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## EU consultations

### EU consultation on nutrient management (INMAP)

**Public consultation, open to 26<sup>th</sup> August 2022, asks for opinions and proposals on nutrient policies, fiscal and regulatory tools, and on nutrient recycling.** General questions ask for input on which impacts of nutrient pollution are important, different actors involved and links to other environmental challenges, including climate. Input is requested on what should be the key actions and policy tools (e.g. fiscal policy, financial incentives ...), consumer actions (e.g. dietary choices) and whether INMAP should address nutrients other than N and P. A section on nutrient recycling asks to identify obstacles to recycling (e.g. cost, regulation, contaminants ...) and priority actions to support nutrient recycling (e.g. targets, taxes, enforcement of legislation ...). Supporting documents or proposals can be submitted.

EU public consultation on INMAP, “Nutrients – action plan for better management”, open to 26<sup>th</sup> August 2022, [HERE](#).



### EU survey on materials and micro-organisms for CE-mark fertilisers or biostimulants

**The Commission has opened a survey, to 16<sup>th</sup> September 2022, on possible additional waste or recycled materials for the EU Fertilising Products Regulation, possible new biostimulants micro-organisms, or other amendments.** Input will be considered for a planned Commission study to identify potential new ‘CMC’ materials or biostimulants micro-organisms which offer significant trade potential, agronomic value and safety. Proposals for materials can either be materials falling outside existing CMCs (possible new CMCs to add into Annex II), modifications of input specifications for existing CMCs, or other processing methods for existing CMCs. Existing CMCs cover (with limitations) composts, criteria, mechanically-processed plant materials, food industry by-products (limited list), precipitated phosphates, ash-derived materials, pyrolysis/hydrocarbonisation materials, some by-products and recovered minerals (see consolidated Fertilising Products Regulation and Commission information sources document 23/5/2022 [here](#)). Before submitting input, you should verify the texts of existing CMCs 1-15. The survey asks to justify Circular Economy, environmental and resource aspects, agronomic efficiency, and to provide supporting data on regulatory aspects, scientific studies, market data, including estimating existing and potential use and trade volumes. Proposals for modifications of Annexes I (PFCs), III (labelling) or IV (certification) can also be submitted.

EU survey on materials for CE-mark fertilisers “EU survey on possible future development of the FPR”, responses by 16<sup>th</sup> September 2022 will be considered for upcoming EU study: [https://ec.europa.eu/eusurvey/runner/possible\\_future\\_development\\_of\\_the\\_FPR](https://ec.europa.eu/eusurvey/runner/possible_future_development_of_the_FPR)

## EU tender for secretariat for fertiliser “Notified Bodies”

The European Commission (DG GROW) has published ex-ante publicity for a tender for “Technical secretariat of the Coordination Group of Notified Bodies for EU fertilising products Group under Regulation (EU) 2019/1009”.

Pre-tender expression of interest, *open to 15<sup>th</sup> July 2022*, via TED <https://etendering.ted.europa.eu/cft/cft-display.html?cftId=11419>

## EU consultation on Environmental Liability

“Environmental Liability Directive (evaluation)”, public consultation (questionnaire) to *4<sup>th</sup> August 2022*. See ESPP [eNews n°66](#) and [HERE](#).

## EU consultation on Waste Framework Directive and food waste

EU public consultation, *open to 16<sup>th</sup> August 2022*, “on the revision of the Waste Framework Directive”. One consultation with two different access pages: “Food waste – reduction targets” [HERE](#) and “Environmental impact of waste management – revision of EU waste framework” [HERE](#).

## ESPC4 and PERM, June 2022

320 participants in Vienna, Austria, and a further 80 online, from more than 30 countries worldwide, joined the 4<sup>th</sup> European Sustainable Phosphorus Conference, making it the biggest conference on phosphorus ever worldwide. With PERM (the 5<sup>th</sup> Phosphorus Research in Europe Meeting), a total of 20 plenary and parallel sessions showed over 60 presentations as well as nearly 50 posters, bringing a wide range of content on links between phosphorus and climate change; global, EU, national, regional and city public policies; recycling technologies; recovered fertilisers and soil science.

Above all, the Conference provided unique opportunities for networking, for the first time since Covid, with extended breaks, dedicated [Swapcard](#) contact and conference networking app, an exceptional social event hosted by Vienna City in the Town Hall’s fabulous Festivities Hall, a site visit and the young researchers’ get together.

All presentation slides and posters, and video recordings of plenaries and selected parallel sessions are now online in the ESPP [Swapcard](#) conference networking app space, accessible to all online and in-person registrants.

