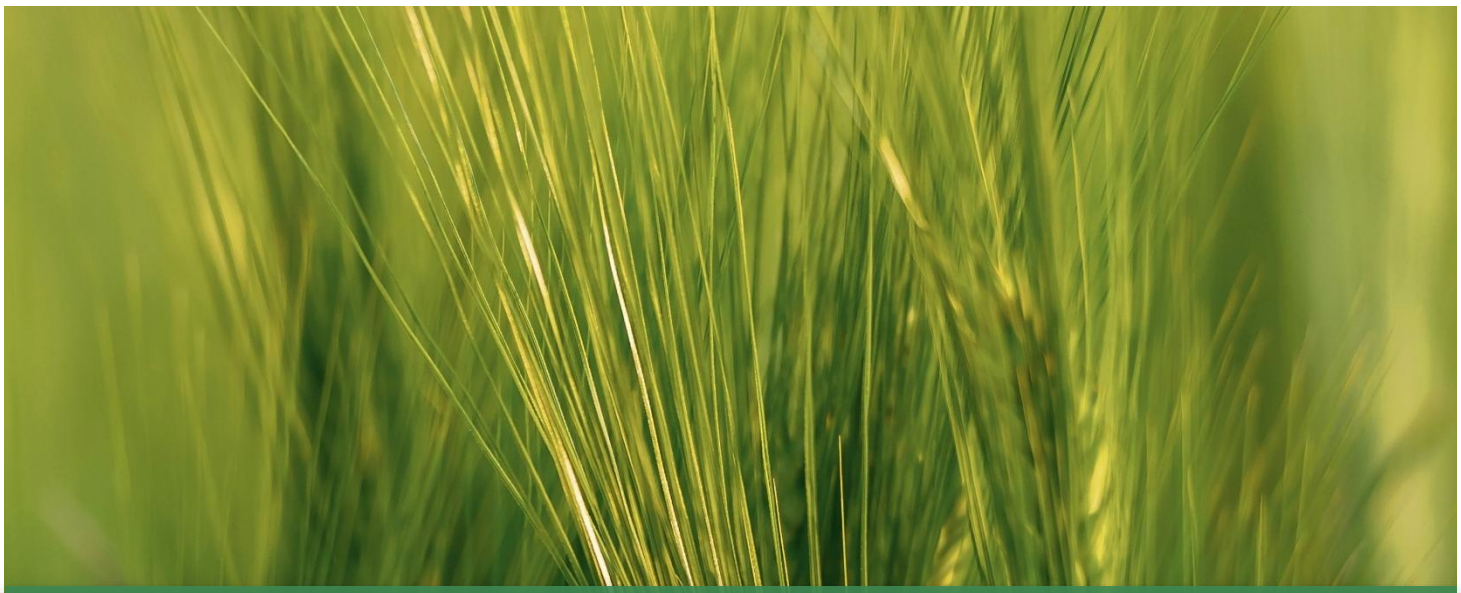
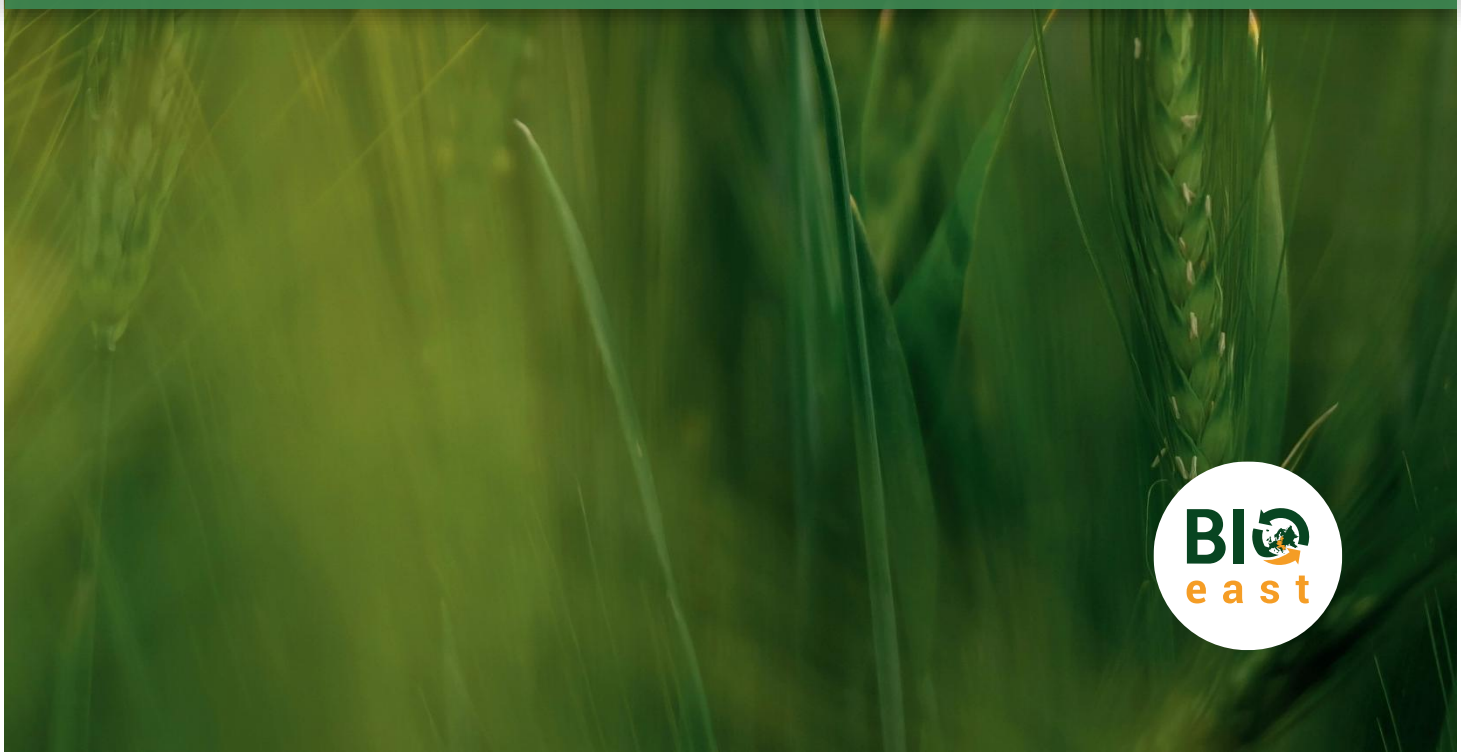


PARTNERING FOR THE FUTURE

’BIOEAST AND BEYOND’ HIGH-LEVEL CONFERENCE ON CENTRAL AND EASTERN EUROPEAN RESEARCH AND INNOVATION PRIORITIES IN THE CONTEXT OF SUSTAINABLE SOIL AND FRESHWATER RESILIENCE, FOOD SYSTEMS SECURITY AND BIOECONOMY-RELATED POLICIES



HU24EU

Hungarian Presidency of the Council of the EU 24

Rapporteur's Report

PARTNERING FOR THE FUTURE

'BIOEAST and Beyond' High-Level Conference on Central and Eastern European Research and Innovation Priorities in the Context of Sustainable Soil and Freshwater Resilience, Food Systems Security and Bioeconomy-Related Policies

4-6 December 2024, Budapest, Hungary

Rapporteurs:

