SMHI

Joel Dahné
Swedish meteorological and hydrological institute

In this presentaion

Goals (deliverables)

Indata

HYPE model

Calibration/Evaluation

Simulation results for Future climate and reduction scenario

ECO SUPPORT

SMHI

Goals (deliverables) -Input to oceanographic models

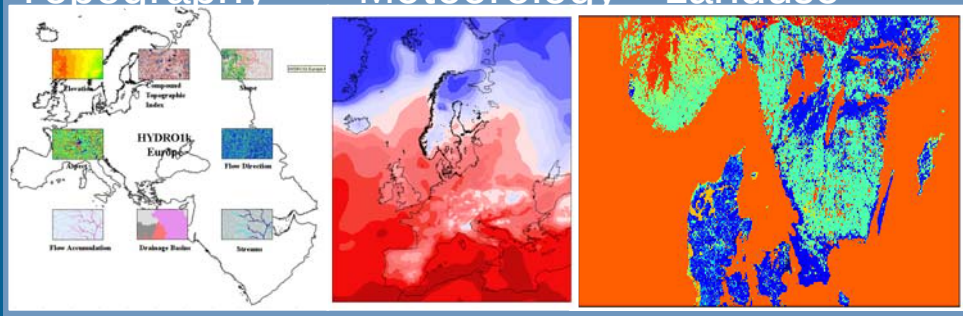
- Predicted discharge at catchment outlets 1960-2100
- Net load of N and P to the sea, 1960-2100

Indata for a pan-Baltic model

- **Topography:**
  HYDRO1k
- **Landuse and Soils:**
  ECOCLIMAP
  European Soils Database
- **Forcing Data (meteorology):**
  ERAMESAN (Patched)
  ECHAM5(KNMI) + RCA3(SMHI)
- **Agricultural Practices Data**:
  CAPRIS-data(agg-eco-model)
- **Atmospheric Deposition Data**:
  MATCH model (SMHI)
- **Point sources and wwt**
  EEA, WHO, EUROSTAT

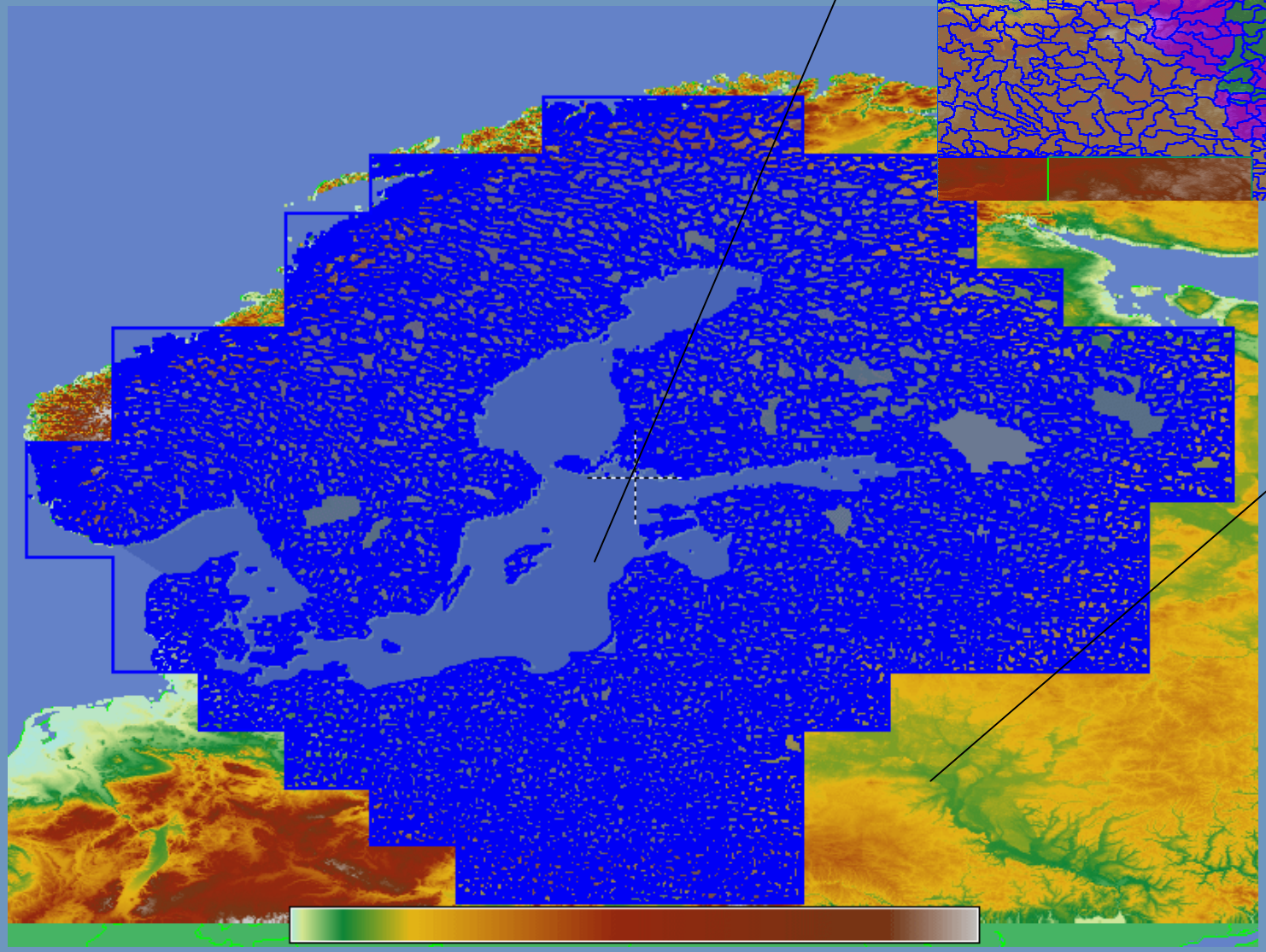
- **Observed water quality (N & P):**
  EEA
- **Observed Runoff**
  GRDC + BALTEX

Topography Meteorology Landuse



Runoff Quality

Program for raster indata preparation WHIST

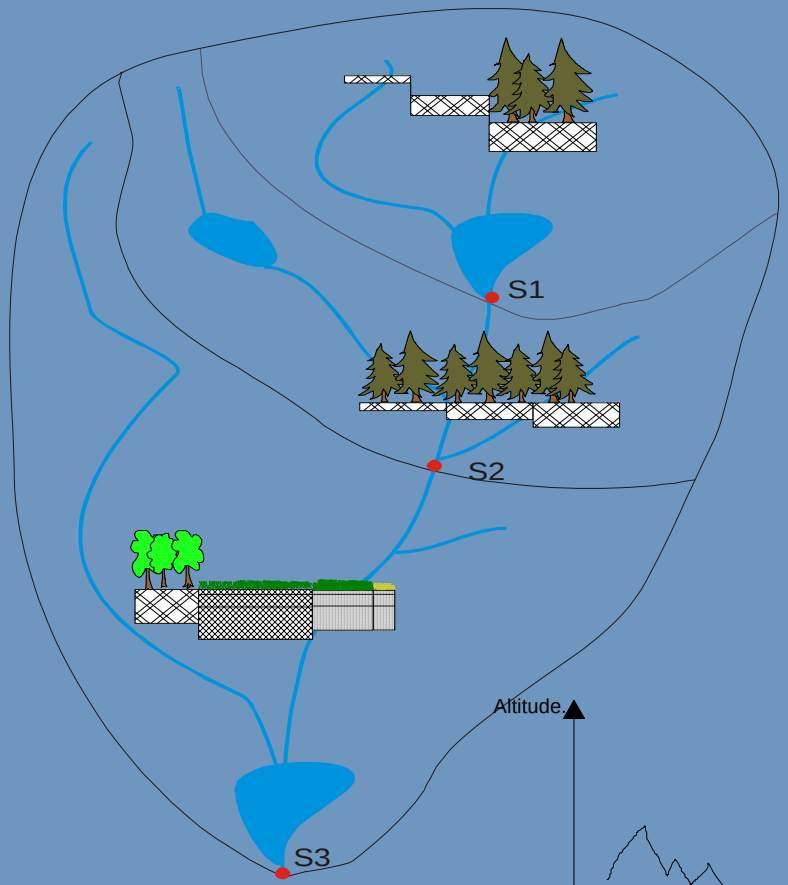


5128 sub catchments

Median size

= 325km^2

HYdrological **P**redictions for the **E**nvironment (**HYPE)** model



Soil classes (7)

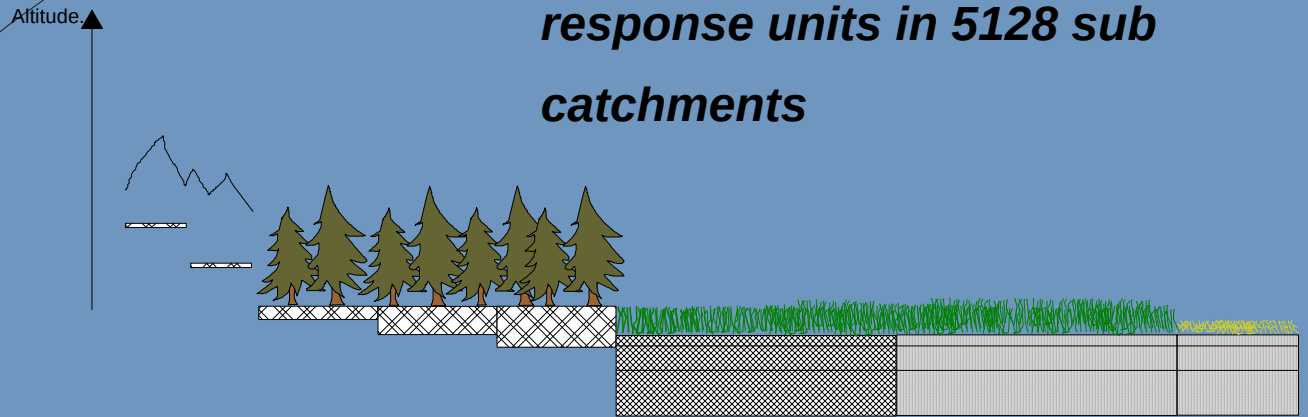
+

Landuse classes (13)

