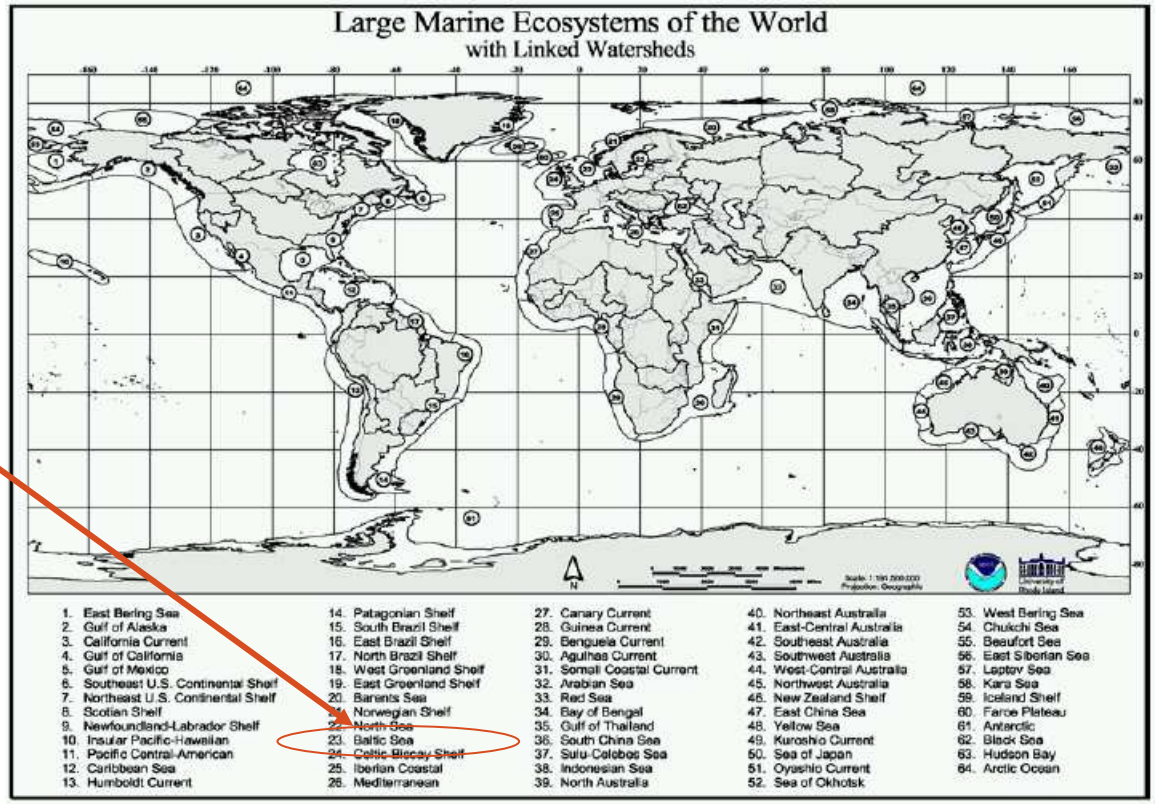
Ūdeņu kvalitātes modelēšanas perspektīvā attīstība Baltijas jūras ekoreģionā

23. Baltic Sea

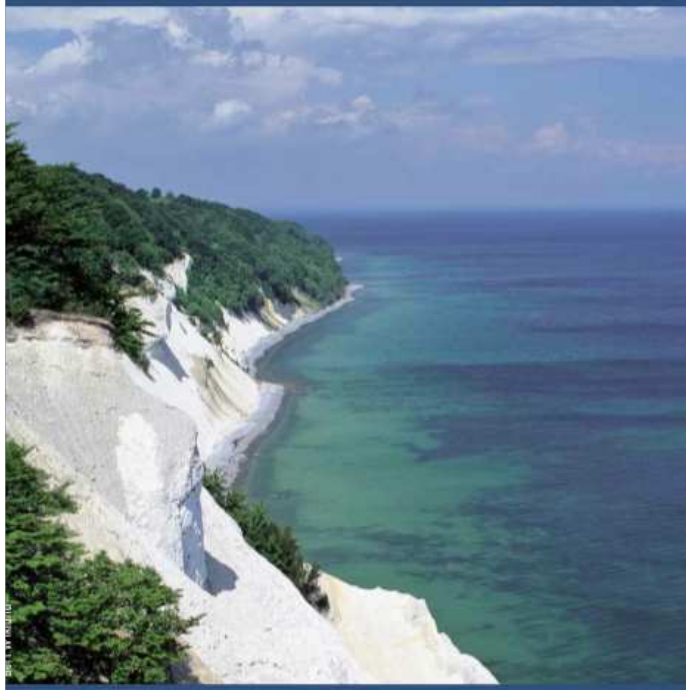


V. Jansons

Latvijas Lauksaimniecības universitāte, Vides un ūdenssaimniecības katedras vad. Jelgava, Akadēmijas 19. LV-3001, e-pasts: viesturs.jansons@llu.lv

The Baltic Sea Acti

A new environmenta for the Baltic Sea reg



Helsinki Commission
Baltic Marine Environment Prot

In order to reach the goal towards a Baltic Sea unaffected by eutrophication

WE AGREE on the principle of identifying maximum allowable inputs of nutrients in order to reach good environmental status of the Baltic Sea,