After this success, candidatures are open to organise the next European Sustainable Phosphorus event in 2024: contact ESPP.

Photos:

1 = (left to right) Jürgen Czernohorszky Councillor for Climate and Environment, Vienna City Council, Johanna Bernsel, European Commission, Ludwig Hermann, Proman (conference organiser) and ESPP President and Rainer Kronberger, Vienna City Administration.

2 = Conference room nearly full for plenary sessions.

3 = Time and space for networking during breaks.

4 = 300 members of the phosphorus community let their hair down and dance at the Conference Dinner hosted by Vienna City (photo S. Omelon with thanks)

Conference web page: <https://phosphorusplatform.eu/espcc4>

All slides, posters, recordings are available to registrants only at:

<https://app.swapcard.com>



## Regulations impacting nutrient recycling

### Consolidated EU Fertilising Products Regulation (FPR) online

The European Commission has made available [here](#) the “consolidated” text of the Fertilising Products Regulation EU 2019/2009, integrating 1<sup>st</sup> technical amendments (ATP [2021/1768](#) of 23 June 2021) and the three ‘STRUBIAS’ criteria: [precipitated phosphate salts and derivatives](#), [thermal oxidation materials](#) and [pyrolysis and gasification materials](#). Note that the consolidated text does not include the Recitals of the amendments, which can be found in the links included in the document indicated below. The consolidated text also does not yet include CMCs 11 (by-products, now published in the [Official Journal 24/6/22](#)) and 15 ([recovered minerals](#), including nitrogen recovered from off-gases, pending publication), nor CMC10 (animal by-products ABPs) because texts to integrate ABPs into CE-mark fertilisers are still not yet proposed.

The Commission has also made available a document including links to legislative documents, CEN standards and Guidance documents for the FPR (23/5/2022 [here](#)).

### ESPP requests European Commission to address obstacles to nutrient recycling

ESPP has asked the European Commission to address obstacles to recycling nutrients as “commodity chemicals”. Placing on the market of recovered phosphoric acid, phosphate or nitrogen salts, as commodity chemicals, is potentially obstructed by the EU Animal Feed Regulation 767/2009 (Annex II \$1 and \$5) which prevents use in animal feed of materials processed from manure or sewage, potentially e.g. phosphoric acid recovered from sewage sludge incineration ash. It is not feasible to place such recovered chemicals on the market if tankers leaving the recycling plant have to carry a label “this batch must not be used in animal feed production”. Commodity chemicals must be fungible, and are sold to either wholesalers or users who will take inputs from different sources for use in several different applications. ESPP has asked the European Commission to confirm that nitrogen salts recovered from off-gases are not concerned by these articles of the Animal Feed Regulation, coherent with the Commission’s statement that off-gases are not concerned by the Animal By-Product Regulation (DG SANTE reply to ESPP of 31\_5\_22, see under Fertilising Products Regulation at [www.phosphorusplatform.eu/regulatory](#)). ESPP has also asked the Commission to confirm that nutrient chemicals recovered from ash are not considered to be processed manure or sewage, and similarly for chemicals extracted from algae grown using manure or sewage inputs (see details in ESPP letter to DG SANTE 7\_5\_2021 at [www.phosphorusplatform.eu/regulatory](#)).

ESPP letter to European Commission (DG SANTE) 3\_7\_2022 at [www.phosphorusplatform.eu/regulatory](#)

### DG SANTE proposes highly restrictive use of Animal By-Products in EU-fertilisers

DG SANTE has still not made public proposals on how to include certain Animal By-Products (ABPs) into the EU Fertilising Products Regulation (FPR), but has published slides suggesting this could be very restrictive and limited. Stakeholders have been waiting for these proposals since March 2016, when the European Commission published the draft FPR with an empty box for ABPs. The published slides suggest that four categories of materials should be authorised in EU-fertilisers under processing conditions already defined in the ABP Regulations (that is, as already widely used in national fertilisers in many Member States): that is, **no additional restrictions for Cat2 and Cat3 ashes, composts, digestates, horns & hooves**. However, other materials would be, under the proposal, subject to important market restrictions: packaging of < 50 kg, mixing with at least 50% plant material. This would mean **significant restrictions for: Dicalcium phosphate and tricalcium phosphate** (presumably meaning where derived from ABPs, esp. bones), **Glycerine, Feathers and down, Processed animal protein (PAP), Hydrolysed protein, Meat and bone meal, Blood products**. ECOFI and EUROFEMA have written to the European Commission objecting that these restrictions are very restrictive, unjustified and essentially exclude the use of these ABPs in agriculture, underlining that they have been widely used in national fertilisers in Member States for many years with no evidence of any BSE case traced back to fertilisers. ESPP does not agree that smaller packaging or mixing with plant materials will prevent misuse by feeding to animals instead of use as fertiliser. This will be further discussed at the EU Fertilisers Expert Group, with stakeholders (including ESPP) and Member States, 14-15 July 2022.