Gábor Király (HU) – *INSTITUTE OF AGRICULTURAL ECONOMICS (AKI)*

Katalin Kujáni (HU) – *KISLEPTEK ASSOCIATION SME*

Maroun El Moujabber (IT) – CIHEAM Bari and PRIMA SAC

George Sakellaris (GR) - *BIOEAST HUB CZ*

Funded by the European Union

CONTENT

ABBREVIATIONS

BIOEAST	Central and Eastern European Initiative for Knowledge-based Agriculture, Forestry and Aquaculture in the Bioeconomy.
CAP	Common Agricultural Policy
CEE	Central and Eastern European
ERA	European Research Area
ESG	Environmental, social, and governance
FP	Framework Program
MS	Member State
NGO	Non-Governmental Organisation
PRIMA	Partnership for Research and Innovation in the Mediterranean Area
R&I	Research and Innovation
WEFE	Water-Energy-Food-Ecosystems Nexus,

EXECUTIVE SUMMARY

The *'BIOEAST and Beyond'* high-level conference, held from December 4-6, 2024, in Budapest, Hungary, convened policymakers, researchers, and stakeholders to explore Central and Eastern Europe's (CEE) role in advancing sustainable soil and water resilience, food system security, and bioeconomy-related policies. Organized under the Hungarian Presidency of the Council of the EU, in collaboration with the European Commission, Standing Committee on Agricultural Research (SCAR) and the BIOEAST Initiative, the event aimed to promote a new pan-European research and innovation agenda focused on Central and Eastern Europe, including the Western Balkans and Eastern Partnership countries.

The conference specific aim was to deliberate on research, innovation, and development priorities within the Central and Eastern European region, including the Western Balkan countries, Ukraine, and Moldova. The overarching goal is to foster advancements that yield collective benefits across the European continent.

The conference gathered a diverse range of participants, including ministers, state representatives, European Commission officials, international organizations, private sector leaders and academics. Discussions centered on assessing systemic challenges and resilience needs, identifying thematic research and innovation (R&I) priorities, and fostering strategic EU Missions and Partnerships to enhance CEE's contribution to the European bioeconomy. Key themes including leveraging the region's biomass resources and strengthening collaboration with EU Member States, the Western Balkans, and Eastern Partnership countries. Participants emphasized that a diversified and decentralized bioeconomy requires resilient agri-food and better industry and energy sectors engagement, alongside a more collaborative approach.

The opening plenary session addressed shocks and resilience in agri-food systems, setting the stage for thematic discussions on carbon-water cycles and nutrition-energy cycles. These sessions underscored the importance of sustainable and concerted soil and water management, biomanufacturing innovations, and circular bioeconomy practices. Interactive methodologies, such as fishbowl discussions, facilitated dynamic exchanges among policymakers, scientists, and stakeholders. Additionally, the World Soil Day Ceremony celebrated the critical role of soil in achieving sustainability goals.

Key outcomes included:

- **Carbon-Water Cycles:** Emphasis was placed on investing in soil as a finite resource, its restoration, real-time monitoring systems, and climate-adaptive farming practices to address the nexus of carbon and water cycles intrinsically linking soil and water. The strategic research agenda in the region could be focused towards priorities related to black soils (chernozem), small water cycles, and the transformation to climate active landscapes by land rehydration and soil health improvement.
- **Nutrition-Energy Cycles:** Participants highlighted the need for biomanufacturing innovations, upcycling food waste, and promoting localized bioeconomy initiatives. The strategic research agenda in the region could be focused towards priorities related systemic approach of the agri-food sector, the network science of food and nutrition, the adaptation and development of regional capacities in modern biomanufacturing focused on sustainability and climate change solutions.

New governance models were proposed to improve policy integration and stakeholder engagement, with a particular focus on empowering farmers and smallholders. Strengthened regional cooperation

within the BIOEAST framework was deemed crucial for addressing shared challenges and implementing regional-focused solutions and creating a long-term transformation agenda based on research and innovation that addresses sustainability and competitiveness at the same time.

Capacity building emerged as a priority, with calls to expand education and training programs to support future bioeconomy actors and counter youth migration from rural areas. Leveraging CEE's biomass potential was identified as a key strategy to reduce external dependency and enhance the region's strategic autonomy. Participants also emphasized the importance of raising societal awareness and fostering multi-stakeholder dialogues to ensure inclusive transitions and secure public support for bioeconomy initiatives.

The PRIMA Partnership was highlighted as an inspiring and successful model for a new pan-European research and innovation initiative, focusing on Central and Eastern Europe, the Western Balkans, and Eastern Partnership countries.

By addressing systemic challenges and advancing innovative approaches, the *"BIOEAST and Beyond"* conference laid the foundation for a resilient, sustainable, and inclusive European Research Area open to all in Europe while focusing on specific needs of a wider macro-region.

The leadership in the forthcoming Council Presidencies, taken over by Poland on 1 January and subsequently Denmark, will be crucial in translating the achievements of the initiative into actionable outcomes.

INTRODUCTION: THE CONCEPT OF THE CONFERENCE

The PARTNERING FOR THE FUTURE *'BIOEAST and Beyond'* high-level conference, held from December 4-6, 2024, in Budapest, Hungary, convened policymakers, researchers, and stakeholders to explore Central and Eastern Europe's (CEE) role in advancing sustainable soil and water resilience, food system security, and bioeconomy-related policies. Organized under the Hungarian Presidency of the Council of the EU, in collaboration with the European Commission and the BIOEAST Initiative, the event aimed to promote a new pan-European research and innovation initiative focused on Central and Eastern Europe, including the Western Balkans and Eastern Partnership countries.

The event was the summit of a series of events during the six-month Hungarian Presidency:

- A Stakeholder Manifesto[1] initiated by the BIOEAST thematic working groups, and signed by more than 150 stakeholders, triggered a joint declaration by 20 agriculture and research ministers from 10 countries to assess the needs and impact of a future partnership to support knowledge transfer and enhance excellence-based research, education, innovation, and development capacities in the macro-region.
- The policy forum[2] on 4 July 2024 aimed to engage all Member States and EU institutions in the discussion. The forum's conclusions call on the Commission and Member States to begin reflecting on these priorities, with further discussions planned at the Agriculture and Fisheries Council and the Research Council.
- The Council conclusion[3] on "A potential Europe-wide R&I initiative on advancing sustainable natural resource management, food systems security and the deployment of the bioeconomy, harnessing the potential of Central and Eastern Europe", approved on 29 November 2024 marks the latest milestone achieved on this journey.

The aim of these events was to familiarize, debate, and promote a specific Presidency priority focused on developing a new pan-European research and innovation initiative with a geographic focus on Central and Eastern Europe, including the Western Balkans and Eastern Partnership countries.

The high-level conference in Budapest from 4-6 December aimed to deliberate on EU research, innovation, and development priorities by having a focus on the Central and Eastern European region, including the Western Balkans and Eastern Partnership countries. The overarching goal was to highlight the specificity of a macro-regionally focused approach to foster advancements that yield collective benefits across the European continent. The objective was twofold: on the one hand, to assess the shocks, challenges, drivers, and needs for a strong and ambitious R&I cooperation and where to invest collective national efforts; on the other, to identify thematic research and innovation priorities for sustainability, resilience, and innovative biomass production and utilization for the macro-region.

