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Federal Department of the
Environment, Transport, Energy and Communications

Federal Office for the Environment FOEN

Switzerland's phosphorus strategy

Flows, potentials and recycling

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Switzerland's phosphorus strategy

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From a waste disposal to a raw materials policy

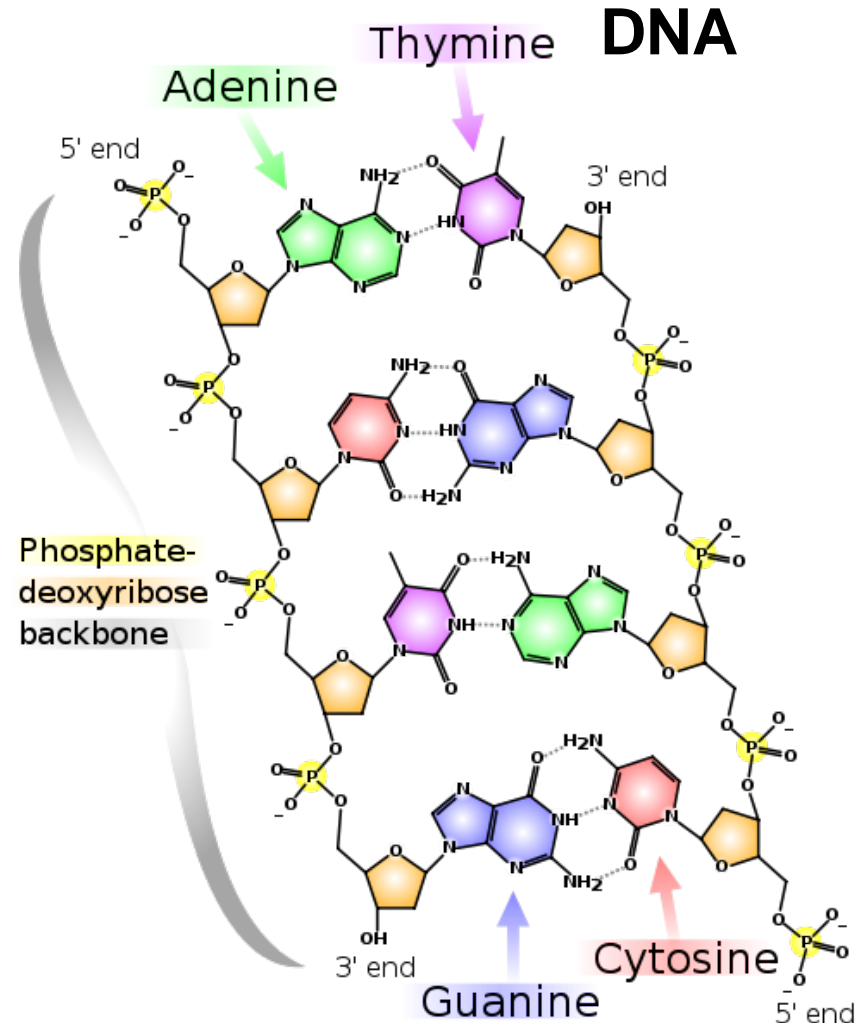
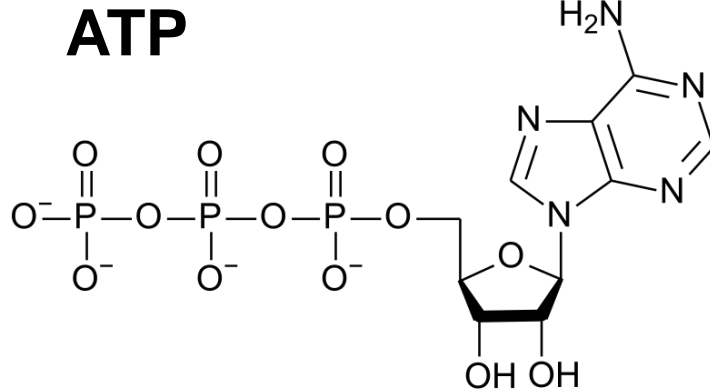
Objectives

- **Sustainable use of raw materials**
- **Ecological waste disposal**
- **Guarantee of safe disposal**
- **Compliance with economic and social requirements for sustainable use of raw materials**