DG SANTE slides presented to the EU Animal Health Advisory Committee, 7<sup>th</sup> June 2022 [here](#)

### Reconsideration of recycled nutrients in Organic Farming

**Recycled nutrients, in particular struvites and recovered ammonia nitrogen, are back onto the EU Organic Farming Expert Group (EGTOP) agenda.** Struvite and calcined phosphates from municipal wastewater were already “approved” by the Commission’s technical committee for Organic Farming six years ago ([EGTOP 2/2/2016](#)) but are today still not included into the EU Organic Farming Regulation. Since then, ESPP has supplied extensive information to the Organic Farming federation IFOAM, a [“reflections” paper](#) has been published by lead experts in FiBL identifying under what conditions recycled phosphorus could be accepted in Organic Farming, and the RELACS project has received EU-funding to assess (amongst others) recycled nutrients. However, no real progress has been made, with the RELACS “Roadmap” proposing more discussion and more research (ESPP [eNews n°66](#)). This is regrettable in that recycling to avoid consumption of non-renewable resources is a foundation of Organic Farming, and Organic Farming risks losing productivity and soil fertility because of inadequate phosphorus supply (see Marie Reimer in [ESPP eNews n°49](#)). In [answer](#) to a [written question](#) from two members of the European Parliament (Peter Jahr, Norbert Lins), the European Commission has replied “Based on the recommendation in EGTOP’s final report on fertilisers, to be published soon, the Commission will take a decision on the possible inclusion of these products”. It is unclear what this means, in that the EGTOP [minutes of 8-10 June](#) indicate that “Recycling of nutrients (struvites,

stripped nitrogen: requests from MSS)" are on the EGTOP work plan for later in 2022. ESPP has written to the European Commission (DG AGRI) requesting clarification (see [www.phosphorusplatform.eu/regulatory](http://www.phosphorusplatform.eu/regulatory), letter of 12/7/2022). This letter further includes precise proposals for text amendments to Annex II of the Organic Farming Regulation 2021/1165 to include the following recycled nutrient products into Annex II of the EU Organic Farming Regulation 2021/1165: **Struvite, Calcined phosphates, Recovered elemental sulphur, Bio-sourced adsorbents used to treat wastewaters, Phosphorus-rich pyrolysis and gasification materials (inc. biochars), Algae and algae products grown to treat wastewater, Vivianite, Recovered nitrogen from off-gases.**

Comments are welcome to ESPP on these amendment proposals ([see annexes to letter of 12/7/2022](#)).

## New ESPP member

### PHOSTER

The EU project PHOSTER aims to deliver a sustainable, replicable, and scalable circular economy solution (TRL 4) for the recovery of secondary minerals and metals from sewage sludge ashes and mining industry by-products to substitute primary critical raw materials (P, Mg) in the fertilisers manufacturing. The University of Ljubljana will re-design sewage sludge thermal treatment by setting the recovery of secondary materials as the first-priority design parameter. Politecnico di Milano will work to optimise wet chemical extraction of P from ashes. Magnesitas Navarras will investigate the best mining by-products to promote the co-precipitation of P and Mg (Politecnico di Milano). Timac Agro Italia will test the recovered materials, mixed with other raw materials, to develop fertilisers complying with relevant regulations and market demand. Social Life Cycle Assessment (SLCA) and Cost-Effectiveness Analysis (CEA) will evaluate environmental and social impacts of the fertilisers obtained from the recovered products. The different processes will be optimised together to maximise beneficial impacts for crops and the environment. The PHOSTER project proudly became a member of the European Sustainable Phosphorus Platform in the view of networking with the most relevant stakeholders in Europe and of broadly disseminating the project concept and results.



PHOSTER is co-funded within the ERA-MIN 3 framework. Project website <https://phoster-project.eu/> and [LinkedIn](#) page.

## Calls for data

### Pathogens and prions in Animal By-Product (ABP) and manure ash

ESPP is looking for data on sanitary safety of ABP ashes, and chemicals derived from such ashes (including ashes from manure combustion). Please send references, reports, data analyses, etc to ESPP. We are continuing to engage with the European Commission to request that ashes from animal by-products (ABPs), and chemicals extracted from them, be authorised under the EU Fertilising Products Regulation (FPR).