[1] Source: https://bioeast.eu/hu/stakeholder-manifesto/
[2] Source: https://bioeast.eu/events-cal/save-the-date-for-high-level-events-during-the-hungarian-eu-presidency/
[3] Source: https://bioeast.eu/ministers-approved-council-conclusions-on-a-potential-europe-wide-ri-initiative-for-sustainable-natural-resource-management-food-security-bioeconomy-on-29-november-2024/

STATE OF THE ART: PROPOSAL FOR A NEWLY ESTABLISHED RESEARCH AND INNOVATION AGENDA GROUNDED IN THE BIOEAST INITIATIVE

Background and context

The world is experiencing an era of profound uncertainty, characterized by numerous disruptions and overlapping crises. Scientists call it the age of polycrisis. Europe is concurrently confronting unprecedented complex and systemic challenges, including past and ongoing crises such as migration, the COVID pandemic, the war between Ukraine and Russia, the escalating climate and biodiversity catastrophe, and the political and economic uncertainties related to the implementation of the sustainability agenda. These crises not only jeopardize the realization of the Green Deal's objectives but also diminish Europe's position in a shifting global order and weaken its competitiveness in the increasingly competitive global markets. Neglecting or mismanaging these challenges would further exacerbate societal challenges, increase adverse natural resource use, and undermine collaboration among European nations.

The shift from a globalized to a polarized world underscores the urgency of adopting transformative approaches to ensure European strategic autonomy. Within this context, the bioeconomy emerges as a vital yet underdeveloped solution, offering immense potential to address these challenges. As global expectations grow for bioeconomy-driven solutions to mitigate energy and food crises, foresight becomes essential to map regional needs and develop tailored strategies.

Central and Eastern Europe (CEE), including the Western Balkans and Eastern Partnership countries, possesses significant untapped potential in this domain. However, the region faces notable challenges, such as resource constraints, climate vulnerabilities, and geopolitical pressures. For example, Ukraine's delicate situation underscores the need for resilient strategies, while the Western Balkans offer opportunities for partnerships that address both regional and global concerns.

By 2024, establishing a robust biomass value chain will be critical for mitigating energy crises and strengthening food systems. Policy solutions must prioritize inclusivity, addressing the needs of vulnerable populations while fostering cross-sectoral collaboration. Systematic mapping of regional needs, supported by well-coordinated cooperation strategies, will be pivotal in defining a resilient future for the European bioeconomy.

Considering the magnitude of these challenges, a transformative agenda and innovative solutions are needed, and the concept of a newly established research and innovation agenda, firmly grounded in the BIOEAST initiative, embodies one such promising vision.

The vision

This vision is founded on the idea of a Europe-wide research and innovation partnership with the objective of enhancing sustainable natural resource management, food systems security, and the deployment of the bioeconomy, leveraging the potential of Central and Eastern European, Western Balkan, and Eastern Partnership countries.

For more than 10 years now, the BIOEAST initiative has been assisting Central and Eastern European (CEE) countries in advancing their bioeconomies through inter-ministerial, bottom-up and top-down

cooperations. Beyond the initiative's governmental nature, it has also been offering a solid transnational strategic research and innovation framework for various joint efforts with the aim to working towards sustainable agriculture, aquaculture and forestry in CEE countries.

The BIOEAST initiative, supported by its extensive organizational background and partners and stakeholders' dedication, is leading a proposal for advancing a long-term transformational agenda centered on macro-regional research and innovation activities for enhancing Europe's sustainability and competitiveness.

Problems, gaps, and needs

Central and Eastern European countries are equipped with insufficient research and technological resources and are continuously falling behind in dissemination, exploitation and adaptation of European-level research results and innovative solutions. Despite the extensive opportunities provided by the current toolbox of the Framework Programs in research and innovation, the participation of CEE countries remains limited due to the process-heavy nature of the European Co-funded Partnerships: the administrative process for EU funds, which is renewed every two years, benefits countries advanced research and innovation governance. The lack of research management capacity leaves these countries in a self-reinforcing cycle: better participation would necessitate enhanced capacities, yet the current framework does not facilitate this.

This necessitates the creation of new research and innovation structures for capacity building, enabling these countries to enter the EU's research and innovation arenas fully equipped.

The development of research and innovation management capacities in the macro-region will not only facilitate more EU-wide high-quality research and innovation initiatives but support the EU's sustainability, competitiveness, and strategic autonomy objectives as well. All these will be hardly achieved without the effective involvement of Central and Eastern Europe.

This leads to the next key point underpinning the concept: the need for a paradigm shifts in the future European discussions on complex challenges.

Europe and its macro-regions are witnessing more and more complex challenges that do not stop at Member States' borders. Therefore, the EU must establish effective and innovative mechanisms to address these complex and systemic challenges that endanger food system security, supply chain integrity, and livelihoods of rural communities.

However, the biomass produced in Central and Eastern Europe, the Western Balkans, and the Eastern Partnership countries, is not yet adequately acknowledged for their essential contributions to these newly established mechanisms. To competitively and efficiently utilize these biomass potentials, while ensuring fair livelihoods for farmers and foresters and fostering the sustainable transition of our food system, activities and initiatives funded under EU Research and Innovation Framework Programme must address the requirements of macro-regions. Moreover, the realization of this contribution has been hindered by certain factors, such as obsolete production and processing facilities, the lack of know-how and low investment in research and innovation. The valorization of biomass and the sustainable management of natural resources should happen locally in the macro-region, it is also incremental to rely on the most up-to-date knowledge and technological innovation, which is generated mainly beyond the region, in other European countries. This makes the role of the more advanced countries' investors in high value-added processes absolute and inevitable.

OVERVIEW OF THE CONFERENCE'S OUTCOMES

This section summarizes the most relevant outcomes of the conference dialogues, broken down into two thematic nexuses, highlighting the challenges and research and innovation priorities.

Carbon-Water Cycles: The Link Between Healthy Soils and Freshwater Resilience

Overview

The Earth's ecosystem fundamentally relies on the global cycles of energy, water, and biogeochemicals. While the significance of the elements transported by these cycles is widely acknowledged, a comprehensive understanding of the cycles themselves and their interconnections remains underrepresented in mainstream political, scientific, and practical discourses. These cycles not only connect the atmosphere, hydrosphere, cryosphere, biosphere, and pedosphere but also play a pivotal role in regulating global and regional climate systems.

Beyond the global water cycle, small water cycles are even more critical for local water supply. These localized cycles involve the continuous movement of water between land and air through processes like evapotranspiration and precipitation. The quality and health of natural and human-managed landscapes significantly influence these small water cycles with possible significant potential even at European scale. Soil is a finite resource and its degradation impacts farming communities and consumers equally. Sources of soil degradation differ from pollution to management issues which can be linked to inappropriate practices in agriculture or water management or other sectors affecting the health of the soil. Degraded soils fail to absorb rainwater, and vegetation-deprived fields lack the capacity for evaporation, resulting in disrupted local water cycles, reduced rainfall, a warming climate, and an increase in extreme weather events differing in nature in coastal and landlocked areas, while interlinked through processes connecting the basic cycles of the Earth system. Consequences of positive changes even at macro-regional level can have an impact at European level influencing interlinkages depending on a better understanding of connection between water and soil.

In this intricate system, a sustainable and inclusive bioeconomy serves as a critical link, creating a circular connection between biological resources and various economic sectors. By integrating soil and water management into the production of food, bio-based products, energy, and other services, the bioeconomy can contribute to advancing EU priorities. These include enhancing food and energy security, achieving climate neutrality, ensure water resilience and driving economic development across Europe.

This section of the report emphasizes the interdependence of healthy soils and freshwater resilience within the bioeconomy framework. It underscores the untapped potential of establishing a pan-European research and innovation partnership to address these interconnected challenges and opportunities to be built on the foundations of long-term research and innovation and deployment of solutions at macro-regional scale. **The section also features the conclusions and recommendations from the Budapest Soil Health Forum**[4], which was organized back-to-back with the Conference to

[4] Source: https://www.soilhealthforum.hu/

discuss topics related to soil health, including biophysical and socio-economic aspects. The full version of the Forum's conclusions and recommendations can be found in the Annex.

