farm to fork strategy has the following policy initiatives:

Organic action plan

The action plan on organic farming, presented by the Commission in March 2021 as part of the farm to fork strategy, outlines a set of actions to increase organic farming in the EU. Its main goal is to boost organic production to reach 25% of the EU's agricultural land use by 2030. EU member states are encouraged to develop national organic farming plans.

The main points agreed by EU ministers are:

- organic farming is important for the sustainability of European agriculture
- developing organic production helps secure incomes and create jobs
- balanced demand and supply of organic products ensure profitability for the sector
- specificities and different situations in member states need be considered when defining targets and interventions
- involving public and private stakeholders is crucial to reaching the strategy's goals

Food security plan

The onset of the COVID-19 pandemic revealed the vulnerability of Europe's food chain to severe supply challenges. In November 2021, the Commission published a communication outlining a contingency plan to ensure food security in Europe during crises. The proposed measures aim to help the EU face up to challenges including extreme weather events, plant and animal health issues, and shortages of key inputs such as fertilisers, energy and labour. They include:

- the creation of a European food security crisis preparedness and response mechanism (EFSCM)
- the establishment of an expert group to help ensure the EU is fully prepared for potential food supply challenges

Global standards on food safety

In February 2022, the Council approved conclusions on food safety standards in international trade, calling for greater integration of sustainability concerns in the work of the Codex Alimentarius Commission. Set up in 1963 by the UN Food and Agriculture Organization and the World Health Organization, the global body provides a forum for negotiations on international food standards, guidelines and codes of practice. The EU and its member states are members of this body.

Carbon farming

Farming and forestry can play a key role in the fight against climate change by absorbing carbon from the atmosphere. In April 2022, the Council adopted conclusions on carbon farming, based on the Commission's sustainable carbon cycles communication which was presented in December 2021, and aiming to encourage agricultural practices that help to capture carbon from the atmosphere and store it in soil or biomass in a sustainable way.

Climate-friendly practices may include:

- planting hedges or trees
- growing legumes
- using catch crops and cover crops
- practising conservation agriculture and maintaining peatlands
- afforestation and reforestation

In the conclusions, ministers recognised the importance of providing financial support that offers sufficient incentive to farmers and foresters to encourage them to adopt these climate-friendly practices.

Sustainable aquaculture

The EU is highly dependent on imports of fishery and aquaculture products. Yet there is potential for this sector to grow in the EU. In July 2022, EU ministers approved Council conclusions calling for a sustainable, resilient and competitive marine and freshwater aquaculture sector in the EU.

18.3 EU biodiversity strategy for 2030

Based on consilium.europa.eu, September 2023

The EU and its member states are committed to setting biodiversity on the road to recovery by 2030. The EU biodiversity strategy for 2030 is the cornerstone of nature protection in the EU and is a key element of the European Green Deal.

The Commission presented the strategy in May 2020. The main actions to be delivered by 2030 include:

- the creation of protected areas covering at least 30% of the EU's land and sea area, extending the coverage of existing Natura 2000 areas
- the restoration of degraded ecosystems across the EU by 2030 through a series of specific commitments and measures, including the reduction in the use and risk of pesticides by 50% by 2030 and the planting of 3 billion trees across the EU
- the allocation of €20 billion per year to protect and promote biodiversity through EU funds and national and private funding
- the creation of an ambitious global biodiversity framework

Ministers called for a significant proportion of 30% of the EU budget and Next Generation EU expenditure allocated to addressing climate action to be invested in biodiversity and nature-based solutions promoting biodiversity. The 'farm to fork' and the EU biodiversity strategies, which were jointly presented by the Commission in 2020, share multiple goals and targets: for instance the reduction in the use of pesticides and fertilisers, the restoration of agricultural land and the management of water.

Nature restoration law

The EU is working on new rules to restore biodiversity and ecosystems, in line with the goals of the EU biodiversity strategy for 2030. The nature restoration law aims to put in place recovery measures that will cover at least 20 % of the EU's land and 20 % sea areas by 2030, and all ecosystems in need of restoration by 2050. The rules would be the first ever focused specifically on the recovery of nature in EU member states.

The nature restoration rules would set binding targets for restoration action for:

- degraded land and sea habitats
- pollinators
- agricultural ecosystems
- urban areas
- rivers and floodplains
- forests

Other EU policies to protect biodiversity

EU efforts to stop the loss of biodiversity and ecosystems are grounded in legislation. This includes the:

- birds and habitats directives
- water framework directive
- marine strategy framework directive

Legislation covering sectors such as pollution, invasive alien species and climate change also contributes to conserving biodiversity by tackling the drivers of its loss. To fund actions on the ground to protect and restore nature, the EU has set up the LIFE programme. Launched in 1992, it is the only EU funding programme entirely dedicated to environmental and climate objectives.

