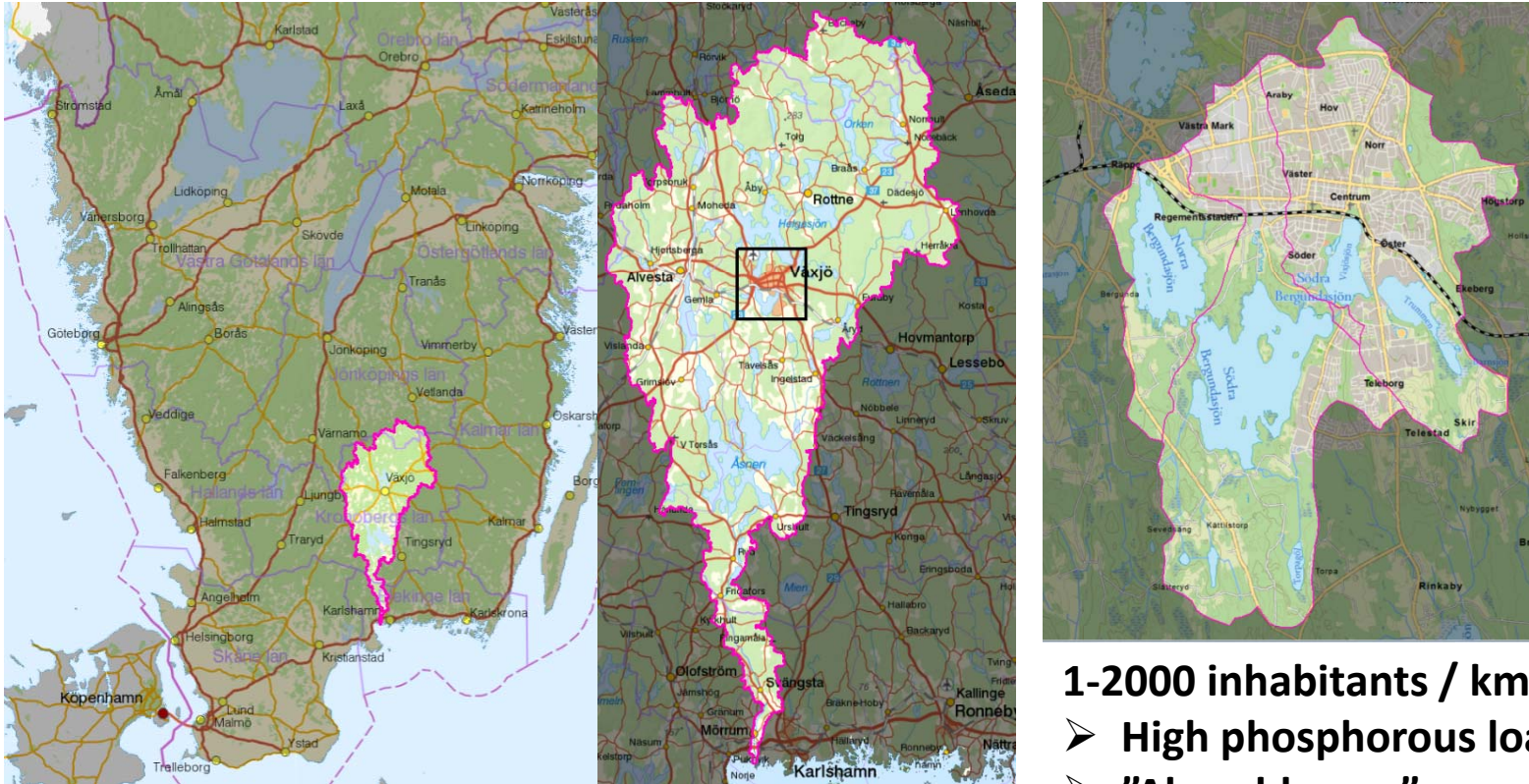


# Restoration of eutrophicated lakes around the city of Växjö

Andreas Hedrén, Växjö Municipality

## River Basin Mörrumsån and the small River Basin "Växjö lakes"



**1-2000 inhabitants / km<sup>2</sup>!**

- **High phosphorous load**
- **"Algae blooms"**

**Lake water quality (eutrophication) has been a critical factor for the city (health and expansion) in the last 200 years...**