WE ALSO AGREE that there is a need to reduce the nutrient inputs and that the needed reductions shall be fairly shared by all Baltic Sea countries,

BEARING IN MIND that the figures are based on the MARE NEST model, the best available scientific information, and thus stressing the provisional character of the data **WE ACKNOWLEDGE** that the maximum nutrient input to the Baltic Sea that can be allowed and still reach good environmental status with regard to eutrophication is about 21,000 tonnes of phosphorus and 600,000 tonnes of nitrogen,

WE FURTHERMORE RECOGNISE that, based on national data or information from 1997-2003 in each sub-region of the Baltic Sea, the maximum allowable nutrient inputs to reach good environmental status and the corresponding nutrient reductions that are needed in each sub-region are as follows:

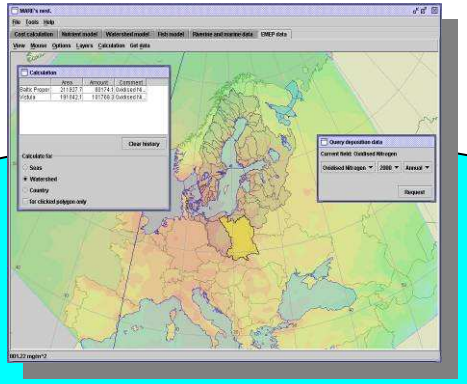
Sub-region	Maximum allowable nutrient input (tonnes)		Inputs in 1997-2003 (normalised by hydrological factors)		Needed reductions	
	Phosphorus	Nitrogen	Phosphorus	Nitrogen	Phosphorus	Nitrogen
Bothnian Bay	2,580	51,440	2,580	51,440	0	0
Bothnian Sea	2,460	56,790	2,460	56,790	0	0
Gulf of Finland	4,860	106,680	6,860	112,680	2,000	6,000
Baltic Proper	6,750	233,250	19,250	327,260	12,500	94,000
Gulf of Riga	1,430	78,400	2,180	78,400	750	0
Danish straits	1,410	30,890	1,410	45,890	0	15,000
Kattegat	1,570	44,260	1,570	64,260	0	20,000
Total	21,060	601,720	36,310	736,720	15,250	135,000

In order to diminish nutrient inputs to the Baltic Sea to the maximum allowable level **WE AGREE** to take actions not later than 2016 to reduce the nutrient load from waterborne and airborne inputs aiming at reaching good ecological and environmental status by 2021,

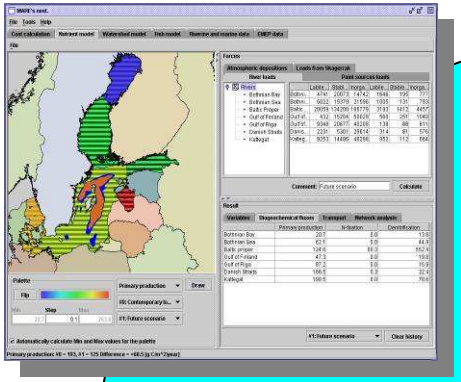
Modelēšana Baltijas jūras baseinā

Mare – Nest modelis (F.Wulf 2003. - 2007. g.)

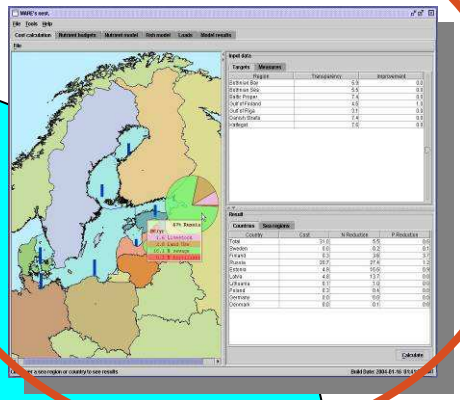
Atmospheric emissions and load



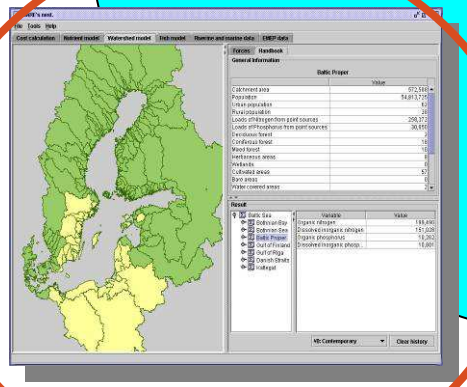
Marine modeling



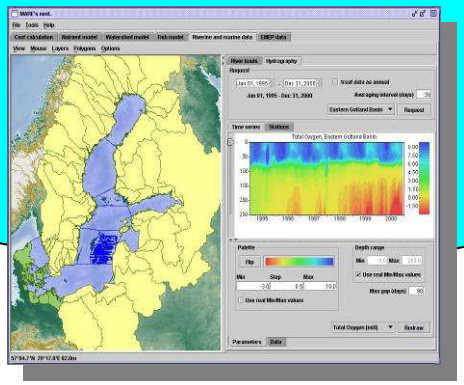
Cost minimization model



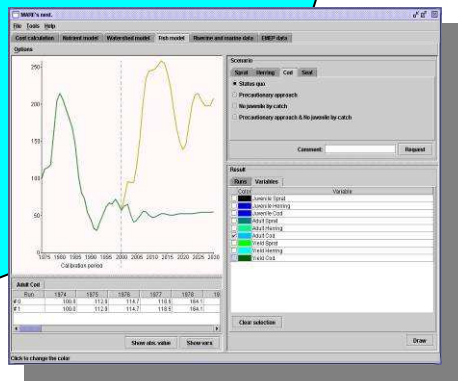
NEST can be used freely
with any computer with Internet
access from
http://www.Balticnest.org