Phosphorus: key element of life

- Not substitutable resource
- Non-renewable resource

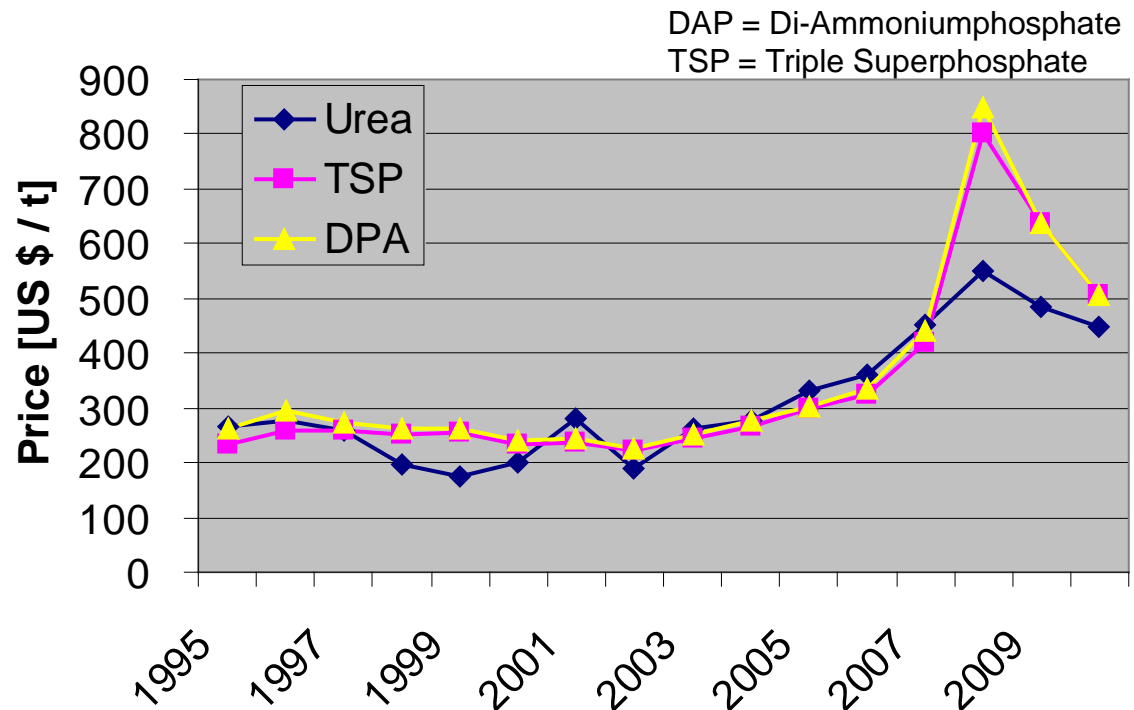




Phosphorus: a few facts and figures

Throughout the world, more than 150 million tonnes of raw phosphates are extracted every year, 90% of which are used for the production of fertilizers and animal feed supplements.

- Continental supply is finite
- Quality of primary supply is diminishing
- Huge (and rising) demand