18.4 Soil strategy for 2030

Based on environment.ec.europa.eu, October 2023

The [EU soil strategy for 2030](#) sets out a framework and concrete measures to protect and restore soils, and ensure that they are used sustainably. It sets a vision and objectives to achieve healthy soils by 2050, with concrete actions by 2030. It also announces a new Soil Health Law by 2023 to ensure a level playing field and a high level of environmental and health protection.

The new EU soil strategy for 2030 is a key deliverable of the EU biodiversity strategy for 2030. It will contribute to the objectives of the European Green Deal. The mission ‘A Soil Deal for Europe’ supports the implementation of the strategy by finding solutions to protect and restore soil health.

The EU soil strategy aims to ensure that, by 2050:

- all EU soil ecosystems are healthy and more resilient and can therefore continue to provide their crucial services
- there is no net land take and soil pollution is reduced to levels that are no longer harmful to people’s health or ecosystems
- protecting soils, managing them sustainably and restoring degraded soils is a common standard

The strategy contains several key actions:

- tabling a dedicated legislative proposal on soil health by 2023 to enable the objectives of the EU soil strategy and achieve good soil health by 2050
- making sustainable soil management the new normal, by proposing a scheme for land owners to get their soils tested for free, promoting sustainable soil management through the CAP and sharing best practices
- considering proposing legally binding objectives to limit drainage of wetlands and organic soils and to restore managed and drained peatlands to mitigate and adapt to climate change
- investigating streams of excavated soils and assessing the need and potential for a legally binding “soil passport” to boost circular the economy and enhance reuse of clean soil
- restoring degraded soils and remediating contaminated sites

- preventing desertification by developing a common methodology to assess desertification and land degradation
- increasing research, data and monitoring on soil
- mobilising the necessary societal engagement and financial resources

18.5 Food 2030

Based on research-and-innovation.ec.europa.eu, October 2023; FOOD 2030 Research and Innovation Pathways for action 2.0, November 2023

Food 2030 is the EU's research and innovation policy framework supporting the transition towards sustainable, healthy and inclusive food systems, that respect planetary boundaries. It is in line with, and supports the goals of the European Green Deal, Farm to Fork strategy and Bioeconomy strategy. Food 2030 is underpinned by the need to foster a multi-actor and systemic approach to research and innovation capable of delivering co-benefits for people's health, our climate, our planet and communities.

Food 2030 sets out a vision for research and innovation that covers the entire food system, linking multiple sectors from primary production (from land and water) to food processing, retail and distribution, packaging, waste and recycling, food services and consumption. It joins up research and innovation actors and activities in different areas and across disciplines to find answers to interconnected and pressing challenges.

Its ambition is to

- strengthen the science-policy-society interface
- improve research and innovation policy coherence and alignment
- boost and leverage research and innovation funding and investment
- narrow the innovation gap (the gap between actual innovation and the innovation that is needed)
- increase market take-up and societal relevance of food systems solutions that can include food products, new ways of doing things, tools and technologies, and services
- support the role of disruptive technologies, new approaches and business models, as well as social, institutional and governance innovation relevant to the food systems transition

The ambition of Food 2030 is to support research and innovation that can deliver co-benefits to these 4 thematic priorities:

Nutrition for sustainable, affordable and healthy diets

- tackling malnutrition and obesity
- improving nutrition and diets for all (for example, to support healthy ageing)
- developing alternative proteins to foster plant-rich diets
- incorporating microbiome-based foods to unlock the power of the human microbiome
- exploring how behavioural changes can influence consumption and dietary habits
- improving food authenticity and safety

- encouraging diversity by forgotten crops for nutrition and resilience

Climate-smart and environmentally sustainable food systems

- climate-smart food systems that are adaptive to climate change, preserve natural resources and ecosystem functions, limit environmental degradation and contribute to climate change mitigation
- natural resources – water, soil, land and sea – are managed responsibly within the Earth’s capacity to ensure that they are available to future generations

Circularity and resource efficiency

- striving towards zero food loss and waste
- more efficient recycling of food loss and waste
- rethinking food packaging for better biodegradable options
- more tailored and local food, and short food supply chains
- ways to reduce the
- use of water and energy across food systems so as to increase resource efficiency across all food system sectors

Innovation and empowering communities

- fostering governance innovation at all levels (local to global), underpinned by a strong science-policy interface
- empowering towns, cities, regions and local actors as agents of change
- tackling food poverty and achieving sustainable and accessible food in cities, towns and regions
- fostering citizen science, food system education and skills building
- developing a true cost-sharing economy for food production and consumption
- supporting a place-based food systems sharing economy from farm to fork and fostering social innovation
- implementing data-driven solutions

11 pathways to achieve the goals

Funding will be made available under Horizon Europe to help find answers to Food 2030 priorities. It will concentrate on 11 areas known as [pathways for action](#):

1. Governance for food systems change
2. Urban food system transformation
3. Food from the oceans and freshwater resources
4. Alternative proteins for dietary shift
5. Food waste and resource-efficient food systems
6. The microbiome world
7. Nutrition and sustainable healthy diets
8. Food safety systems of the future
9. Food systems Africa
10. Data and digital transformation
11. Zero Pollution food systems

Food 2030 has inspired and led to the creation of the Horizon Europe Partnership for Safe and Sustainable Food Systems for People, Planet and Climate and is supportive of the goals of the EU Mission: A Soil Deal for Europe.