Drainage basin modeling



Marine and runoff data



Food web model

RECOCA

Reduction of Baltic Sea Nutrient Inputs and Cost Allocation within the Baltic Sea Catchment

"Augu barības elementu noplūdes samazināšana Baltijas jūras baseinā, ietverot nepieciešamās izmaksas piesārņojuma samazināšanai"

Fredrik Wulff, Stockholm University, Sweden (SU-BNI)

Christoph Humborg, Stockholm University, Sweden (SU-ITM)

Carl-Magnus Mörth, Stockholm University, Sweden (SU-IGG)

Hans Estrup Andersen, Århus University, Denmark (ÅU)

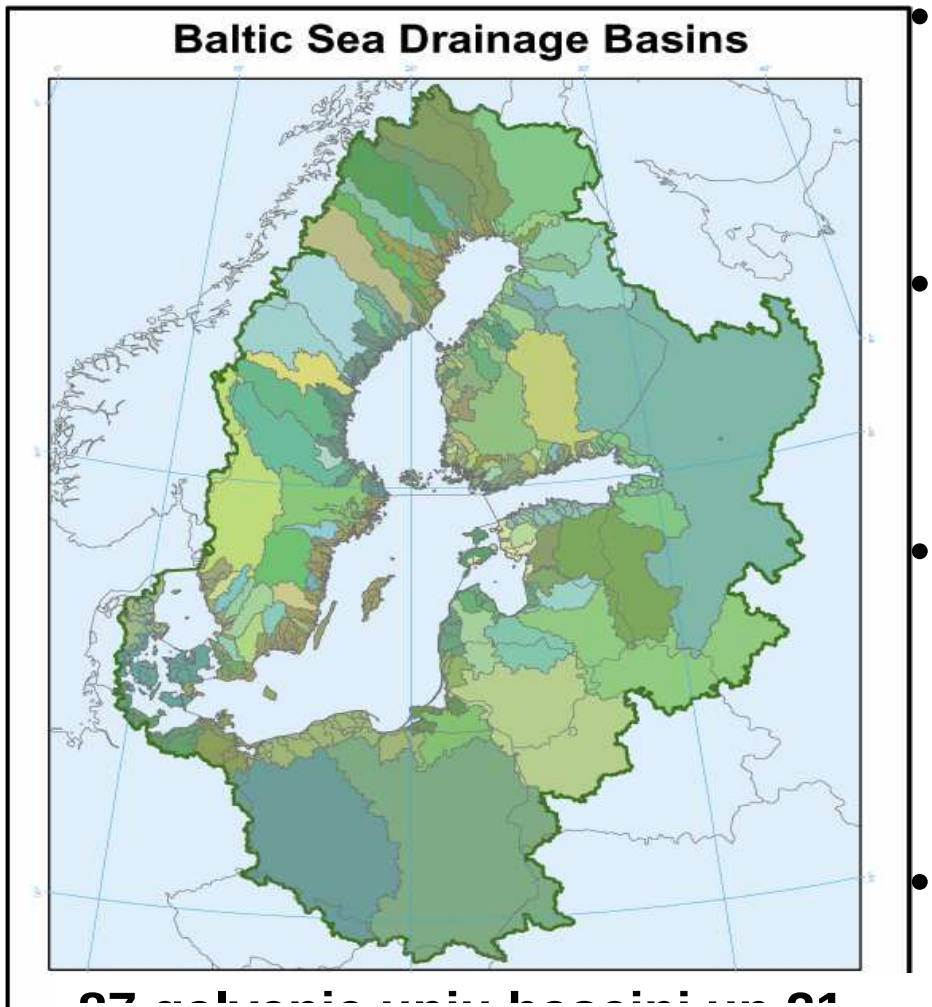
Katarina Eloffsson, Swedish Agricultural University, Sweden (SLU)

Tomasz Zylicz, Warsaw University, Poland (WEEC)

Viesturs Jansons, Latvia University of Agriculture, Latvia (LLU)

Adam Was, Warsaw University of Life Science, Poland (SGGW)

Per Stålnacke, Norwegian Institute for Agricultural and Environmental Research, Norway (Bioforsk)