Challenges

LACK OF KNOWLEDGE AND RECOGNITION

- The global natural cycles that underpin Earth's ecosystems—and, by extension, human civilization—remain insufficiently prioritized in strategic and policy dialogues concerning the sustainability transition of European food systems.
- Global and local (small) freshwater flows, as common goods, link primary production, nutrient retention, solar energy distribution, and cloud formation through processes such as precipitation, evaporation, transpiration, and infiltration.
- In this context, natural and human-managed landscapes play a critical role, acting as transformation and distribution layers that sustain these vital natural cycles. Poorly managed biomass and soils, however, lead to diminished resilience and reduced climate stability at local, regional, national, continental, and global levels.
- Despite their importance, the majority of EU soil ecosystems continue to be managed through unsustainable practices to maximise production disregarding soil health and associated ecosystem services. This is resulting in prolonged erosion, carbon loss, land-use changes, contamination, and, most critically, a weakened soil-water nexus.
- While water flows that connect regions across borders and the diversity of Europe's soil types represent significant elements of the continent's natural heritage, there is currently no systematic methodology or comprehensive knowledge base addressing how unsustainable soil management and land-use changes impact these water cycles.
- Additionally, the crucial role of farmers in maintaining the soil-water nexus is poorly recognized by policymakers and society. Many farmers themselves are unaware of the broader consequences of their actions. Yet, every piece of cultivated land is intrinsically connected through small water cycles, which collectively contribute to the global water flow.

COMPETITION AND STRATEGIC AUTONOMY

- While a unified global understanding of the bioeconomy concept is still lacking, competition in this sector is expected to intensify as the USA and China expand their presence in the global bioeconomy arena, posing additional challenges to the EU's sustainability objectives.
- The rising global demand for food and bioresources- whether for bioenergy or non-bioenergy purposes - accelerates land-use competition, potentially leading to further intensification, deforestation, and urbanization.
- This directly impacts the EU's climate neutrality goals, as soil, water, and agricultural ecosystems hold significant but underutilized potential as carbon sinks.
- Europe's abundant biomass resources could play a pivotal role in enhancing the EU's strategic autonomy and that of its partner countries, reducing dependence on external energy and input sources.
- However, increasing competition for biomass, combined with existing challenges such as climate change, sustainability compliance, and volatile food prices, risks further marginalizing farmers - particularly smallholders - within the value chain.
- The current bioeconomy value chain remains resource-intensive, prioritizing biological resources but lacking sufficient policy coordination and innovative support from research. This hinders progress toward more localized, value-added production and limits opportunities for stakeholders across the value chain.

GEOPOLITICAL AND TERRITORIAL CHALLENGES

- As globalization continues to evolve, it brings with it increasing polarization and uncertainty, making these challenges a pervasive part of modern life. In response, the need for resilient and transformative policy frameworks has become more critical than ever.
- Countries in the Western Balkans and Eastern Partnership regions face unique challenges within their bioeconomy sectors. While their agricultural sectors present significant potential to drive advancements in bioeconomy, achieving this requires substantial and long-overdue investments in support systems such as R&D, climate change adaptation, and measures to counteract rural depopulation.
- The ongoing war in Ukraine vividly demonstrates the devastating impact of military operations on natural resources, including soil, water systems, and marine ecosystems. However, the full extent of these impacts remains to be thoroughly assessed and quantified due to ongoing hostilities.

POOR STAKEHOLDER AND SOCIETAL ENGAGEMENT

- Purposeful stakeholder engagement is crucial for creating inclusive and sustainable natural resource management frameworks. Yet, broad and meaningful involvement remains an often overlooked or underdeveloped component of science and policy dialogues.
- Land-use practitioners, including farmers and foresters, play a pivotal role in maintaining the intricate balance between soil health and freshwater resilience through their management practices. Despite their critical contributions, they often lack the societal recognition and support they deserve.

R&I priorities for the future

- The first step in advancing a pan-European research and innovation partnership is to fully harness the potential of existing policies, scientific initiatives, and the opportunities they offer for collaborative action in areas such as sustainable soil and water resilience, food system security, and the bioeconomy. Need for a long-term institutionalized research and innovation agenda connecting macro-regions in their actions can make a difference at European level.
- Policy frameworks like the Common Agricultural Policy, the Common Fisheries Policy, the Water Framework Directive and the Cohesion Policy, along with peer networks such as the Standing Committee on Agricultural Research, the BIOEAST Initiative, the Regional Rural Development Standing Working Committee, and the International Bioeconomy Forum, provide a robust platform for future collaborations. Additionally, funding programs like Horizon Europe, large scale initiatives such as the EU Mission “Restore Our Ocean and Waters,” and “A Soil Deal for Europe” offer significant opportunities to drive joint progress.
- As Europe advances its bioeconomy strategy amidst increasing competition for biomass, it is essential to prioritize sustainability and inclusiveness. This focus ensures that developing bio-based value chains does not lead to adverse social impacts, particularly on vulnerable stakeholder groups like smallholders and rural households.
- A critical need exists to rethink the EU’s governance structure to embed the water-soil nexus into relevant public policy frameworks. The Nature Restoration Law and the Soil Strategy for 2030 in synergy with the future Water Resilience Strategy provide a strong foundation for fostering synergies and addressing trade-offs, facilitating a paradigm shift toward sustainable landscape and freshwater resource management. This new holistic paradigm must recognize the totality of water cycles, the diversity of European soils and emphasize regional perspectives and solutions.
- These future public policies must prioritize land users and their evolving role in climate change mitigation; however, this new approach should be introduced through a thoughtful and participatory process. This new approach will mean that farmers and foresters might be encouraged not

only for environmentally sustainable production but also for being tasked with influencing global water cycles through their soil and water management practices.

- Synergies between EU, national, and private funds are vital to realizing the EU's bioeconomy vision, incorporating high-tech bioeconomy functionalities, and strengthening interconnections across the entire bio-based value chain.
- A supportive and inclusive regulatory environment is particularly important for start-ups and SMEs working in the blue economy or bioeconomy, as evidence shows that many European innovation projects centered on novel concepts begin their commercialization outside Europe.
- In addition to broadening partnerships across countries, national engagement strategies should be implemented to enhance stakeholder participation in aligning policies, strategies, and visions for the future development of the European bioeconomy.
- Communication, effective exchange of best practices, and awareness-raising must be central to accelerating the transition to sustainable food systems and more localized, advanced bioeconomy sectors.
- Soil health indicators are necessary tools for assessing the conditions of our soils. The importance of adequate and repeated soil testing within harmonised monitoring systems cannot be overemphasised. We need to invest in advanced technologies and collaborative platforms that enable effective tracking and data sharing within and between regions.
- While there is a wealth of knowledge about soil resources including natural processes and management issues, there are still major gaps in knowledge that require coordinated research.
- One of the most urgent gaps to fill is the development of scientific understanding of soil health improvement options of fertile land under cultivation, in particular black soils, and of soils that are not under cultivation, but can be reutilized for food production (e.g., marginal land, urban soils).
- The challenge of climate change, in particular, the threat of desertification, poses a serious threat to soil productivity and thus to human livelihoods. Climate change makes the need for proactive soil conservation strategies very urgent.
- Institutional support plays a key role in addressing soil health challenges. Governments and policymakers must prioritize soil health by creating, implementing and enforcing supportive policies, funding research, and creating conditions that encourage the adoption of sustainable soil management practices and provide the means for change. This must be coupled with strengthening independent advisory services, ensuring that farmers, land managers, and communities have access to the impartial expertise and knowledge they need to make informed decisions.
- The representation of future generations' rights was also a key point of the dialogues. This is a critical matter for two reasons. It is essential to guarantee that future generations of land users, including farmers and foresters, have opportunities and conditions that will maintain their jobs, sustain their livelihoods, and protect their lands. On the other hand, it is also crucial to consider future generations of the entire population and how to represent their rights in decisions regarding those natural resources that will be vital to their future well- being.
- Future strategies developed to address soil health challenges must persist in offering resources for knowledge generation, information exchange, and facilitation of multi-stakeholder innovation partnerships.