18.6 Bioeconomy strategy

Based on research-and-innovation.ec.europa.eu, October 2023

The [bioeconomy strategy](#) will accelerate the deployment of a sustainable European bioeconomy. It has 5 goals:

- ensure food and nutrition security
- manage natural resources sustainably
- reduce dependence on non-renewable, unsustainable resources
- limit and adapt to climate change
- strengthen European competitiveness and create jobs

The strategy contributes to the European Green Deal, as well as industrial, circular economy and clean energy innovation strategies. They all highlight the importance of a sustainable, circular bioeconomy to achieve their objectives. The strategy is implemented by means of an action plan.

The bioeconomy action plan contains 14 concrete actions:

Strengthen and scale up the biobased sectors, unlock investments and markets

- mobilise stakeholders in developing and deploying sustainable biobased solutions
- launch a €100 million circular bioeconomy thematic investment platform
- analyse enablers and bottlenecks for the deployment of biobased innovations
- promote and develop standards
- facilitate the deployment of new sustainable biorefineries
- develop substitutes to fossil-based materials that are biobased, recyclable and marine biodegradable

Deploy local bioeconomies rapidly across the whole of Europe

- launch a strategic deployment agenda for sustainable food and farming systems, forestry and biobased products
- launch pilot actions for the deployment of bioeconomies in rural, coastal and urban areas
- support regions and EU countries to develop bioeconomy strategies
- promote education, training and skills across the bioeconomy

Understand the ecological boundaries of the bioeconomy

- enhance knowledge on biodiversity and ecosystems
- monitor progress towards a sustainable bioeconomy
- promote good practices to operate the bioeconomy within safe ecological limits
- enhance the benefits of biodiversity in primary production

Foresight from The Standing Committee on Agricultural Research (SCAR) has been instrumental in developing national bioeconomy research and innovation strategies for EU countries and for the Commission.

The BIOEAST initiative offers a shared strategic research and innovation framework for working towards sustainable bioeconomies in Central and Eastern European countries.

18.7 Environment action programme to 2030

Based on environment.ec.europa.eu, October 2023

On 2 May 2022 the 8th Environment Action Programme entered into force, as the EU's legally agreed common agenda for environment policy until 2030. The action programme reiterates the EU's long-term vision to 2050 of living well, within planetary boundaries. It sets out priority objectives for 2030 and the conditions needed to achieve these. Building on the European Green Deal, the action programme aims to speed up the transition to a climate-neutral, resource-efficient economy, recognising that human wellbeing and prosperity depend on healthy ecosystems.

The 8th EAP calls for active engagement of all stakeholders at all levels of governance, to ensure that EU climate and environment laws are effectively implemented. It forms the EU's basis for achieving the United Nation's 2030 Agenda and its Sustainable Development Goals.

The long-term priority objective is that, by 2050 at the latest, Europeans live well, within planetary boundaries, in a well-being economy where nothing is wasted. Growth will be regenerative, climate neutrality will be a reality, and inequalities will have been significantly reduced.

There are six priority objectives to 2030:

- achieving the 2030 greenhouse gas emission reduction target and climate neutrality by 2050
- enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change
- advancing towards a regenerative growth model, decoupling economic growth from resource use and environmental degradation, and accelerating the transition to a circular economy
- pursuing a zero-pollution ambition, including for air, water and soil and protecting the health and well-being of Europeans
- protecting, preserving and restoring biodiversity, and enhancing natural capital
- reducing environmental and climate pressures related to production and consumption (particularly in the areas of energy, industry, buildings and infrastructure, mobility, tourism, international trade and the food system)

In line with the European Green Deal's oath to 'do no harm,' the 8th EAP supports an integrated approach to policy development and implementation. Article 3 of the action programme sets out the enabling conditions needed to achieve the priority objectives. Among others, it highlights the need for:

- a full implementation of existing legislation
- significantly decreasing the Union's material and consumption footprints
- achieving environmental fairness

- boosting sustainable finance
- making use of economic and tax incentives to facilitate the sustainability transition
- phasing out fossil fuel subsidies
- developing a summary 'beyond GDP' dashboard
- uptake by and cooperation at all levels of policy-making between different levels of actors
- harnessing the potential of digitalisation
- ensuring that policy action is firmly anchored in latest science and knowledge

