European Sustainable Nutrient Initiative (ESNI): Aims and Principles

1. Preambule

The Biorefine Cluster Europe (www.biorefine.eu) was founded in 2012 as an open-access, free-of-charge cluster to stimulate and help projects collaborate in terms of communication, stakeholder engagement and creating impact in the biobased circular economy domains. The Cluster focuses on 6 domains, of which nutrient recycling is the most represented topic, with 22 running projects dealing with nutrient recovery.

Nutrient recycling

Renewable energy

Water Recovery and use

Biomaterials & Eco-Design

Biochemicals

Value Chain Assessment

In light of further nurturing the community aspects of experts dealing with this topic, in 2019, the European Sustainable Nutrient Initiative (ESNI) was launched to bring together EU projects, stakeholders and EU officials in an annual physical event. The first edition was a great success, bringing together more than 200 scientists, policymakers and stakeholders from industry and agriculture, but, unfortunately, in the years thereafter, ESNI was forced to be organised virtually (online) due to COVID.

In 2022, the Biorefine Cluster Europe (coordinated by Ghent University, BE) and the H2020 FERTIMANURE project (led by the BETA Tech Center, ES) launched the **Nutrient Recycling Community**, gathering BCE projects from the nutrient recycling domain. This community aims to foster collaboration between relevant initiatives and projects around nutrient recycling in Europe and serve as a platform to exchange knowledge and good practices. In that sense, the community launched 4 working groups that are led by different EU projects: Technologies for nutrient recycling coordinated by FERTIMANURE; agronomic performance of fertilising products coordinated by LEX4BIO; sustainability assessment (environmental, economic and social) coordinated by NOVAFERT; and Policy working group coordinated first by SYSTEMIC and after that project ended by NUTRI2CYCLE. These working groups have already organised an intensive series of webinars and several roundtables to discuss hot topics.

Re-branding the Nutrient Recycling Community

To better acknowledge the interconnection between activities, we propose re-branding the Nutrient Recycling Community into the European Sustainable Nutrient Initiative (ESNI), which itself has developed into a well-known brand as a recurrent annual event. The annual event would continue being celebrated yearly, since now the "ESNI Conference", at which we would also associate an annual ESNI General Assembly for the community members. The interconnection as a brand associated with the Biorefine Cluster Europe would be maintained by using both logos and referring to the BCE as 'ESNI powered by the Biorefine Cluster Europe'.

2. ESNI Mission, Vision and main Goals

ESNI mission is to foster collaboration among European entities engaged in nutrient recycling, facilitating the exchange of valuable experiences and identifying knowledge gaps to guide future research. By serving as a valuable resource for all stakeholders, including the private sector, policy makers, and society, ESNI aims to enhance partnerships and contribute to the advancement on the state-of-knowledge and technology of nutrient recycling.

Our vision is to establish ESNI as a leading research reference in Europe, capable of offering comprehensive solutions and insights to address nutrient-related challenges identified by the European Commission, the European Parliament, and the private sector. Furthermore, the ESNI community strives to become a prominent platform that facilitates the widespread adoption of research and innovation in nutrient recycling, leveraging the expertise of its members.