At present, Cat2 and Cat3 ashes (including combustion of manures) are included in the text of the FPR (CMC 13) but are not yet authorised, pending modification of the Animal By-Products Regulation. We hope that a proposed text will be presented at the EU Fertilisers Expert Group 14-15 July. Industry and stakeholders have together been asking for progress on this for several years now.

For Cat1 ash, the European Commission has indicated to us that it plans to mandate EFSA to assess sanitary safety of Cat1 Animal By-Product ashes (see [DG SANTE reply 31 5 22](#)). ESPP hopes that this EFSA evaluation will also cover non-fertiliser uses of Cat1 ash (e.g. recovery of phosphoric acid or phosphate chemicals for use in industry or animal feed or human food applications).

ESPP has therefore launched a literature and data search for information on sanitary safety of Cat1 ash, or of chemicals processed from Cat1 ash, contracted to Kevin McDonnell's team at University College Dublin. The most sensitive question for EFSA will be possible detection of prions in ash (or capacity of ash to transmit bovine spongiform encephalitis). Any data on sanitary safety (pathogens, prions) in Cat2-3 ash (including manure ash) is also very welcome as supporting evidence.

**If you have any such data or information, please can you let us know and send to ESPP (email below):** copies of, or references of, published papers, reports, etc., copies of pathogen or prion analyses of Animal By-Product or manure ash, or of ash derived products, any other possibly relevant data. If data is confidential, please let us know so that we can ensure confidential handling without disclosure.

ESPP call for literature, reports, data etc. on pathogens and sanitary safety of Animal By-Product ashes (inc. manure ashes). Please send information by 15<sup>th</sup> July 2022 if possible. [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)

## Nitrogen recovery and recycling

**ESPP is looking for literature, technology information or data on nitrogen recovery and recycling of Nitrogen.** The aims are to identify technologies recovering Nitrogen from wastewaters, manure or digestates, food processing, etc., analyse development stage of these processes and identify key companies and R&D centres working in this area. We are also interested in data on sanitary safety of recovered Nitrogen products (pathogen data). ESPP has contracted a literature search and analysis to Atkinson Tumbure (researcher based in Ireland, with experience in New Zealand, Zimbabwe). Please send any reports, paper references or other sources of data to ESPP (email below).

*ESPP call for literature, reports and data on Nitrogen recovery and recycling technologies.  
Please send information by 15<sup>th</sup> July 2022 if possible. [info@phosphorusplatform.eu](mailto:info@phosphorusplatform.eu)*

## Industry and policy

### Animal Feed industry (FEFAC) paper on nutrient recycling in feeds

**The feed industry federation notes the potential to increase “circular feed” and nutrient recycling in animal feed, whilst not competing with human food use, the need to address regulatory obstacles and the importance of safety.** FEFAC underlines that circularity for animal feed must be in synergy with the feed conversion ratio (which indicates resource input efficiency, for which nutrient digestibility is important). Twelve examples of nutrient recovery practices are presented, including sugar production, beer brewing, industrial fermentation, grass bio-refining, dairy production, animal by-products and calcium phosphate from gelatine production (animal bones). The position paper notes that in practice, nearly none of the raw materials used in animal feed are of human food grade, for economic reasons. FEFAC emphasises that ensuring food chain safety in nutrient recycling to feed is essential. FEFAC suggests nonetheless that potential exists for increasing nutrient recycling to feed, that this should be mapped looking at emerging circular economy practices, and that some regulatory obstacles should be addressed, where these are more rigid than necessary to achieve safety. In particular, FEFAC notes the problem of the outright exclusions of Annex III of the Animal Feed Regulation 767/2009 (see ESPP request to European Commission, above), and obstacles to use in animal feed of Cat 3 Animal By-Products as inputs for algae or micro-organism production. Spotlight examples presented, where regulatory obstacles are hindering safe recycling, are: insect farming, algae production, phosphate recovery from sewage sludge incineration ash, single cell proteins

*“Circular feed. Optimised nutrient recovery through animal nutrition”, [FEFAC 13<sup>th</sup> June 2022](#). The European Feed Manufacturers’ Federation (FEFAC) brings together compound animal feed industry associations from 25 countries and the European associations EMFEMA (on-farm mineral mixes) and EFFPA (former foodstuffs to feed).*