The Environment action programme to 2030 covers the following policy areas:

- Air: EU action to improve air quality and reduce air pollution
- Chemicals: EU action to ensure chemicals are safe, for health and the environment
- Circular economy: The EU's transition to a circular economy with a focus on green growth
- Industry: EU action to make industry more sustainable and reduce industrial emissions
- Marine and coastal environment: EU action to protect Europe's coasts, seas and oceans
- Nature and biodiversity: EU action on environmental conservation and protection
- Noise: EU action to reduce environmental noise pollution
- Plastics: EU action on plastic production and pollution to contribute to a circular economy
- Soil and land: EU action for the sustainable use of soil and land
- Sustainable development: EU commitment to sustainable development in Europe and worldwide
- Urban environment: EU action to promote the sustainability of European cities
- Waste and recycling: EU action on waste management, treatment and recycling
- Water: EU action on water issues, to protect water resources

18.8 Long-term vision for rural areas

Based on ec.europa.eu, October 2023

The European Commission has put forward a [long-term vision](#) for the EU's rural areas, identifying the challenges and concerns, as well as highlighting some of the most promising opportunities that are available to these regions. Based on foresight and wide consultations with citizens and other actors in rural areas, the Vision proposes a Rural Pact and a Rural Action Plan, which aim to make Europe's rural areas stronger, connected, resilient and prosperous.

To successfully respond to the megatrends and challenges posed by globalisation, urbanisation, ageing and to reap the benefits of the green and digital transitions, place-sensitive policies and measures are needed that take into the account the diversity of EU's territories, their specific needs and relative strengths.

This long-term Vision for the EU's rural areas aims to address those challenges and concerns, by building on the emerging opportunities of the EU's green and digital transitions and on the lessons learnt from the COVID 19 pandemic, and by identifying means to improve rural quality of life, achieve balanced territorial development and stimulate economic growth.

Rural Pact

The Rural Pact will engage actors at EU, national, regional and local level, to support the shared goals of the Vision, foster economic, social and territorial cohesion and respond to the common aspirations of rural communities. The Commission will facilitate this framework through existing networks, and encourage the exchange of ideas and best practices at all levels.

EU Rural Action Plan

The Commission has also put forward an Action Plan to prompt sustainable, cohesive and integrated rural development. Several EU policies already provide support to rural areas, contributing to their balanced, fair, green and innovative development. Among those, the Common Agricultural Policy (CAP) and the Cohesion Policy will be fundamental in supporting and implementing this Action Plan, while being accompanied by a number of other EU policy areas that together will turn this Vision into a reality.

The Vision and Action Plan identify four areas of action, supported by flagship initiatives, to enable:

- Stronger: focus on empowering rural communities, improving access to services and facilitating social innovation;
- Connected: to improve connectivity both in terms of transport and digital access;
- Resilient: preserving natural resources and greening farming activities to counter climate change while also ensuring social resilience through offering access to training courses and diverse quality job opportunities;
- Prosperous: to diversify economic activities and improve the value added of farming and agri-food activities and agri-tourism.

18.9 The EU missions

Based on research-and-innovation.ec.europa.eu, October 2023

The 5 EU Missions launched by the European Commission aim to deliver concrete solutions to big societal challenges by putting research and innovation into a new role, combined with new forms of governance and collaboration, as well as by engaging citizens. From beating cancer to protecting our oceans, the Missions address issues that really matter for ordinary citizens. They are grounded on the idea that complex societal challenges require coordinated and interdisciplinary efforts across Europe. They have a clear goal and a well-defined timeframe to help deliver concrete results with broad impact.

The 5 EU Missions are:

1. Adaptation to Climate Change: support at least 150 European regions and communities to become climate resilient by 2030
2. Cancer: working with Europe's Beating Cancer Plan to improve the lives of more than 3 million people by 2030 through prevention, cure and solutions to live longer and better
3. Restore our Ocean and Waters by 2030
4. 100 Climate-Neutral and Smart Cities by 2030

5. A Soil Deal for Europe: 100 living labs and lighthouses to lead the transition towards healthy soils by 2030

They put research and innovation into a new role, combined with new forms of governance and collaboration, as well as by engaging citizens.

For the GEH especially the mission Adaptation to Climate Change and the mission A Soil Deal for Europe are relevant. These missions are further described below.

Adaptation to Climate Change

The [Mission on Adaptation to Climate Change](#) focuses on supporting EU regions, cities and local authorities in their efforts to build resilience against the impacts of climate change.

The Mission contributes to putting the EU's adaptation strategy in practice by helping the regions to

- better understand the climate risks they are and will be confronted with in the future
- develop their pathways to be better prepared and cope with the changing climate
- test and deploy on the ground innovative solutions needed to build resilience

The Mission's objective is to accompany by 2030 at least 150 European regions and communities towards climate resilience. This Mission will also help deliver the European Green Deal.