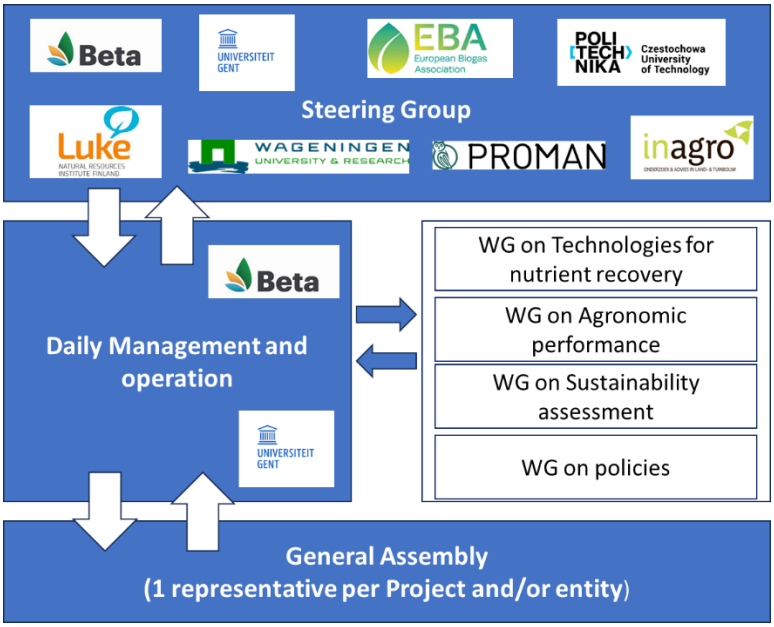
ESNI has set forth the following **goals** to achieve its mission and vision:

1- Facilitate collaboration among relevant European entities involved in nutrient recycling.
2- Identify key challenges in nutrient recycling outlined in major EU strategic documents.
3- Understand the needs of the private sector, including fertilizer industry, farmers, and technology providers.
4- Propose new research initiatives to address the identified challenges.
5- Promote the adoption of existing research and innovation outcomes.
6- Communicate research and innovation results in a manner accessible to all relevant stakeholders.
7- Foster collaborative research and joint work to amplify the impact of R&D at the EU level.
8- Serve as a practical tool for policy makers and the private sector, providing valuable insights and support.
9- Foster and assist the policy recommendation activities from EU projects towards regional, national and European policy makers

By pursuing these goals, ESNI aims to promote sustainable nutrient recycling practices, contribute to the circular economy, and address critical challenges in the field.

3. ESNI organisational structure

The following figure represents how ESNI will be organized.



A dedicated **steering committee** comprising nine experts from diverse European institutes plays a crucial role in providing ESNI with strategic vision, guidance, and operational support. The committee members chair or coordinate associated Working Groups and other community support activities. Regular meetings are scheduled every three months to review progress, define key tasks, and outline activities for ESNI. Additional meetings can be arranged to address relevant topics as they arise.

The expected contribution of the steering group is defined as follows:

1.- Facilitate Continuous Evaluation: The steering committee will conduct ongoing evaluations to assess the progress made within ESNI and its associated activities. By analyzing outcomes, impacts, and feedback, the committee will provide valuable insights and recommendations to enhance the effectiveness and efficiency of ESNI's initiatives.

2.- Shape the Roadmap: The steering committee will actively participate in defining the roadmap for ESNI and its working groups. Based on their expertise and knowledge, the committee members will identify and prioritize the main topics and areas that ESNI should focus on, ensuring alignment with the broader goals and objectives of the organization.

3.- Address Adoption Challenges: Recognizing the importance of research and innovation uptake by industrial and policy stakeholders, the steering committee will engage in detailed discussions to identify the primary barriers and gaps hindering the adoption process. By pinpointing these obstacles, the committee will propose strategies and recommendations to foster greater acceptance and utilization of R&I outcomes among relevant stakeholders.

4-. Foster Collaboration and Partnerships: The steering committee will actively seek opportunities to foster collaboration and partnerships with relevant organizations and institutions working in the field of nutrient recycling. By leveraging their network and

expertise, committee members will facilitate connections, encourage knowledge exchange, and explore potential synergies to maximize the impact of ESNI's initiatives.

5.- Promote Knowledge Dissemination: The steering committee will actively promote the dissemination of knowledge and best practices within the field of nutrient recycling. They will encourage the sharing of research findings, innovative approaches, and successful case studies among ESNI members and the wider community. By participating in the organizing of ESNI conferences, workshops, and webinars, the committee will facilitate the exchange of information, foster learning, and inspire further advancements in nutrient recycling practices.