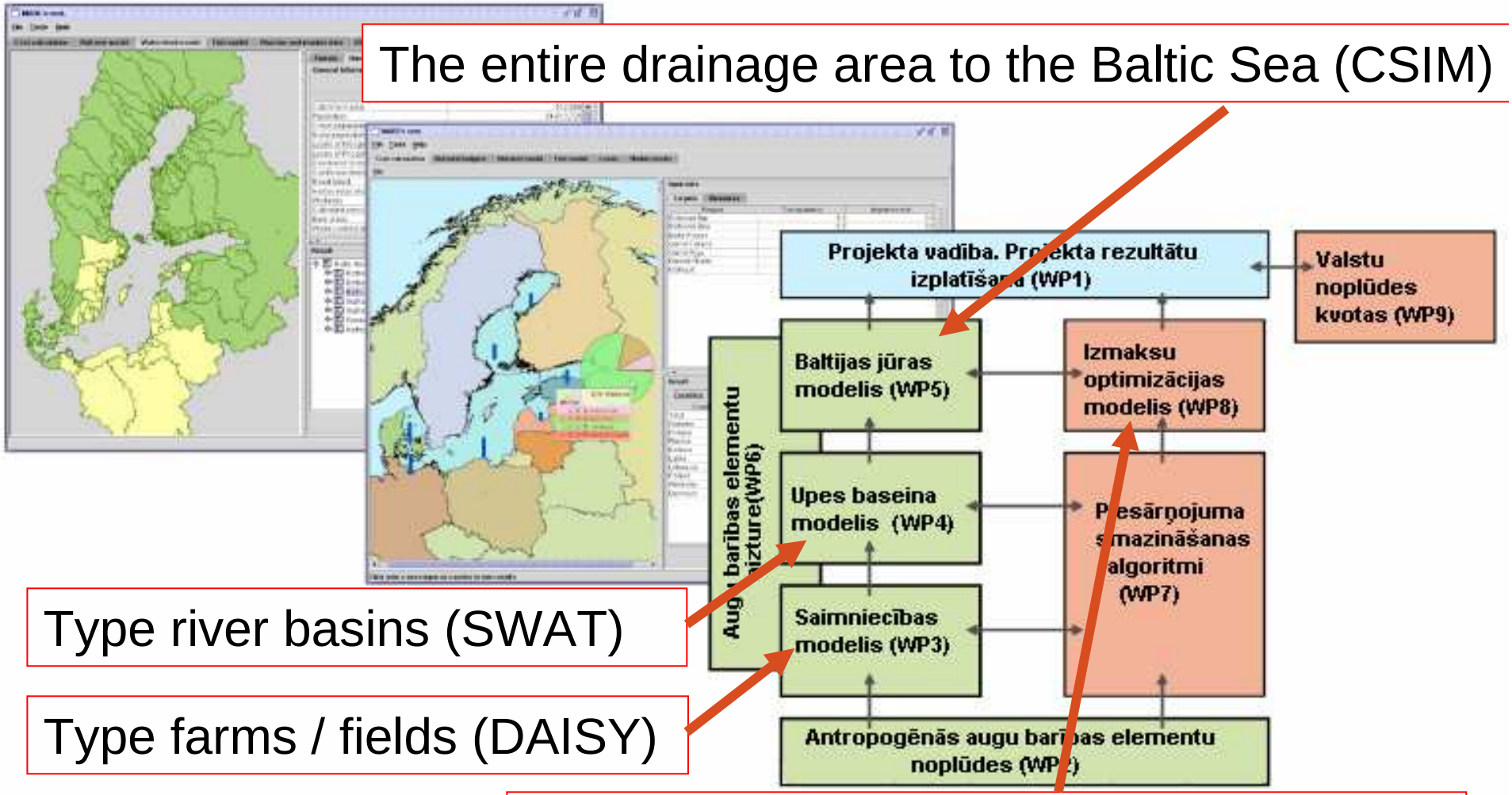


- **PLC 5 (HELCOM) aprēķini valstīs tiek izpildīti ar dažādiem paņēmieniem un dati nav salīdzināmi**
- **WFD izpilde prasa ūdens kvalitātes un ūdens saimniecisko pasākumu efektivitātes, to izmaksu modelēšanu.**
- **Baltijas jūras baseinam nepieciešams vienots un reģionālām īpatnībām pieskaņots augu barības elementu noplūdes modelis iekšzeme – jūra**
- **Kompleksam jūras baseina modelim jāietver iespējas saistīt**

HELCOM rekomendācija 28E/14 prasa valstīm harmonizēt difūzā piesārņojuma noteikšanas metodes, saistot tās ar kopēja metodikas izstrādāšanu upju baseinu ūdens kvalitātes noteikšanai un tās harmonizētu pielietošanu, ar mērķi saistīt augu barības elementu noplūdes ar jūras vides ekosistēmas stāvokli un piesārņojuma samazināšanas izmaksām.