=

SLC classes (55)

Total: 78 000 Hydrological response units in 5128 sub catchments



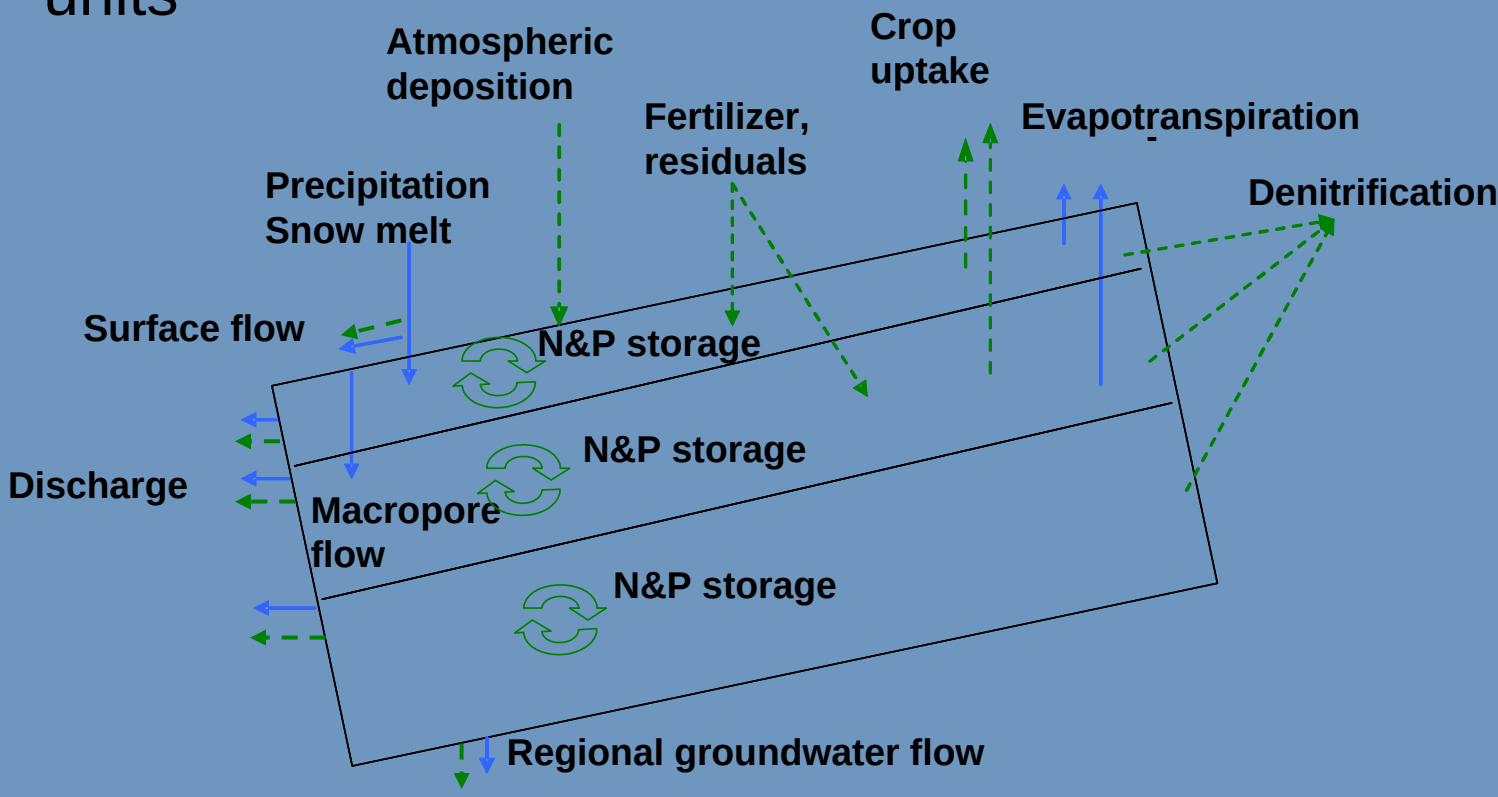
Processes in hydrological response units

Sources for N&P:

- Fertilization
- Atm. Dep.
- Residues
- Mineralization

Sinks for N&P:

- Denitrification
- Crop up-take
- Adsorption



SMHI

Calibration/Evaluation

Calibration of Water model against observed daily streamflow.

Calibration of Water quality model against observed seasonal and annual concentration in rivers

Most parameters dependent on soil or landuse. => not calibrated to regions!

Proper evaluation yet to be done

	RIVER	AREA km^2
1	VISTULA	193935
2	**ODER**	**111242**
3	NEMANUS	97946
4	DAUGUVA	90001
5	NARVA	58216
6	KEMIJOKI	55647
7	GÖTAÄLV	51274
8	GLAMA	41432
9	MUONIO	39206
10	DALÄLVEN	29109
11	**KOKEMAENKOJI**	**27303**
12	UMEÄLV	26394
13	INDALSÄLVEN	25810
14	LJUSNAN	20375
15	NORRSTRÖM	19257
16	MOTALA STRÖM	15026
17	LIELUPE	14090
18	BÖLEBYN	13191
19	LIVAJOKI	12588
20	SKELLEFTEÄLV	12294
21	VENTA	8477
22	PÄRNU	5967
23	KYRONJOKI	4829
24	SIIKAJOKI	4669
25	LAPUANJOKI	4555
26	LJUNGBYÅN	4299
27	EMÅN	4178
28	WARNOW	3971
29	PEENE	3809
30	GIDEÄLVEN	3736
31	HELGE Å	3642
32	INA	3639
33	ÄTRAN	3033
34	KASARI	2639
35	LESTIJOKI	2638
36	AURAJOKI	1995
37	RICKLEÅN	1851
38	SLUPIA	1673
39	UECKER	1574
40	EURAJOKI	1460
41	TUDE A	579
42	PARSETA	443

Some prelimary results

SMHI
2010-01-11

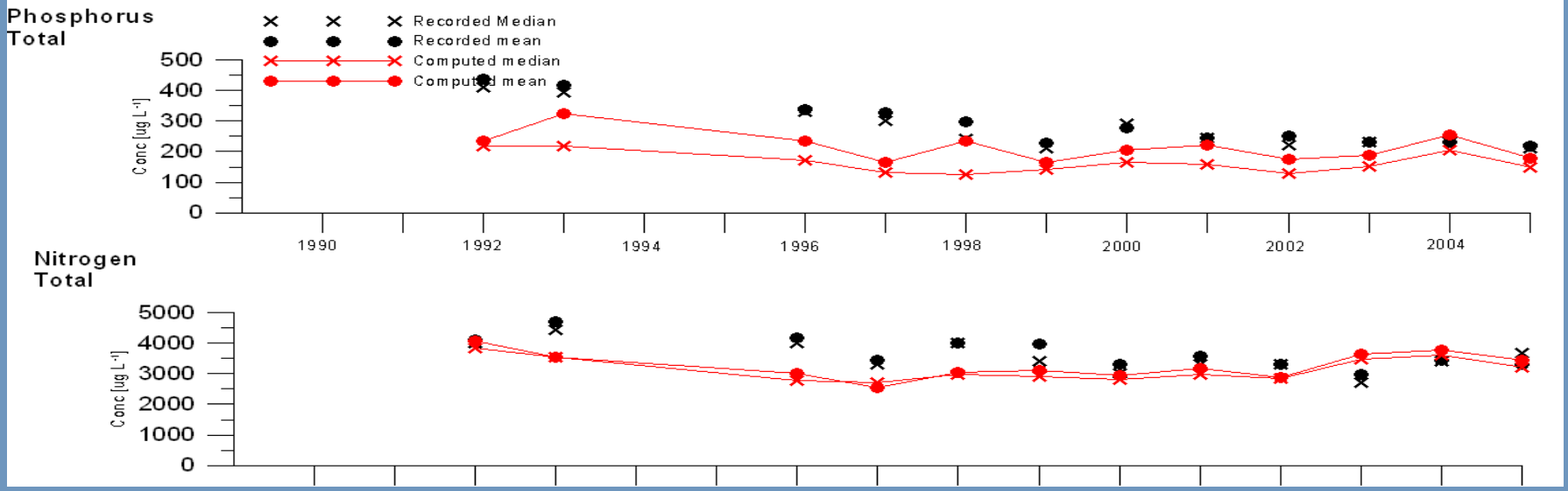
Station:

