P-TRAP

Diffuse phosphorus input to surface waters - New concepts in removal, recycling and management -

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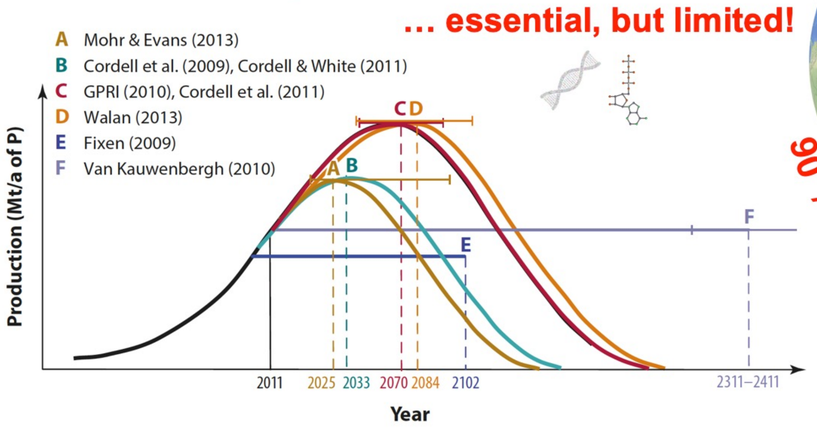
H2020 ITN-ETN European Training Research Network – 7 countries – Interdisciplinary International Intersectoral – Innovation – Education

REA Success Story!

P-TRAP 2019 - 2023

Why P matters

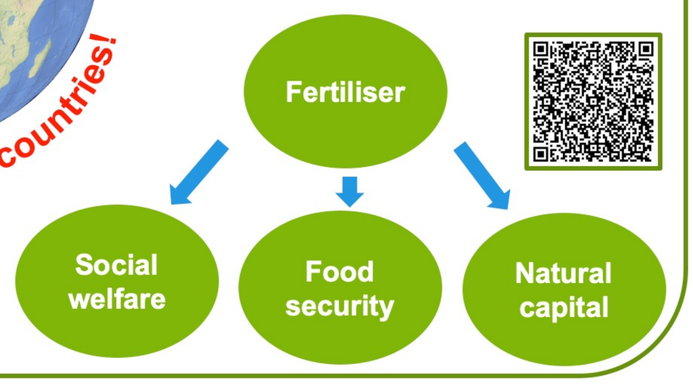
… essential, but limited!



Global phosphate depletion scenarios based on different assumptions (Cordell and White 2014)

Scarcity

- Phosphate rock as finite resource
- Mismanagement / inefficient use
- Lack of access
- Geopolitical risks
- Lack of effective global governance



11 projects, 7 countries

Scientific approach of P-TRAP

P-TRAP will target two interlinked global problems

1) flux of phosphate from agricultural areas to surface waters
2) enhanced loading of surface water with phosphate causing eutrophication.

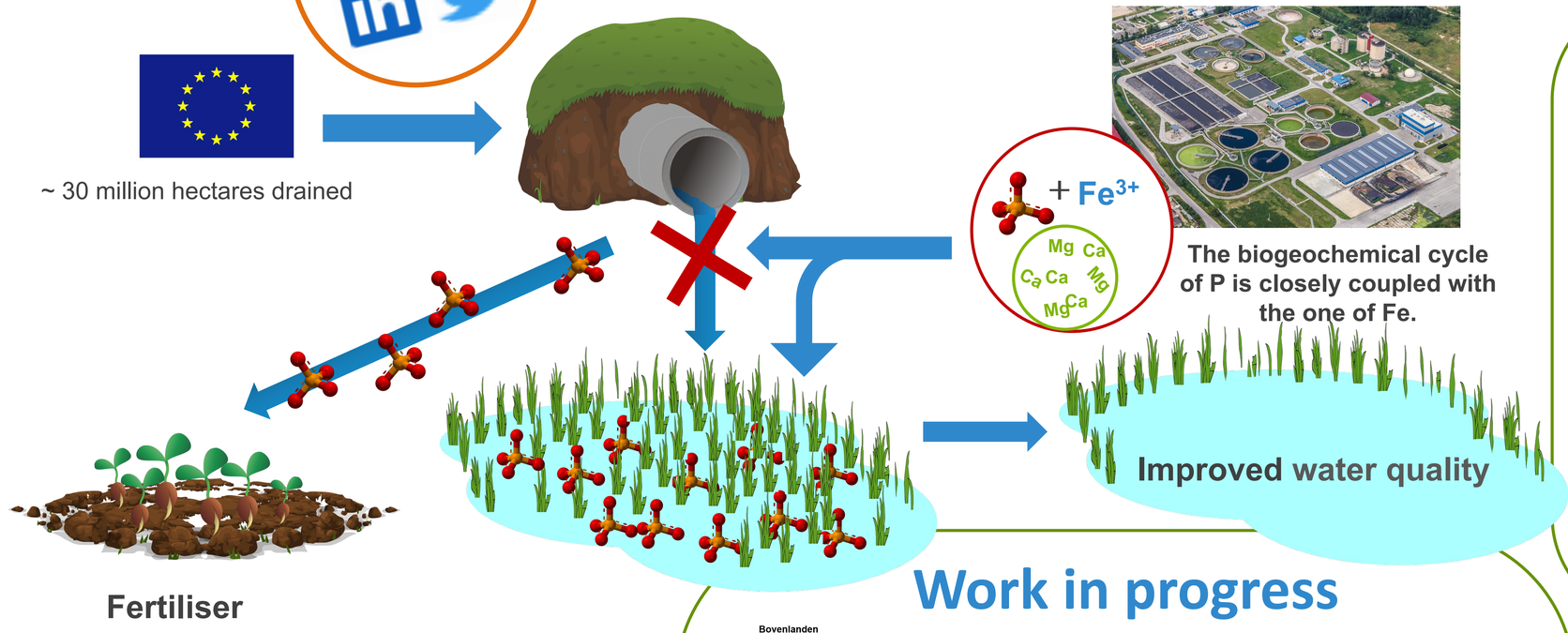
Both are in conflict with our understanding of circular economy and a key challenge in meeting the objectives of the EU Water Framework Directive.