EU countries, regions and cities have an essential role to play in implementing the Mission as they are key agents of change in deploying new technologies and experimenting innovative solutions that address regional and local needs. The Mission aims to get a wide range of regions and communities on board and assist them, alongside their national adaptation strategy, on their specific journey, whether they are just starting out or are already taking steps towards adaptation to climate risks.

Calls in the Adaptation to Climate Change mission are launched under the Horizon Europe Work Programme.

A Soil Deal for Europe

The mission [A Soil Deal for Europe](#) has the main goal to establish 100 living labs and lighthouses to lead the transition towards healthy soils by 2030.

The Mission leads the transition towards healthy soils by:

- funding an ambitious research and innovation programme with a strong social science component
- putting in place an effective network of 100 living labs and lighthouses to co-create knowledge, test solutions and demonstrate their value in real-life conditions
- developing a harmonised framework for soil monitoring in Europe
- raising people's awareness on the vital importance of soils

The mission has 8 objectives:

1. reduce desertification
2. conserve soil organic carbon stocks
3. stop soil sealing and increase re-use of urban soils

4. reduce soil pollution and enhance restoration
5. prevent erosion
6. improve soil structure to enhance soil biodiversity
7. reduce the EU global footprint on soils
8. improve soil literacy in society

The Mission will support the EU's ambition to lead on global commitments, notably the Sustainable Development Goals (SDGs), and contribute to the European Green Deal targets on sustainable farming, climate resilience, biodiversity and zero-pollution. It is also a flagship initiative of the long-term vision for rural areas.

Living labs are places where to experiment on the ground. Soil health living labs will be partnerships between multiple partners and different actors, like researchers, farmers, foresters, spatial planners, land managers, and citizens who come together to co-create innovations for a jointly agreed objective. Living Labs will be established at territorial, landscape or regional scale, with several experimental sites covered underneath.

Lighthouses are single sites, like a farm or a park, where to showcase good practices. These are places for demonstration and peer-to-peer learning. Here good practices are tested or in place and can be showed to inspire other practitioners to move towards sustainable land management. In addition, in lighthouse sites, researchers work together with land managers to ensure that research responds to concrete needs encountered in the field.

Calls in the A Soil Deal for Europe mission are launched under the Horizon Europe Work Programme.

18.10 EU-Africa Innovation Agenda

Based on research-and-innovation.ec.europa.eu, October 2023

On 20 July 2023, the African Union (AU) and the European Union (EU) adopted the new joint [AU-EU Innovation Agenda](#), which aims to transform and increase the innovative capacities and achievements of European and African researchers and innovators into tangible outputs, such as products, services, businesses and jobs. Supported by the Global Gateway, the AU-EU Innovation Agenda will represent the mainstay of the cooperation on Science, Technology and Innovation between Africa and Europe, for the next decade.

The Agenda includes 4 objectives, with short-, medium- and long-term actions, grouped according to the priority areas of AU-EU Cooperation in Research and Innovation (R&I), namely Public Health, Green Transition, Innovation and Technology and Capacities for Science, in addition to Cross-cutting issues.

The joint AU-EU Innovation Agenda is accompanied by the [Roadmap](#), which provides an overview of the governance and coordination of the Agenda as well as an inventory of implementing initiatives. It will be constantly updated on a quarterly basis to include additional initiatives in the coming years. Several initiatives will contribute to its implementation, including programmes by the European Commission such as Horizon Europe and the Global Gateway Africa-Europe Investment Package, the AU Commission, EU and AU Member States and other organisations.

18.11 CAP, potential eco-schemes

Based on agriculture.ec.europa.eu, October 2023

The Commission published a list of [potential agricultural practices](#) that the eco-schemes could support in the future common agricultural policy (CAP). This list aims to contribute to the debate around the CAP reform and its role in reaching the Green Deal targets. This list also enhances transparency of the process for establishing the Strategic CAP Plans, and provides farmers, administrations, scientists and stakeholders a base for further discussion on making the best use of this new instrument.

Part of the CAP reform currently under negotiations between the European Parliament, Council and the Commission, eco-schemes are a new instrument designed to reward farmers that choose to go one step further in terms of environmental care and climate action. The future CAP will play a crucial role in managing the transition towards a sustainable food system and in supporting European farmers throughout. Eco-schemes will contribute significantly to this transition and to the Green Deal targets.

CAP Strategic Plans will put into practice enhanced conditionality, eco-schemes, farm advisory services as well as agri-environmental and climate measures and investments to address the Green Deal targets, in particular those stemming from the Farm to Fork Strategy and the Biodiversity Strategy for 2030, and to fulfil the climate and environmental specific objectives of the CAP.