### Fertilising products and EU agricultural statistics (SAIO Regulation)

**ECOFI and EBIC say statistics on all fertilising products should be included in the new European agricultural statistics system (EASS), in coherence with the product categories (PFCs) of the EU Fertilising Products Regulation (FPR).** The European Commission has proposed, within the Green Deal, a new regulation on statistics on agricultural input and output (SAIO), intended to integrate data on agricultural production (including Organic Farming), agricultural prices, plant protection products (PPPs) and nutrients. The proposed Regulation is currently under discussion by the European Parliament and Council. The European Biostimulants Industry Council (EBIC) and the European Consortium of the Organic-Based Fertilizer Industry (ECOFI) position asks that SAIO covers all “fertilising products”, not only inorganic and organic fertilisers, that is all PFCs of the EU Fertilising Products Regulation (FPR 2019/2009). The federations also ask that the EU’s economic and customs statistics system (NACE) be updated to cover all FPR PFCs and that statistics track fertilisers authorised for Organic Farming (in order to help address confusion between “organic fertilisers” as defined in the FPR, that is containing organic carbon, and fertilisers for Organic Farming, which can be mineral).

*“EBIC and ECOFI urge the inclusion of data on all fertilising products in the Regulation on Statistics on Agricultural Input and Output (SAIO) in line with Europe’s Green Deal targets”, [9<sup>th</sup> March 2022](#)  
EU proposal for a Regulation on Statistics on Agricultural Input and Output (SAIO): [Eur-Lex](#).*

### Evoqua to take forward Ostara struvite recovery technology

**The market leader in struvite recovery from sewage and ESPP member, Ostara, has signed with Evoqua Water Technologies, a leader in water treatment technologies, for sales and implementation in Europe and North America.** Ostara’s Pearl® system from Evoqua recovers phosphorus as high-purity Crystal Green struvite (magnesium ammonium phosphate) granules from wastewaters, in particular from digestate filtrate in biological phosphorus removal (EBPR) sewage works, where this can improve biological P and N removal and sludge dewatering. Ostara has today some 24 installations operating or under construction worldwide. Evoqua serves more than 38 000 customers and 200 000 installations worldwide providing global reach to Ostara and enabling to offer synergy with treatment solutions including biological P removal systems and upgrading, denitrification, advanced anaerobic digestion and biogas production, ammonia removal, degassing, etc. Evoqua also offers innovative ballasted clarification and tertiary filtration systems ([ballasted clarifiers](#)) for P-removal applications (see [SCOPE Newsletter n°141](#)).

*EVOQUA: [www.evoqua.com/nutrientrecovery](http://www.evoqua.com/nutrientrecovery)  
Press release 16<sup>th</sup> September 2021 [here](#).*

## Food industry sustainability plan

**FoodDrinkEurope (the EU food and beverage industry federation) “Action Plan” targets climate change, packaging and nutrition, as well as food loss and waste and a circular and resource efficient food chain.** Phosphorus and fertilisers are however not mentioned. The proposed industry Nutrition Action Project targets healthier diets and lifestyles, noting that over half of European adults and a third of children are overweight, including addressing “malnutrition and diet-related health conditions” and addressing in particular labelling and food safety. Nutrition is considered as mainly reducing salt and sugar, but also promoting “sustainable beef” or “healthy snacking”.

“Action Plan For Sustainable Food Systems”, FoodDrinkEurope, 15<sup>th</sup> June 2022 [here](#).

## Nordrhein-Westfalen publishes P-recovery fact sheets prepared by DPP and FHNW

**FHNW (University of applied Sciences and Arts Northwestern Switzerland) has compiled 11 fact sheets (in German) on phosphorus recovery processes with the help of DPP and the technology providers:** struvite / calcium phosphate precipitation (AirPrex, PhosForce, Stuttgart process), EuPhoRe, Pyrophos, AshDec, Ecophos, Parforce, Phos4Life, direct application of ash to land, sewage sludge incineration ash use in the fertiliser industry. The 2-page fact sheets outline the process, rate of P-recovery, % P in output product and plant availability (NAC solubility), and provide information on existing installations and company contacts. The fact sheets were commissioned by the German Land of North Rhine-Westphalia as part of a project performed by SWECO, DPP, FHNW, Talanwälte, Fraunhofer ISI and ATEMIS. Besides the factsheets, the project report contains an analysis of all relevant legislation, infrastructure of North Rhine-Westphalia, a characterisation of the relevant technologies, scenarios with cost estimation for phosphorus recovery in North Rhine-Westphalia and recommendations.

