Interreg Baltic Sea Region

Co-funded by the European Union

CIRCULAR ECONOMY CiNURGi

CiNURGi Policy Recommendations

30/9/2026

A summary how to promote Market Development, Policy Coherence and Safe Use of Recycled Nutrients

Mission Statement

These recommendations are designed to accelerate the transition from a linear to a circular nutrient economy, replacing imported mineral fertilizers with safely recovered, regionally produced recycled nutrient fertilizers in the Baltic Sea Region (BSR). They address the environmental policies designed to combat eutrophication in the Baltic Sea, addressing directly the aims for nutrient recycling in the HELCOM Baltic Sea Regional Nutrient Recycling Strategy (BSRNRS).

A circular nutrient economy and nutrient recycling in general relies on biomasses from the agricultural, municipal and industrial sector as sources for nutrients such as phosphorus. The availability of these biomasses varies across the Baltic Sea Region as do the technologies used for the recovery and recycling of nutrients. The CiNURGi - Circular Nutrients for a Sustainable Baltic Sea Region project has charted the availability of biomasses and available technologies, tested technologies and production methods for nutrient recycling, evaluated the market conditions of recycled nutrients and assessed the agronomic value of bio-based fertilizer, and drafted quality standards in order to produce these recommendations.

The recommendations are divided into 6 overarching objectives which follow and correspond to those in the Baltic Sea Regional Nutrient Recycling Strategy:

- BSR as a Model Area for Nutrient Recycling
- Reducing Environmental Impacts
- Safe Nutrient Recycling
- Knowledge Exchange and Awareness Raising
- Creating Business Opportunities
- Improving Policy Coherence

The document includes a reference to each of the Baltic Sea Regional Nutrient Recycling Strategy objectives, an introduction to them, key challenges to overcome and CiNURGi recommendations for future steps forward. To assist the reader to assess the feasibility of these recommendations, they include references to whom should take the proposed action and how long it might take to complete it. The division into near-term and medium term indicate a timeframe of zero to three years or three to seven years. This offers a timeline for how soon we might accomplish changing the status quo.

These policy recommendations have been created as part of the Interreg BSR funded CiNURGi project (2023-2026), based on the findings in report D2.3 Policy Recommendations for Recycled Nutrient Fertilisers in the Baltic Sea Region, Advancing Market Development, Policy Coherence, and Safe Use of Recycled Nutrients, April 2026, by Piotr Skowron, Damian Wach, Monika Karsznia, Cheryl Marie Cordeiro, Henning Lyngsø Foged, Erik Sindhöj, Agata Witorożec-Piechnik, Aleksandra Bibow, Eetu Virtanen, Sari Luostarinen, available on the project homepage https://interreg-baltic.eu/wp-content/uploads/2026/05/D2.3-Policy-Recommendations-FINAL.pdf

HELCOM Baltic Sea Regional Nutrient Recycling Strategy objectives and Baltic Sea Action Plan actions supporting their implementation and follow-up

Each objective of the Baltic Sea Regional Nutrient Recycling Strategy is linked to prioritized actions included in the updated Baltic Sea Action Plan (BSAP). This connects implementation of the Strategy directly to the BSAP follow-up framework and strengthens the coherence between the two policy documents. Implementation is followed through the BSAP mechanisms, with HELCOM Contracting Parties reporting on progress and allowing for periodic review and adjustment where needed. The HELCOM Working Group on Source to Sea Management of Nutrients and Hazardous Substances and Sustainable Agricultural Practices (WG Source to Sea) has a key role in following implementation and facilitating cooperation among relevant stakeholders. The CiNURGi project has contributed to the implementation of several of these BSAP actions through its work. The actions directly supported by CiNURGi are highlighted in the table on the next page.

HELCOM Baltic Sea Regional Nutrient Recycling Strategy objectives and Baltic Sea Action Plan actions supporting their implementation and follow-up

