1. *Phosphorus, carbon, nitrogen, climate and food security*

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Janne Helin– Natural Resources Institute Finland (Luke): Impacts of global food demand and income growth on phosphorus demand

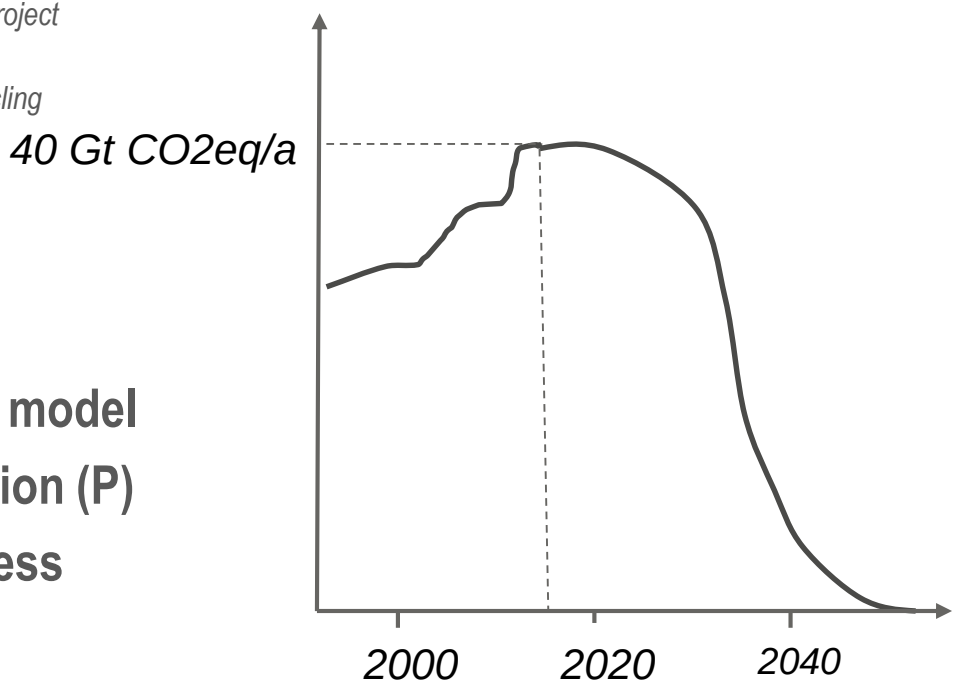
Paul Withers– Lancaster University UK: The role of phosphorus in the resilience and sustainability of the UK food system

Jari Liski– Finnish Meteorological Institute: Finnish Carbon Action pilot project

Juha Helenius– University of Helsinki:
Agroecological symbiosis: food system redesign for bioenergy and recycling

Presentations

- **Global prediction of P need**
- **Geophysical and socioeconomic model**
- **Soil model for carbon sequestration (P)**
- **Pilot local symbiosis, digestion less nutrient loss**



Source: Kevin Anderson, ***Gordon Goodman Memorial Lecture,*** *2017*

2. Nutrient Circular Economy

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We have moved from theory to action, but how to we scale up?

1) Require the right price

- Must value co-benefits, not just P
- Consumer perceptions are important (citizens, industries)

2) Integrating across scales and sectors will be key

3) Linking explicitly other goals, esp. climate change

- Funding opt, biomass energy value, soil C sequestration

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ESPC3 parallel session 3: Nutrients in agriculture and livestock

Moderator: Oscar Schoumans
Wageningen University and Research (WUR)

Rapporteur: Kimo van Dijk
European Sustainable Phosphorus Platform (ESPP)

Presentation 1: Nutrient management best practices in dairy production for Italian cheese
Giuliana D'Imporzano - LIFE-DOP

- Objectives: innovation and enhanced:
  - Slurry manure management
  - Fertilizer and field management
  - Stable management
- Potential flows taken into account: milk, cheese, slurry, manure and digestate

Presentation 2: Tools to calculate manure quantity and quality and to plan regional manure nutrient recycling in Finland

Sari Luostarinen - Luke

- Finland aims to be a model country in nutrient recycling
  - Need for supporting tools to understand what all affects what
- Finnish normative manure system to be used in nutrient recycling
  - Model to calculate manure quantity and composition
  - Hotspots of manure are modelled and mapped, to link net supply and net demand
- Nutrient calculator for planning regional nutrient recycling
  - Putting together the masses and spatial distribution of all organic wastes and by-products available, scenarios for processing them into new products and using them in fertilisation according to field soils and produced crops
- Practical implementation of nutrient recycling still modest in Finland
  - Too many stakeholders reluctant to change and take the lead

Presentation 3: PEGaSus project Phosphorus efficiency in pigs and poultry: bridging the gaps in the phosphorus value chain