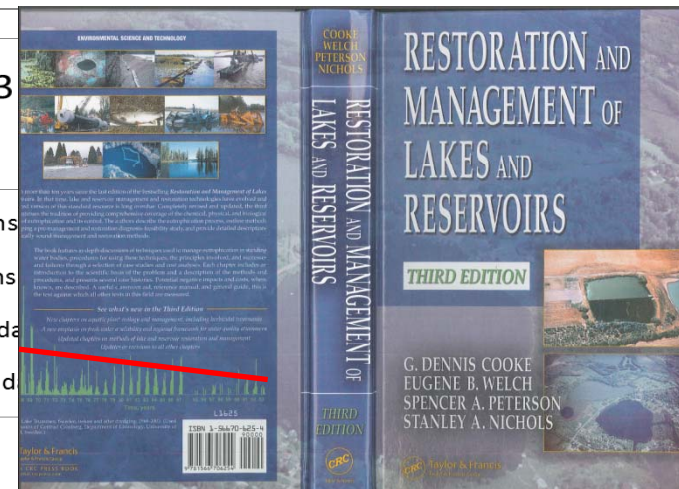
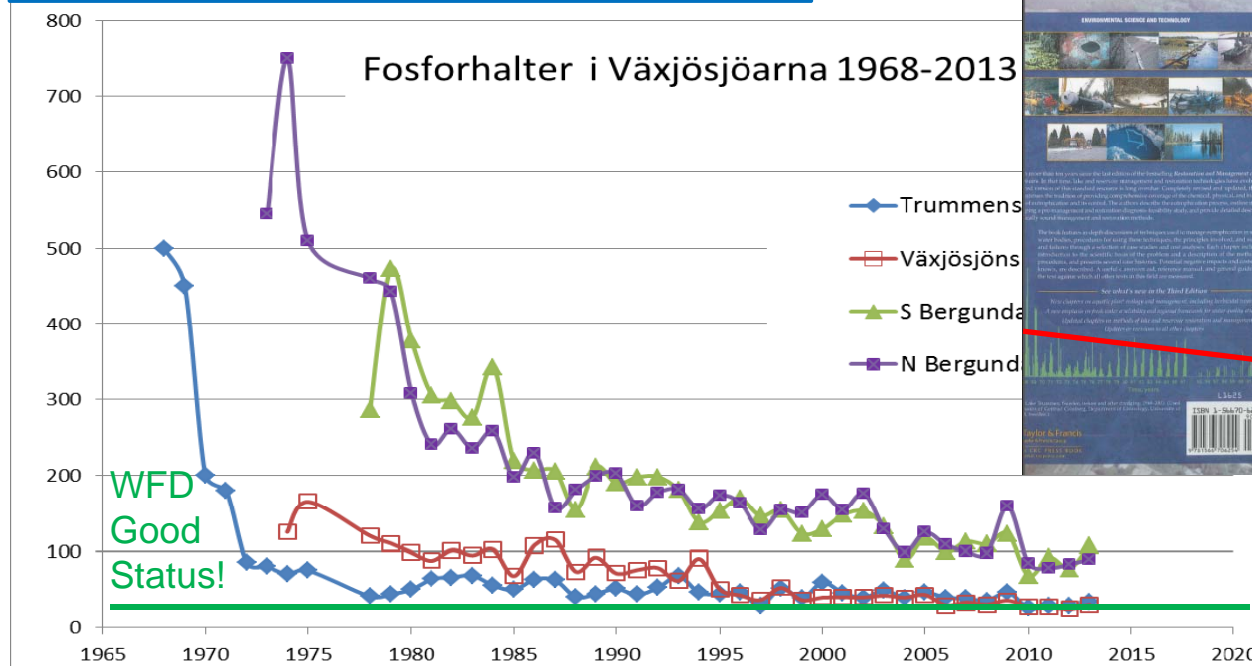
# Improvement in lake water quality: Phosphorous (P)

## Most successful actions:

- Dredging in lake Trummen and Väjösjön
- 99% P-reduction in sewage treatment work.
- Stormwater management etc.
- Reduced P-loading!