6.- Monitor Policy Developments: Recognizing the significance of policy frameworks in shaping the landscape of nutrient recycling, the steering committee will monitor policy developments at the European level. They will stay informed about emerging policies, regulations, and directives related to nutrient management and recycling. Based on this understanding, the committee will provide insights and recommendations on how ESNI can align its activities and contribute to the achievement of policy objectives.

Through these additional contributions, the steering committee will strengthen ESNI's collaborative efforts, stay informed about policy developments, and actively promote knowledge sharing, ultimately driving the adoption of sustainable nutrient recycling practices across Europe.

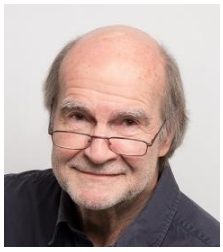
Members of the Steering Committee:

Prof. Erik Meers *leads the RE-SOURCE LAB at Ghent University, specialized in resource recovery from biobased sources, with a distinct spear point on nutrient recycling research. Erik Meers has a Master in Cell- & Gene Biotechnology, a Master in Environmental Engineering and a PhD in Applies Bioscience Engineering. From the Ghent University he is involved in a number of national and European research projects dealing with nutrient recycling, several of which as coordinator. He is founder of the Biorefine Cluster Europe (www.biorefine.eu) an open-forum initiative focusing on inter-project collaborative platform focusing on joint activities, joint deliverables and exchange of expertise. He is also the chair of the Scientific Advisory Council of the European Biogas Association (EBA) and member of the EBA board. In recent past, he was the coordinating expert for the EIP Focus Group on Nutrient Recycling (EIP AGRI), expert in the STRUBIAS panel (Fertilising Product Regulation ; DG GROW) as well as the SAFEMANURE / RENURE expert panel (DG ENVI) and co-chair of the Research Task Force (TF5) associated to the Biomethane Industrial Partnership (BIP) between the European Commission and the biobased industries. In Flanders, he coordinates the regional nutrient platform (Nutricycle Vlaanderen).*

Evi Michels *is portfolio manager at the RE-SOURCE lab at the University of Ghent. In this capacity she is involved in the management of several national and European project in the field of environmental technology with a specific focus on the agro-industrial sector. Her expertise lies in the area of nutrient recovery from manure and digestate and its processing into mineral fertilizers. She is also involved in the day-to-day management of the Biorefine Cluster, an integrating knowledge hub that connects projects*

in the field of energy and nutrient cycles. Finally, she is also the co-founder of the regional nutrient platform "NutriCycle Vlaanderen".

***Ana Robles** holds a PhD in Agriculture from Bonn University. After a two-year postdoc at the BioEconomy Sciences Center in Germany, Ana Robles led the Phosphorus research line in the Resource lab (Ghent University, BE). She has authored more than 30 publications in international journals and has deep scientific experience in nutrient recovery and nutrient use efficiency. Ana has also managed several EU projects related to nutrient recycling and currently coordinates the ESNI community as part of the Biorefine Cluster Europe.*



***Ludwig Hermann** has 35+ years of experience as technology, sustainability, and innovation manager on three continents, was co-founder and long-term CEO of ASH DEC Umwelt AG, is co-inventor of minerals/ash decontamination, phosphorus recovery, energy conversion and efficiency technologies, author and co-author of several patents, reports, papers and book chapters on recovery of critical materials, nutrient recycling and renewable energy.*

***Lucile Sever** is the Policy Officer in charge of following the Circular Economy dossiers at the European Biogas Association. She is dealing with legislation related to agriculture and environment and coordinates the EBA Working Group Circular Economy. Previously, Lucille worked for INREAE and as a public and legal affairs officer in the Wine and Spirits sector. Lucile holds a master's Degree in European Studies from the Catholic University of Louvain and a master's degree in Vine and Wine Law from the University of Bordeaux.*