Arno Rosemarin - SEI

- Phosphorus efficiency in pigs and poultry production: bridging the gaps in the phosphorus value chain
- Strategies to increase bioavailability, digestibility and efficiency of plant phosphorus in mono-gastric animals to reduce inorganic feed additives
- Reduce phosphorus losses as discharges
- Global increase of CAFOS – concentrated animal feeding operations – up to 10k pigs
- Pigs and poultry have very low take up of organic phosphorus, compared to cattle and dairy cows
- Animal-centred model of the phosphorus cycle

Presentation 4: Baltic experience of slurry acidification

Erik Sindhöj - RISE Agrifood and Bioscience

- Baltic slurry acidification: reducing nitrogen loss from agriculture by implementing slurry acidification technologies
- Manure can be acidified in stable, in storage or in field
- Only performed by Baltic countries, aim is to spread this method to other countries
- Variable positive but sometimes also negative results in certain years
- Farmers are generally sceptical in this new practise
- Acidification could have positive benefits for phosphorus solubility in soils when manure is applied

Recommendations & conclusions (1)

- 5 R principle should be leading:
  - **Realign** inputs where possible
  - **Reuse** organic waste streams (sludge, manure, ...)
  - **Recover** nutrients from 'wastes' for recycling
  - **Reduce** nutrient losses to minimize eutrophication
  - **Redefine** the system if needed
- Need for phosphorus pollution permit, accounting and trading system to be implemented across EU
- EU resolution on Best Available Technologies is one of the tools, but there is need for more regulatory action
- Livestock production is living at a too high trophic level, not sustainable with the world population
- Both social and technical challenges and solutions are needed
- Need for regional approaches and co-ownership, as a region to close the nutrient cycle and fulfil the need for nutrition within the system
- Both the whip (regulation) or carrot (subsidies) strategies should be used

Recommendations & conclusions (2)

- The more recycled fertiliser will be used, the cheaper it gets, but we need to start and the financial and tax system should change
- CAP should be reformed with nutrient recycling included, not only nitrogen, but also phosphorus
  - Farmers must be rewarded for the additional investments for better nutrient management
  - There is a need for a tax for the input and/or output of sectors and the system, must be in the reform of the CAP or in the EU circular economy package
- Biggest challenge is the social transition among businesses, organizations, governments and citizens
- Consumers should reduce meat consumption which could deliver potential increase in nutrient use efficiency, but export is an important driver for animal production
- It is not the farmer that has to decide where to go, but society as a whole including policy makers, businesses, consumer and citizens

Key messages for ESPC3

- **Need for phosphorus pollution permit, accounting and trading system to be implemented across EU**
- **Need for regional approaches and co-ownership, as a region to close the nutrient cycle and fulfil the need for nutrition within the system**
- **CAP should be reformed with nutrient recycling included, not only nitrogen, but also phosphorus:**
  - **Farmers must be rewarded for the additional investments for better nutrient management**
  - **Need for a tax for the input and/or output of sectors and the system, can be in the reform of the CAP or in the EU circular economy package**

Leon Korving Wetsus Phosphorus removal from dilute sources
Esa Salminen Speeding up recovery of the Baltic
Anne-Mari Ventelä Commercial fishery removing P
Bengt Simonsson Nutrient removal from Sediment
Linda Kumblad Björnöfjärden case

4. Policy tools for sustainable use of Ecological nutrient restoration

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Internal loading needs addressing for short term timely solution whilst land based measures for long term. Long term monitoring crucial ecological effects uncertain.

Wetsus – P from diffuse sources. Trying regenerative adsorption having rejected wetlands due to area needed.
Vahanen - internal Baltic loading needs addressing as recovery time long even if helcom reached. Oxygenation concerns of long term efficacy, chemicals not tried in seawater apart from aluminium. Sediment removal possibility
Pyhärjävi – fishing removes P in a commercial way and keep Daphnia which eat plankton. Climate change presents challenge.
Techmarket – top sediment removal used direct on soil or forest or remove elements and make methane/hydrogen silt into cement
Baltic Sea 2020 – took bay from bad to good using land-based and aluminium

6. Policy tools for sustainable use of nutrients

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- Presentations: Austria, Poland, Netherlands, Germany/Central America
- Different nutrient flows, policies: between Member States, regions, sectors …
- Insufficiently holistic policy approach: waste water & agriculture, P-removal & recycling, climate & energy, soil health & carbon, SDGs, food system & diet …
- Some EU policies make things worse (e.g. end of Milk Quotas and CAP) or pose obstacles (e.g. "processed manure" in Nitrates Directive)

→ *Importance of regulatory context and policy drivers*
- need supra-national approaches / force of international agreements

→ *Conditions for policy success: knowledge base (data, science, demonstration projects), enforcement/ monitoring, stakeholder & end-user dialogue, economics*

→ *Innovative policy tools and policy mixes: e.g. phosphorus "rights", links to good practice codes, food industry purchasing criteria …*