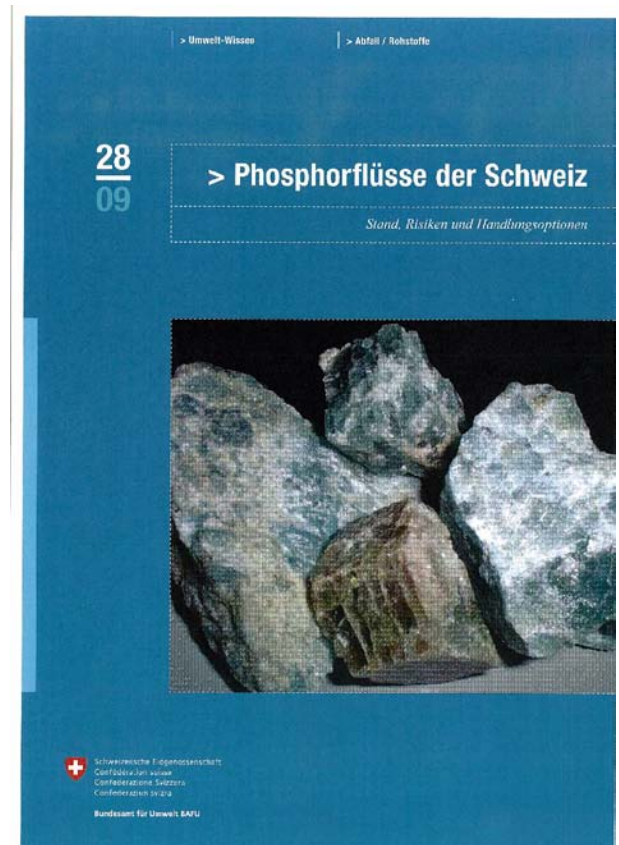


Source: <http://www.ers.usda.gov/Data/FertilizerUse/>

Phosphorus flows in Switzerland

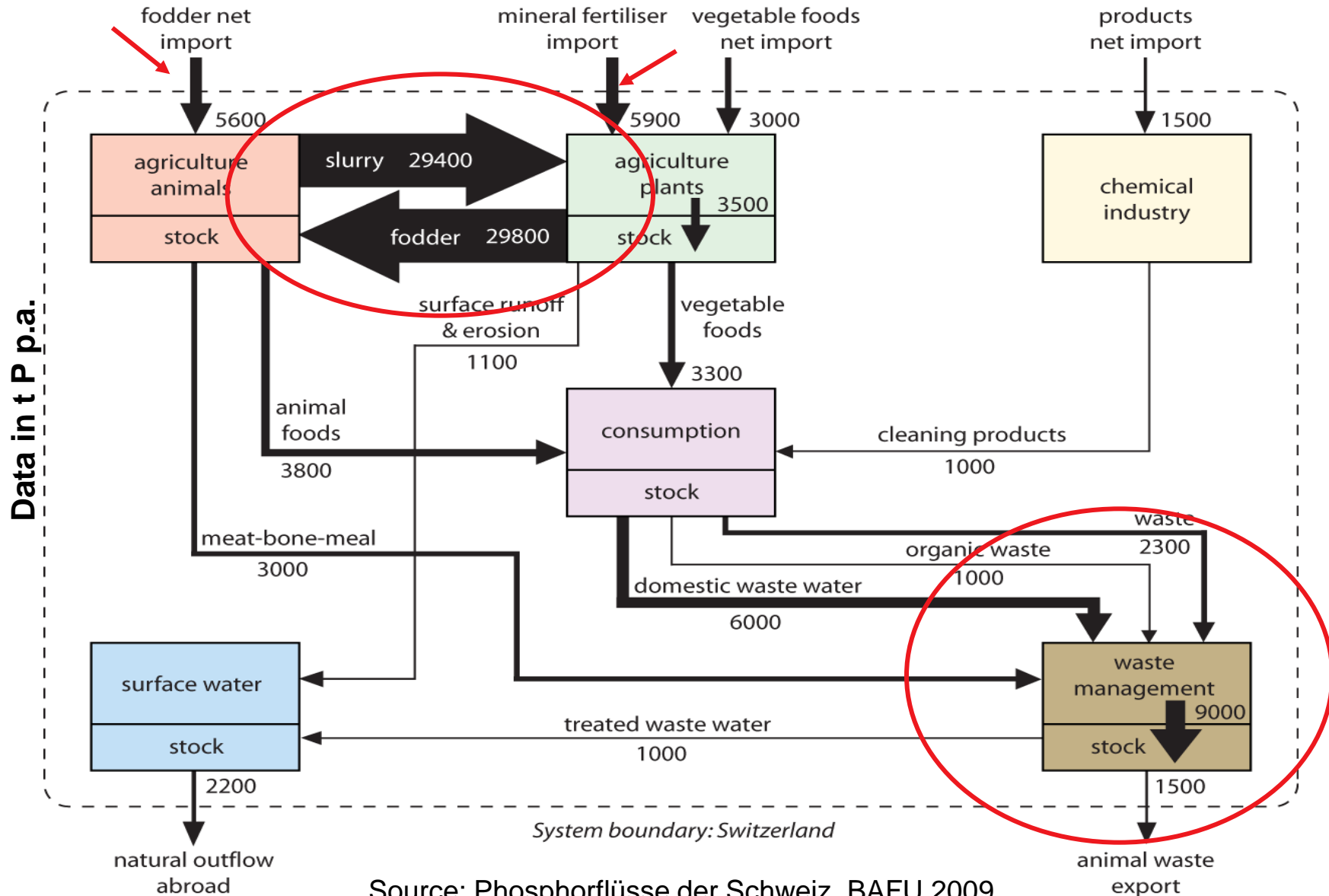
For the analysis of the phosphorus household in Switzerland ,
the **method of substance flow analysis** was applied.

The phosphorus cycle was set up in agreement with the quantitative and qualitative importance of the individual processes that phosphorus undergoes in Switzerland.





Main phosphorus flows in Switzerland (simplified)



Source: Phosphorflüsse der Schweiz, BAFU 2009

Phosphorus flows in Switzerland: Main features

Phosphorus Input

- Switzerland is a net importer of phosphorus (approx. 16'500 tonnes p.a.)
- About 90 percent of imports are used in the agricultural sector
- About 10 percent of imports are used for the production of non-biogenic goods (e.g. cleaning products)

Agriculture

- Agriculture: Cycling of approx. 29'500 tonnes p.a.
- Losses (run-off and products): approx. 4'500 tonnes p.a.

