



TOWARDS SUSTAINABLE PHOSPHORUS MANAGEMENT IN EUROPE



Chris THORNTON*, Kimo VAN DIJK**, Christian KABBE***

* info@phosphorusplatform.eu European Sustainable Phosphorus Platform (ESPP)
www.phosphorusplatform.eu ** Dept. Soil Quality, Wageningen University and Research
centre, P.O. Box 47, 6700 AA, Wageningen, The Netherlands *** Coordinator of EU FP7
project P-REX <http://p-rex.eu/> at Kompetenzzentrum Wasser Berlin, Cicerostraße 24,
10709 Berlin, Germany



Summary

Phosphorus (P) is a non-renewable resource, irreplaceable for food production. Losses to surface waters exceed Planetary Boundaries by $8x^i$ and P is the main reason for failure to achieve European water quality objectives. This offers major opportunities for improving management, recycling, the bio-nutrients circular economy and rural/farm job creation. The EC Communication on Sustainable Phosphorus 2013 identified stakeholder concerns and possible actions. Phosphate rock was added to the EU List of Critical Raw Materials in 2014. Bio-nutrients were identified as a priority in the European Commission public consultation on Circular Economy policy in 2015. The EU FP7 P-REX project published proposed policy orientations in 2015. The European Sustainable Phosphorus Platform (ESPP) brings together stakeholders (industry, users and market, regulators, innovation, NGOs) in an active network to address phosphorus management, use efficiency, recycling (reuse, recovery). ESPP ensures stakeholder dialogue and input to decision makers, e.g. on R&D and innovation policies, data on nutrients to support stewardship (DONUTSS), EU Fertiliser Regulation recast and criteria for struvite and biomass ashes, REACH, BAT documents, BEMPs (EMAS), standards (CEN, ISO ...). ESPP maintains an inventory of P-recycling R&D and facilitates innovation dissemination, experience transfer, value chain communication to market.

Phosphorus use in Europe

Information on phosphorus flows in Europe (van Dijk et al. 2015)ⁱⁱ shows that (in 2005) the EU-27 imported nearly 2.4 million tonnes of phosphorus (P, i.e. 2 400 Gg P), of which somewhat less than half accumulated in agricultural soils and just over half was lost as waste. Phosphorus use efficiency (PUE) was around 70% in crops but retention in animal products was only 24%, so that in total 28% of net P input finally reached supplied human food products. Around 4% of net phosphorus input was lost to surface waters, potentially contributing to eutrophication when reaching lakes, rivers or estuaries.

The authors conclude that there are wide variations between different European countries and regions, but that generally phosphorus use in EU-27 was characterized by relatively (1) large dependency on (primary) imports, (2) long-term accumulation in agricultural soils, especially in west European countries, (3) large losses throughout entire society, especially emissions to the environment and sequestered waste, (4) little recycling with the exception of manure, and (5) low use efficiencies, because of aforementioned issues, providing ample opportunities for improving sustainability of phosphorus management.

EU Critical Raw Material

In 2014, the European Commission added phosphate rock to its list of (now 20) Critical Raw Materialsⁱⁱⁱ. These materials are defined by high economic importance and a high risk for supply security. Phosphate rock is considered by the EU Commission report to be subject to “high supply risk”; the principal use of phosphate rock is in fertilisers and global demand is expected to increase (because of growing world population and so need for food), and there are no alternatives to phosphorus in fertiliser and animal feeds to produce food. European policies to address raw materials criticality include improving efficiency of materials use and recycling, waste policy and international cooperation to address supply security.

An update of the EU’s assessment of phosphate rock criticality is currently underway. The stakeholder meeting underlined issues with the methodology used (MSA = Raw Materials System Analysis) and the lack of adequate data on P flows and stocks (see below). ESPP input underlines that the assessment should consider not only “phosphate rock”, but also phosphorus in all forms (P) in order to **address bio-nutrients and recycling**, and also specific forms of phosphorus, in particular **White Phosphorus (P4)** which is critical for strategic industries (chemicals, fire safety, electronics) and is no longer produced in Europe (100% technological import dependency).