Nordrhein-Westfalen Steckbriefe (P-recovery fact sheets), in German, 28/2/2022, [here](#) and on the Swiss Phosphorus network [www.pxch.ch](http://www.pxch.ch). The complete project report [here](#)

See also the updated (6/2022) ESPP-DPP-NNP Nutrient Recovery Technology Catalogue <http://www.phosphorusplatform.eu/techcatalogue>

## Research

### Nearly half of global food production depends on mined phosphate rock

**The anthropogenic signature of soil-available phosphorus is estimated country by country worldwide, based on soil P pools modelling, fertiliser, animal feed and crop data since 1950.** Country-specific modelling of exchanges between pools of stable and labile phosphorus in soils are combined with annual data 1950 – 2017 for mineral P fertiliser and mineral animal feed P-additives, livestock and manure, crops (and so model estimates of crop P harvest), human population and sewage sludge, modelled losses to water, imports and exports (international trade of agricultural products). Anthropogenic content of soil P pools before 1950 are assumed negligible. The study estimates the anthropogenic signature of the labile soil phosphorus pool, worldwide, at 45% ( $\pm 8\%$ ), with Western Europe, North America and Asia around 60%, whereas Eastern Europe are around 40%, Africa 30% and Australia and New Zealand below 20%. Assuming that crop production depends on soil P availability, which approximates to labile soil P, this means that nearly half of today’s global food production today depends on phosphorus originating from mined phosphate rock. It should be noted that this dependency includes past application of mineral fertiliser (or of mineral-origin P via e.g. manure), i.e. includes “legacy P” in soils, so does not inform on the vulnerability of current food production to today’s level of phosphate rock use, but rather informs on the combined past and present contribution of phosphate rock to current level of food production. The authors note, for example that a drastic reduction in mineral P fertiliser application would only slightly reduce this modelled anthropogenic P signature because P-recycling would impact both anthropogenic and natural P-fluxes similarly.

“Anthropogenic signature of global agricultural soil phosphorus”, full paper, published by Nature Portfolio but still under review, not yet accepted for publication 7/2022 <https://doi.org/10.21203/rs.3.rs-1741339/v1> and “To what extent our food production depends on anthropogenic phosphorus?”, EGU22-7944 abstract, 6/2022 <https://doi.org/10.5194/egusphere-equ22-7944> J. Demay, T. Nesme, B. Ringeval, S. Pellerin.

### Increasing research into nutrient recovery

**A literature review 2000 – 2020 shows exponentially increasing publications on nutrient recovery, with papers addressing mainly phosphorus recovery, and papers on biological recovery routes particularly increasing.** A total of 1869 publications were found with phosphorus recovery, nitrogen recovery in the title, keywords or abstract, reaching 350/year in 2020. The number per year is increasing, particularly since 2014, from close to zero in 2000. China, USA and Australia are indicated to be the most prolific countries, but if taken together, the total from EU countries is higher. The authors consider that the number of publications today is not yet considerable, and can be expected to continue to increase with an S curve, maybe reaching maturity with a plateau of around 1600 publications per year from around 2040 (that is over four times more publications per year than today). The number of publications into biological routes for nutrient recovery is especially expected to increase. The authors also provide analysis on the most prolific journals, bibliometric attractivity and activity indexes.

“Technical advances on current research trends and explore the future scope on nutrient recovery from waste-streams: a review and bibliometric analysis from 2000 to 2020”, T. Kamilya et al. Environmental Science and Pollution Research 2022, [DOI](#).

## Main climate impact of phosphate fertiliser is in use phase

**Data modelling of greenhouse emissions from P-rock mining, fertiliser production and use on arable crops in China suggests that nearly 60% are related to crop production.** This study assesses greenhouse emissions from phosphate rock mining (<10% of total supply-chain emissions), fertiliser production and fertiliser use on maize rice and wheat in China. Total phosphorus-related greenhouse emissions in China (for grain production) are estimated to have increased by more than five times since 1980 to c. 45 Tg CO<sub>2</sub>-eq. The authors note that fertiliser production in China is highly fragmented, with many small, inefficient units. Data is based on field fertiliser trials in a number of locations across China 2005 – 2014. The climate emissions from fertiliser use are based on the CO<sub>2</sub> emission factor for using P fertilizer of 1.63 kg CO<sub>2</sub>-eq / kg P<sub>2</sub>O<sub>5</sub> (Huang et al., 2017, Wang et al., 2017) and also on nitrogen climate gas emissions from MAP and DAP. This results in calculated total supply-chain emissions for MAP and DAP significantly higher than for TSP (mainly because of the nitrogen content of MAP and DAP) and lowest for SSP. The authors conclude that improving phosphorus use efficiency in fertiliser use offers important potential synergies with reducing greenhouse emissions.