To be supported by eco-schemes, agricultural practices should:

- cover activities related to climate, environment, animal welfare and antimicrobial resistance
- be defined on the basis of the needs and priorities identified at national/regional levels in their CAP strategic plans
- their level of ambition has to go beyond the requirements and obligations set by conditionality
- contribute to reaching the EU Green Deal targets

The list of potential agricultural practices includes organic farming practices, agro-ecology such as crop rotation with leguminous crops or low intensity grass-based livestock system. Furthermore, they also comprise carbon farming, with for example conservation agriculture or the extensive use of permanent grassland. Other agricultural practices that could be supported by eco-schemes include precision farming with for instance precision crop farming to reduce inputs or the use of feed additives to decrease emissions from enteric fermentation, and husbandry practices in favour of animal welfare and/or reducing the needs for antimicrobial substances.



The European Partnerships

19. The European Partnerships

From: research-and-innovation.ec.europa.eu, December 2023

European Partnerships bring the European Commission and private and/or public partners together to address some of Europe's most pressing challenges through concerted research and innovation initiatives. They are a key implementation tool of Horizon Europe, and contribute significantly to achieving the EU's political priorities. By bringing private and public partners together, European Partnerships help to avoid the duplication of investments and contribute to reducing the fragmentation of the research and innovation landscape in the EU.

The partnership candidates were collected across 5 areas:

1. health
2. digital, industry and space
3. climate, energy and mobility
4. food, bioeconomy, natural resources, agriculture and environment
5. partnerships across themes

For the Green ERA-Hub, the Partnerships in food, bioeconomy, natural resources, agriculture and environment are most relevant. This is especially so for the AgroEcology Partnership, the Animal Health and Welfare Partnership and the FutureFoodS Partnership. The Green ERA-Hub aims to collaborate with the Partnerships, work in synergy and to prevent overlap.

19.1 The Agroecology Partnership

From: The Agroecology Partnership's SRJA, February 2023

Accelerating Farming Systems Transition: Agroecology Living Labs and Research Infrastructures; The Agroecology Partnership

The [partnership](#) aims to promote a European large-scale endeavour for an agricultural sector that is fit to meet the targets and challenges in relation to climate change, biodiversity loss, food security and sovereignty and the environment, while ensuring a profitable and attractive activity for farmers.

Vision

Team-up and unlock the transition to agroecology so that farming systems are resilient, productive and prosperous, place-sensitive, as well as climate, environment-ecosystem, biodiversity and people-friendly by 2050.

Objectives

Three **General Objectives** (GO, long-term goals) will contribute to achieving the 2050 vision of the partnership:

- **GO1.** Mainstream the principles of AE to redesign farming systems across a diverse Europe.

- **GO2.** Build-up and expand collaborations to co-create and share knowledge and solutions that empower all actors (producers, consumers, policy makers, civil society) to engage in AE transition.
- **GO3.** Contribute to fulfilling the Sustainable Development Goals and the Green Deal targets by 2030 and climate neutrality in Europe by 2050 by supporting the implementation of key EU strategies and policies.

To achieve these general objectives, this partnership will support research and related activities. The partnership will achieve this by focusing on five **Specific Objectives** (SO) to be delivered by the end of the partnership, 2030-2035:

- **SO1.** Increase research-based knowledge on the benefits and challenges of AE and its potential for farming, food, climate, ecosystem services and environmental impacts reduction as well as resource use and societal impacts; this implies research on e.g. AE benefits and trade-offs for climate change mitigation and adaptation.
- **SO2.** Develop and co-create innovations to reduce and share the risks of transition for both individuals and collectives. Living Labs, by definition, bring together actors to co-create innovation in real life conditions while reducing risks for both the individual farmer (or other actors) and the collective.
- **SO3.** Improve the sharing and access to knowledge on AE as well as reinforce the agricultural knowledge and innovation systems for AE across Europe, considering culture, gender, and youth aspects; this will be achieved through a network of Living Labs and RIs, as well as targeted communication to different actors; this also includes removing the current barriers and lock-ins that prevent the engagement of scientists, advisors and farmers in AE transition.
- **SO4.** Build a monitoring and data framework to measure progress of AE transition and improve data valorisation and sharing; harmonised methods and a set of common indicators will be developed to measure progress, integrating currently fragmented data repositories, including those of research infrastructures, and making them available.
- **SO5.** Exchange with policy makers (research and sectoral) and stakeholders on AE transition and mainstreaming of AE practices to contribute to improved governance, policies, and institutions, based on evidence and to provide supportive mechanisms; in order to achieve impact, the involvement of policy makers and stakeholders is needed and policies and governance adapted to support AE transition.

The following four core themes (CTs) have been identified by the Partnership to accomplish the Agroecology Partnership's vision and objectives, and identifying the knowledge and the innovations that are necessary to accelerate AE transition in a consistent way, encompassing local, national and European scales.