RECOCA modeļa shēma

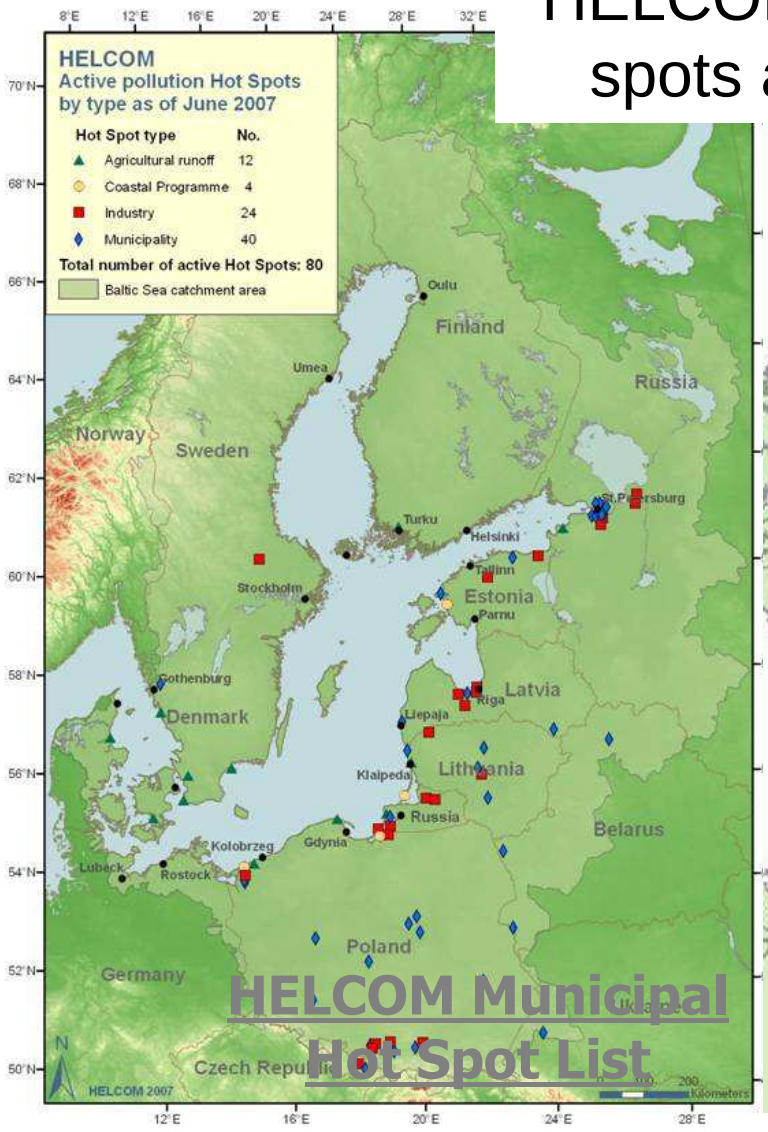
Modelling nutrient losses at three nested levels

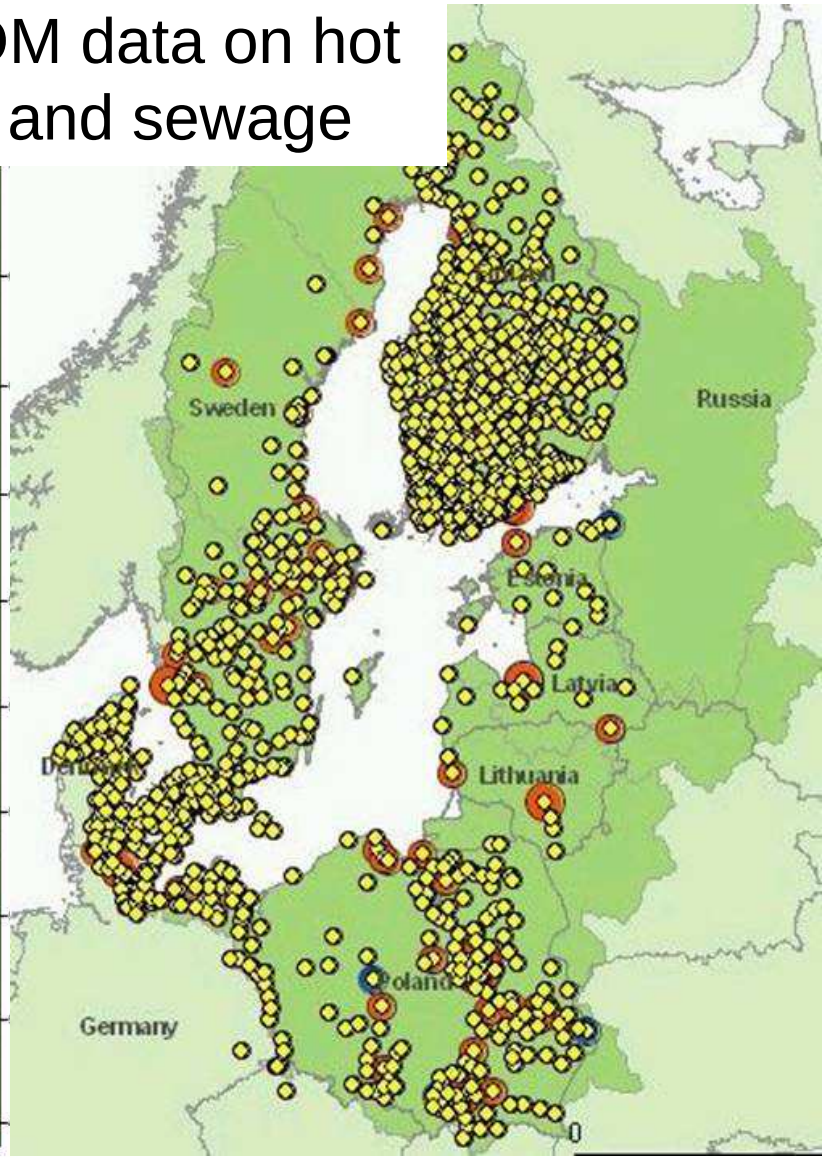


RECOCA WPs

- Data update and NANI
- Nested and hierachial model approaches
- Detailed modelling of type watersheds as forcing for large scale models
- Retention of nutrients as a major link between scientific and economic models