Strategy Objective	Relevant BSAP actions (shortened)	Implementation
Overarching implementation	E30 – Implement measures to achieve the objectives of the Baltic Sea Regional Nutrient Recycling Strategy by 2027.	National
1. Baltic Sea region as a model area for nutrient recycling	E31 – Advance annual field-level fertilization planning and farm-gate nutrient balancing. E32 – Enhance the use of recycled nutrients and fertilize according to crop needs.	National National / Joint
2. Reducing environmental impacts	E8 – Improve soil structure and aggregate stability to reduce phosphorus losses from agricultural land. E13 – Develop BAT/BEP recommendations to reduce ammonia and greenhouse gas emissions from manure management. E14 – Develop recommendations for manure management for selected animal groups. E17 – Reduce nutrient surplus in fertilization practices. E20 – Reduce agricultural ammonia emissions through updated HELCOM guidance on BAT/BEP.	National / Joint Joint Joint National Joint
3. Safe nutrient recycling	E33 – Develop safety requirements for recycled fertilizer products and minimize harmful compounds.	National / Joint
4. Knowledge exchange and awareness raising	E11 – Improve dialogue between farmers, authorities and decision makers. E12 – Enhance mutual learning among farmers on best practices and innovative technologies. E34 – Increase knowledge and promote education and advisory services on nutrient recycling.	National / Joint National National
5. Creating business opportunities	E35 – Improve market conditions for recycled fertilizer products by setting incentives.	National
6. Improving policy coherence	E18 – Investigate and implement economic instruments supporting improved nutrient use and recycling. E36 – Enhance cross-sector cooperation and exchange on sustainable food systems and nutrient recycling.	National / Joint National / Joint

The Baltic Sea Region as a Model Area for Nutrient Recycling

The Baltic Sea Region should become a model area for nutrient recycling, demonstrating best practices in monitoring, data sharing, technology development, and coordinated policy implementation.

The Baltic Sea Region can become a global model for nutrient recycling using long-term data on nutrient loading from HELCOM Pollution Load Compilation and a strong tradition for transnational cooperation. Agriculture is a major source of nutrient loading, while simultaneously needing nutrient inputs. Regional nutrient imbalances are often linked to intensive livestock production in some areas and heavy dependence on imported mineral fertilisers in others. Becoming a model area requires data on nutrient recycling potential, its current use and possibilities for improvement, including substituting mineral fertilizers with recycled nutrients. CiNURGi's biomass mapping provides an important first step, while also revealing significant data gaps and methodological differences between countries.

Key challenges:

Fragmented data, definitions, and monitoring systems
The absence of harmonised data is a primary barrier to promoting nutrient recycling in the Baltic Sea Region. National data on nutrient-rich biomasses, processing volumes, product qualities, and end-uses are scattered, inconsistent, and incomplete across countries. Even definitions of nutrient recycling differ, making regional comparison difficult.

Regulatory divergence within and across countries
Despite shared EU legislation, Baltic Sea Region countries apply regulation related to nutrient recycling differently. Regulatory gaps and lack of clarity also exist between sectors within individual countries. Enhanced coordination of policies is needed to promote nutrient recycling across the Region.

Economic barriers and limited market development
High (initial) investment needs, logistical complexity, and persistent cost differences between recycled and mineral fertilizers undermine market viability. Even with supportive policies, functioning markets for recycled utrients remain limited benefits of nutrient recycling.

Unequal access to nutrient recycling technologies
The availability and readiness of nutrient recycling technologies vary across the Region, affecting the capacity to process nutrient-rich biomasses into concentrated, safe, and marketable products. Solving the imbalances between nutrient availability and fertilization need relies on processing a sufficient share the recyclable biomasses.

Insufficient stakeholder engagement and public awareness
Many stakeholders in the chain of production, use and regulation often lack comprehensive understanding of the benefits, risks, and practical requirements of nutrient recycling. Public perception, including concerns about safety and odour, limits societal support and slows market uptake.

Absence of a coordinated long-term monitoring system
No regional system currently exists to collect, update, and publish data on nutrient recycling potential and actual recycling rates, or to facilitate cross-country comparisons. Such a system is necessary to target interventions effectively, assess impact, and/or steer investment and policy toward national and HELCOM Baltic Sea Action Plan (BSAP) targets.

Policy Recommendations:

1. Establish a harmonised regional monitoring system for nutrient recycling

National governments should designate a responsible organisation to build and maintain national nutrient flow datasets using harmonised definitions, indicators, and reporting methodologies. Monitoring should cover nutrient recycling potential (production and nutrient content of nutrient-rich biomasses), current treatment pathways, product qualities, amounts and end use, and regional surplus-deficit patterns. Datasets should be integrated with existing reporting obligations of nutrient-rich biomasses.
Priority and actors: Near-term. National ministries, HELCOM, statistics/research organisations.

2. Harmonise regulatory frameworks for managing nutrient-rich biomasses

National governments should work toward alignment of definitions, contaminant limits, end-of-waste criteria, and permitting pathways for nutrient-rich biomasses. Harmonised quality assurance systems and joint labelling standards would reduce investor uncertainty and enable cross-border movement of recycled fertilising products consistent with the EU FPR (2019/1009).
Priority and actors: Near- to medium-term. National ministries, European Commission, HELCOM.