EEA#: PL_RV_CS320003
Subid: 9991549
River: Oder

Geo:
AreaWhist: 111242km2

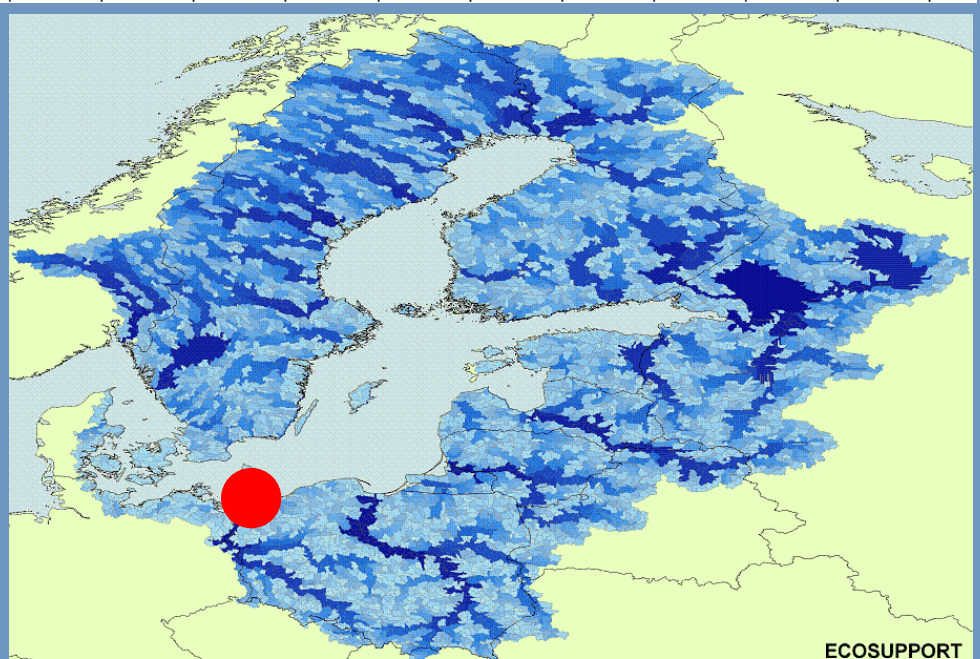
LandUse[%]
Lake: 0
Broadleaf: 9
Conifer: 18
Agriculture: 55
Other: 12

SoilClass[%]
Fine: 18
Coarse: 50
Medium: 25
Bare Land: 0
Till: 0
Peat: 2
Urban: 1
Other: 0



River:

Oder



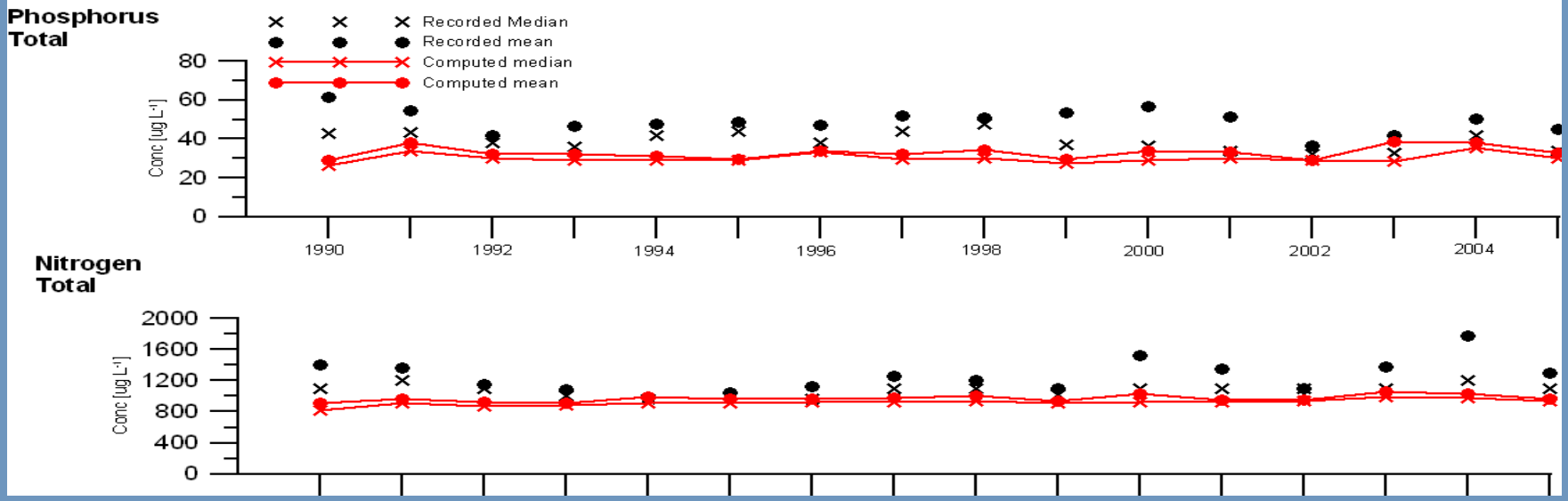
SMHI
2010-01-11

Station:
EEA#: FI_RV_6450
Subid: 358509
River: Kokemaenjoki

Geo:
AreaWhist: 27303km2

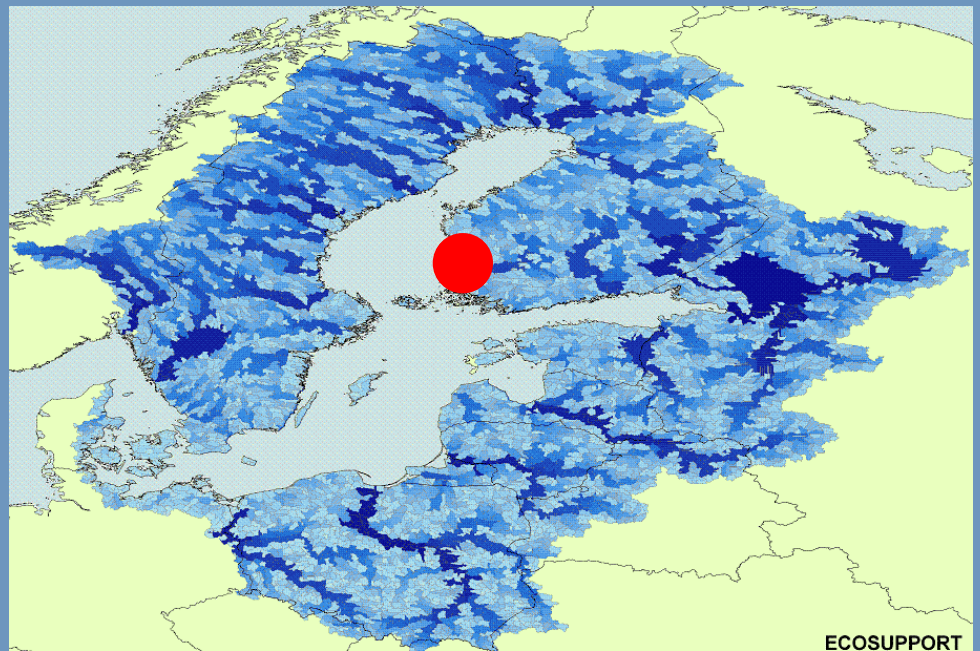
LandUse[%]
Lake: 10
Broadleaf: 21
Conifer: 58
Agriculture: 4
Other: 3

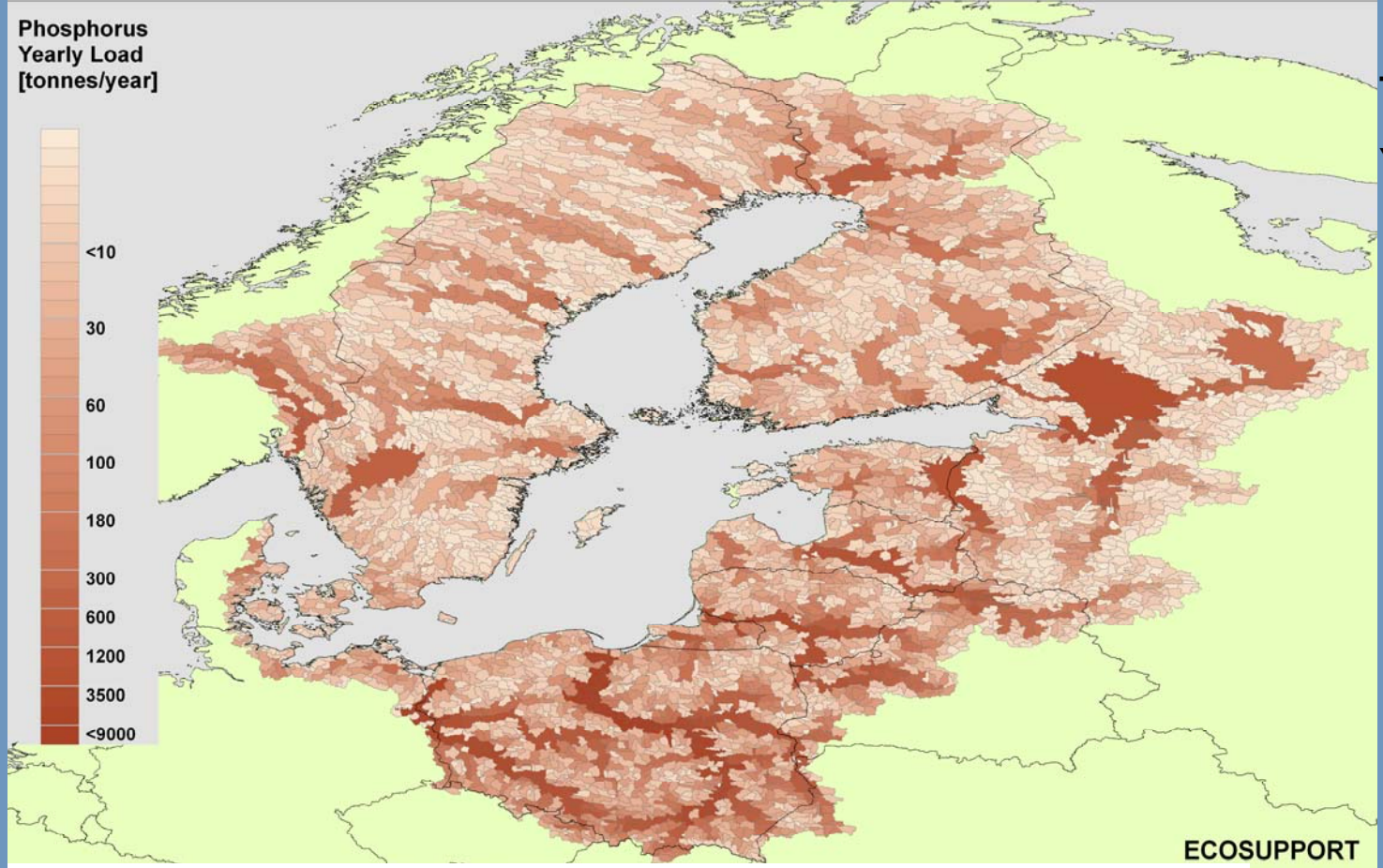
SoilClass[%]
Fine: 12
Coarse: 0
Medium: 0
Bare Land: 0
Till: 64
Peat: 11
Urban: 0
Other: 0