***Sander Vandendriessche** works as a researcher in the department of Energy & Circular Economy at Inagro, where he is working on multiple Flemish and European projects. His expertise is mainly focused on nutrient recovery from manure and farm scale anaerobic digestion. Furthermore, he is actively involved in the Flemish nutrient platform Nutricycle Vlaanderen. Before that, he worked two years at a manure processing company, where he was able to have a close look on how manure processing is being performed in practice.*

***Kimo van Dijk** is researcher at Wageningen University & Research (WUR) working in the Sustainable Soil Use team on nutrient management and recycling. His work includes all kind of aspects regarding valorization of organic residual and waste flows into biobased fertilisers, including manure, digestate, compost, process water, waste water and sludge (communal and industrial). Specific expertise is on nutrient flow analysis, business cases development, nutrient recovery and reuse concepts and technologies, impact and life cycle assessment, emissions, circular sanitation systems and stakeholder engagement. In addition, he is program manager for the research innovation program regarding nutrients (including inputs, recycling, efficiency, emissions, etc.) part of the Dutch national knowledge and innovation agenda (KIA).*

Krystyna Malińska *is a lecturer and a researcher at Częstochowa University of Technology (Poland) in the area of environmental and agricultural engineering with particular interests in nutrient recycling, composting, biodegradable plastics for agriculture. She received PhD in environmental engineering and MSc., Eng. in food technology. She received scholarships from Fulbright and Norman E. Borlaug International Agricultural Science and Technology Fellowship Program. Krystyna has been coordinating TopMinds mentoring Program (organized by Fulbright Poland and Top 500 Innovators)*

Kari Ylivainio *is a Senior Scientist at the Natural Resources Institute Finland (Luke). He holds on MSc in the field of agricultural chemistry and physics (University of Helsinki) and PhD in Environmental Soil Science (University of Helsinki). His working career has focused on plant nutrition and related processes in soils, especially on optimizing phosphorus fertilization in crop production and minimizing losses to the environment. Currently he is coordinating H2020-project (LEX4BIO), where the aim is to optimize the use of bio-based fertilisers in crop production while minimizing risks to the environment, ensuring food and feed safety and supply*

General Assembly consists of one representative from each of the ESNI members. General Assembly will meet yearly in a closed setting, preferably in person, coinciding with the ESNI conference. The General Assembly will be able to propose improvements to work done by the community, propose new activities and vote for the major decisions that should be taken.

Plenary Forum will take place at the annual physical conference in Brussels, expanded to all the stakeholders attending the event.

Working Groups are set up to provide thematic content and are coordinated by a leading EU project which will be directly in touch with the operational management team. The members of the working groups will work to discuss and provide relevant information for those specific challenges identified by the working groups or the steering group. Activities like webinars, workshops, roundtables, summer schools, etc., will be organised online or face-to-face. In the Steering Group, these activities will be assessed with adjustments, new ones initiated etc.

ESNI **management and daily operations** will be done mainly by the team from Ghent University, BETA Technological Center and IMPACT npo. Additionally, support from the partners and projects involved in ESNI is also expected to organise some activities (summer schools, webinars, events from projects, etc.).

4. **Working Groups**

1. Technologies for nutrient recovery: this working group focuses on revising and discussing innovative technological approaches for recovering nutrients from different side streams. This working group aims to boost collaboration among different projects by sharing their scientific findings, bottlenecks and limitations identified, solutions and cases of success.
2. Agronomic performance of fertilising products: this working group aims to gather all the knowledge related to assessing the agronomic performance of fertilising products,

including laboratory and field testing. Discussion on methodologies used, analysis done, quality assessment etc., are relevant aspects of this working group.

3. Sustainability assessment (environmental, economic and social): projects in this working group cooperate towards finding common approaches for assessing sustainability aspects of the technologies and recovered nutrients. In this regard, efforts are made to discuss common goals, scopes and methodological choices for developing coherent life cycle inventories.
4. Policy working group: This group aims to thoroughly analyse the regulatory framework affecting the practical use, application and commercialisation of potentially recovered products. Identifying regulatory bottlenecks and potential solutions is expected to work on preparing joint position papers of the projects participating in reaching policymakers and regulatory stakeholders.