3. Strengthen economic incentives and market conditions

Financial instruments should be designed to bridge the cost gap between recycled and mineral fertilizing products, reflecting societal benefits (reduced emissions, avoided fertilizer import) and barriers to market entry. Priority should be given to value chains with high nitrogen and phosphorus recovery and practical solutions for use on farms. Recommended instruments include performance-based payments, investment grants, logistics support and public procurement mandates.
Priority and actors: Near-term. National ministries, municipalities, EU (CAP and cohesion funds).

4. Support technology development and redistribution infrastructure

Investment should target technologies separating and concentrating nutrient into high quality, transportable products. Data on spatial distribution of nutrient-rich biomasses should guide infrastructure toward areas with the greatest potential to address surplus-deficit imbalances.
Priority and actors: Medium-term. National ministries and authorities, EU, private sector.

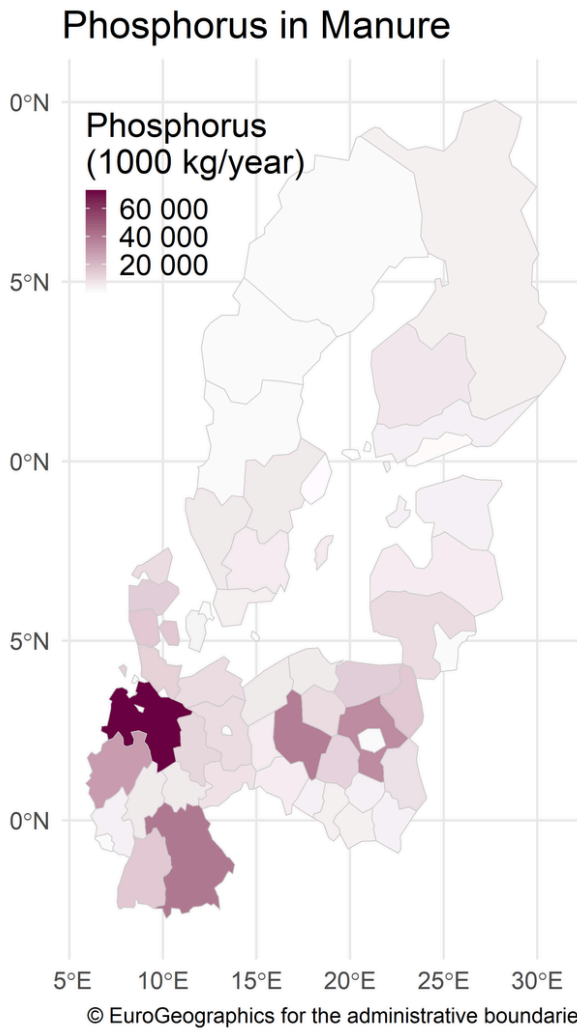
5. Strengthen cross-sector advisory services and knowledge exchange

National advisory services should integrate options of recycled fertilizing products into fertilization planning tools and provide crop-specific guidance. Communication strategies should directly address stigma of waste and/or need for changes in logistics by emphasising verified agronomic performance, environmental safety, economic benefits, and fluent practices. Cross-sector platforms should be supported to accelerate knowledge-exchange and aligning implementation practices.
Priority and actors: Near-term. National advisory services, research organisations, HELCOM, project networks.

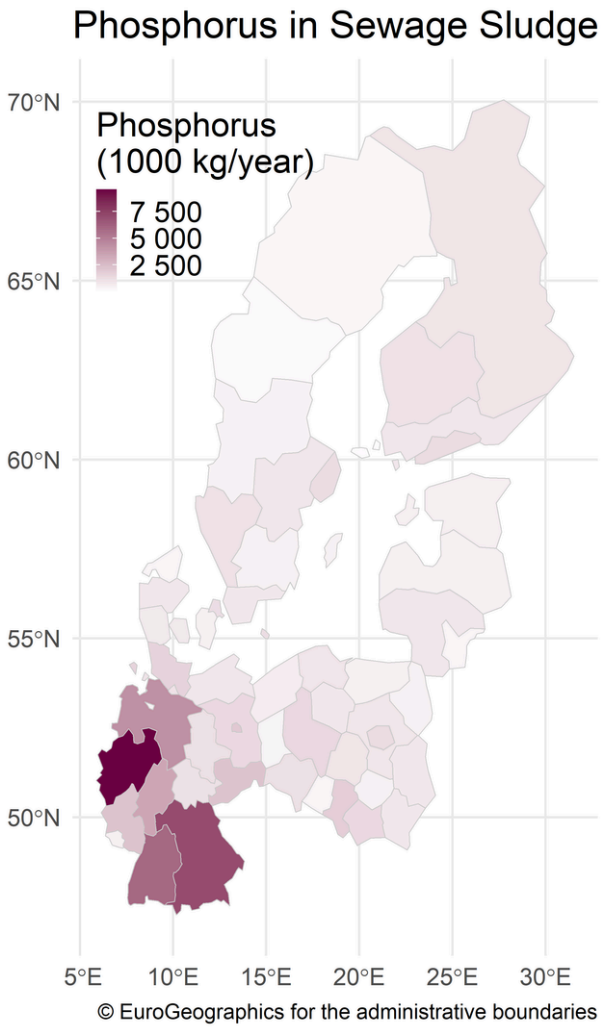
6. Establish clear governance and financing mechanisms at national level