River:

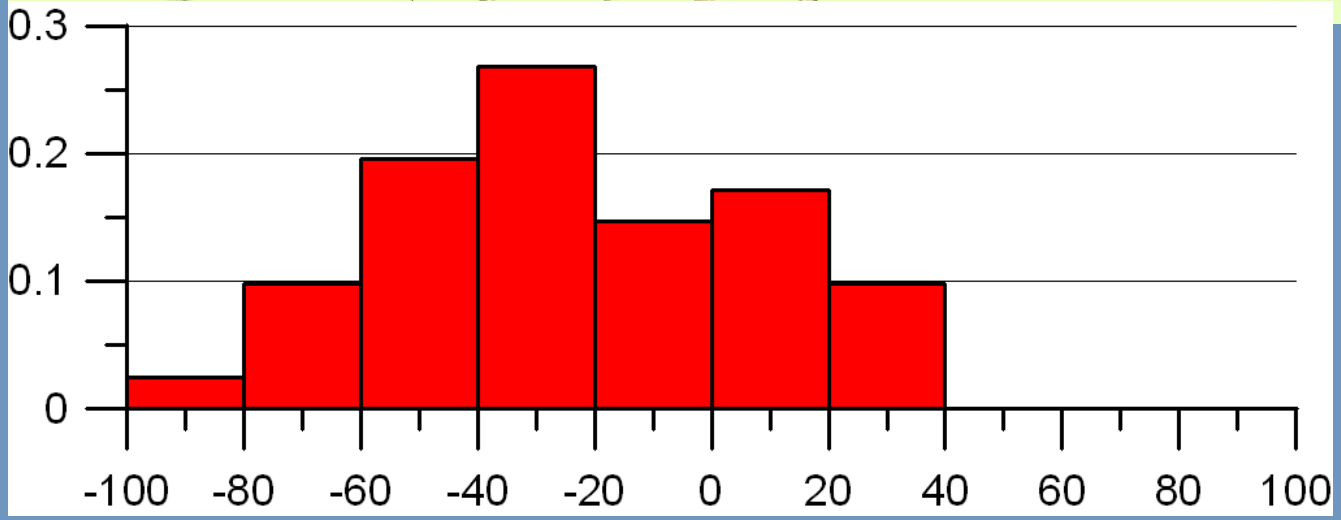
Kokemäenjoki





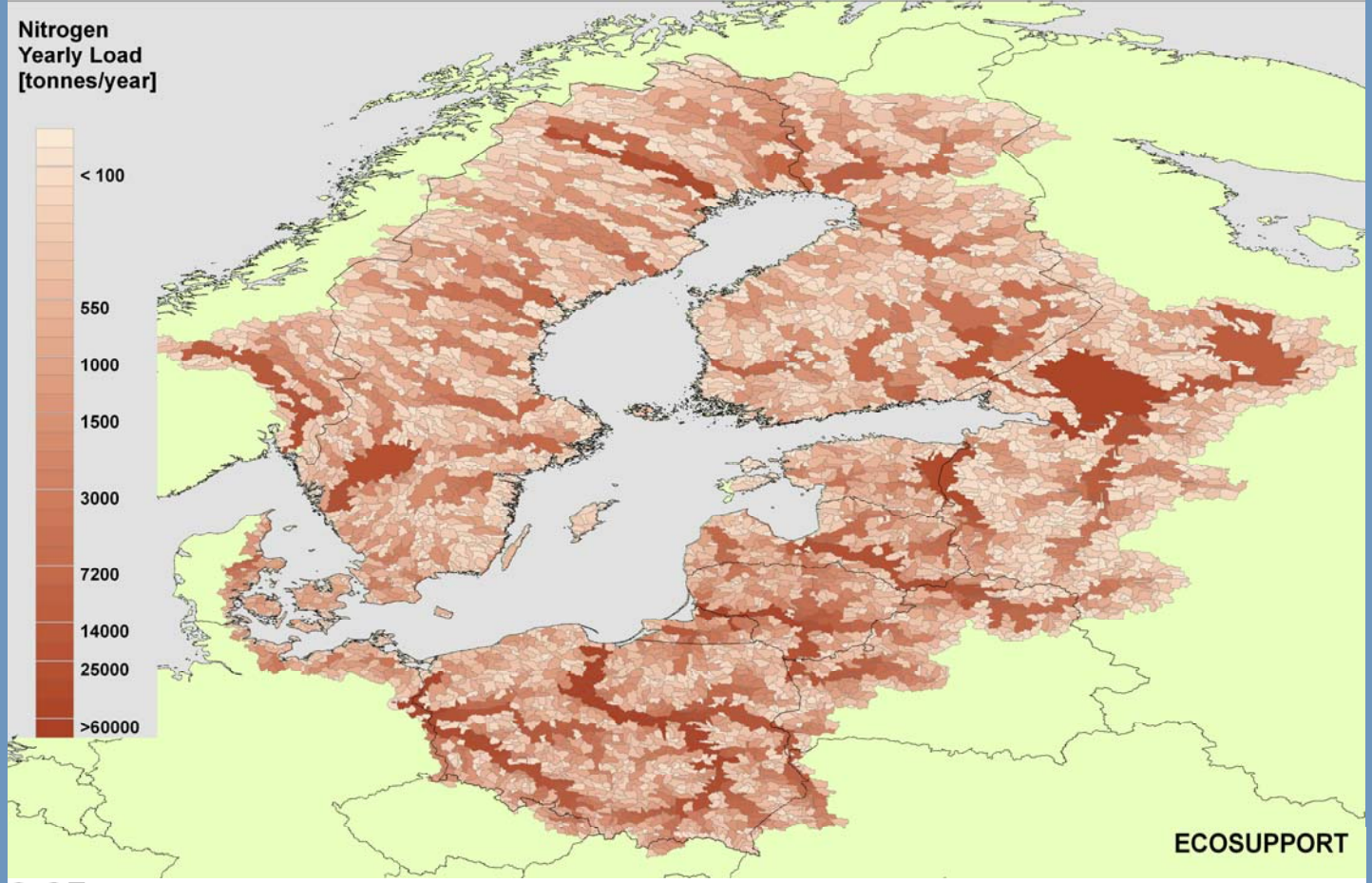
Total Phosphorus

Yearly load to sea



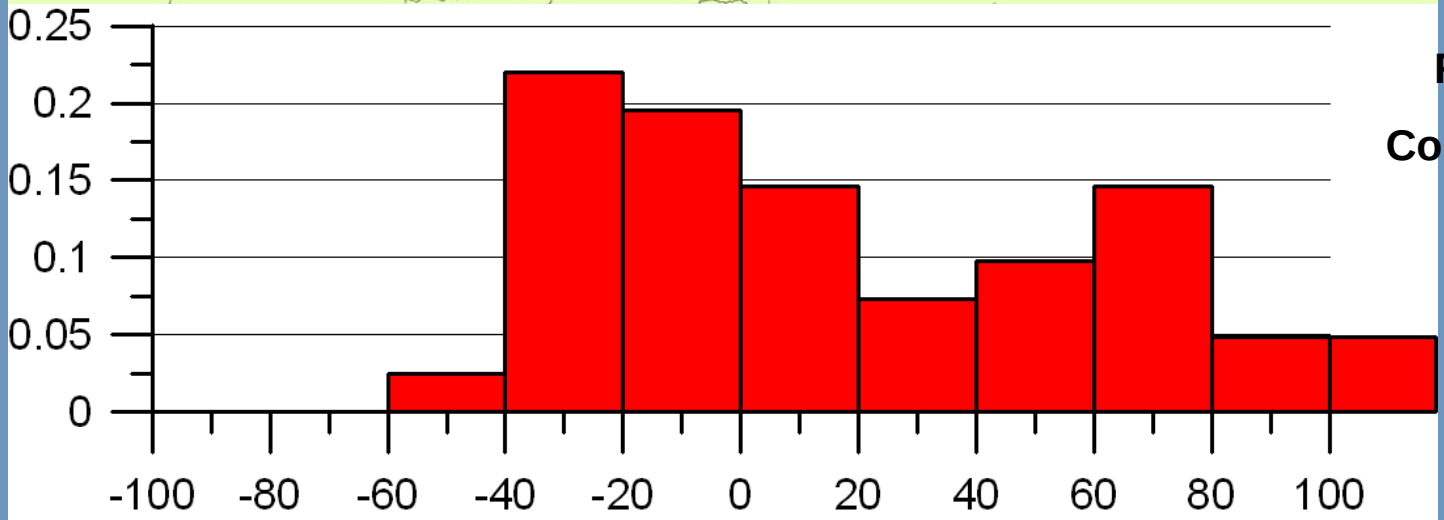
Relative error [%]