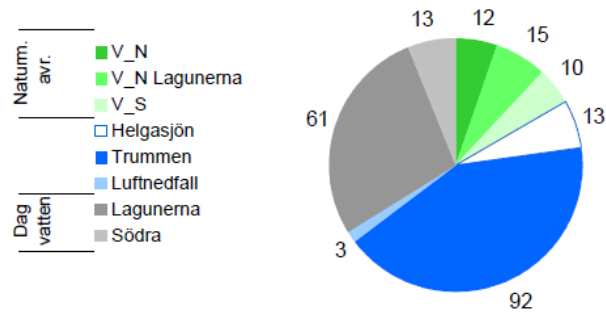
## Driving forces behind improvement today?

- Less reaktive phosphorous (P) in sediment **ALTHOUGH** higher P-content!
- Downstream export (Lake Bergundasjöarna)

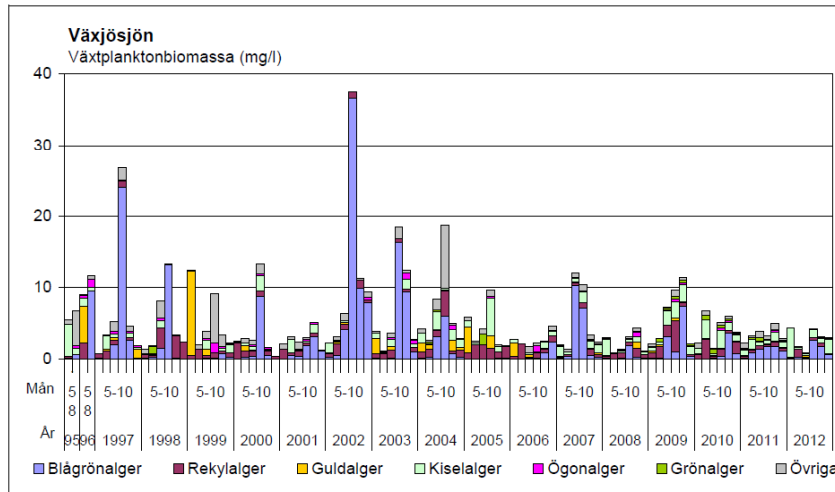


# 2011-2014: Profound investigations

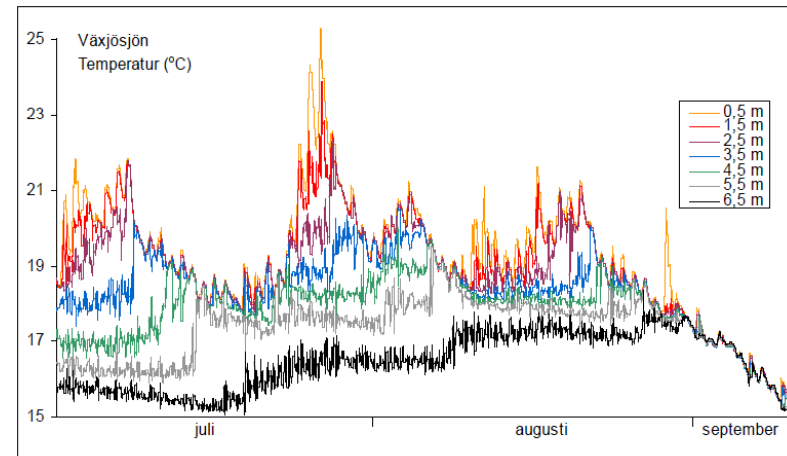
P-sources:



Phytoplankton etc:



Physical aspects especially temperature:



# Summary of Action Plan 2014-2020

## ETAPP 1: Trummen - Växjösjön - S Bergundasjön åtgärdas 2014-2017.

prio 1			år	kostnad mkr	bidrag mkr	SUMMA MKR
	<b>Trummen</b>					
1	extern	Nya dagvattendammar kvarnbäcken	2014			
1	extern	Förstudie våtmark Skir	2014	0,15	0,07	
1	extern	genomförande våtmark Skir	2017	2	troligt	
1	Intern	Vegetationsetablering	2014-2016	0,6	0,25	
	<b>Växjösjön</b>					
1	extern	Nytt reningssteg Lagunerna	2015-2016		3	
1	extern	Nytt reningssteg Välludden	2015-2016		1	
1	Intern	Al-behandling	2016		6	
1	Intern	Vegetationsetablering	2015-2018	0,6	0,25	
	<b>Summa kostnader TR + VXO 2014-2018</b>					<b>13,35</b>
	<b>S Bergundasjön</b>					
1	Intern	Al-prov samt förstudie/experiment	2014	0,5		
1	Intern	Al-behandling genomförande	2016-2017	25		
1	extern	dagvattenrening torparängen		2		
1	Intern	Vegetationsetablering	2016-2018	0,6	0,25	
	<b>Summa S Bergundasjön 2014-2018</b>					<b>28,1</b>
1	3 el 4 sjöar	utökade bottenundersökningar	2014-2017		1	
	<b>Summa prio 1 år 2014-2017</b>					<b>42,45</b>
2	Intern	ev reduktionsfiske TR	2år		1	
2	Intern	ev reduktionsfiske VXO	2år		1	
2	Intern	ev reduktionsfiske SB	2år		2	
	<b>Summa Prio 2</b>					<b>4</b>

## ETAPP 2: N Bergundasjön åtgärdas 2018-2020.

		Våtmark	2018-2020	40		
		Aluminiumbehandling	2018-2020	15		
	<b>Summa totalt</b>					<b>101,5</b>

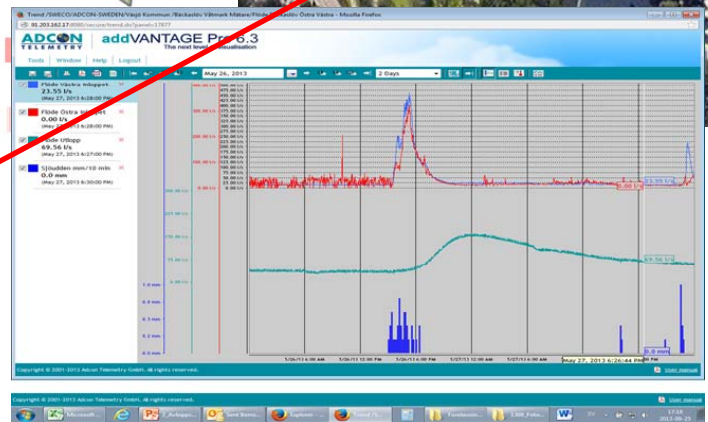
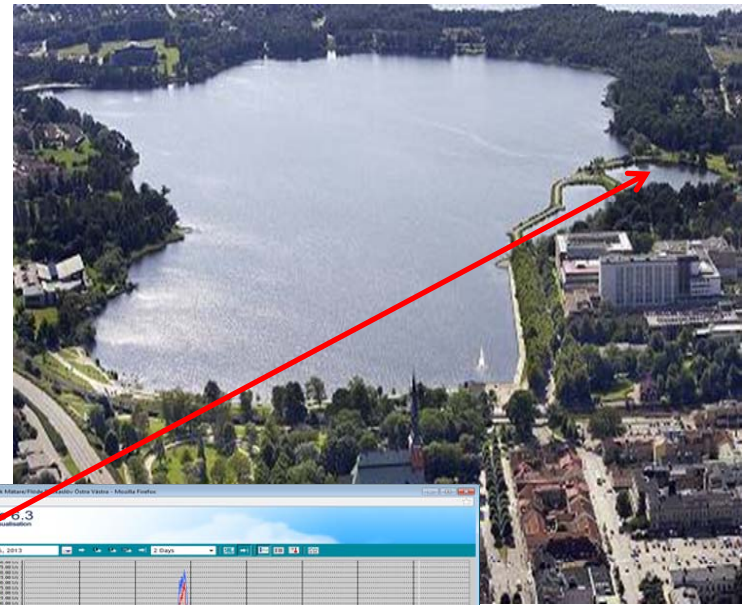
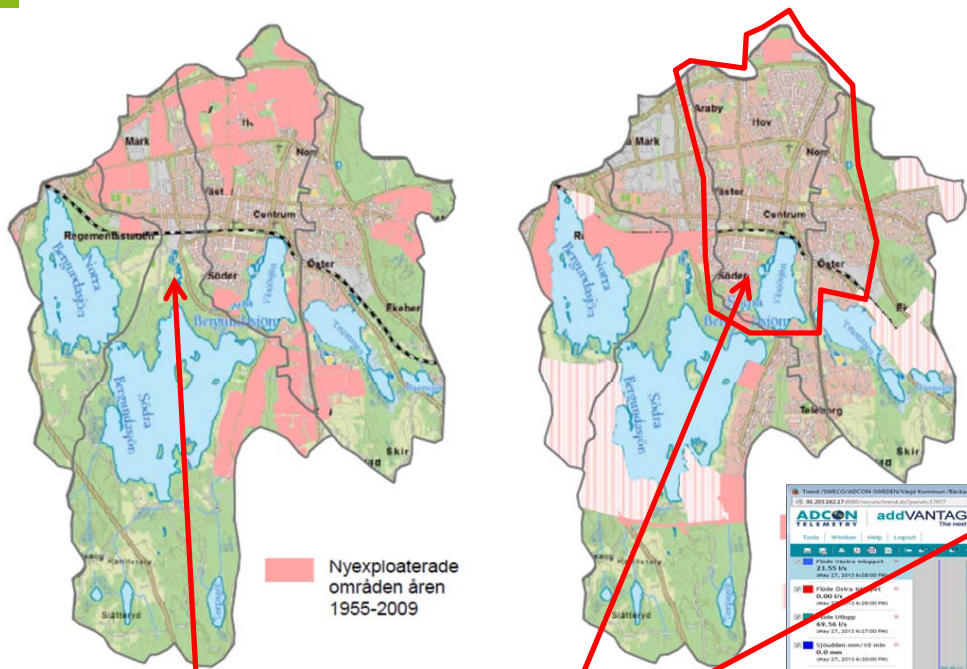
### Three different types of actions:

1. Reduced nutrient load (Phosphorous)
2. Stabilize Phosphorous in lake sediment
3. Improved biological structure (more submerged vegetation, less algae).

### Two phases:

- 1) Lake Trummen, lake Växjösjön, lake S Bergundasjön
- 2) N Bergundasjön

## External sources: Storm water, natural runoff and wastewater. minimize effects of recent and previous activities



Already 85% P-reduction!  
➤ Vegetation  
➤ Equalized flow

Reduction from current 70 % to 85% P-reduction.

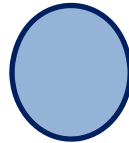
**Internal P-loading from sediment:**

**Natural lake**

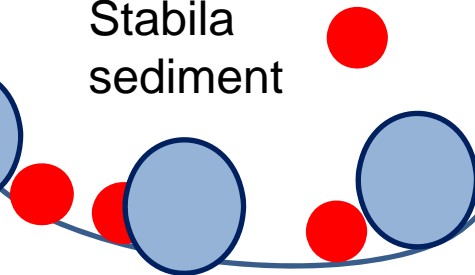
**P, Phosphorous**



**"P-binders":  
Fe, Al, Ca.**

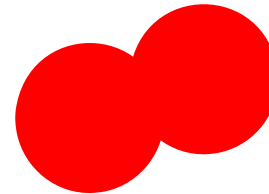


Stabila sediment

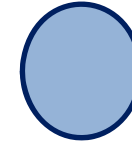


**Eutrophic lake**

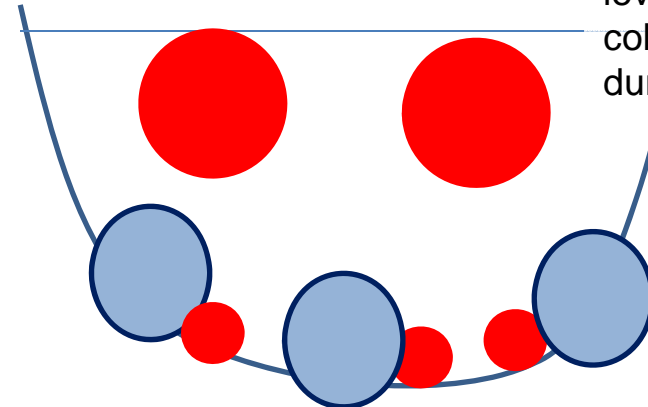
**P, Phosphorous**



**"P-binders":  
Fe, Al, Ca.**



New more dynamic equilibrium: high levels of P in water column, especially during summer



Solution? – Add Aluminium to sediment!



## Internal biological processes must be improved!



Copyright: Blom



**More** plants, zooplankton  
and periphyton - **less** algae!



*"Prediction is always difficult, especially about the future"*

-Niels Bohr-