Waste treatment

- Approx. 13'500 tonnes p.a. are treated in waste management
- Only about 13% is recycled (compost and fermented matter)
- Net sink: >80% losses (landfilling, cement industry, treated wastewater)



Phosphorus recovery potential

Phosphorus can be recovered from the following sources in Switzerland:

- **Compost and fermented matter (1'100t P/a)**
- **Sewage sludge and sewage sludge ash (7'800t P/a)**
- **Animal waste, Bone meal (3'000t P/a)**

Other potential sources include:

- **Bottom ash from waste incineration plants (3'200t P/a)**



Potential areas of innovation for phosphorus efficiency

New sources

- Phosphates from lake and sea sediments

Industry

- Development of new phosphorus-based fertilisers (efficiency of fertilisers – with improved efficiency bioavailability)

Plant cultivation

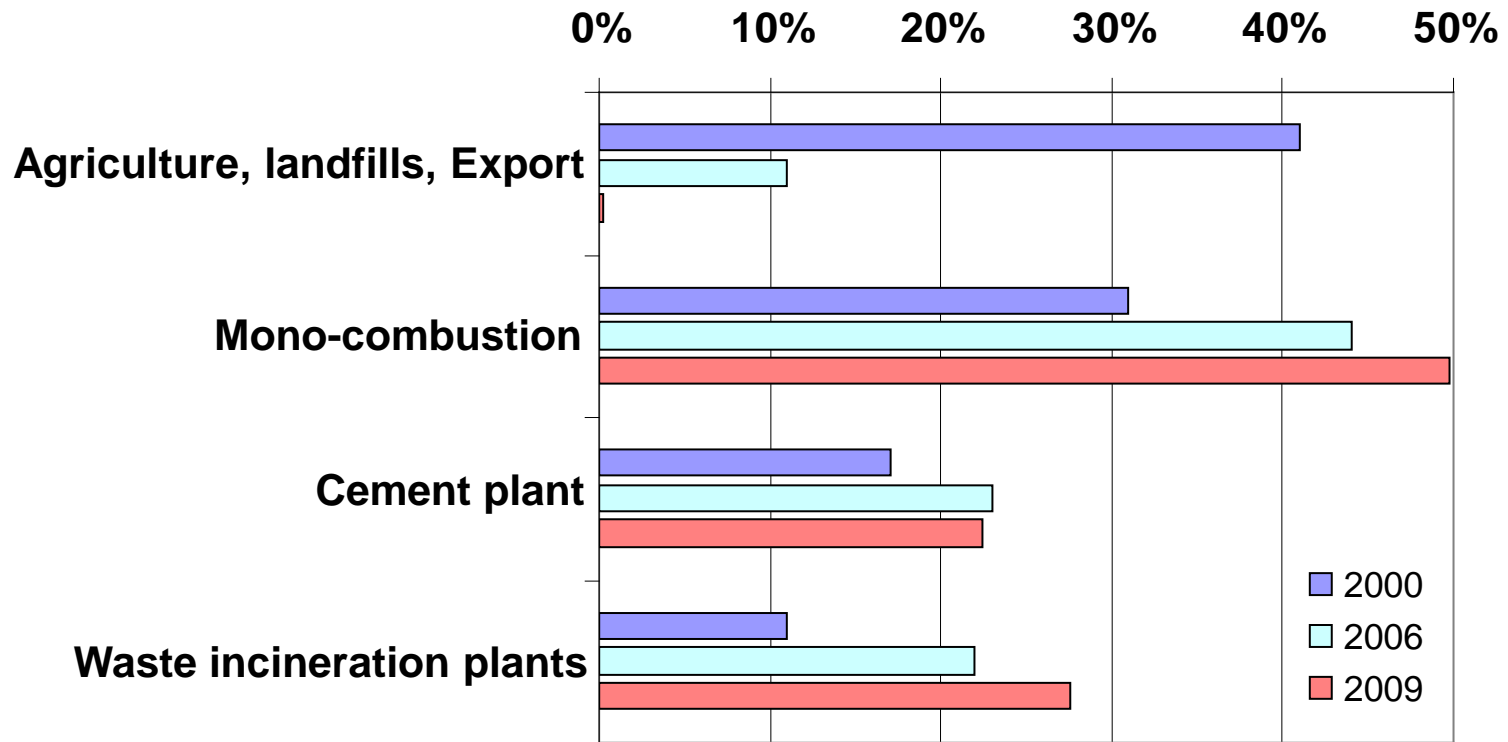
- Phosphorus mobilisation in soil through micro-organisms; innovative plant cultivation (improved phosphorus resorption rates, increased phosphorus efficiency bioavailability)