Each Baltic Sea Region country should establish or update a coordination mechanism linking agriculture, environment, water, waste, and bioeconomy authorities, with clear mandates for nutrient recycling policy. Sectorial silos are detrimental to promoting nutrient recycling. A national nutrient recycling observatory function, whether a dedicated body or a designated ministerial unit, should ensure maintenance of data, publication of indicators, and proposals for adaptive policy adjustments. Financing frameworks should combine grants, blended finance, and results-based payments.

Priority and actors: Near- to medium-term. National governments, inter-ministerial coordination bodies.



Spatial distribution of phosphorus in livestock manure in the Baltic Sea Region. Source: LUKE Natural resources and bioeconomy studies 82/2025



Spatial distribution of phosphorus in sewage sludge in the Baltic Sea Region. Source: LUKE Natural resources and bioeconomy studies 82/2025

Reducing Environmental Impacts

Nutrient recycling should reduce nutrient losses and emissions, prevent contamination of the environment, improve soil quality and carbon sequestration, and support optimized fertilization.

Thought bio-based fertilizers can substitute mineral fertilisers and may in some cases replace current waste handling practices that affects the environment and climate negatively, bio-based fertilizer production always has a climate footprint. It comprises of energy consumption for processing and transport, and lower recycling efficiency; especially processing involving thermal and oxidative processing, such as incineration, pyrolysis, composting and nitrification means large losses of organic matter and nitrogen, often followed by a reduced amount of plant available phosphorus.

Nutrient recycling cannot be assumed to be environmentally beneficial by default; and it is important to evaluate the justification of bio-based fertilizer production on a case-to-case basis, considering both environmental, climate and overall socioeconomic impacts.

Key challenges:

Confusion about nutrient recycling terminology make policy and research goals unclear
CiNURGi found that terms such as “nutrient recycling”, “nutrient-rich wastes” and “bio-based fertiliser” are applied inconsistently. This hinders common standards, comparable statistics, and realistic recycling targets.

Insufficient accountability for nutrient losses
In several Baltic Sea Region countries, nitrogen regulation is based on nitrogen content in manure and bio-based fertilizer at the time of field application rather than during excretion or bio-based fertilizer production. This excludes a significant share of nitrogen and does not call for actions to reduce the losses for enhanced nitrogen use. Regulated field-effect coefficients in some systems further reduce farm accountability, weakening incentives for improved manure management.

No harmonised method for measuring socioeconomic benefits
No regional standard currently enables consistent comparison of the environmental performance of bio-based fertiliser value chains. CiNURGi developed the SOUP method to compare nutrient recycling impact (NRI), direct emission impact (DEI) and guiding social cost (GSC). Without harmonisation, evidence-based public support remains difficult.

Insufficient nutrient recycling from wastewater
Wastewaters contain a substantial potential for nutrient recycling, which is often unexploited due to regulatory, safety, logistic and economic barriers. Although wastewater treatment has greatly reduced direct discharges, around 90–95% of influent phosphorus is typically captured in sewage sludge, requiring safe recovery routes. CiNURGi found sludge-based chains replacing incineration among the strongest performers for nutrient recycling and societal value.

Policy Recommendations

1. Clear and official definitions for nutrient recycling terminology

The European Commission should establish a regulatory terminology to distinguish between organic recycled fertilisers and soil improvers, to clarify relevant material types for nutrient recycling. The use of officially defined terms would support consistent classification, recycling targets and monitoring, aligned with the EU Soil Mission framework. They would also clarify relevant raw material/waste types and fertilising products for achieving recycling targets, and vice-versa the waste types that are relevant for processing into soil improvers without the negative environmental impact.
Priority and actors: Near-term. European Commission, national agriculture and environment ministries, HELCOM.

2. Move toward full farm-gate nutrient accountability

National Policies should be revised to adequately incentivise the reduction of nutrient losses in animal housing and storage of manure and recycled fertilising products. National regulation should consider transitioning toward farm-gate nutrient balance requirements that make farms accountable for all nutrients entering the system. Such an approach would incentivise broader adoption of low-emission housing systems, covered storage facilities, and precision application technology, aligning national nitrogen governance more closely with HELCOM Baltic Sea Action Plan ambitions and with the principle of full nutrient cycle accountability.
Priority and actors: Medium-term. National agriculture and environment ministries; European Commission through the Nitrates Directive review; HELCOM.

