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Cost-Efficient Protection of the Baltic Sea

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1. Precious Baltic Sea

Well-established fact:

People in the Baltic Sea countries value the clean Sea

- Willingness to pay
  - Willingness to act
  - Willingness to cooperate
- **Cost-efficiency:** how to act and cooperate wisely

2. Multiple meanings of cost-efficiency

Meaning 1. Minimize joint costs to achieve a given nutrient reduction target

== maximize nutrient reduction subject to a given budget

Meaning 2. Something is cheap…

Meaning 3. Choose those measures that provide the highest ratios of **reduction/cost**

3. Baltic Sea Action Plan revised

	Nitrogen reduction		Phosphorus reduction	
	tons	%	tons	%
BSAP 2013	87 710	0,11	14 288	0,37
BSAP 2007	128 390	0,16	13 356	0,34
Difference	**- 40 680**	**- 0,05**	**+ 932**	**+ 0,03**

Emphasis on agricultural loads persists:

" WE ACKNOWLEDGE that sustainability of agricultural production is a key to the success of reaching input reductions for Good Environmental Status, **RECALLING** that agriculture substantially contributes to the nutrient inputs to the Baltic Sea"

Question: Is it really?

4. Two good news

- ***Nutrient abatement in WWTP.s is cheap***
  - Holds for both N and P abatement
  - This especially good news for Russia, Poland and the Baltic States, as they still have a large potential to reduce loads from point sources
  - **Minor problem**: Nitrogen abatement requires long-lasting initial investment, that is, monetary funds
- ***New efficient measures for agriculture available***
  - Phosphorus loads can be reduced quite a lot
  - Good news for Finland, because phosphorus reduction potential from point sources is small

5. Costs in agriculture and WWTPs

Marginal abatement costs
(Short-term and current means for agriculture)

Nitrogen (kg)
Agriculture: 20%: € 9,4
WWTPs: 90%: € 11,7

Phosphorus (kg)
Agriculture: 20%: €229
WWTP.s: 95%: €17

6. WWTPs important for cost-efficiency

Allocation of reduction				Abatement costs (M€)		
WWTPs		agriculture		WWTPs	agriculture	total
N	P	N	P	M€	M€	M€
47 000	6 200	83 000	7 200	404	10 952	11 356
87 000	10 600	42 800	2 800	814	717	1 531

Green alternative: Urban Waste Water Directive for WWTPs and the rest to agriculture (and other nonpoint sources)

Red alternative: Cost-efficiently WWTP.s reduce 90% of N and 95% of P and the rest to agriculture (and other nonpoint sources)

Green alternative: costs huge 11.4 billion euros annually
Red alternative: cost 1,5 billion euros, 13.5% of green alternative

7. Reducing P in agriculture: clay soils

Gypsum reduces
- ***Dissolved P*** loads by 29%
- ***Particulate P*** loads by 57%
- Reduction is immediate and persists over many years

Other impacts
- No yield losses
- Improves soil structure
- Reduces erosion (2 t/yr)
- Reduces herbicide runoff
- Creates sulphates; not a problem in seas

8. The promise of gypsum

Reduction of phosphorus loads when gypsum is applied (hectare)			
P runoff	**Load (gr)**	**Reduction (gr)**	**Load remaining (gr)**
DRP	400	116	284
PP	900	513	387
Total P	**1 300**	**629**	**671**

Reduction of total phosphorus is huge: 48,4%

How about costs?

Assuming the impacts prevail at least five years

unit cost of reduction is 66 €/kg

9. Reduction potential for Finland

Archipelago Sea & Gulf of Finland

- Reduction potential is 150 - 230 tons

Total costs: 55 million euro

- ***25% of annual agri-environmental payments***
- ***costs 11 M€ annually***

Society can afford this sum for agriculture

10. Recommendations

Two stage approach for the Baltic Sea policies

1. **Reduce** nutrient loads from WWTP.s at once
2. **Facilitate** long-term adjustment of agriculture
   - Reduce of high soil P content
   - Allocate production to best fields parcels
   - Design new features of nutrient-smart agriculture

A large scale use of gypsum in Finland

Research on the applicability of gypsum in other states in the Baltic Sea region

11. Baltic Sea Action Plan

	Nitrogen			Phosphorus		
	load	reduction	%	load	reduction	%
Denmark	44 000	2 890	0,07	1 100	38	0,03
Estonia	56 000	1 800	0,03	1 600	320	0,20
Finland	49 000	2 430	0,05	1 700	330	0,19
Germany	46 000	7 170	0,16	500	110	0,22
Latvia	44 000	1 670	0,04	3 000	220	0,07
Lithuania	93 000	8 970	0,10	3 500	1 470	0,42
Poland	318 000	43 160	0,14	22 000	7 480	0,34
Russia	83 000	10 380	0,13	4 000	3 790	0,95
Sweden	74 000	9 240	0,12	1 600	530	0,33
Total	**807 000**	**87 710**	**0,11**	**38 900**	**14 288**	**0,37**