Compared to 41 rivers



Total Nitrogen

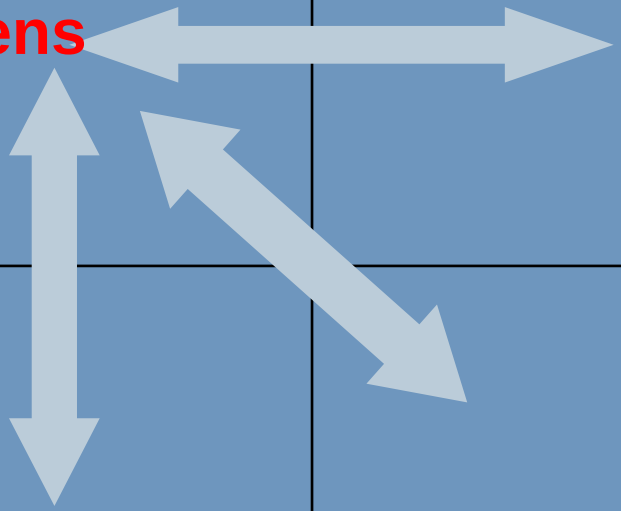
Yearly load to sea



Relative error [%]

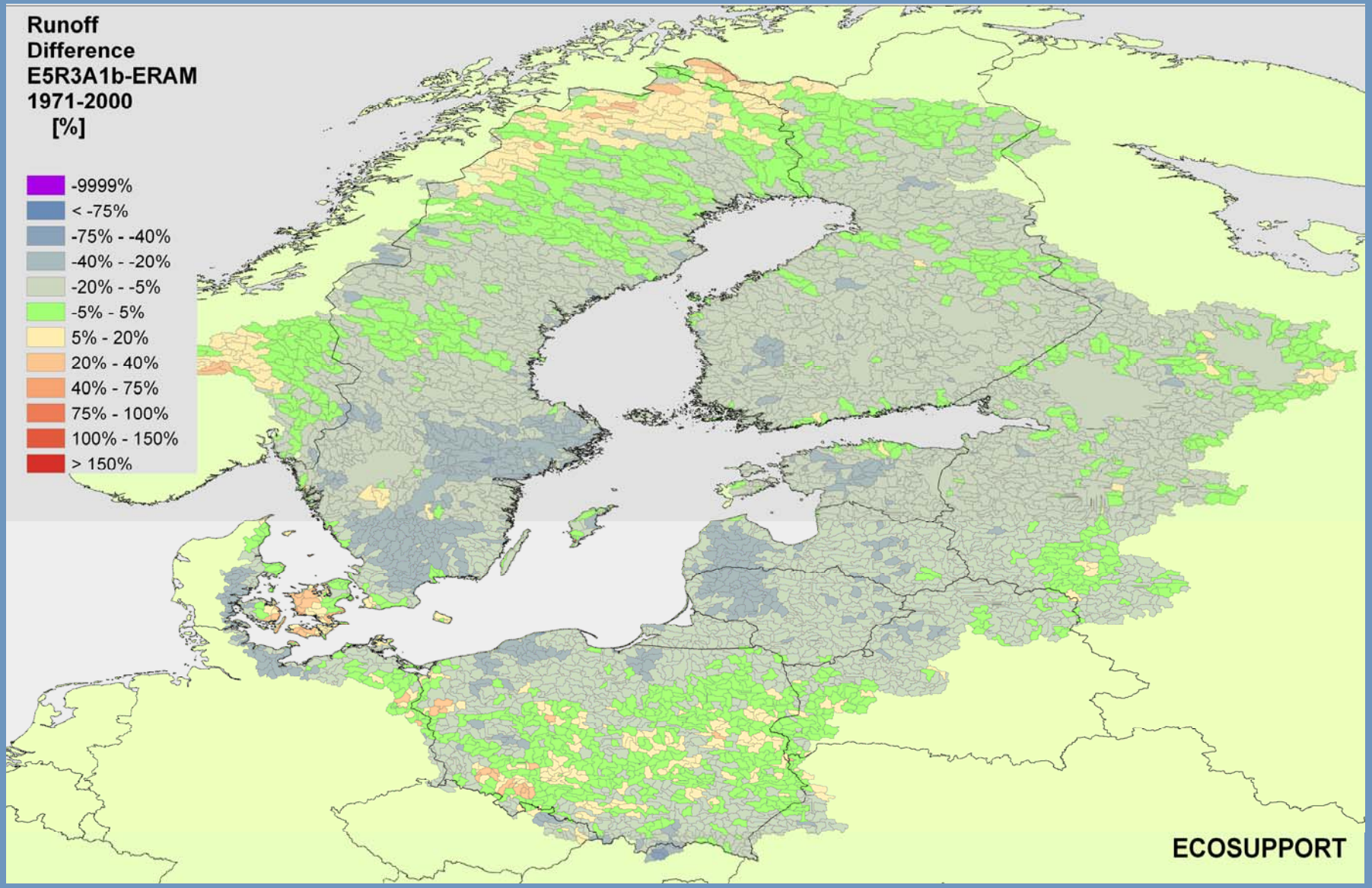
Compared to 41 rivers

Clim. scen / Load	1971-2000	2071-2100
Load as today	Referens	
Reduced load		

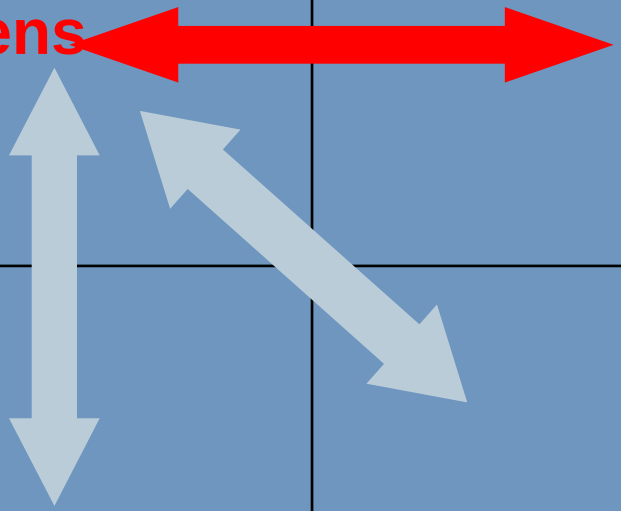


- Climate scenario: GCM: ECHAM5(KNMI), RCM: RCA3(SMHI)
- Reduction scenario: Loads from Point sources and waste water reduced by 20%

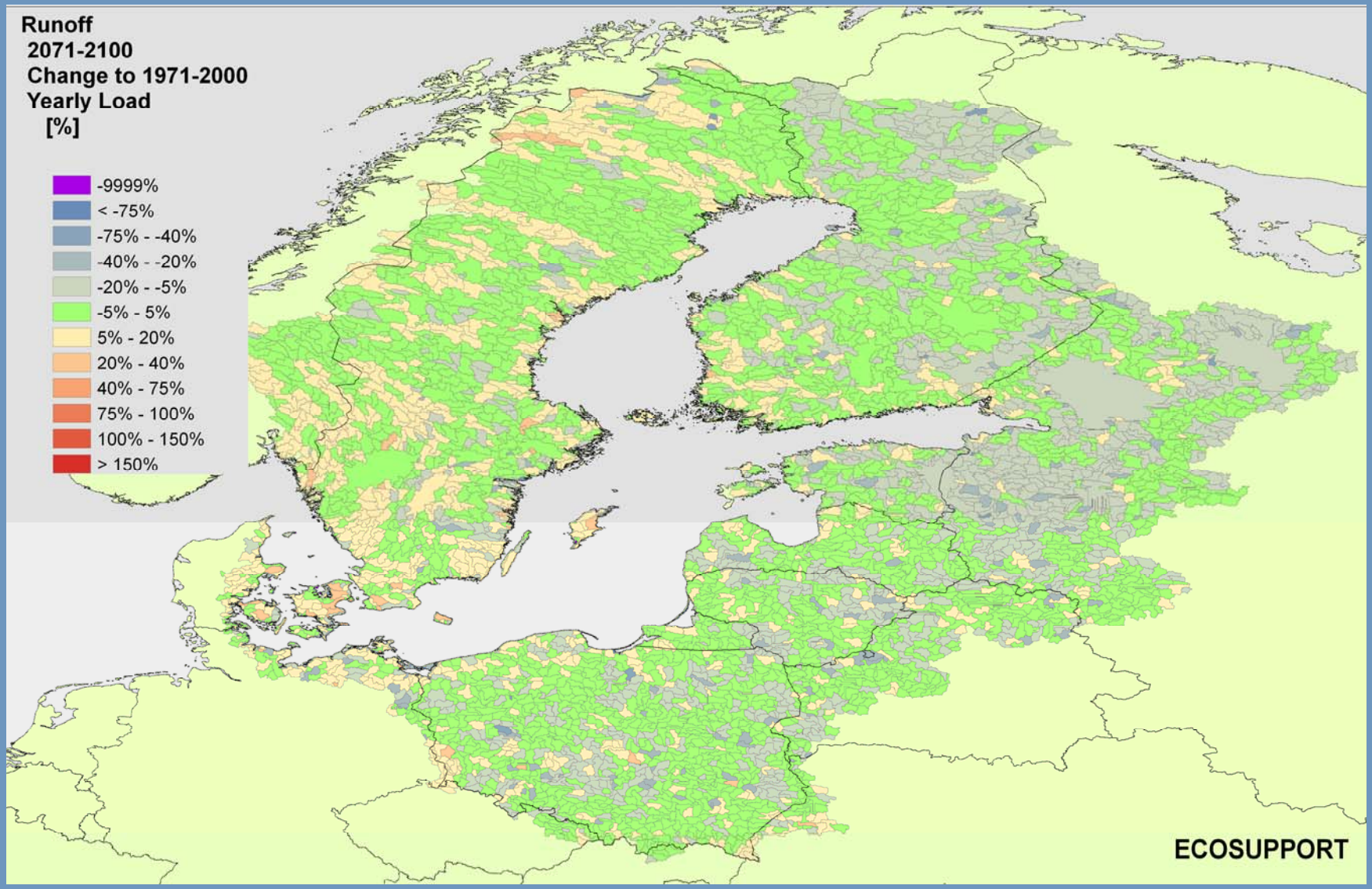
Going from *observation based* forcing data to Regional Climate Models