3. Improve methods for assessing the impacts of nutrient recycling

National authorities and research organisations should further develop and test approaches for assessing the environmental, climate and socioeconomic impacts of nutrient recycling value chains. Comparable assessment can support policy development and decision making. Methods developed in CiNURGi can provide input to this further work. Regional cooperation through HELCOM and EUSBSR PA Nutri can support exchange of methods, data and experience.
Priority and actors: Medium-term. Research institutes, national authorities, HELCOM, EUSBSR PA Nutri.

4. Establish safe phosphorus recovery from sewage sludge

Governments and wastewater utilities should engage in research and innovation for increasing phosphorus recovery from sewage sludge without risking soil pollution and preferably based on methods that also preserve the nitrogen content. National roadmaps should define minimum phosphorus recovery rates for large wastewater treatment plants and the end-of-waste classification of recovered phosphorus products should be clarified.
Priority and actors: Near- to medium-term. National environment ministries, wastewater utilities.

Safe Nutrient Recycling

Nutrient recycling should minimise risks to human health and the environment from contamination and increase research and knowledge sharing on risks and safe practices.

Ensuring the safety of recycled fertilising products is essential for protecting human health and the environment and for building user confidence. The EU Fertilising Products Regulation (EU) 2019/1009 provides a regulatory framework, while the Sewage Sludge Directive (86/278/EEC) and the Animal By-Products Regulation (EC) 1069/2009 address specific source materials and risks. National requirements provide safeguards but also differ and add complexity when looking at the situation across the Baltic Sea Region.

The CiNURGi project explored quality assurance approaches for recycled fertilising products, covering hygiene and stability, nutrient availability, contaminants and physical impurities, as well as practical product properties. The work highlighted differences between national frameworks and the need for proportionate, risk-based quality assurance. Voluntary schemes complement legislation and can support product transparency and trust. Important gaps remain, particularly for emerging contaminants such as PFAS, microplastics, pharmaceuticals, and antimicrobials, which are still insufficiently addressed in regulatory frameworks across the region.

Key challenges:

Inadequate assessment and regulation of emerging contaminants
PFAS, microplastics, pharmaceuticals, antibiotics, antimicrobial resistance genes and other emerging contaminants are poorly regulated across the Baltic Sea Region. Analytical methods are not sufficiently established and are still under development. Current regulatory frameworks, including the EU Sewage Sludge Directive (86/278/EEC), do not adequately address growing concerns related to these substances.

Knowledge gaps on long-term soil and health risks
Evidence is still limited on the long-term accumulation of contaminants in soils, crop uptake pathways, and ecosystem effects. Further long-term research is needed to support robust risk-based limits and application guidelines for recycled fertilising products.

Inconsistent quality assurance and product information
Differences in feedstocks and processing methods can result in variable product quality and contaminant profiles in recycled fertilizing products. Quality assurance, certification and product information are not applied consistently across the Baltic Sea Region, limiting transparency and comparability for regulators and users.

Insufficient preventive practices and awareness
Preventing contaminants from entering biomass streams is more effective than removing them later. Source separation, exclusion of unsuitable feedstocks and other preventive practices are not consistently applied, while awareness of contamination risks and safe practices also varies across the value chain.

Policy recommendations

1. Improve assessment and analytical methods for emerging contaminants contaminants

Baltic Sea Region countries should strengthen the assessment of emerging contaminants in recycled fertilising products and support the development of validated and standardised analytical methods suitable for the relevant materials. Regional cooperation would support comparable occurrence data and a common evidence base for assessing risks and informing regulatory development.
Priority and actors: Near-term. National environment authorities, research organisations, European Commission, HELCOM.

2. Strengthen long-term research and science-based safety criteria

National and regional research programmes are needed to improve knowledge of contaminant accumulation, transformation, crop uptake and ecosystem effects. Scientific evidence should be used to develop and update risk-based limit values, quality criteria and application guidance for recycled fertilising products.
Priority and actors: Medium-term. National environment and agriculture authorities, research organisations, European Commission, HELCOM.

3. Strengthen quality assurance and transparent product information

Baltic Sea Region countries should promote consistent quality assurance for recycled fertilising products including clear information on product safety, nutrient availability and practical use. EU requirements should provide a common basis, complemented where useful by voluntary quality assurance and certification schemes.
Priority and actors: Near-term. National agriculture and environment authorities, European Commission, industry associations.