AIM of P-TRAP as an European Training Network

Research	• Develop new methods and approaches to trap phosphate • Constrain uncontrolled loss of P in one system and prevent others from overload
Training	• Educate a new generation of "cross–thinking" scientists
Networking	• Provide a platform to gain knowledge and experience in cutting-edge research and in environmental business practices.

Follow us!

3 Scientific Work Package



The biogeochemical cycle of P is closely coupled with the one of Fe.

Work Package 1

Develop, test, and optimise novel approaches for capturing P in agricultural drainage areas

Convert P-containing Fe(III)-oxides into marketable fertilisers

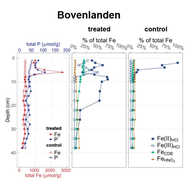
Work Package 2

Establish an innovative method for mitigating eutrophication in lakes by using by-products from water treatment

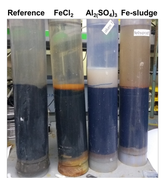
Work Package 3

Develop deterministic and quantitative models for processes & mechanisms controlling the behaviour of P during the transformation of Fe minerals

Work in progress

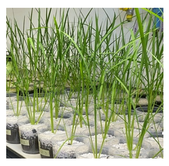


P release from sediments of lakes has been investigated. Fe-treatment introduced an Fe-pool into the sediment which is efficiently able to bind P . A transition of the diagenetic regime, from S- to Fe-dominated, reduces the P flux to the overlaying water. However, the longevity of this treatment is not clear yet.

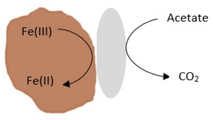


Sediment from a eutrophic reservoir was incubated with various **P retention materials**, incl. iron sludge recovered as a by-product of water treatment. Addition of Fe-sludge performed equally well as the addition of aluminium and Fe salts to reduce P fluxes from sediments.

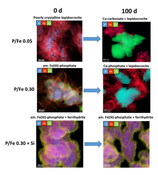
The behaviour of **Iron Coated Sand (ICS)** as a recycled material is studied under low redox conditions, and also the kinetics of P adsorption on ICS. The results demonstrate the ability of ICS to reduce the P load in surface waters.



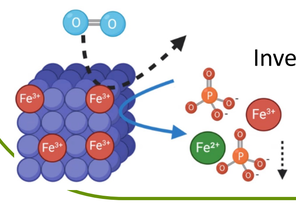
Pot experiments were used to investigate **fertilizer effectivity** and efficiency of vivianite and P-containing materials. Results indicate a low effect compared to a standard fertilizer, and an increase of iron uptake. To be continued…



Microbial **Fe(III) bio-reduction experiments** indicate an increase of Fe(II) production at higher P concentrations. Secondary mineralization products are vivianite and green rust, produced by Fe-reducing bacteria. Results demonstrate the feasibility of microbial transformation of P-trapping material to vivianite and the role of process parameters and their optimization.



Aging impacts P release. Fe(III)-precipitates release P back into solution during aging. In the presence of Ca, released P can re-precipitate as Ca-carbonates or Ca-phosphates. Si stabilizes Fe-P coprecipitates against aging and prevents re-solubilisation of P.

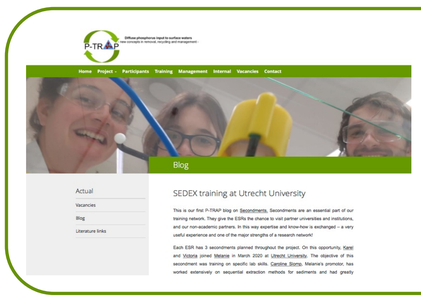


Investigation on **reactivity of vivianite** depending on redox status conducted, first results indicate that surface oxidation inhibits dissolution.

… & training!

Joint activities and courses to benefit from each others experience and solve problems together.

Scientific networking to introduce your project, present results, and become part of the research community.



Secondments & visits as chance for cultural exchange and knowledge transfer

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie Grant Agreement No 813438.

Want to learn more about P-TRAP?

Visit us at our **website** and get more details about the project.

Get introduced to P-TRAP by our first **E-Learning module**

Watch **Lordinas pitch** on how to use microbes for fertilizer production

Follow the **Blogs** of our ESRs and join their scientific journey!

Check our first **scientific publications,** e.g. *Barcala et al. 2021 Environ. Res. Lett. 16 015003*