Core Theme 1

Redesigning agroecosystems – Under this core theme, the partnership will identify and test both suitable farming practices adapted to local conditions and appropriate landscape planning approaches aiming to reduce the use of agrochemical inputs through e.g. the closure of nutrient and energy flows, or the development of biological control methods, while enhancing landscape and agroecosystem biodiversity. The final aim of this CT is to increase the resilience of agroecosystems to climate change

and extreme climatic events, while increasing the provision of food, feed, fibre, biomass, and ecosystem services from farming. Socioeconomic aspects associated to the redesign of agroecosystems, and the development of decision support tools for farmers and advisors will also be covered by this CT.

Core Theme 2

Redesigning agroecology value chains – Activities under this core theme will focus on the adaptation of territorial/landscape value chains to the transformation of agroecosystems brought by the AE transition, through better understanding of farmer, market, and consumer linkages, with respect to agroecological products. It connotes the involvement of stakeholders, the provision of technological innovations and the construction of appropriate business models. Different scenarios must be constructed and assessed with the participation of the different stakeholders of those European districts/territories/regions engaged in AE transition, defining a common vision of the resulting landscape after the agreed interventions, and considering the potential associated socio-economic and environmental benefits and trade-offs. As is the case for other CTs, CT2 will build on the experience of the organic farming sector and cooperation with the Sustainable Food System candidate partnership is envisaged.

Core Theme 3

Agroecology Living Labs (LLs) and Research Infrastructures (RIs) as instruments enhancing multi-actor involvement for AE transition and the acceleration of creation and adoption of innovations. – Activities deployed under CT3 will increase knowledge and understanding on the criteria the AE LLs and RIs should meet to accelerate AE transition and the methodologies, tools, governance, and organisational aspects supporting their operation. LL indicators need to be defined both for assessing their impact on AE transition and their individual performance. Research under this CT will also identify the enablers and drivers promoting the participation of the different stakeholders in LLs and RIs, and subsequently propose sound incentives to enhance their cooperation.

Core Theme 4

Enablers of agroecology transition – Activities under this core theme will address the research needs related to the enabling environment needed to accelerate the AE transition, such as the enhancement of coherence across sectoral policies and instruments, the development and implementation of decision support tools for policy- and decision makers, and the incentives to engage stakeholders in long-term initiatives. The development and assessment of conceptual frameworks, methodologies, and tools will also be carried out under CT4.

19.2 The European Partnership Animal Health & Welfare

From: Strategic Research and Innovation Agenda EUP AH&W, 2023

The European Partnership [Animal Health & Welfare](#) (EUP AH&W) will generate key knowledge and develop innovative methodologies, tools and products to promote sustainability in livestock production, both for terrestrial and aquatic animals. It will support the development of an animal friendly livestock sector and reduce the risk of animal infections, both from endemic and emerging origin. The Partnership will also enhance public health and wellbeing by enhancing cross-sector collaboration in a One Health – One Welfare perspective.

EUP AH&W will actively engage with chain actors and stakeholders, and support evidence-based intervention and policy making in the fields of animal health and welfare.

Vision

The vision of the EU Partnership on Animal Health and Welfare is to provide society with a sustainable livestock production sector. Infectious animal diseases are controlled with appropriate means, antimicrobials are used prudently, and animal welfare is respected in every phase of the production process, until death. This will be achieved through strengthened cooperation between public research and innovation entities, and collaboration with relevant partners, including relevant authorities, the animal health industry and other stakeholders such as NGOs.

Ambition

The ambition of EUP AH&W is to build a strong research and innovation framework strengthening Europe's capacity to act on a preventive approach and raise healthy animals in sustainable systems that support a high level of animal welfare. It will bring together authorities responsible for and scientists active in the sectors of animal health, animal welfare, public health, food safety, economic sustainability and the environment. It will cover a large area of activities, such as farm management; animal based (welfare) measures; livestock resilience; zoonoses; vector-borne, food-borne pathogens and emerging diseases at primary production; and other issues such as antimicrobial resistance. The mobilisation of resources from both RPOs and FOs together with EC co-funding will allow to achieve ambitious, crosscutting, interdisciplinary and coordinated objectives at the transnational level.

In addition, a fifth transversal priority area of socio-economic aspects will be studied along the four previous ones.