4. Prevent contamination and strengthen awareness of safe practices

Authorities and operators should strengthen source separation, exclusion of hazardous feedstocks and other measures preventing contaminants and pathogens from entering nutrient recycling chains. Farmers, operators, regulators and other stakeholders should have access to clear guidance on risks, safe handling and good practices.
Priority and actors: Near-term. National environment and agriculture authorities, advisory services, industry associations, HELCOM.

Knowledge Exchange and Awareness Raising

Knowledge exchange and awareness raising should support research and technological development, facilitate knowledge transfer, increase awareness of the benefits of nutrient recycling, and promote a holistic view of food production.

A lack of accessible, reliable, and actionable knowledge about recycled nutrient fertilizing products remains a major barrier to their uptake in the Baltic Sea Region. Stakeholder consultations indicate that farmers are the key group influencing the demand for recycled fertilizing products, with their decisions shaped by product quality, cost, safety assurance and practical agronomic guidance.

CiNURGi's stakeholder engagement across the region has identified several recurring barriers, including price sensitivity compared to mineral fertilizers, uncertainty about nutrient release, practical challenges related to storage and application, and unclear regulatory and certification requirements. Consumer concerns have a more indirect effect on the demand for recycled fertilizing products, mainly by influencing the consumers' choices on food products and the marketing decisions of food-chain actors.

Key challenges:

Data access and knowledge gaps across the value chain
Reliable and up- to- date data on nutrient-rich biomasses and properties of recycled fertilising products are not systematically available, and industries and municipalities are not required to report nutrient flows. This limits the ability of producers and policymakers to assess recycling potential, and the implementation of HELCOM Baltic Sea Action Plan measure E32 remains difficult without comprehensive national nutrient flow data

Limited farmer acceptance and trust
Many farmers remain hesitant to use recycled fertilizing products due to concerns about safety, agronomic performance, most effective application, and real cost. Stakeholder consultations show a clear preference for pelletised or granulated products. On the other hand, some food-chain actors limit the use of sewage-based materials due to contaminant risk and potential reputation hazard. Independent field trials and reliable certification systems are essential to build confidence in recycled fertilizing products across the region.

Weak integration of nutrient recycling into formal education and advisory systems
Nutrient recycling and recycled fertilizing products are not consistently included in agricultural education or advisory training, and content related to them is insufficiently integrated into shared knowledge. Limited access to advisory tools and cross-sector learning platforms, together with knowledge gaps among practitioners - rather than technology availability - remain a primary barrier to adopting recycling practices across the Baltic Sea Region

Fragmented and uncoordinated research and project knowledge
Research on recycled fertilizing products is conducted by many actors in the Baltic Sea Region, but result sharing between projects is limited. Knowledge generated through past initiatives is scattered across numerous reports and often does not reach practitioners or policymakers, reducing the impact and long-term use of project results.

Policy recommendations

1. Mandate transparent data reporting on nutrient turnover in waste and biomass streams

National legislation should require industries and municipalities to report nutrient turnover (Nitrogen and Phosphorus) in the waste and biomass streams they manage. These data should be incorporated into national nutrient flow monitoring systems and made accessible to businesses and policymakers through a publicly available platform.
Priority and actors: Near-term. National ministries, regional authorities, producers of recycled fertilising products.

2. Enhance the digital fertilizer label with practice-relevant recycled fertilizing products information

National authorities and industry associations should promote voluntary enhanced digital labelling for recycled fertilising products, building on EU FPR and digital labelling rules, by providing additional practice-oriented information, such as organic farming approval status, reliably assessed nutrient availability, carbon stability, and guidance on storage, transport, and application equipment.
Priority and actors: Near-term. National ministries, fertilizers producer associations, European Commission.

3. Integrate nutrient recycling into formal agricultural education and advisory training

Experienced researchers and stakeholders from the nutrient recycling sector should collaborate with agricultural education institutions to share knowledge and best practices regarding recycled fertilizing products for use in secondary and higher education curricula, as well as in the continuing vocational training of agricultural advisors. The knowledge shared should encompass regularly updated modules covering recycled fertilizing product properties, legal regulations, and practical guidelines.
Priority and actors: Near- to medium-term. National ministries, agricultural universities, farmer advisory bodies.

4. Prioritise demonstration trials and farmer-to-farmer learning

Awareness campaigns should build on independent field trial results demonstrating recycled fertilising products performance under real conditions, supported by farm demonstration networks and farmer-to-farmer exchange. National subsidy schemes should provide incentives for farmers who host demonstration trials or participate in learning networks.
Priority and actors: Near-term. National ministries, advisory services, research institutes, farmer organisations.