European Commission Communication on Sustainable Use of Phosphorus

In 2014, the European Commission published conclusions (SWD(2014)263) to the Consultative Communication on the Sustainable Use of Phosphorus (COM(2013)517, see ESPP’s SCOPE Newsletter n° 95) underlining that “closing the phosphorus cycle is both possible and desirable” and identifying the following needs for action:

- Increasing knowledge of P supply (resources) and demand (flows)
- Security of supply
- Risk assessment of contaminants in mineral or in recycled fertilisers as used
- Recovery of P from wastewaters, food waste and other biodegradable wastes
- Improving P use in agriculture
- Innovation and research in P use, mining & processing, environmental impacts of P, agronomic P-efficiency, P-recovery and recycling
- Policy instruments and integration of P into existing legislation
- Awareness raising, including through nutrient Platforms



Need for better information on bio-nutrients

Adequate, up-to-date, useable **data on flows of N, P, K, Mg and other nutrients is essential to define stewardship objectives, targets and actions**, and to monitor their effectiveness, for regulators, industry and users (market). An interesting initiative in this area is the national Observatory of Mineral and Organic Fertilisation established by the French fertiliser industry (ANPEA, Unifa, CAS, AFCOME)^{iv}. ESPP is launching work with stakeholders to define how to improve nutrient data for decision making and recycling industry development (DONUTSS)^v.

Van Dijk et al. (above) have estimated the **potential for phosphorus recovery and recycling in Europe**, concluding that phosphorus recycling from waste streams other than manure could represent 274-396 ktP/year, i.e. around one quarter of current EU mineral phosphorus fertiliser consumption (1 448 ktP/year). Additionally, large amounts of P in manures are already recycled, including through on-farm use (1 736 ktP/year).

There is also a clear **need for better information concerning recycled nutrient products**, many of which are new or are evolving: agronomic value, use and application, quality. With support of 60+ organisations, ESPP submitted to EIP-AGRI (European Innovation Partnership for Agriculture, Horizon 2020 / DG AGRI) a “Focus Group” proposal on agronomic use of recycled nutrients, covering fertiliser value; nutrient loss mitigation; contaminants; impacts on soil, BMPs for handling and application; circular economy and farm added-value^{vi}.

Policy recommendations

The **EC published conclusions of the phosphorus recycling workshop** (organised parallel to the 2nd European Sustainable Phosphorus Conference, 2015)^{vii} noted that some P-recycling processes are already at the commercial production scale and underlined the need for policy support for phosphorus recycling. The workshop identified R&D needs including: flow studies, social science, value-chain actions, risk assessment of organic contaminants, full-scale demonstration projects, R&D to support standards and BAT/BEMP, regional approaches niche markets, clustering of projects and networking.

The **EU-funded FP7 project P-REX “Policy Brief”** 2015^{viii}, coordinated by Christian Kabbe, recommends the following to enable widespread implementation of P recycling from wastewater

- EU phosphorus recycling target and roadmap for implementing this target
- Regional phosphorus policies
- Adaptation of existing legislation to recycled nutrients, level playing field to mineral-based fertilisers, and implementation guideline
- Mechanisms to share costs of phosphorus recycling: e.g. quotas or recovery obligations
- Funding of full-scale demonstration installations



Platforms in action

The **European Sustainable Phosphorus Platform (ESPP)** launched 2013, addresses P recycling (recovery, reuse), P supply, P management and use efficiency in a sustainable and safe food chain, from farm to diet. National nutrient platforms are operational in Netherlands, Flanders, Germany, the Baltic (BSAG), with projects in UK, Norway, Czech Republic. ESPP also cooperates with the North America (NAPPS) and Japanese platforms, and with the Global Partnership on Nutrient Management (GPNM). The platforms bring together industry, regulators, technology suppliers, R&D, farmers organisations, NGOs and enable:

- **Networking** of expertise, projects, success stories, value chains
- **Stakeholder dialogue with decision makers** and input to policy and regulation
- **Innovation, knowledge and R&D dissemination**, from production through to market
- Development of a **vision for P sustainability** in Europe, communications, awareness raising

The platforms strongly promote **innovation** and its implementation in nutrient sustainability