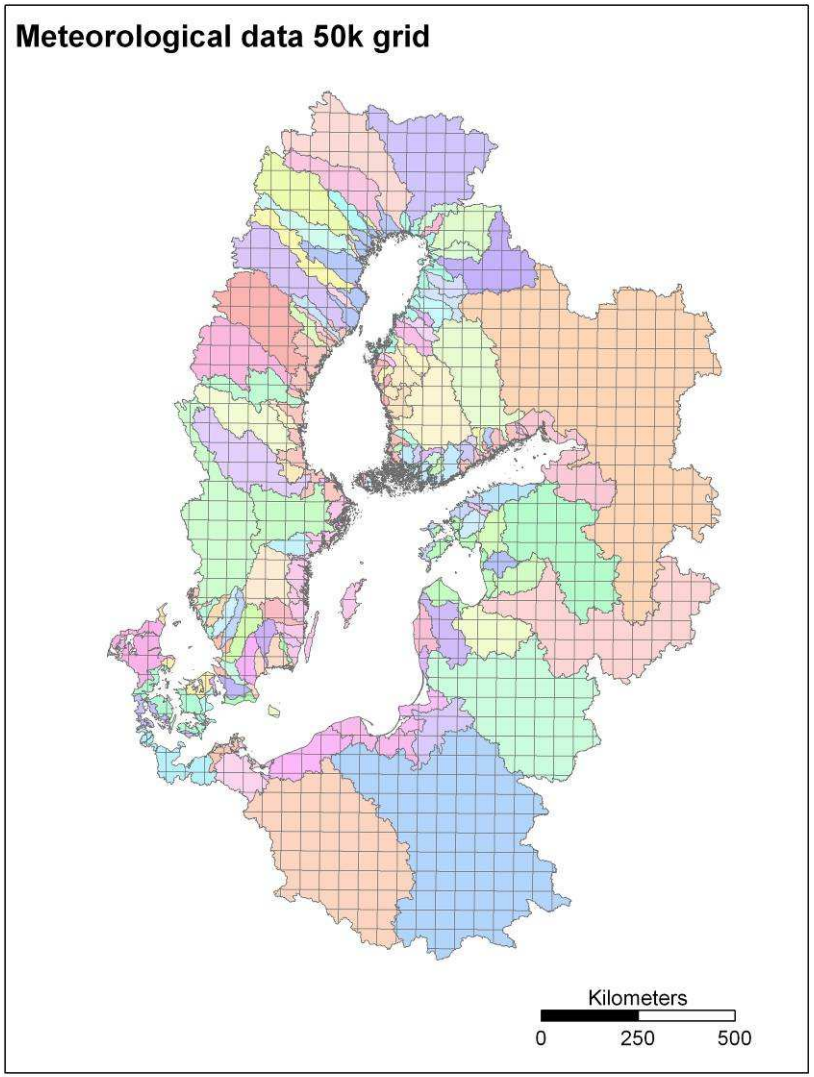
HELCOM data on hot spots and sewage

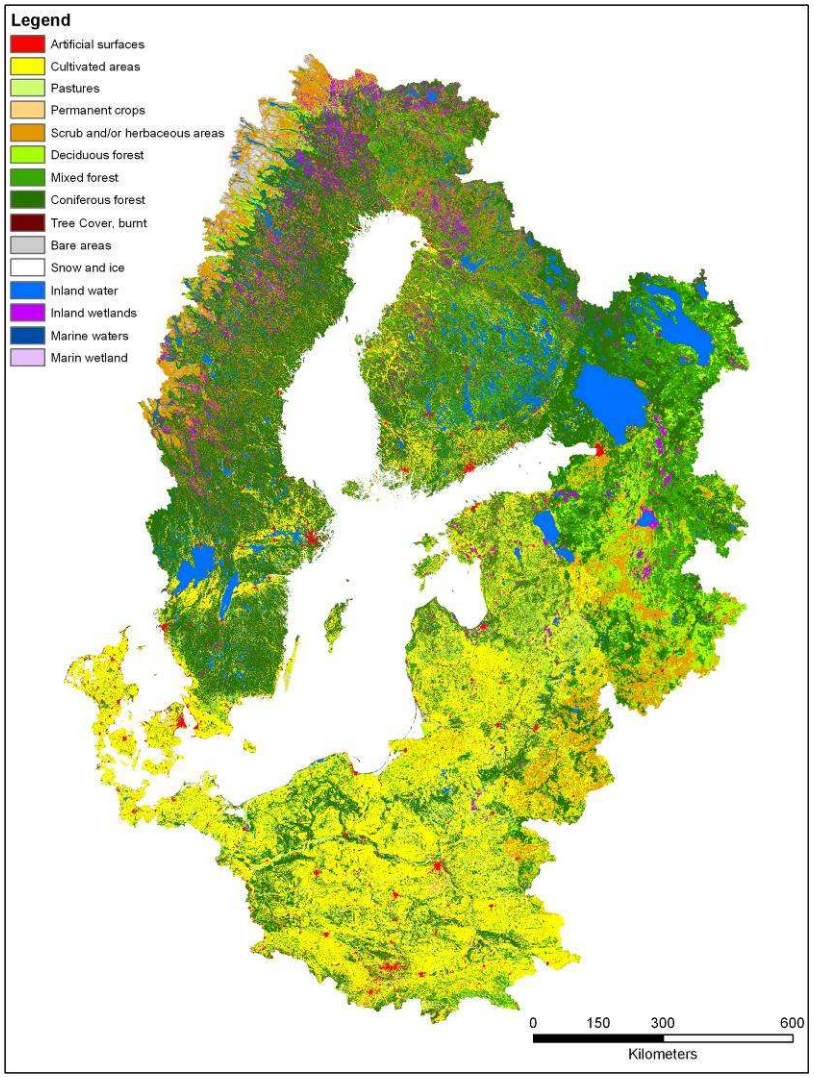