“Synergies in sustainable phosphorus use and greenhouse gas emissions mitigation in China: Perspectives from the entire supply chain from fertilizer production to agricultural use”, H. Gong et al., *Science of the Total Environment* 838 (2022) 155997, [DOI](#).

## Phosphorus flows in Ontario

**Project undertaken with financial support from the Government of Canada assesses phosphorus flows and recovery potential for the Province of Ontario, Canada,** as part of wider effort to define and develop a Canadian Nutrient Recovery and Reuse Platform. The report on phosphorus flows in Ontario, led by Canada’s longest-standing environmental NGO, [Pollution Probe](#), in collaboration with researchers, follows the stakeholder phosphorus [forum](#) organised in March 2018 ([ESPP eNews n°38](#)) which recommended studying P flows to provide a foundation for the creation of a Canadian nutrient recovery and reuse platform with regional hubs. The report concludes (fig.6, p21, see below) that the largest use sector for phosphorus in Ontario is agriculture, importing 56 ktP/y in fertilisers and 23 ktP/y in animal feed and animals. Chemical imports for uses other than fertiliser production are estimated at 22 ktP/y. The report looks at the “end use” of this imported phosphorus, most of which (56 ktP/y) goes into food products (crop food products, meat, milk and eggs), with other significant “uses” being chemicals exported (14 ktP/y), bio-ethanol production (6 ktP/y), P-losses to water (5 ktP/y) and phosphorus accumulation in soils (9 ktP/y). Unlike in some other publications, these identified “end uses” include intermediate stages (e.g. P in food products, which will be returned to crops via sewage or food waste, or end up in landfill) and uses where no P is finally present (bio-ethanol). P flows to composting and to anaerobic digestion, and P flows from municipal wastewater treatment to land application are also estimated in the report. The potential for phosphorus recovery in recycling in various flows is discussed (manure, slaughterhouse waste, sewage, etc.). Examples of technologies and case studies are presented..