5. Activities

5.1. Conferences

ESNI will continue to organise an annual physical gathering in Brussels (ESNI Conference), where EU projects meet and engage with EU policymakers and other relevant stakeholders. Moreover, linked to the annual event, a General Assembly of the community will be organised the day before or the day after the conference.

In addition to the ESNI conference, the ESNI community will be actively participating and contributing to other relevant events organised at the EU level: ManuResource, BioRefine Cluster conference, RRB, events organised by projects being part of ESNI, and finally, other events that the Steering Group members will identify as strategic.

5.2. Webinars

Since the start of the Nutrient Recycling Community, different webinars targeting the theme of the working groups described in Section 4 of this document have been organised.

Webinars aim to present relevant results and exchange knowledge on different relevant topics, meet and learn from experts in each field, raise discussion among ESNI members and detect critical challenges when working together.

Webinars will generally be online in sessions no longer than 2-3 hours.

5.3. Workshops and roundtables

Workshops and roundtables will generate fruitful discussions among ESNI members and other experts on a specific topic. Although it may be virtual, these activities will preferably be organised face to face, where more relevant outputs can be obtained. This will be a potential activity that ESNI can promote in existing conferences and events.

5.4. Summer Schools

Specific activities targeting PhD students will also be organised. In that sense, ESNI will support the organisation of different summer schools for PhDs (e.g., in the frame of relevant Marie-Curie or COST Action programs) as well as Master students (e.g., in the frame of relevant

Erasmus Mundus programs) that could be promoted by the different projects that are members of the community. Furthermore, ESNI will help identify relevant topics to be raised in the summer schools, provide relevant speakers, and open these activities to other PhDs involved in the ESNI community.

5.5. Joint activities and initiatives between projects

Another objective of ESNI will be to increase and promote collaboration between projects. The webinars, conferences and all the activities organised in the framework of ESNI will be helpful to detect possible joint activities such as the preparation of joint documents between projects for increasing the impact, joint scientific publications, joint experiments, staff exchange, preparation of new project proposals, etc.

5.6. Digital Media

5.6.1. Website

The ESNI community will enjoy a dedicated webpage on the Biorefine Cluster website, where all the relevant information related to ESNI will be available to interested stakeholders. In addition, the structure's webpage will include specific references to the projects actively involved in the ESNI community and related events and activities, news, videos and publications. Furthermore, UGent/Impact will regularly update the ESNI webpage with relevant items provided (whereas relevant) by community members. This will be the major digital tool to spread information about the community and raise awareness of its activities.

5.6.2. Bulletin

The ESNI community will provide regular updates on its past and forthcoming activities. For that, for every two issues, the BCE Bulletin will include a section with highlights on the ESNI activities, information on the upcoming events as well as outcomes of joint collaborations (i.e., position papers, summer schools). Part of the news in the Bulletin will also be intended to give visibility to the ESNI members and promote their scientific project outcomes. The Bulletin will reach various stakeholders from the quadruple helix and ensure that ESNI is widespread.

5.6.3. Social Media

All the activities related to the ESNI community will be promoted via the existing social media channels of the Biorefine Cluster Europe. Specifically, Twitter and LinkedIn will promote the ESNI's upcoming activities (such as events and webinars) and achieved outcomes (i.e. joint publications). UGent will manage the social media channels; however, to keep them alive and duly updated, members of the ESNI community will also provide relevant inputs to the newsfeed. This will contribute to attracting various stakeholders operating in nutrient recycling and regularly informing them on the development of the ESNI community.

5.6.4. E-library

All the documents produced by ESNI (joint positions, factsheets, etc..) will be duly stored in the E-Library of the Biorefine Cluster website. The E-library already gathers more than 300 publications from project members of the Biorefine Cluster Europe. In doing so, the ESNI

community will ensure the long-lasting availability of its outcomes, which will be downloadable by all interested stakeholders.

Our members