Nutrition-Energy Cycles: Food System Security and Locally Valorised Biomass and Biowaste in the Bioeconomy.

Overview

The transformation of food systems is increasingly prioritized by policymakers, researchers, and citizens due to its significant role in mitigating climate change. However, food system-related R&D&I projects and initiatives often lack cohesion. Current solutions tend to address only isolated components of the food system and rarely engage all relevant stakeholders effectively. Collaborative efforts are essential to enhance the efficiency and impact of these initiatives. Such as the FOOD 2030 Project Collaboration Network which connects over 80 projects and 120 living labs, all focused on developing social, technological, and governance solutions to transform the food system.

A systemic policy framework is critical for driving food system transitions. Existing policy dialogues address food systems in a fragmented manner, often relying on CAP instruments and lacking a holistic value chain approach. Incremental research and innovation, which make only minor improvements to technologies and efficiencies, fall short of providing evidence-based solutions that policymakers can adopt.

The FOODOME project

On 4 December the Barabas Lab presented the Foodome project which aims to track the full chemical complexity of food and develop quantitative tools to understand the impact of these chemical compounds on health. The overarching aim of the project illustrates the framework in which food systems need to operate, as it analyses from production to the health of society at system and network level.

It uses big data and network science tools to reveal the health implications of the entire (bio)chemical spectrum of our diet. The project implements a database that maps food chemicals and their associations with diseases and health effects, using natural language processing techniques to extract information from millions of research papers. It includes creating knowledge graphs linking food chemicals to wellness and disease, identifying food molecules with beneficial health effects, predicting food and drug interactions, and understanding nutritional and chemical changes induced by food processing. The goals are to provide an accurate chemical description of food, to map diet-gene interactions and to develop new strategies for food safety and drug development. The Foodome has the potential to revolutionize nutritional science, improve public health, and provide new strategies for food safety and drug development, offering personalized dietary recommendations based on a deep understanding of the interactions between food, genes, and health.

Challenges

LOCALIZED SOLUTIONS

Solutions that succeed in one Member State may not be effective in others due to differences in economic, social, and technological contexts. Research must support locally anchored solutions to maximize impact. For issues like food waste, packaging, biomass capacity, resource management and consumer behaviour, locally driven research and solutions can be more effective, provided all value chain actors are actively involved.

THE FOOD SYSTEMS-BIOMANUFACTURING NEXUS

The nexus between food systems and biomanufacturing is an emerging area of research and innovation. Biobased sectors demand higher levels of risk management and capital than many others. Advancing these sectors in the bioeconomy requires supportive policies, such as taxonomies for biobased products and the establishment of demonstration and pilot plants.

Key connections between food systems and biomanufacturing include:

- Upcycling
- Cellular agriculture
- Next-generation input materials
- Non-food and by-product management

Leveraging these connections requires a higher degree of interdisciplinarity, multistakeholder engagement, and shared understanding.

POLICY INTEGRATION AND REGIONAL INVESTMENT

Participants highlighted the need for long-term policy frameworks capable of driving regional investments in the bioeconomy. These frameworks must adopt a comprehensive food systems approach that reduces fragmentation and integrates diverse policy domains such as taxation, trade, food safety and hygiene, energy, land management, and the CAP. Regional research results and recommendations should be prioritized to achieve well-defined policy objectives.

FOOD SYSTEM TRANSFORMATION

- The food system encompasses several components, including food production, processing, preparation, consumption, retailing, distribution, and waste management. These components face geopolitical challenges and diverse regional endowments. However, the current European Food System Policy lacks a holistic approach to managing these interrelated elements, resulting in fragmented legislation and disjointed food value chains. Furthermore, policy dialogues and strategic documents rarely reference the concept of a “food system.”
- The fragmentation and lack of systemic approach mean that essential ground-level data is missing. Such data could provide a solid legal foundation for policymakers and researchers to achieve effective outcomes addressing economic, societal, and environmental dimensions.
- A significant research gap exists between different domains and disciplines—particularly between natural and social sciences—hindering the development of a diversified and resilient food system. Such a system is necessary to withstand unpredictable economic, political, and environmental crises.
- A regional approach to food systems is essential which should include and empower farmers to be part of change. The needs of urban and rural citizens, Central and Eastern European (CEE)

countries, Western European countries, Mediterranean regions, and Northern European consumers differ significantly. While recognizing these distinctions, joint and interdisciplinary research should be prioritized.

- New governance models that embrace a multistakeholder and value-chain approach are lacking. These models could be developed and improved through local living labs, where local actors can test, adapt, and implement regionally anchored management, collaboration, and technological solutions.
- Engaging social sciences in agricultural research remains a challenge, making it difficult to reach vulnerable populations. A key question is how to ensure the participation of these societal actors and make them visible in strategic agendas.
- The European Food Bank serves as an example of a living lab that bridges different stakeholders. It demonstrates the importance of linking agri-food chain actors—such as processors, retailers, and environmental organizations—to tackle food waste effectively. All uneaten food has an environmental impact, and achieving food waste reduction goals requires changing social norms and developing economically viable models. However, these social needs vary regionally and demand tailored management and regulatory instruments. Farmers and HoReCa sector should be involved more in this procedure.
- The complex management of food waste and bioeconomy sectors shall be framed at policy level because the current food waste reduction and food redistribution system are socially responsible, environmentally sustainable but economically not viable. This is where social norm toward food donation should be changed, policy should (tax incentives, norms etc.) be revised.
- The local food system and its varying farming, logistics and social instruments takes part in mitigation of climate change therefore its policy background needs more attention and support.

SYSTEMATIC APPROACH FOR THE BIOECONOMY SECTOR

- The Bio-based Industries Consortium has developed country reports and a biomass map outlining the bioeconomy landscape, including key actors, crops, farming sizes, RDI sectors, universities, biorefineries, strategies, and technology levels. These reports highlight the high biomass potential of CEE (Central and Eastern European) countries while revealing that their processing industries and value chains remain underdeveloped.
- Addressing brain drain by offering new opportunities and perspectives—especially for young experts—is a critical challenge for BIOEAST countries.
- Political decisions are required to reduce the price disparity between bio-based materials and fossil-based products. If BIOEAST countries aim to be competitive in the bioeconomy sector, current tax and competition policies must be adjusted to provide room for bio-based materials. A clearer prioritization of biomass usage and political focus is essential.
- An effective, fair, less complex, and predictable regulatory framework is needed to enable investors to adopt long-term strategies with confidence.
- Greater policy support is crucial to foster connections between research, policymaking, and the practical needs of farming systems.
- The need for a multidisciplinary approach was emphasized by many participants, both in the design and implementation of bioeconomy strategies. A recurring topic was the increased involvement of social sciences in bioeconomy processes, highlighting the importance of integrating diverse perspectives.
- While the mapping of biomass potential has already been developed, the next step should focus on mapping the entire bioeconomy system and exploring its potential in BIOEAST regions.
- The bioeconomy sector relies heavily on experimental data, some of which can be generated using AI. However, many biological processes cannot yet be modelled or piloted by current AI systems, as these depend on robust primary data sets. Moreover, much of the data is maintained by various

RDI projects, which often lack mechanisms for long-term maintenance and accessibility, particularly for SMEs.

