

# Gypsum – a cost-efficient measure to boost water protection in agriculture



Photo: Janne Artell

16.12.2020

Markku Ollikainen

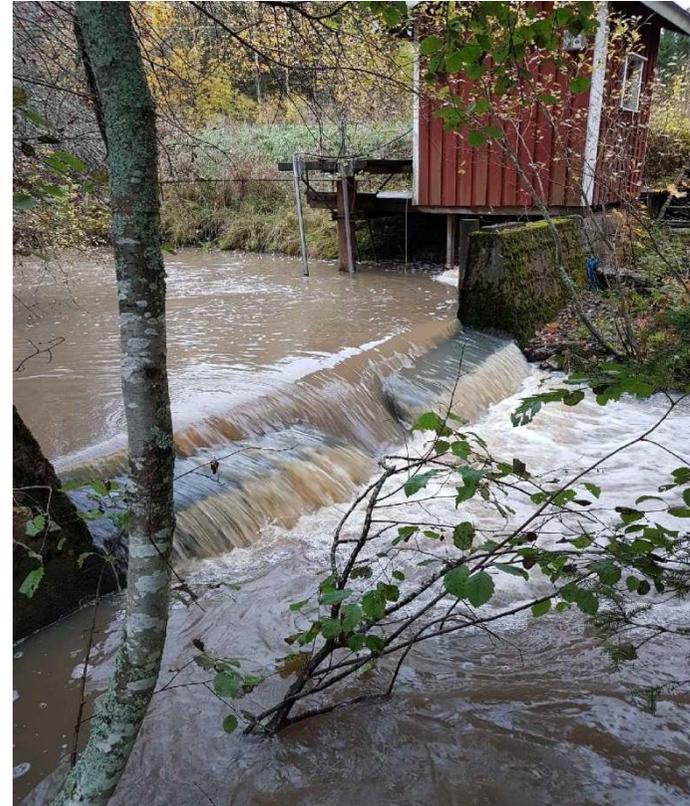
University of Helsinki

# Content

- **Gypsum: cost-efficiency**
- **Farmers' experience from gypsum amendment**
- **Gypsum amendment and reduction in phosphorus loads to the Baltic Sea**

## Background: reducing P runoff from agriculture

- Phosphorus runoff from agriculture:
  - Erosion: PP
  - Soil phosphorus content: DRP
- Current measures
  - Buffer strips and zones
  - Winter-time plant cover
  - Catch crops
  - Tillage methods
  - Wetlands
  - Reduced fertilizer intensity
- Weaknesses of the measures for P
  - Ineffective and uncertain
  - Efficient for N not for P
  - Trade-off between PP and DRP
  - Costly
- Any better alternative?



***Gypsum amendment of clay soil fields***

# Cost-efficiency of gypsum

## Experience from the pilots

- Reduction of PP 50% and DRP 25%
- Soil P content varies over fields and areas
- Archipelago Sea catchment:
  - Average total P 1.3 kg/ha
- Costs of gypsum amendment:
  - average cost 220 €/ha
  - (Covers material, transport and spreading)



**Cost per reduced P kg: 70€/kg**

For comparison:

- Using current agricultural practices in the short-run: costs of 30% P reduction are 220€/kg