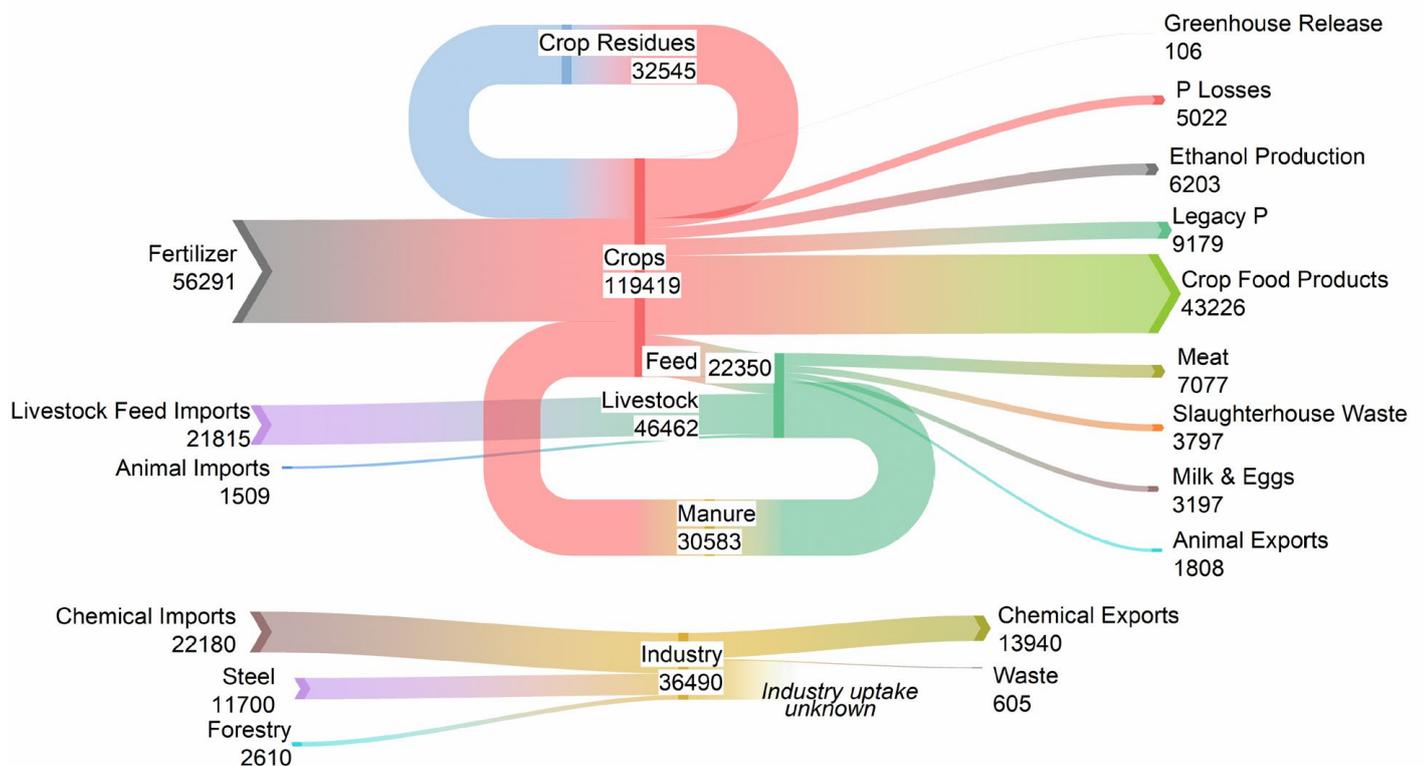


Figure 6 from the report: *Phosphorus Flows (t/a) through Ontario’s Agricultural and Select Industrial Sectors (2019)*. Note “greenhouse” in this figure means agricultural glasshouses and does not refer to climate emissions. “Mapping Phosphorus Flows in the Ontario Economy”, *Pollution Probe et al.*, 2022, 164 pages [online here](#).

## Another unhelpful Life Cycle Analysis ?

A “screening LCA” on organic fertilisers illustrates, as is often seems to be the case, how Life Cycle Analysis can fill many pages to produce unhelpful “science”. This study claims to develop LCA (Life Cycle Analysis) and LCI (Life Cycle Inventory) for various organic fertilising materials. Materials such as sewage sludge, manures, digestates are compared to “commercial organic” and “commercial organo-mineral” fertilisers. In the Supplementary Information p10 (\$3.5) comparison is also made to mineral fertilisers. The study suggests that the most significant environmental impacts of producing organic fertilising materials are in thermal drying and dewatering, but considers the impacts of producing raw manure as zero (LCA standard practice for waste). This is misleading, because sewage sludge or manure are not dried to produce fertiliser but for storage and disposal reasons, whereas on the other hand manure can be considered as an inherent part of livestock production, which has significant environmental impacts. Nitrogen losses during manure storage (ammonia and climate emissions) are taken into account, but not emissions during application and then from soils, whereas these vary considerably between different organic materials and different mineral nitrogen fertiliser chemicals. The study shows, as often in LCAs, that the results depend principally on “Deus ex Machina” allocations of emissions to input secondary materials and LCA boundaries. With the parameters applied, this study concludes that untreated manures and sewage sludge, and manure digestates, have the lowest LCA, (predictably, as no emissions are allocated to their production, and because emissions during use and from soil are not considered), that commercial organic fertilisers and treated organic waste streams have similar LCA with generally higher impacts than mineral fertilisers.

“Screening LCA of French organic amendments and fertilisers”, A. Avadí, *The International Journal of Life Cycle Assessment* (2020) 25:698–718, [DOI](#).

## Ignoring weather variation results in P-targets 50% too high

Modelling for Lake Erie suggests that failure to consider natural weather variation leads to substantial over-estimation of environmental phosphorus targets and so inadequate actions. The modelling included agriculture and crop economics, the soil P cycle and decision makers perceptions of environmental risks. Environmentally “Risk-neutral” and “Risk-averse” management strategies were modelled, both based on average expected weather conditions, but when variability of weather is taken into account, both result in soluble phosphorus loads which are beyond fixed water quality objectives in one year out of two. If 85% reliability of achieving target P-loads is defined as an objective (taking into account weather), this requires a 30% reduction in P-inputs (additional to 16% reduction already required based on average weather) and leads to a 15% profit loss for farmers under “current” weather conditions, and a 23% loss under estimated climate change conditions (RCP 8.5). Cultivation of cover crops and of less nutrient-intensive crops are also required. The authors note that climate change reinforces these conclusions, but has less impact than taking account of current weather variability which already requires considerable reductions in P input limitations and changes in agricultural practices.

“Containing the Risk of Phosphorus Pollution in Agricultural Watersheds”, M. Wildemeersch et al., *Sustainability* 2022, 14, 1717. [DOI](#).

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