Waste management

- Phosphorus recycling from waste
 - Sewage sludge
 - Animal waste
 - Bone meal
- } 10'800 t P/a



Disposal of sewage sludge in Switzerland



➤ **200'000 tonnes p.a. in dried matter**

➤ **Direct use in agriculture prohibited since 2008 because of BSE and contamination with organic pollutants !!!**



Combustion plants for sewage sludge in Switzerland

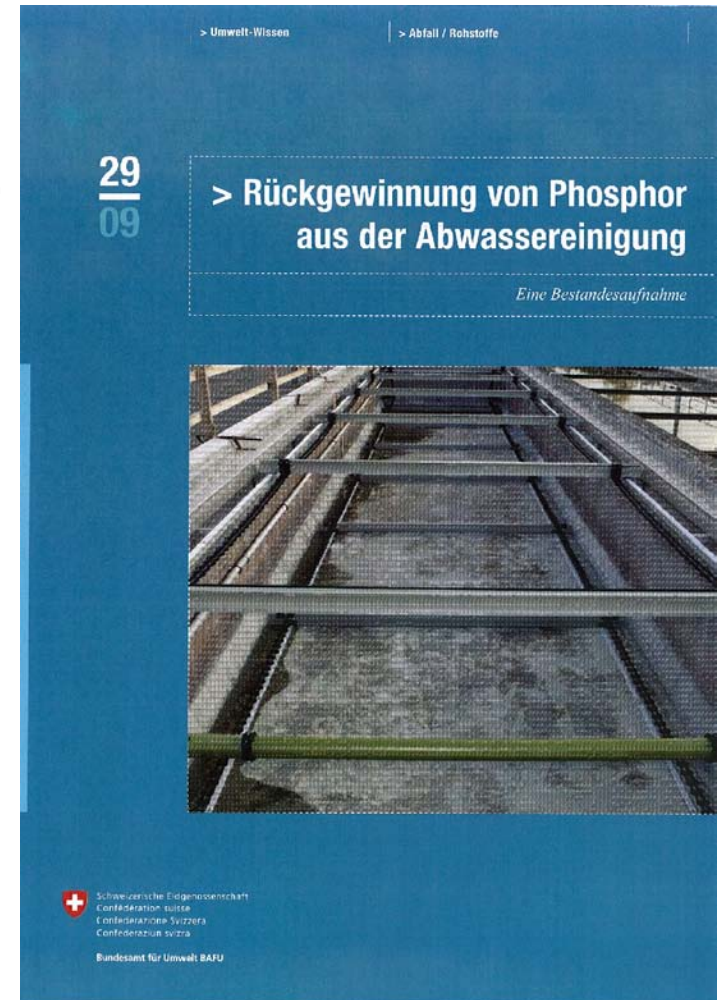


● 14 Specialized combustion plants for sewage sludge



Phosphorus recycling

Among the 30 processes available worldwide for phosphorus recovery, several have the potential to make a long-term contribution in a competitive market.





Phosphorus recycling

- **Approximately 30 processes have been developed world-wide for phosphorus recovery from waste water and sewage sludge**
- **5 processes have been tested in pilot or small-scale industrial plants in recent years**
 - ➔ **3 processes recover secondary phosphate from sewage in the water resulting from sewage dehydration**
 - ➔ **1 process recovers phosphorus from sludge after biogas production**
 - ➔ **1 process treats ash from mono-combustion in a thermo-chemical process**



Legal aspects

Within the scope of the revision of the Swiss Federal Waste Disposal Ordinance, the Federal Office for the Environment intends include the following requirements:

Phosphorus contained in high P-concentration waste streams such as sewage sludge, animal waste and bone meal must be recovered, or steps must be taken to ensure that it can be recovered in the near future.

To this end:

- The efficiency of the P-recovery processes must be improved.
- The fertilizing efficiency of the recovered P must be improved
- The overall environmental impact of fertilizers based on recovered P must be smaller or at most equal to the impact of fertilizers based on directly extracted P.



Conclusions

- **Phosphorus is an essential non-renewable resource. In terms of both quantity and quality its supply is not secured.**
- **With the aid of substance flow analyses it is possible to quantify the main sources of losses and the recovery potentials.**
- **In practical, political and social terms, the best solution is to extract phosphorus from wastewater or sewage sludge and thus reduce the need to import mineral fertilisers.**
- **Nutrient management in agriculture needs to be further optimised, with the additional benefit of reducing pollution.**
- **The existing legislation needs to be adapted.**



**Although it has (very) limited raw material resources,
Switzerland will (eventually) become a phosphorus exporter!**



Thank you for your attention