# Large-scale pilot in the river Savijoki

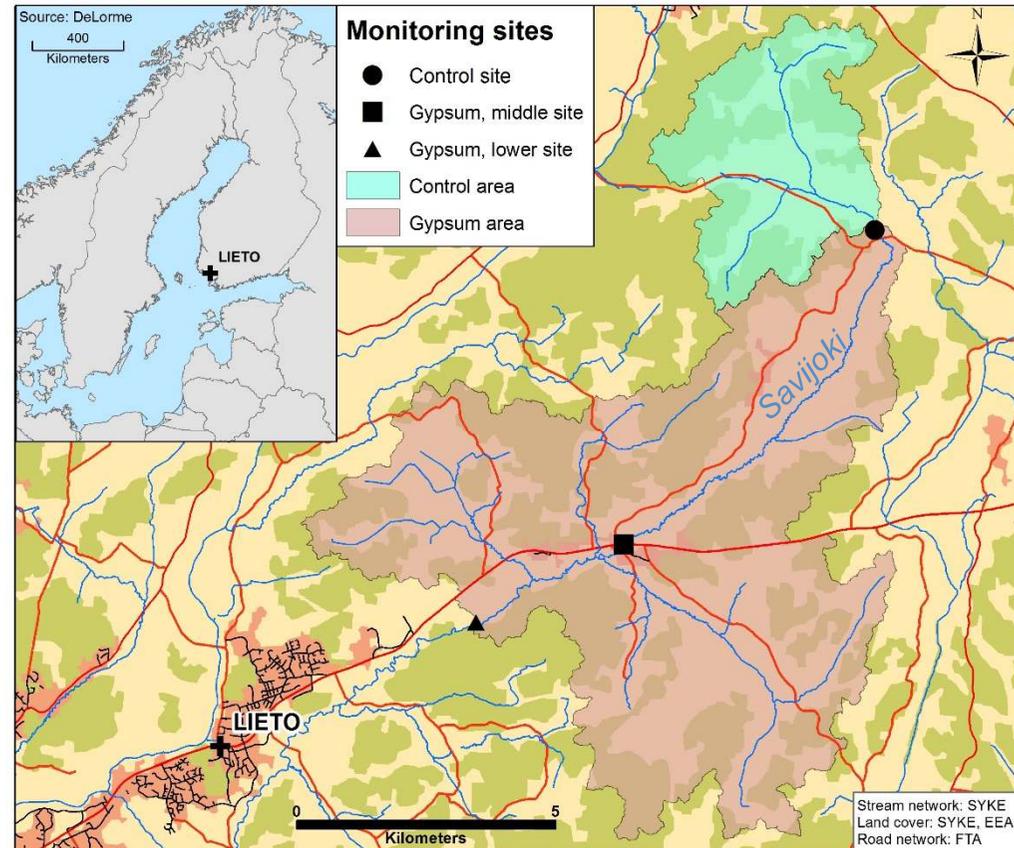
## **THE PILOT IN NUMBERS**

55 farms

1559 hectares

6270 tons of gypsum

144 truck loads



*The research was conducted by the University of Helsinki and the Finnish Environment Institute in the project SAVE (2016–2018), funded by the Ministry of the Environment. The monitoring of the impacts and the funding continues in the project SAVE2 (2019–2020). The pilot was implemented in collaboration with the NutriTrade project (2015–2018) funded by the EU Interreg Central Baltic programme.*

# Farmers' experience

## Comprehensive surveys:

- 2016 (after spreading), 2017, 2018 (impacts on fields and yields)
- High response rates
- Questions cover experience and data on annual cultivation decisions

## • Motives of participation

- To support research on new protection measures
- To improve the reputation of agriculture
- Curiosity on the use and impacts of gypsum amendment
- To improve the quality of local waters
- To enhance social cohesion among farmers
- To get Sulphur on the fields

## • Gypsum application

- No special problems in spreading (favorable Fall)
- Some farms (20%) had problems with the timing of delivery

# Farmers' observations from fields

- **Observations a year after application**
  - No yield penalty; higher yields in some field parcels
  - Soil quality improved on some farms: conventional and conservation tillage (both 30% )
- **How spreading promoted soil compaction**
  - Two-thirds: no impacts
  - One third: a little bit has taken place
- **Tracks from spreading on fields**
  - Most (75%) no tracks
  - Some tracks 25%
- **Large scale application**
  - 70% recommends using gypsum to other farmers
  - 70% are willing to use gypsum again
  - Local people appreciated farmers' efforts

# Farmers' worries on gypsum

## Comparison of surveys in 2016 and 2017

### Yield penalty

- 49% (2016) & 33% (2017)

### Soil compaction

- 51% (2016) & 30% (2017)

### Gypsum amendment may reduce funding for traditional water protection measures

- 65% (2016) & 60% (2017)

So, the worries have decreased along with accumulated experience from gypsum amendment (but are not zero yet)

- The reduction is statistically significant for soil compaction

# Gypsum and the Baltic Sea

## Countries of interest

- Clay soils dominant in Denmark, Finland and Sweden; also Poland (with more coarse soils) and Northern Estonia

## Rough estimates

- Agricultural P loads from these countries is 8 000 tons
- Gypsum could reduce about 1500 - 2 000 tons of loads
- Contribution to implementation of the BSAP P targets: 20 %



# Preliminary calculation

country	P loads (total)**	P loads from gypsum-fit soils*	Reduction (50%)	Reduction (40%)
Denmark	500	250	125	100
Finland	1700	850	425	340
Poland	5200	2600	1300	1040
Sweden	600	300	150	120
<b>Total</b>	<b>8000</b>	<b>4000</b>	<b>2000</b>	<b>1600</b>

\*) very rough estimate covering P loads from clay and coarse soils with an assumption that 50% of loads come from soils amenable to gypsum amendment

\*\*) Source Helcom

Lab experiments are underway and will provide more detailed information on the impact of gypsum amendment on Danish and Polish soils

# GYPSUM - SOLUTION FOR THE BALTIC SEA REGION?

- Cost-efficient, immediate reductions to the agricultural phosphorus loads
- Should be supported by agri-environmental policy both at national and international level
- Should be studied in various local conditions in the Baltic Sea region