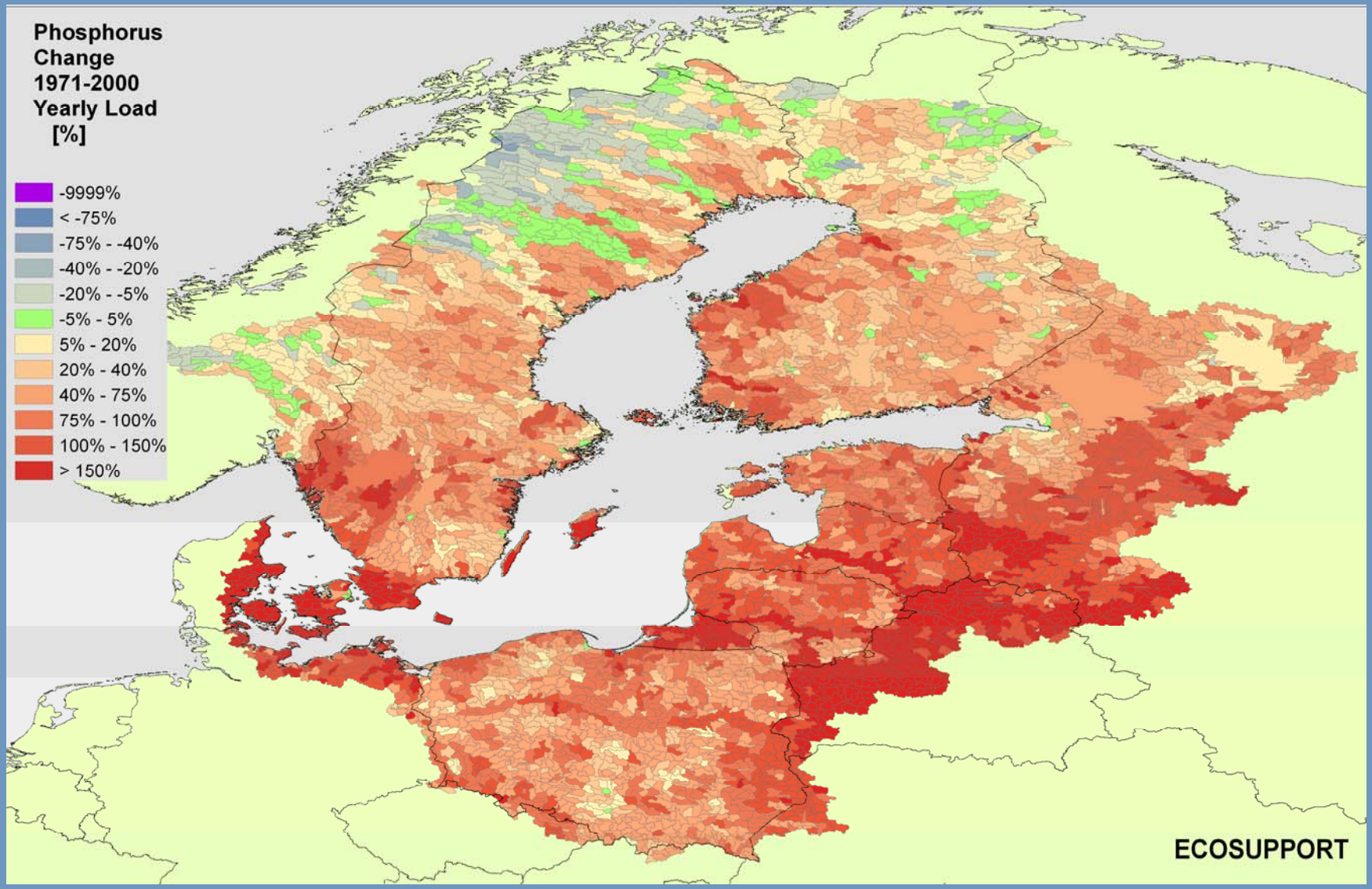


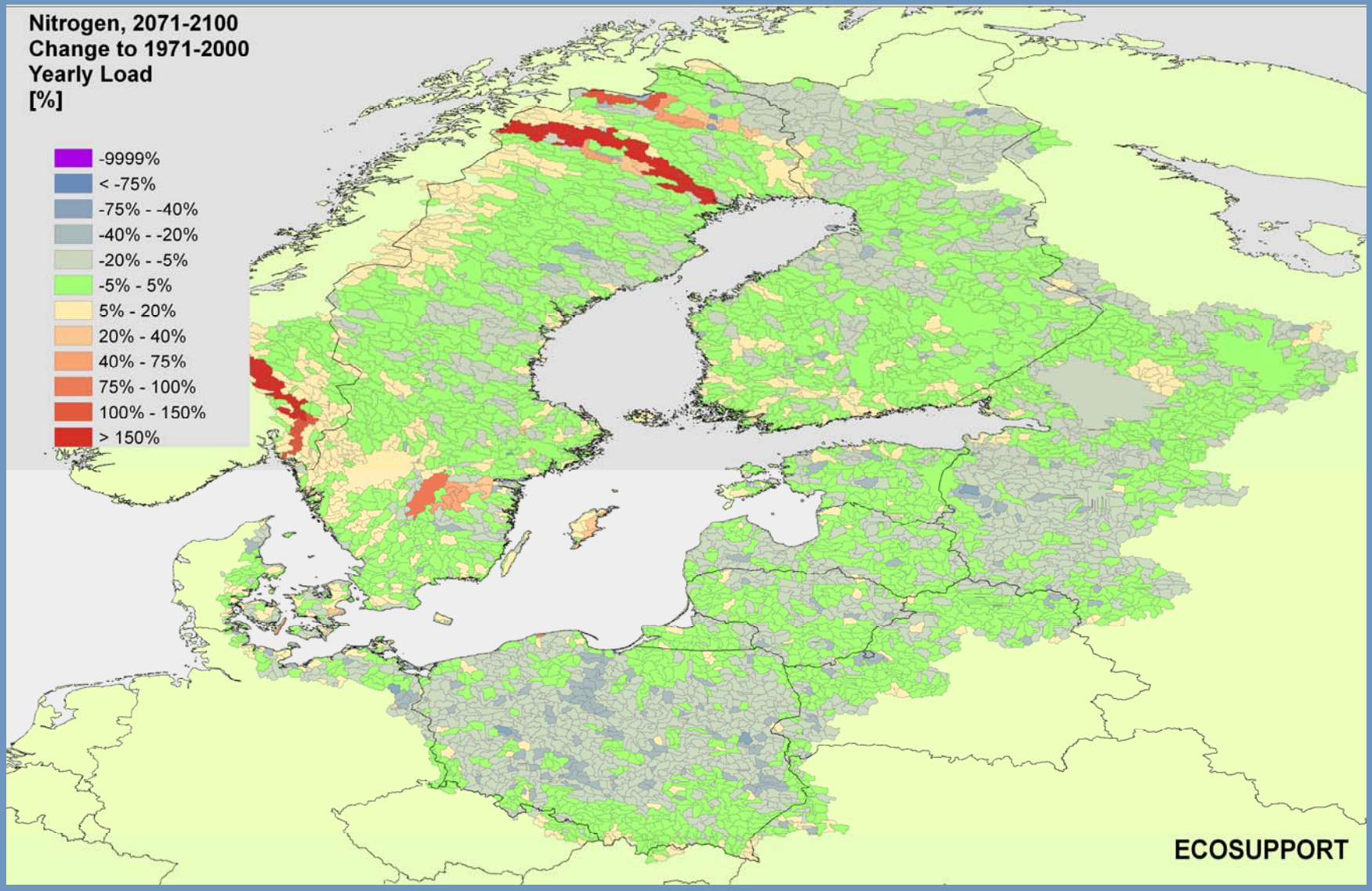
RCM / Load	1971-2000	2071-2100
Load as today	Referens	
Reduced load		



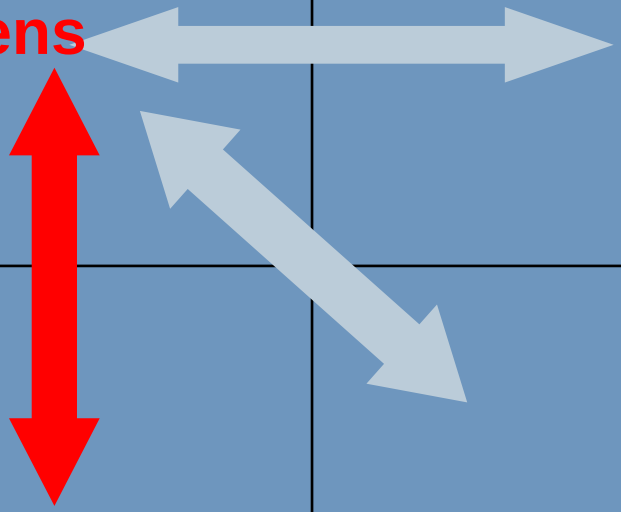
- Climate scenario: ECHAM5(KNMI), RCA3(SMHI)
- Reduction scenario: Point sources and WWT reduced by 20%