5. Create open-access knowledge infrastructure and multi-stakeholder platforms

Open-access platforms should compile innovations, best available technique data, field trial results and recycled fertilising products research outputs. Multi-stakeholder platforms linking farmers, SMEs, local authorities, and researchers should be established to facilitate knowledge exchange and support implementation. Research funding should require open-access publication and active engagement with practitioner communities

Priority and actors: Near- to medium-term. National research funding bodies, EU (Horizon Europe), HELCOM, EUSBSR PA Nutri, project networks.

6. Strengthen cooperation across research projects on nutrient recycling

National and EU research funding bodies should introduce additional incentives for application RNF-related projects and require project outputs that are accessible to practitioners and policymakers. A dedicated Baltic Sea Region knowledge exchange platform, potentially hosted by HELCOM or EU Strategy for the Baltic Sea Region Policy Area Nutri (EUSBSR PA Nutri), should coordinate research activities, prevent duplication, and translate results into actionable policy guidance.

Priority and actors: Medium-term. European Commission, HELCOM, EUSBSR PA Nutri.

Left: Demonstration event by Farmers' Parliament *Zemnieku saeima* 20 August 2026
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Down left: Field trail by Institute of Soil Science and Plant Cultivation (IUNG) summer of 2025
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Creating Business Opportunities

Economic incentives should encourage new business models with cross-sectoral cooperation, and improve the economic viability of nutrient recycling.

Developing a healthy market in nutrient recycling with demand and supply for bio-based fertilizers requires economic incentives for all actors in the value chain from organic waste collection to use of the nutrients for crop fertilisation. Economic incentives could consist of support to investments or operational costs, or support for innovation and knowledge sharing. They should result in profitable nutrient recycling business, both for the value chain actors and for the entire society.

CiNURGi's assessment found that value chains seldom achieve cost parity with mineral fertilisers under current conditions, and fewer than half are socio-economically justified when accounting for full value chain costs. Paired with farmers' willingness to pay approximately half the market price for bio-based fertilizer compared to equivalent nutrients in mineral fertilisers, causes a structural market gap that is partly technical and partly policy based. Low farmer willingness to pay, combined with insufficient economic incentives, fails to compensate producers for the verified environmental benefits of nutrient recycling.

Key challenges:

Data access and knowledge gaps across the value chain

Systems for rewarding those who contribute to nutrient recycling for the ecosystem services they deliver to society are not yet in place. The instruments should be designed to redirect to value chain operators the verified societal benefits they generate. Socio-economic values are not transferred to value chain actors, and market instability discourages investment.

Nutrient recovery technologies require significant capital investment. Effective nutrient recycling requires facilities for separation and phosphorus recovery, as well as logistics chains for biomass collection and RNF distribution. CiNURGi found that only five of eleven assessed value chains delivered positive societal returns. Other research has similarly found that high production costs are barriers for BBF production in Poland.

Low demand for bio-based fertilizers from crop farmers

Though the regional surplus-deficit imbalance in the Baltic Sea Region is well documented, indicating areas in demand of nutrients, it doesn't follow that there is a demand for bio-based fertilizer. Recycled fertilizeing products are typically more expensive than mineral fertilisers, less predictable in performance, and more difficult to apply.

The need for price competitive bio-based fertilizers with a high content of readily plant-available nutrients that can be handled with existing logistics facilities and field spreading equipment is confirmed by farmer preference analyses, which also highlights on market aversion to bio-based fertilizer with content of material stemming from municipal wastewater.

Policy Recommendations

1. Value chain actors should receive CSP-based public support for the ecosystems services their bio-based fertilizer production deliver

CiNURGi's policy analysis found that possibilities for offering financial incentives for nutrient recycling via national CAP Strategic Plans (CSP), based on EU's CAP, are given low or no prioritisation in Baltic Sea Region Member States. EU Member States should explore and deploy the available options within CAP eco-scheme and agri-environment-climate measure frameworks to reward nutrient recycling, including practices, tools, and investments that replace synthetic mineral fertilisers with recycled and organic alternatives. The measures should be designed to revert verified societal benefits of nutrient recycling to value chain actors, including the value of reduced nutrient losses, avoided GHG emissions, and displacement of mineral fertiliser imports, regardless of the specific technology or facility type involved. Recommended instruments include: investment grants for establishing processing, and logistics infrastructure for bio-based fetilizer production; operational support; funding for testing, certification, and demonstration activities; carbon and nutrient credit schemes rewarding verified nutrient retention and GHG emission reductions; and public procurement mandates requiring bio-based fertilizers in public land management.
Priority and actors: Near-term. National governments, municipalities.