- The CEE region generates over 100 million tons of waste materials annually, which could be converted into new materials using chemical and organic processes. However, fossil-based economies continue to dominate policies in the region, hindering the development of a sustainable bioeconomy.
- Connecting the two topics (bioeconomy and food system) gives an option that biomanufacturing can potentially be a follow-up of the Food systems on the basis that Biomanufacturing processes can use residuals as raw materials.

MISSING MULTISTAKEHOLDER COLLABORATION AND SOCIETAL ENGAGEMENT

- Enhancing the regional bioeconomy sector requires better utilization of by-products at the production level. A significant knowledge gap exists regarding the potential applications of by-products, which must be addressed to unlock their full value.
- The University of Natural Resources and Life Sciences in Vienna (BOKU) has launched the Centre for Bioeconomy, member of the European Bioeconomy Universities Alliance having good connections with the BIOEAST region. This initiative aims to advance education processes at various levels. It was emphasized that while food is a vital component of bioeconomy, the concept is much broader, necessitating strategic and interdisciplinary thinking.
- Biomass value chains are highly fragmented, and region-specific technological solutions are not adequately applied. As a result, there is a lack of conversion of innovative knowledge and know-how into practical business processes. Stronger collaboration and dialogue between research and technology providers, investors, and other stakeholders are essential to stimulate local investments in the bioeconomy sector.
- Both the bioeconomy and food sectors require co-creation initiatives that actively involve multiple stakeholders to ensure effective implementation. Examples from Western European countries like France and Denmark highlight the success of such co-creation models in fostering collaboration among bioeconomy actors, demonstrating the efficiency and financial viability of locally based technological solutions.
- Policy efforts should place greater emphasis on raising public awareness and understanding of the bioeconomy and food sectors. Such initiatives are critical for fostering societal engagement and support for sustainable practices.
- Involvement of the social sciences for bioeconomy research is a challenge in many cases because the co-financing mechanism does not provide enough resources and does not give enough space for social sciences.

R&I priorities for the future

- The first step is to establish a Food System network fully operating in the BIOEAST region by 2030 in order to boost the inclusivity and rebalanced funding mechanism in these countries. The aim is to involve the different actors in BIOEAST countries to strengthen social sciencies and to build strategies on real local needs.
- The network science to be connected to the food systems sciences. Volume of data generated in the fields of nutrition and food safety and security is expected to grow exponentially due to advancements in mass spectrometry technology and AI/ML capabilities. Organizations in these fields, including research labs, government entities, international agencies, and food producers must prepare for big data management and analytic capabilities. Testbed case in the macro-region (as the FOODOME project) can be implemented.

- The sustainable and effective use of food waste, providing environmental and economic benefits, that is why more concentrated and locally anchored projects are needed which can involve technology providers, social sciences, ESG sectors, NGOs, HoReCa sectors, public authorities and citizens. The main objective is to ensure food security by preserving edible food and transferring non-edible food for bioenergy in a sustainable and economically viable way.
- Horizon projects enable MS to create urban and rural living labs, allowing farmers and citizens to find a common language that can help the transition where people are part of the process. This multiactor and transdisciplinary approach should be improved in BIOEAST countries.
- Thus, implementation of new technologies is an expensive activity co-financing models and investment in technology research shall be encouraged in BIOEAST countries.
- Education at all levels and tailoring education curricula and research topics accordingly in bioeconomy sector need special attention by MS and RDI actors.
- Digital agriculture perspective shall provide space for all parts and processes of food systems to improve the data-driven technologies, social fairness, transparent food chains and environmentally friendly solutions to mitigate carbon footprint.
- Enabling data-driven local food systems to foster the transition to sustainable food systems to reduce knowledge gaps on local food systems in Europe, advancing data-driven approaches that support the transition to fair, healthy, and environmentally friendly food systems.
- A new mechanism for a better valorisation of biomass allows to improve the balance between harvested and non-harvested biomass.
- Bioeconomy research lacks a clear focus on specific domains e.g., biorefineries, novel materials, textiles etc. The collaboration between education, research and industry actors can be boosted by national programs, matchmaking events. This step is followed by building biomass value chains in BIOEAST countries based on the environmental and social endowments.
- The new technology investments depend on adaptation of governance models which provide multisectoral and multistakeholder approach to exit the agricultural sector and engage the energy sector.

Concluding Plenary: Strengthening the ERA: The Role of a Regionally Tailored Pan-European R&I Initiative

The year 2025 marks a significant milestone for the Bioeconomy in Europe, with the adoption of a new Bioeconomy Strategy. During the panel discussion, particularly highlighted by the EC Directors, several critical elements shaping the content and structure of the new strategy were discussed:

1. **Core Principles of the Bioeconomy Strategy**

    - The foundational keywords—**Research & Innovation, Sustainability, and Competitiveness**—remain central, as in previous strategies.
    - It should be aligned with R&I priorities which shall provide a new life science package
    - The Strategy is driven by three key principles: **Societal Needs, Economic-Business Considerations, and Democracy**. These principles are non-negotiable and essential.
    - The new Common Agricultural Policy (CAP) prioritizes engaging all related stakeholders, with particular emphasis on Central and Eastern Europe (CEE).

2. **Implementation Plan**

    - A concrete implementation plan is necessary to achieve high levels of effectiveness. While it must be adaptable to regional and sectoral particularities, the plan should focus on three primary areas:

- Research & Innovation Agenda
- Missions
- Biotech and Biomanufacturing Priorities

3. Focus on Central and Eastern Europe

- The panel emphasized challenges and opportunities in the CEE region, providing recommendations for improved implementation and effective transition pathways:
  - Lack of National Bioeconomy Strategies
    Unlike Western European countries, many CEE states have yet to adopt national Bioeconomy Strategies, limiting their ability to address emerging challenges.
  - Policy Implementation
    Alongside adopting strategies, there is a need for concrete, long-term policies to guide solutions and ensure resilience.
- Crises and Challenges
  The region faces various crises, including political instability, generational gaps, technological disparities, and geopolitical tensions. Combined with environmental and economic challenges, these issues demand specific, tailored responses to foster resilience and drive the transition.

4. Recommendations from the BIOEAST Manifesto Topics

The panel discussed four interconnected areas outlined in the BIOEAST Manifesto—**Soils, Freshwater, Biomanufacturing, and Food Systems**—and provided several recommendations:

1. **New Research Areas**
   - Explore competitive areas like **bio-fertilizers** and **biocosmetics** while integrating new approaches such as **quality management**.
2. **Linking Domains and Regions**
   - Promote regional collaboration to avoid fragmentation and ensure inclusivity. Prioritize actions that reflect regional and cross-sectoral needs.
3. **Engaging Authorities**
   - Regional and public authorities must be actively involved in planning and implementation stages.
4. **Choosing Beneficial Solutions**
   - Prioritize solutions that provide the greatest societal benefit, avoiding options that prioritize cost over quality.
5. **Key Drivers for Effective Processes**

5. To enhance productivity and create sustainable business models, the panel suggested:

- Actively involving and engaging relevant stakeholders, with particular focus on strengthening their involvement.
- Persuading private investors to support initiatives.
- Establishing a supportive political environment to facilitate long-term strategies.
- Proposing sustainable, attractive solutions across all aspects of development.
- Adopting a dedicated agenda shared by all key players.
- Institutionalizing the entire concept for consistency and accountability.
- Placing greater emphasis on regional needs and industry-specific requirements.