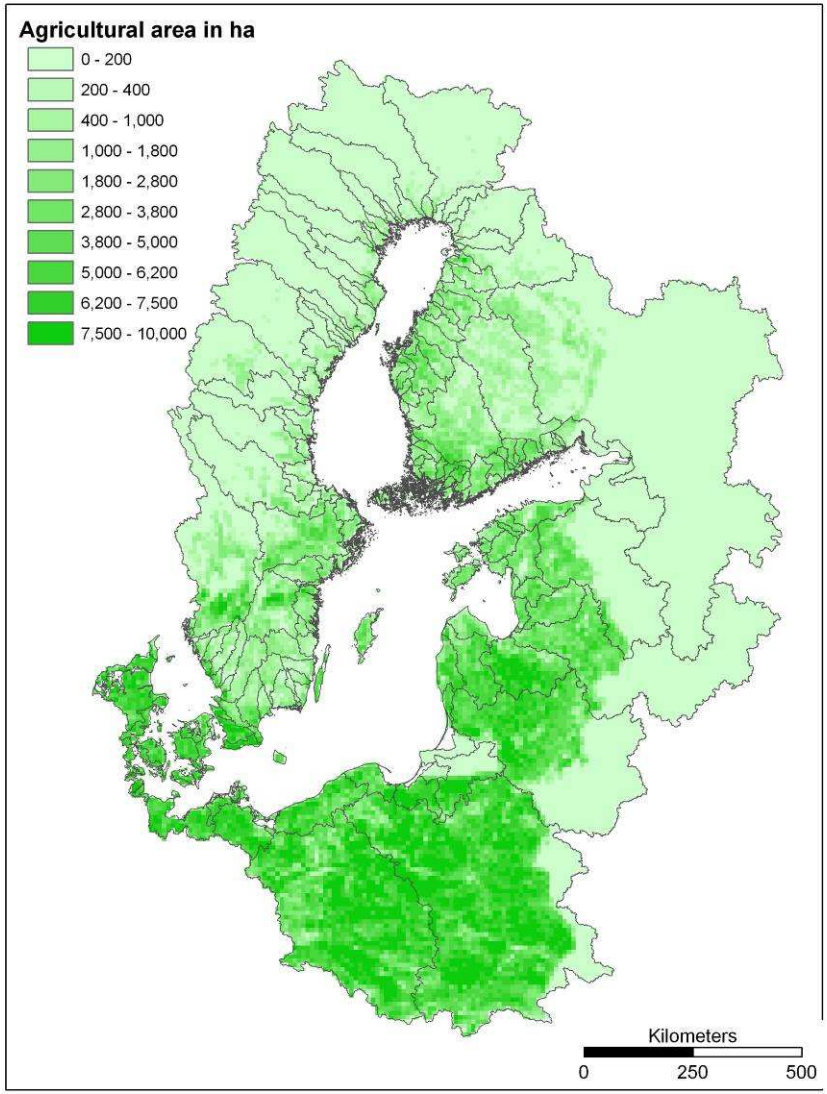


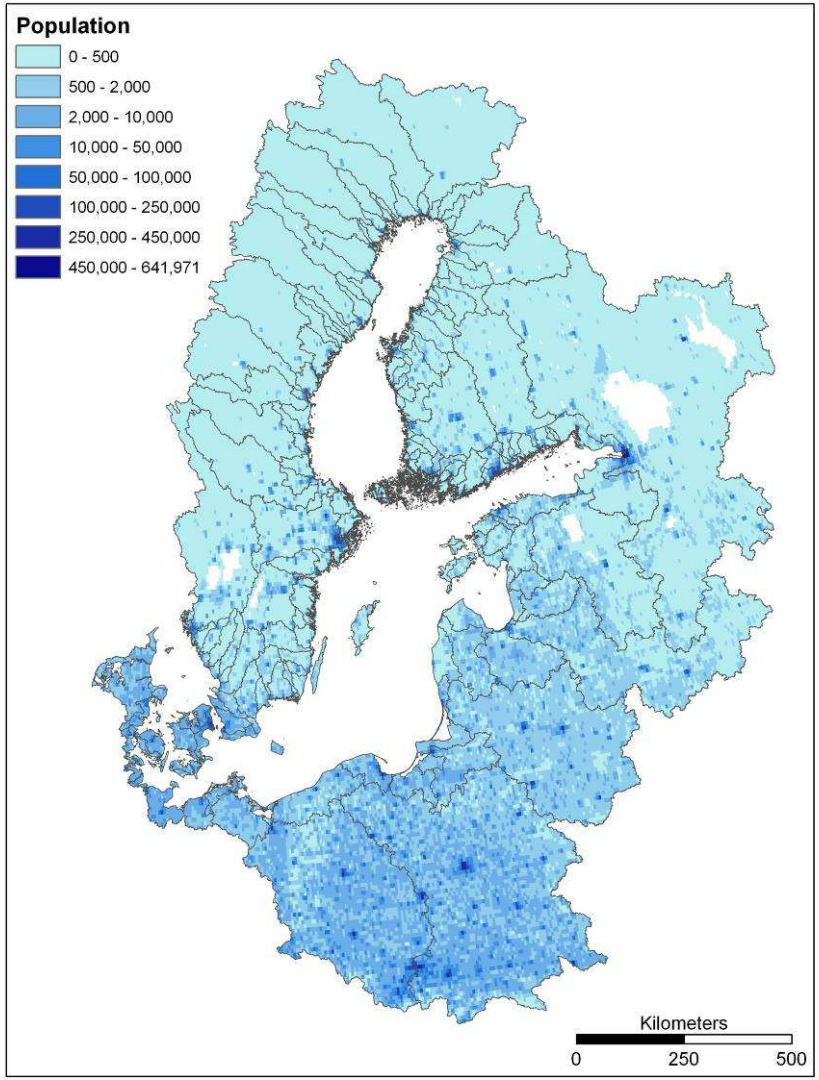