2. Strengthen via CSP funds innovation in bio-based fertilizers that comply with crop farmers valuation criteria

Regional circular economy clusters, industrial symbiosis networks, and working groups should be supported to facilitate research and innovation in BBFs that comply with crop farmers valuation criteria. Support instruments should explicitly reward applications to develop bio-based fertilizers that deliver positive environmental and socioeconomic impact, and prioritise cross-sector partnerships that integrate knowledge exchange across agriculture, water and wastewater, food industry, and technology sectors.
Priority and actors: Medium-term. National governments, EU, regional authorities, private sector.

3. Integrate bio-based fertilizer use via CSP funding into nutrient budgeting and fertilisation

Field trials with bio-based fertilizers, along with similar testing and laboratory analysing activities, should clarify the agronomic performance of specific bio-based fertilizers in relation to the nutrient supply of the crops. Operational Groups should be supported in sharing knowledge and building trust among crop farmers to the use of recycled nutrients for crop fertilisation. New standards and knowledge to the agronomic effect of recycled nutrients in various BBF types, including their readily plant available share of recycled nutrients, should be bult into Farm Sustainability Tools for nutrient budgeting and fertilisation planning etc. It should be ensured that farm advisors - assisting crop farmers with nutrient budgeting and fertilisation - are trained to integrate recycled nutrients into their farm advice on fertilisation, and to explain the impacts on environment and climate.
Priority and actors: Near-term (annual CSP budgeting). National agriculture ministries, farm advisory services, Operational Groups, FaST tool providers.

Improving Policy Coherence

Policy coherence should be improved through increased cooperation between governmental agencies and an updated legal framework that facilitates nutrient recycling.

Nutrient recycling cuts across several policy areas, including waste, fertiliser, agricultural and environmental policy. CiNURGi's analysis of 11 recycled fertiliser value chains identified barriers related to approval and CE-marking procedures, end-of-waste criteria, fiscal incentives, sewage sludge regulation and implementation through CAP Strategic Plans. A key finding is that regulatory fragmentation and lack of clarity occur not only between countries but also within national frameworks.

At the same time, several EU and Baltic Sea policy frameworks support nutrient recycling. However, CiNURGi's analysis found that regulatory barriers often outweigh these incentives across the assessed value chains. Improving coherence between policy areas and translating common objectives into coordinated implementation are therefore central challenges.

Key challenges:

Incoherence across sectoral legislation
Nutrient recycling lies at the intersection of waste, fertilizing product, agricultural, water and energy policy. Requirements developed separately for these sectors can create regulatory gaps, overlaps and conflicting requirements for producers and users of recycled fertilizing products.

Regional commitments are not consistently translated into national action
Baltic Sea countries have agreed on common nutrient recycling objectives and measures through the HELCOM Baltic Sea Action Plan and the Baltic Sea Regional Nutrient Recycling Strategy. However, their implementation through national legislation, policy instruments and CAP Strategic Plans remains uneven.

EU and Baltic Sea regional policies are not sufficiently coordinated
Several EU policies support nutrient recycling, but their implementation is not systematically coordinated with HELCOM and EU Strategy for the Baltic Sea Region objectives. This can result in disconnected priorities, implementation processes and monitoring across governance levels.

Policy Recommendations

1. Strengthen coordination between national authorities

Each Baltic Sea country should establish or strengthen a coordination mechanism involving authorities responsible for agriculture, environment, water, waste, energy, and other relevant sectors. These mechanisms should identify conflicting requirements, clarify responsibilities, and coordinate national nutrient recycling policies.
Priority and actors: Near-term. National governments and relevant ministries.

2. Accelerate implementation of HELCOM Baltic Sea Action Plan nutrient recycling measures

Countries should systematically review how Baltic Sea Action Plan actions E32, E33, E35 and E36 are reflected in national legislation, policy instruments and CAP Strategic Plans. Remaining implementation gaps should be identified and addressed, with HELCOM supporting regional coordination and follow-up.
Priority and actors: Near- to medium-term. National agriculture and environment ministries, HELCOM.

3. Strengthen coordination between EU and Baltic Sea regional policies

The coordination role of EU Strategy for the Baltic Sea Region Policy Area Nutri should be strengthened to better link relevant EU policies with implementation of HELCOM nutrient recycling objectives. Cooperation between EUSBSR PA Nutri, HELCOM, the European Commission and national authorities should support aligned priorities and monitoring across governance levels.
Priority and actors: Near-term. EUSBSR PA Nutri, HELCOM, European Commission, national governments.

4. Develop a regional roadmap for policy convergence

HELCOM and PA Nutri should develop a Baltic Sea regional roadmap identifying concrete steps towards greater policy coherence in nutrient recycling. The roadmap should define priorities, responsibilities, milestones, and review points and provide a common basis for monitoring progress across the region.
Priority and actors: Medium-term. HELCOM, EUSBSR PA Nutri, national governments, European Commission.