The key outcomes and conclusions from this panel discussion are as follows:

1. **Focusing on the complexity of Bioeconomy**
   A sustainable bioeconomy can offer solutions in agriculture, forestry, and the food industry, while also driving the transformation toward a sustainable economy by providing biomass, including waste, to other industrial sectors.

2. **Leveraging the Bioeconomy Potential of Central and Eastern Europe, Including Ukraine, Moldova, and the Western Balkans**
   The region's available biomass, biological, and natural resources, including soil and freshwater, offer a strong foundation for sustainable development. However, significant investments in research and innovation are necessary to fully realize this potential.

3. **Ensuring Political Commitment from Interested Countries**
   Clear political commitment is crucial, particularly in terms of financing and prioritization, to establish long-term, institutionalized macro-regional cooperation in the bioeconomy.

4. **Adopting a Higher Level of Ambition**
   A more ambitious and strategic approach to research and innovation is essential to effectively address current and future challenges.

5. **Supporting the BIOEAST Manifesto**
   The thematic areas outlined in the stakeholders' manifesto, *"Sustainable supply chains and strengthened local processing of bioresources in Central and Eastern Europe,"* should be further developed and implemented.

6. **Defining Region-Specific Priorities**
   Regional priorities should be clearly identified, with a focus on enhancing and streamlining cooperation in research, development, and innovation (RDI) projects. PRIMA is a good example how the European added value can be increased from macro-regional perspective.

7. **Integrating Research and Innovation with Broader Frameworks**
   Research and innovation (R&I) must be closely aligned with the economy, the Single Market, and long-term policies to ensure sustainable development.

8. **Prioritizing Public Procurement**
   Public procurement should be recognized as a key driver of innovation and economic growth.

9. **Increasing Investments**
   Substantial investments at all levels are essential to achieve meaningful progress in the bioeconomy.

10. **Strengthening Responsibility and Connectivity**
    Responsibility at all levels must be enhanced, guided by three key objectives:
    - Visibility: Ensuring actions and initiatives are easily identifiable.
    - Awareness: Promoting broad understanding of efforts and goals.
    - Connectivity**:** Building robust, meaningful connections across sectors and regions.

PRIMA as an example for macro-regional R&I cooperation

Established in 2018 under Article 185 of the Treaty on the Functioning of the European Union (TFEU), **PRIMA** – **P**artnership for **R**esearch and **I**nnovation in the **M**editerranean **A**rea operates under a collaborative governance model that ensures equal participation among its 20 member countries, including both EU and non-EU nations. This model fosters joint decision-making and shared project ownership, laying a strong foundation for effective cooperation.

Its community comprises 238 funded projects, engaging over 2,300 participants from diverse sectors such as research, policymaking, agriculture, and industry. With a total budget of €350 million, these projects focus on practical, regionally tailored solutions to address challenges like water scarcity, food insecurity, and the impacts of climate change. PRIMA stands as a testament to the power of science diplomacy and regional collaboration, successfully leveraging economies of scale and cross-border synergies to tackle critical Mediterranean challenges. By uniting countries under a shared vision, PRIMA has created a platform that leverages collective resources, expertise, and innovation to address critical issues such as water scarcity, food security, and climate resilience.

PRIMA has made meaningful contributions to integrating scientific research into policy frameworks, supporting national and regional strategies across the Euro-Mediterranean area. By aligning its efforts with the European Green Deal, Farm to Fork Strategy, and Water-Energy-Food-Ecosystems (WEFE) Nexus, the cooperation fosters connections between research outputs and policy implementation. Its funded projects provide actionable insights on critical challenges such as soil degradation, water management, and agro-food sustainability. PRIMA exemplifies the power of science diplomacy and regional collaboration, effectively leveraging economies of scale and cross-border externalities to address critical challenges in the Mediterranean.

Building Trust Through Science:

- PRIMA acts as a neutral platform that unites countries across the Mediterranean, enabling collaboration even in politically sensitive contexts.

Enhancing EU Soft Power:

- PRIMA demonstrates the EU's commitment to addressing regional challenges, positioning the Mediterranean as a hub of innovation and enhancing the EU's geopolitical influence.

Driving Innovation Diplomacy:

- By fostering collaboration on emerging technologies and sustainable practices, PRIMA positions the region as a global leader in innovation, particularly in areas such as climate resilience and sustainable agriculture.

CONCLUSION

What did the event achieve?

Europe is facing time pressure to deliver tangible results to enhance sustainability and competitiveness. The high-level conference on "BIOEAST and Beyond; Partnering for the Future" which has brought together more than 300 key stakeholders, experts, and policymakers from across Europe to address some of the most pressing challenges. The overarching goal was to foster fruitful discussions on the critical themes of sustainable soil and water resilience, food system security, and the bioeconomy. The conference specific aim was to deliberate on research, innovation, and development priorities within the Eastern European region, including the Western Balkan countries, Ukraine, and Moldova.

The event intended to raise awareness of a macro-regional cooperation which has capability to increase competitiveness and sustainability of Europe by using the regional potential. The speakers and discussions pointed out that the region's available biomass, biological, and natural resources, including soil and freshwater, offer a strong foundation for sustainable development. However, significant investments in research and innovation are necessary to fully realize this potential.

What are the key milestones achieved during the Hungarian Presidency of the Council of the EU?

The conference was a milestone in a process started on 4 July in Brussels, by organizing the policy forum on “Partnering for the Future”, when the 10 BIOEAST countries announced that they were signing a common declaration on their commitment to develop a geographically focused Research and Innovation Initiative.

On 29 November the adoption of the Council Conclusions “on a potential Europe-wide R&I initiative on advancing sustainable natural resource management, food systems security and the deployment of the bioeconomy, harnessing the potential of Central and Eastern Europe” represents a significant step forward. These conclusions emphasize the importance of leveraging the bioeconomy to address societal, environmental, and economic challenges while focusing on the untapped biological resources’ potential of Central and Eastern Europe.

The Council asked the Commission for a gap analysis that will assess the need, feasibility, and potential impact of a new pan-European Research and Innovation (R&I) initiative. This initiative holds the promise of advancing European Strategic Autonomy while ensuring the inclusion of Central and Eastern Europe, the Western Balkans, and other candidate countries.

The discussions have deepened the understanding of four thematic areas: soil, freshwater, food systems and biotechnology. The aim was achieved to bring up thematic areas and their nexus from the Central and Eastern European perspective: to set up the first pillars of a future Strategic Research and Innovation Agenda.

- **On Systemic Shocks and Resilience:** The conference addressed the urgency of fostering resilience in our agri-food systems and bioeconomy sectors in response to challenges such as climate change and geopolitical tensions.
- **On Carbon-Water Cycles Nexus:** it was explored that the critical interlinkages between healthy soils and freshwater resilience, emphasizing the need for geographically focused governance models and specific R&I agendas that promote sustainable land and water management.

- **On Nutrition-biomanufacturing Cycles Nexus:** it was highlighted that the importance of food system security and locally valorised biomass, showcasing how bioeconomy solutions can be both innovative and inclusive and could bring added value and new value chains at local level to rural areas.
- **On Policy Frameworks and Partnerships:** it was discussed how collaborative efforts, such as the BIOEAST Initiative, can align regional and European priorities to foster an institutionalized, long-term and unified approach to sustainability and innovation.
- On representing the rights of future generations: Current decisions must ensure the recognition of future generations' rights to our natural heritage and fulfil their demands for sustainable food, feed, fiber, advanced bio-based products, services, and bioenergy.