Runoff
2071-2100
Change to 1971-2000
Yearly Load
[%]
-9999%
< -75%
-75% - -40%
-40% - -20%
-20% - -5%
-5% - 5%
5% - 20%
20% - 40%
40% - 75%
75% - 100%
100% - 150%
> 150%
ECOSUPPORT

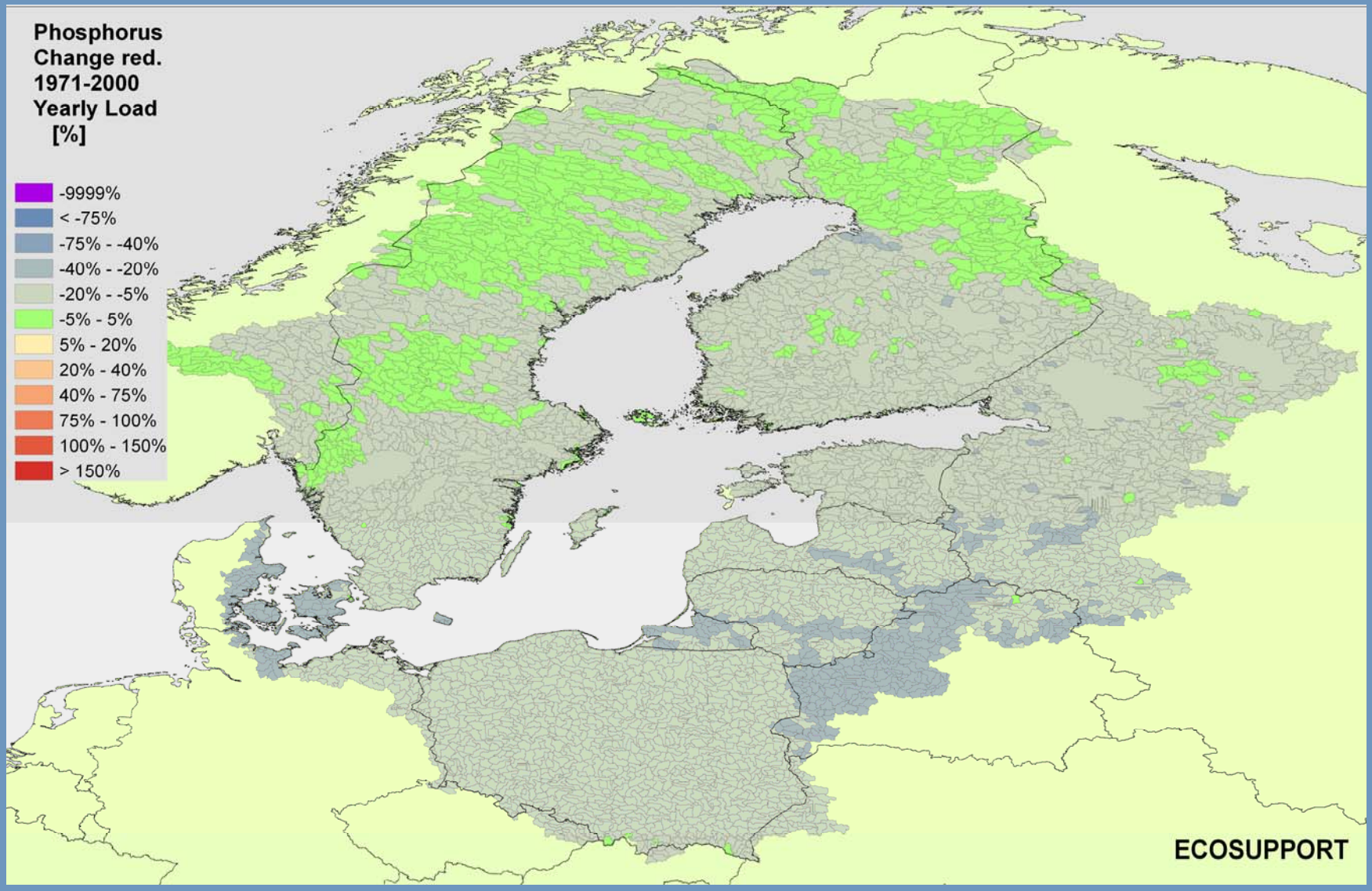

Phosphorus
Change
1971-2000
Yearly Load
[%]
-9999%
< -75%
-75% - -40%
-40% - -20%
-20% - -5%
-5% - 5%
5% - 20%
20% - 40%
40% - 75%
75% - 100%
100% - 150%
> 150%
ECOSUPPORT

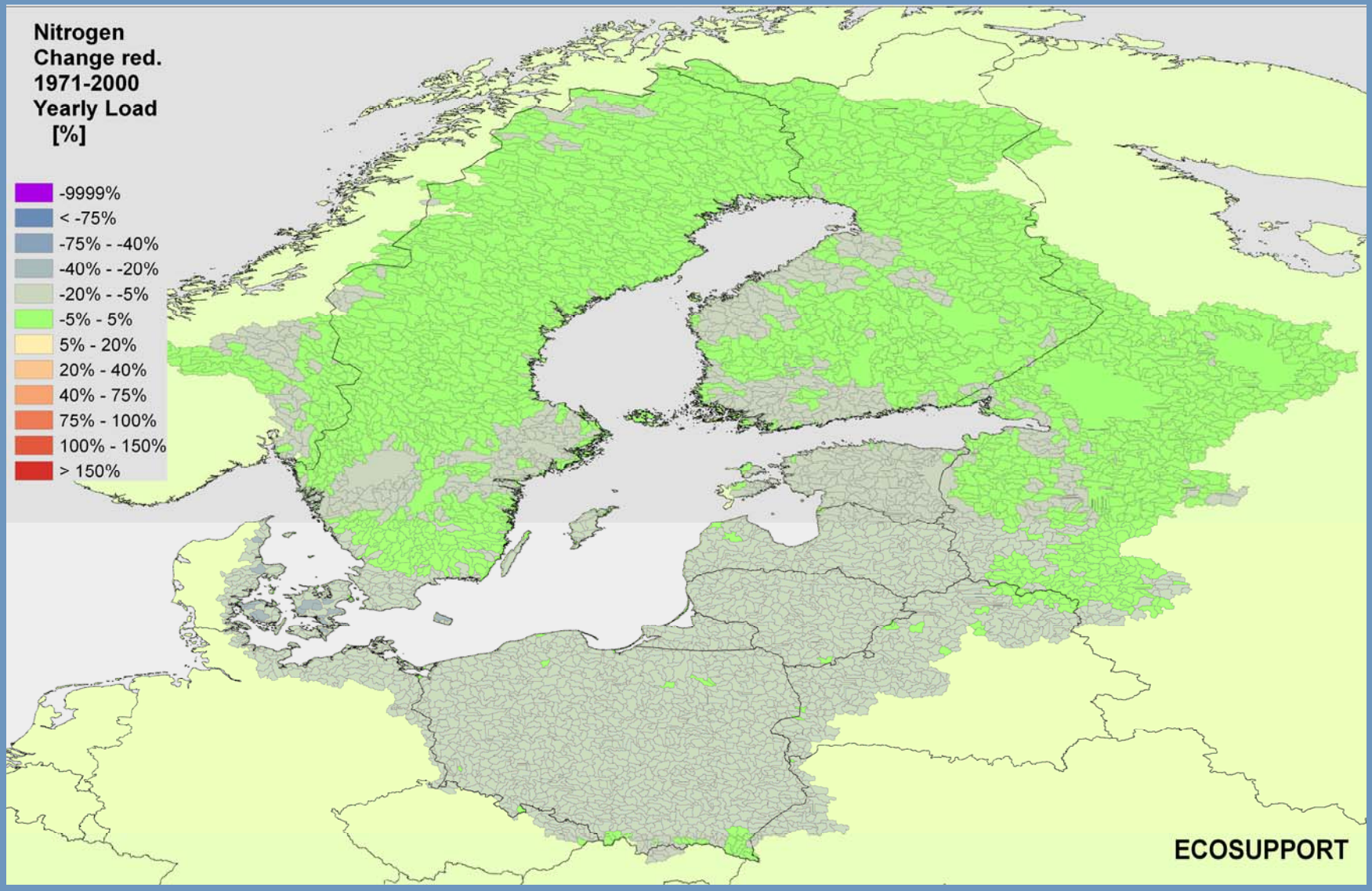

Nitrogen, 2071-2100
Change to 1971-2000
Yearly Load
[%]
-9999%
< -75%
-75% - -40%
-40% - -20%
-20% - -5%
-5% - 5%
5% - 20%
20% - 40%
40% - 75%
75% - 100%
100% - 150%
> 150%
ECOSUPPORT

RCM / Load	1971-2000	2071-2100
Load as today	Referens	
Reduced load		

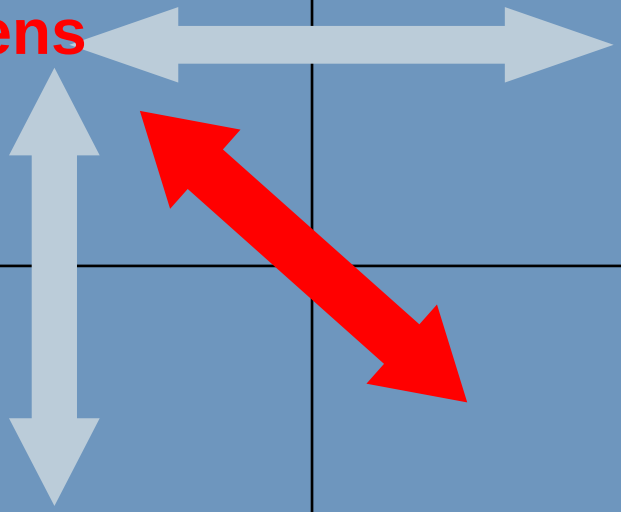


- Climate scenario: ECHAM5(KNMI), RCA3(SMHI)
- Reduction scenario: Point sources and WWT reduced by 20%