Objectives

The general objectives of the Partnership are:

- GO1. To contribute to better control animal infectious diseases and to reinforce the preparedness of all actors
- GO2. To place animal welfare at the foreground of animal production

Based on the general objectives outlined above, the following four specific objectives are proposed by the Partnership:

- SO1. To facilitate the cooperation between all relevant actors on the prevention and control of animal infectious diseases and the monitoring of animal welfare
- SO2. To boost research and to increase the evidence-base to develop products and tools for animal disease control and animal welfare monitoring
- SO3. To enhance cross-sector cooperation and collaboration (One Health-One Welfare perspective)
- SO4. To strengthen the dissemination and uptake of project outputs to societal, political and private stakeholders

The Partnership on Animal Health and Welfare identified five priority areas which are each accompanied by operational objectives:

Priority Area: Surveillance / monitoring systems and risk assessment for animal health and welfare

- OO1. Contribute to design and harmonize surveillance and monitoring systems for animal health and welfare
- OO2. Contribute to adapt risk assessment and alert communication to the new needs in animal health and welfare

Priority Area: Procedures, methodologies and tools to analyse animal health and welfare

- OO3. To develop diagnostic procedures, methodologies and tools to support the surveillance of animal health
- OO4. To develop procedures, methodologies and tools to support the monitoring of animal Welfare

Priority Area: Management and husbandry guidelines on farm including aquaculture, during transport and at slaughter

- OO5. To develop guidelines and preventive tools to fight against animal infectious diseases on farm and during transport
- OO6. To develop guidelines and prototype solutions that advance animal welfare on farm, during transport and at the end of life

Priority Area: Treatments & vaccines

- OO7. To develop new interventions and treatments, or improve existing ones, against specific priority animal infectious disease
- OO8. To develop new vaccines or improve existing vaccines, including adjuvants and immunomodulators

Transversal Priority Area: Integrated approach, including socio-economic aspects of animal health & welfare

- OO9. To develop an integrated approach on animal health and welfare including socioeconomic aspects

19.3 FutureFoodDS Partnership

From: Partnership *Sustainable Food Systems - Strategic Research and Innovation Agenda, January 2023*

The ambition of the FutureFoodDS is to collectively develop and implement an EU-wide committed research and innovation (R&I) partnership which accelerates the transition towards diets that are healthy, safe and sustainably produced and consumed in resilient EU and global food systems.

Impact (what FutureFoodDS would like to achieve):

A European Sustainable Food System in 2050 and beyond based on inter-connected, territorialised, sustainable food systems (being fair, safe, healthy, biodiverse, ..)

FutureFoodDS has its focus on post-farming and -fishing.

General objective (FutureFoodDS wants to):

1. Understand what sustainable food systems (SFS) are, how they function and how to enable their development;
2. Demonstrate that the partnerships 'systemic approach' functions as a catalyst – for many food systems (FS) actors – to jointly transform FS into SFS (also beyond the lifetime of the Partnership);
3. Ensure that the well-governed Partnership contributes to SFS via frameworks and evidence-supporting policy options for EC objectives in Farm to Fork Strategy, Missions, Green Deal and the UN-SDGs
4. Co-create with various actors in a diversity of Living Labs³ to develop SFS concepts.

Specific objectives (leading to concrete outputs that are generally applicable):

1. Deepen insights in SFS research and innovation in particular in 4 thematic R&I areas, all considered from a FS lens and supporting transition through Living Labs;
2. Develop an innovative, systems approach that changes our way of collaborative working in RIPE activities;
3. Establish a vibrant epistemic community based on accepted working procedures, joint activities, and pooled resources that works together with related Partnerships.

Outcomes:

- EU-wide functioning Partnership, based on collective and inclusive actions, providing knowledge for realising European SFS Policies, as well as public and private sector opportunities
- Strong foundation for a European SFS Research Area, connected to global initiatives, with harmonised EU-wide policies and regulations, while respecting locally diverse contexts

Goals and activities:

WHAT

R&I 1: Change the way we eat

Transition to sustainable healthy diets everywhere: shifting dietary patterns and consumption of safe, healthy, nutritious, affordable, accessible, equitable with reduced environmental footprint and culturally accepted foods.

R&I 2: Change the way we process and supply food

Supply-and demand-side research and innovation topics reorienting the activities in post-farming and fishing to reach sustainable healthy diets.

R&I 3: Change the way we connect with food systems

Citizen engagement and consumer trust in reoriented food systems delivering sustainable diets.

R&I 4: Change the way we govern food systems

Leverage points for local, national, EU and global transition pathways, public procurement, F2F code of conduct & local initiatives (incl. cities).

HOW

Activity A: Pooling R&I resources and programming

Joint transnational R&I support via project funding and alignment of funding priorities and mechanisms enabling multi-actor and systems approaches

Activity B: Launching a food systems observatory

Platform for sharing methods, metrics, data and assessments on the sustainability performance of food systems

Activity C: Establishing a food systems knowledge hub

For complex FS, transformative research and FS-Labs on systemic innovations at different scales (using a 'vitrine' for demo's)

Activity D: Knowledge sharing and scaling

Adapting knowledge systems, innovation & demo platforms and science-policy- society interfaces for ensuring impact.