Collaboration and Next Steps

Strong Foundation for Progress: The Hungarian Presidency together with the BIOEAST networks, with the SCAR and European Commission, noted significant support from the scientific community, which has identified key challenges and is actively engaged in finding solutions. This collaboration forms a solid foundation for the next steps.

A Pivotal Year Ahead: The coming year will be critical for the future of the EU as discussions on CAP and R&I policy instruments take center stage.

Essential Collaborations: Close collaboration with Polish and Danish colleagues will be vital to successfully addressing the tasks ahead.

Strategic Knowledge Sharing: Delivering the right information at the right time is essential to achieving maximum impact.

Overcoming Fragmented Knowledge: Current efforts are hindered by a "patchwork" of knowledge from various projects, which impedes the development of systemic solutions.

Need for Stability and Cooperation: A transition to systemic approaches requires stable, predictable, long-term, institutionalized regional cooperation and robust institutions focused on R&I.

What can be the EU added value, if we go on? (Experiences from PRIMA)

The PRIMA initiative is a good example of a macro-regional cooperation that can generate responses to challenges at European level in the field of R&I. PRIMA's contributions to the European Research Area (ERA) are evident through the advertisement of research positions, networking of research infrastructures, promotion of open-access publications, and facilitation of accessible scientific data. These efforts align with ERA's objectives of fostering a cohesive and innovative research landscape across Europe. The outlined contributions highlight PRIMA's significant role in extending the European Research Area while addressing pressing challenges in the Mediterranean region.

At the same time, PRIMA strengthens resilience in the Mediterranean region by addressing critical issues such as food security and water scarcity, particularly in the face of global disruptions like pandemics and conflicts. Its emphasis on capacity building ensures that solutions are deeply rooted in local contexts, enhancing their relevance and sustainability. By integrating science diplomacy into its framework, PRIMA tackles not only scientific challenges but also broader geopolitical and socio-economic issues, contributing to regional stability and enhancing the EU's soft power. Moreover, PRIMA has successfully addressed the fragmentation of R&I efforts in the Mediterranean by adopting strategic approaches.

The experience of PRIMA proved that macro-regional cooperations on the field of R&I is crucial to tackle the current challenges and can provide more targeted answers based on the local socio-economic needs. Thus, on one hand there is a need to build structures in CEE countries to enable and trigger the R&I potential, as well, as the wide adoption and adaptation of developed technologies. This should and could be the basis for coping with challenges, building a competitive economy, and ensuring a sustainable future.

On the other hand, there is a need of local networks capable of reflecting on the future needs of the macro-region in bioeconomy, including food systems, biomanufacturing and biotechnology, as well as the protection and efficient use of natural resources.

By making a better use of the natural and biological resources of Central and Eastern Europe with a special regard to soil, freshwater, biomass and biowaste utilization, the European strategic autonomy and food systems security can be put on new foundations.

In the context of European Single Market, this would result in positive spill-overs as well: providing better access for all EU countries to various forms of sustainably produced biomass, as well as better investment opportunities in innovative, cross-border biotech and biomanufacturing companies.

An additional added value will be the improvement of societal understanding and acceptance of sustainable use of natural resources including soil and freshwater, the systemic approach for the food, bioeconomy, biotechnologies and biomanufacturing and making these societies aligned with European values while developing locally tailored pathways for the successful green transition.

Future steps and recommendations

In the following the month the Polish Presidency of the Council of the EU could guarantee to further develop theBIOEAST initiative's agenda. Poland's leadership will be crucial in ensuring that the priorities set by the Council Conclusions and thematic areas identified at the conference are translated into actionable outcomes.

One of the next steps is to react on the Council Conclusions' Call to carry out a gap analysis on a potential new Europe-wide R&I initiative. This analysis must serve as the foundation for identifying research gaps and opportunities that are critical for achieving sustainability, resilience, and innovation across Europe. The analyses to be set up by the European Commission could be supported by the SCAR.

Finally, under the Polish Presidency the next step is to create a consortium which could help to build up a strategic agenda and roadmap for a future Research and Innovation Initiative. On that road the BIOEAST Initiative should provide its position towards the upcoming negotiations. Then this position paper could serve as a cornerstone for the upcoming negotiations on the Multiannual Financial Framework (MFF) and Horizon Europe's successor, FP10. It is vital that BIOEAST countries articulate the macro-region's priorities and ensure they are fully recognized within the broader European framework. Additionally, a future BIOEAST position paper must reflect the political priority, unique strengths and challenges of the Central and Eastern European macro-region. This document should provide clear recommendations and actionable priorities for future programming periods, ensuring that our collective efforts contribute to a more inclusive and sustainable ERA.

ANNEX

The Budapest Soil Health Forum's conclusions and recommendations

Healthy soil supports life on Earth and the sustainability of human societies. Despite the recognition of the importance of soil health in plant growth, environmental sustainability, biodiversity and many ecosystem services, soil resources still face serious threats worldwide.

The 'Budapest Soil Health Forum' was organised in Budapest in December 2024 to discuss topics related to soil health, including biophysical and socio-economic aspects, back-to-back with the "BIOEAST and Beyond High Level Conference on Central and Eastern European Research and Innovation Priorities" organised by the Hungarian Presidency of the Council of the European Union.

Events of the Forum, including conferences on "Artificial Intelligence for Soil Health" and "Improving Soil Health, Amendments, Monitoring and Modelling" a workshop on "Soil Organic Carbon and Soil Health" and panel discussions on "Soil Management Innovation" were dedicated to detailed discussions from novel techniques of monitoring and soil management to knowledge gaps of soil processes and needs for improvement in policy implementation.

With the conclusion of the Forum, we shall highlight several issues that require urgent attention and action.

Soil health indicators are necessary tools for assessing the conditions of our soils. The importance of adequate and repeated soil testing within harmonised monitoring systems cannot be overemphasised. We need to invest in advanced technologies and collaborative platforms that enable effective tracking and data sharing within and between regions.

While there is a wealth of knowledge about soil resources including natural processes and management issues, there are still major gaps in knowledge that require coordinated research.

The challenge of climate change, in particular, the threat of desertification, poses a serious threat to soil productivity and thus to human livelihoods. Climate change makes the need for proactive soil conservation strategies very urgent.

Institutional support plays a key role in addressing soil health challenges. Governments and policy-makers must prioritize soil health by creating, implementing and enforcing supportive policies, funding research, and creating conditions that encourage the adoption of sustainable soil management practices and provide the means for change. This must be coupled with strengthening independent advisory services, ensuring that farmers, land managers, and communities have access to the impartial expertise and knowledge they need to make informed decisions.

Future strategies developed to address soil health challenges must persist in offering resources for knowledge generation, information exchange, and facilitation of multi-stakeholder innovation partnerships.

The Budapest Soil Health Forum discussed the options to address the above issues and supports the aspirations of the BIOEAST initiative as outlined in its "Stakeholder Manifesto" and calls upon the participants of the "BIOEAST and Beyond High Level Conference" and stakeholders across sectors from regional to EU level to mobilise resources, expertise, and efforts to improve soil health for all, for present and future generations.

Compiled by members of Organising and Advisory Boards participating

in the Budapest Soil Health Forum

04.12.2024 Budapest, Hungary