- inventory of P-recycling technology assessments (WETSUS)^{ix}
- inventory of current and recent P-recycling R&D projects^x
- R&D needs (see EC P-recycling workshop, above)
- update of farm Best Nutrient Management Practice (BMP) fact sheets^{xi}

ESPP and its partners are directly involved in a range of **current EU regulatory and policy processes**:

- EU Fertiliser Regulation recast: taking recovered nutrient products into account and EU criteria development (JRC) for struvite, biomass ashes
- Organic Farming Regulation: proposed validation of recycled P products
- REACH (EU chemicals regulation): Art 2(7)d “recovered” substances, by-products
- BAT BREFs (Industrial Emissions Directive): waste incineration, pig & poultry production
- BEMPs: EMAS (EU Eco-Management and Audit Scheme Regulation) “agriculture”
- EIP-AGRI Focus Group proposal: agronomic use of recovered nutrient products
- EU Critical Raw Materials list: MSA update
- standards: CEN SABE, ISO 275 ...

A key current development is the **proposed EU Circular Economy policy**^{xii}. The Ellen MacArthur Foundation^{xiii} estimates that a circular economy system for food production could cut Europe’s food cost per person by 30%. Bio-nutrients were identified as a priority sector for EU Circular Economy policy by a quarter of respondents to the EU’s 2015 public consultation. ESPP is actively involved in this process, fostering stakeholder input to policy development.



-
- ⁱ "Taking planetary nutrient boundaries seriously: Can we feed the people?", *Global Food Security* 3 (2014) 16-21
<http://www.sciencedirect.com/science/article/pii/S2211912413000540> (Open Access)
- ⁱⁱ Van Dijk, K. C., Lesschen, Jan Peter and O. Oenema. "Phosphorus flows and balances of the European Union Member States." *Science of the Total Environment*, accepted 2015.
- ⁱⁱⁱ See ESPP's SCOPE Newsletter n° 104 on www.phosphorusplatform.eu
- ^{iv} see ESPP's SCOPE Newsletter n° 109 <http://www.afcome.org/wpcontent/uploads/2014/10/Création-Observatoire-national-de-laferilisation-minérale-et-organique.pdf>
- ^v DONUTSS workshop (Data on Nutrients to Support Stewardship), Ghent, 3-4 September 2015, with support of the EU Commission (DG GROW) and BioRefine www.phosphorusplatform.eu
- ^{vi} See ESPP's SCOPE Newsletter n° 114 on www.phosphorusplatform.eu
- ^{vii} See ESPP's SCOPE Newsletter n° 115 and 111: "Circular approaches to phosphorus: from research to deployment", 48 pages, European Commission Directorate-General for Research and Innovation 2015, ISBN 978-92-79-46827-8
<http://bookshop.europa.eu/en/circular-approaches-to-phosphorus-pbKI0115204/> conclusions of the workshop on phosphorus recycling, 4th march 2015, Berlin, organised by the European Commission, P-REX and ESPP parallel to ESPC2 (2nd European Sustainable Phosphorus Conference)
- ^{viii} P-REX policy brief, March 2015: see ESPP's SCOPE Newsletter n° 111 and 115 http://prex.eu/uploads/media/P-REX_Policy_Brief_final.pdf
- ^{ix} WETSUS « Inventory and summary of technology assessments of phosphorus recycling technologies » regularly updated, see ESPP's SCOPE Newsletter n° 109 and 105, www.phosphorusplatform.eu under 'Downloads'
- ^x see ESPP's SCOPE Newsletter n° 111 www.phosphorusplatform.eu
- ^{xi} see ESPP's SCOPE Newsletter n° 115 www.phosphorusplatform.eu
- ^{xii} European Commission public consultation on the Circular Economy (closed 2th August 2015)
http://ec.europa.eu/environment/consultations/closing_the_loop_en.htm based on proposed 'Roadmap' (April 2015)
- ^{xiii} "Growth Within: a circular economy vision for a competitive Europe", 100 pages, 25th June 2015, Ellen MacArthur Foundation, McKinsey Center for Business and Environment, SUN (Stiftungsfonds für Umweltökonomie und Nachhaltigkeit)
<http://www.ellenmacarthurfoundation.org/news/latest-research-reveals-more-growth-jobs-and-competitiveness-with-a-circular-economy>