Phosphorus
Change red.
1971-2000
Yearly Load
[%]
-9999%
< -75%
-75% - -40%
-40% - -20%
-20% - -5%
-5% - 5%
5% - 20%
20% - 40%
40% - 75%
75% - 100%
100% - 150%
> 150%
ECOSUPPORT

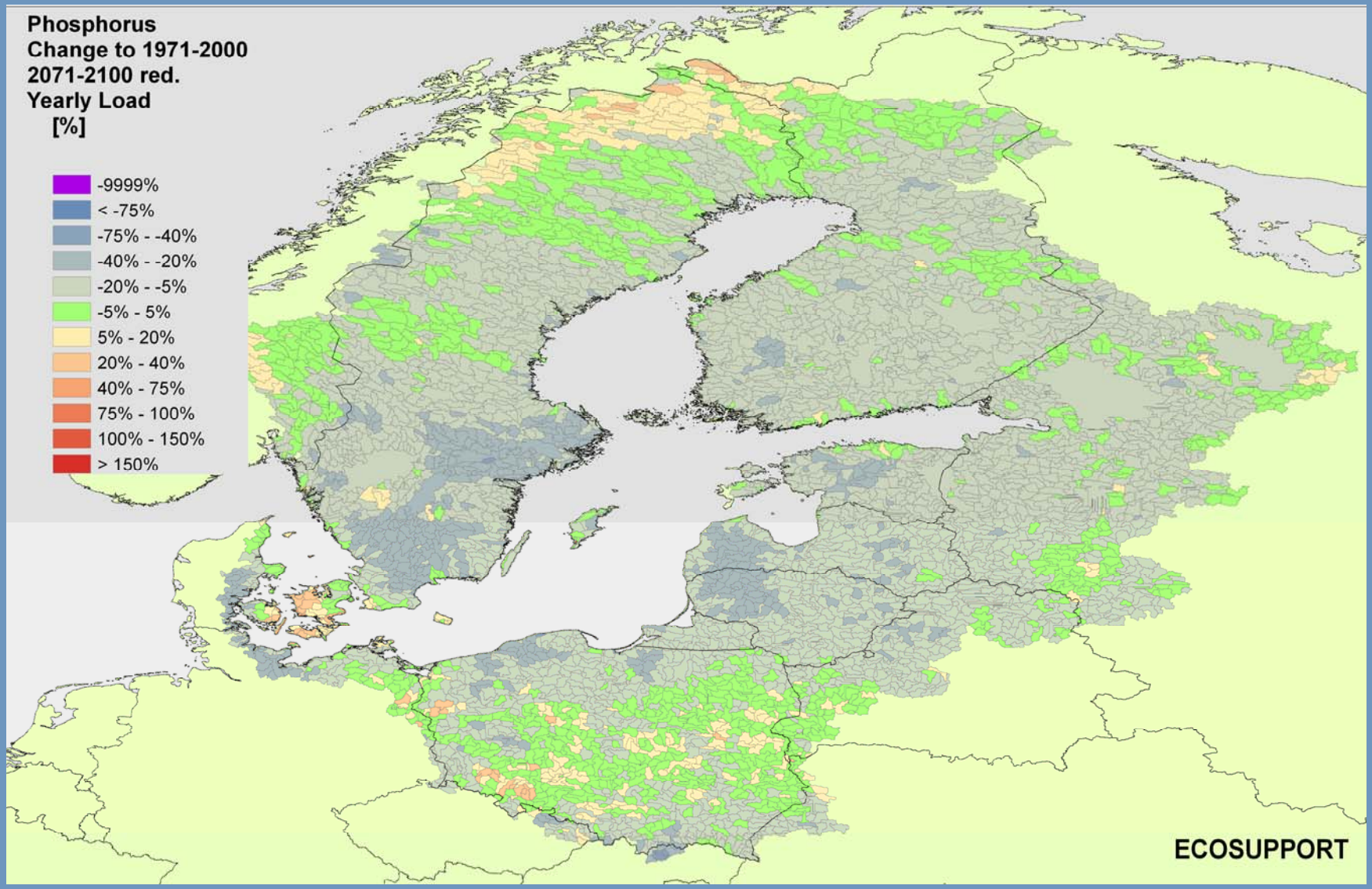

Nitrogen
Change red.
1971-2000
Yearly Load
[%]
-9999%
< -75%
-75% - -40%
-40% - -20%
-20% - -5%
-5% - 5%
5% - 20%
20% - 40%
40% - 75%
75% - 100%
100% - 150%
> 150%
ECOSUPPORT

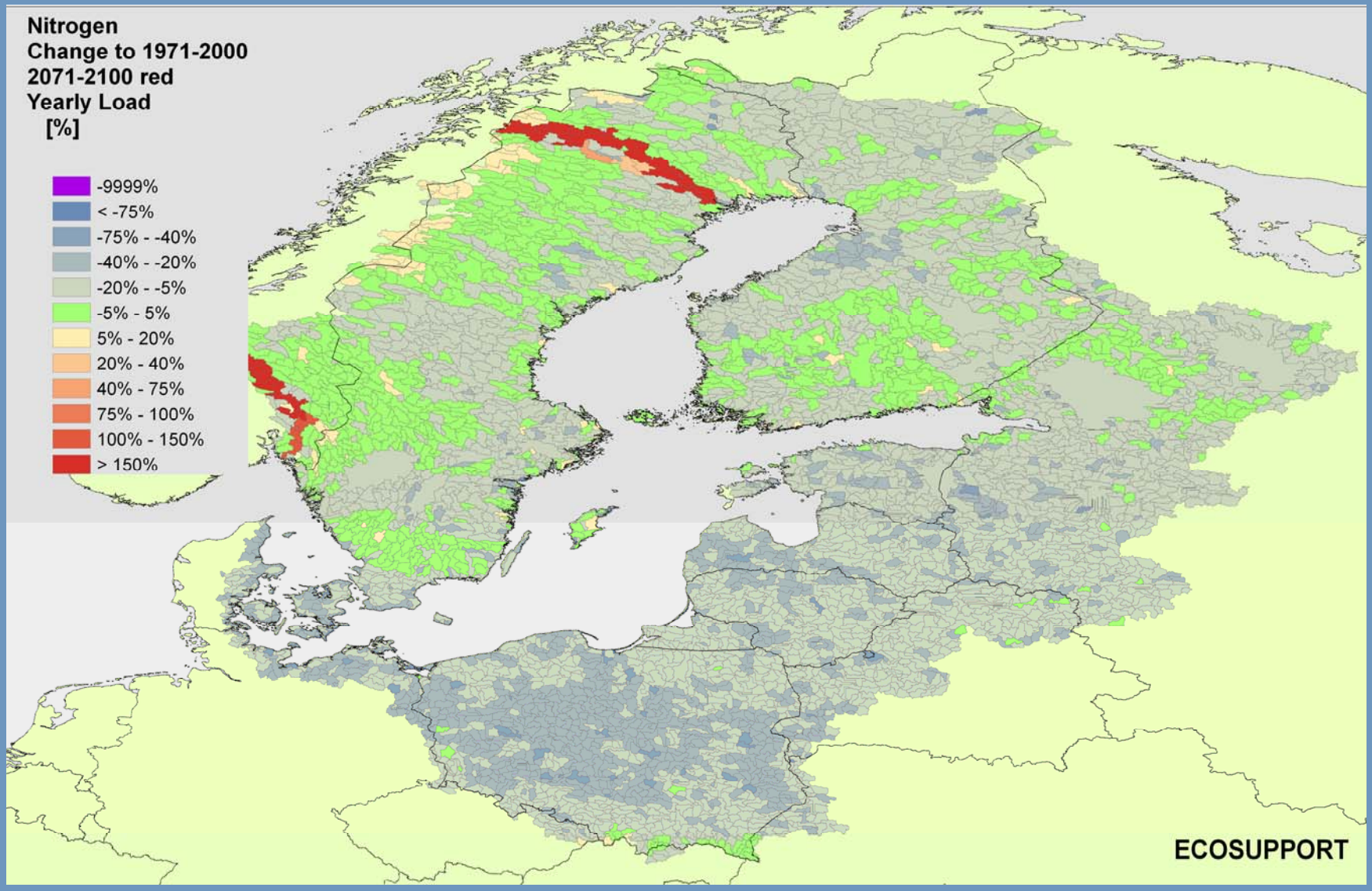
RCM / Load	1971-2000	2071-2100
Load as today	Referens	
Reduced load		



- Climate scenario: ECHAM5(KNMI), RCA3(SMHI)
- Reduction scenario: Point sources and WWT reduced by 20%

Evaluating the combined effects of nutrient load reduction and climate scenarios for the Baltic Sea catchment




Nitrogen
Change to 1971-2000
2071-2100 red
Yearly Load
[%]
-9999%
< -75%
-75% - -40%
-40% - -20%
-20% - -5%
-5% - 5%
5% - 20%
20% - 40%
40% - 75%
75% - 100%
100% - 150%
> 150%
ECOSUPPORT

Preliminary conclusions

- **Climate run:**

  -Increase in phosphorus load due to more intense rainfall

  -Decrease in nitrogen load due to deacreased flow => increase in retention time.

Combined effects:

Nutrient loads will decrease

Future work

- Validation of results => Further calibration and model improvement.
- Validate that the model can reproduce changes in external loads of nutrients
- Reduction scenarios from HELCOM-BSAP
- GCM/RCM runs
- ...

Thank you for your attention