HELCOM Municipal Hot Spot List

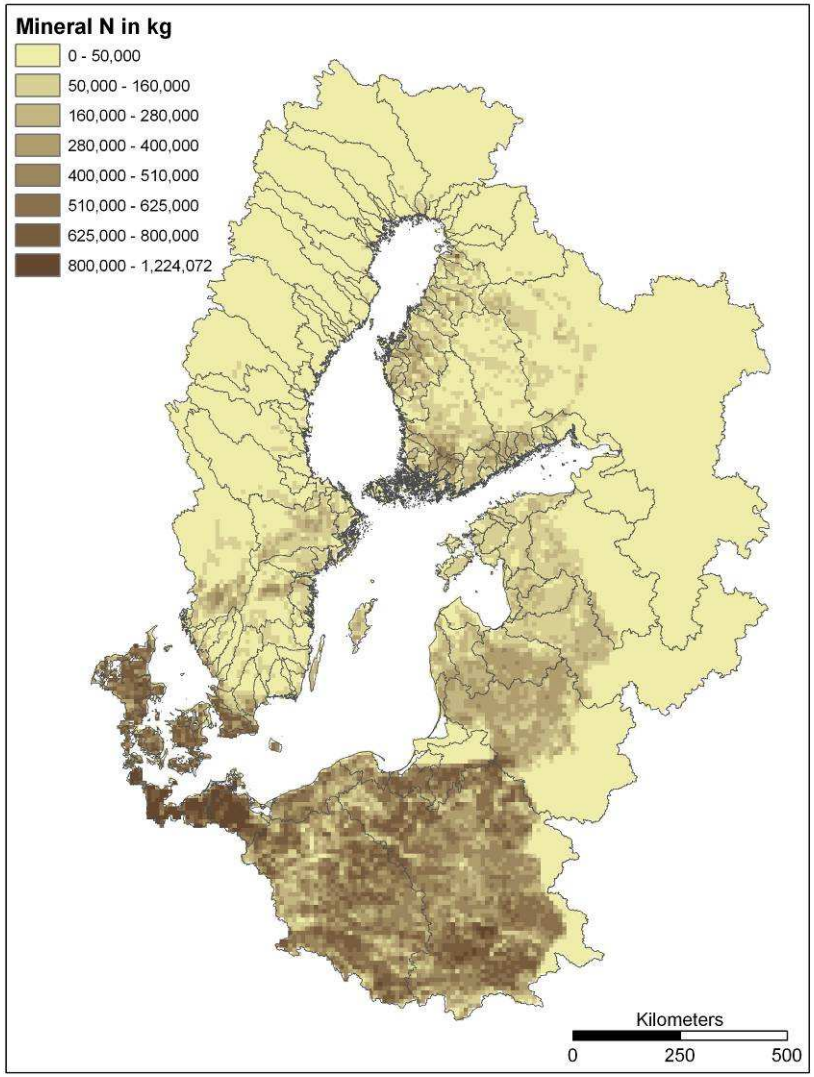
PLC-4 MWWTP List

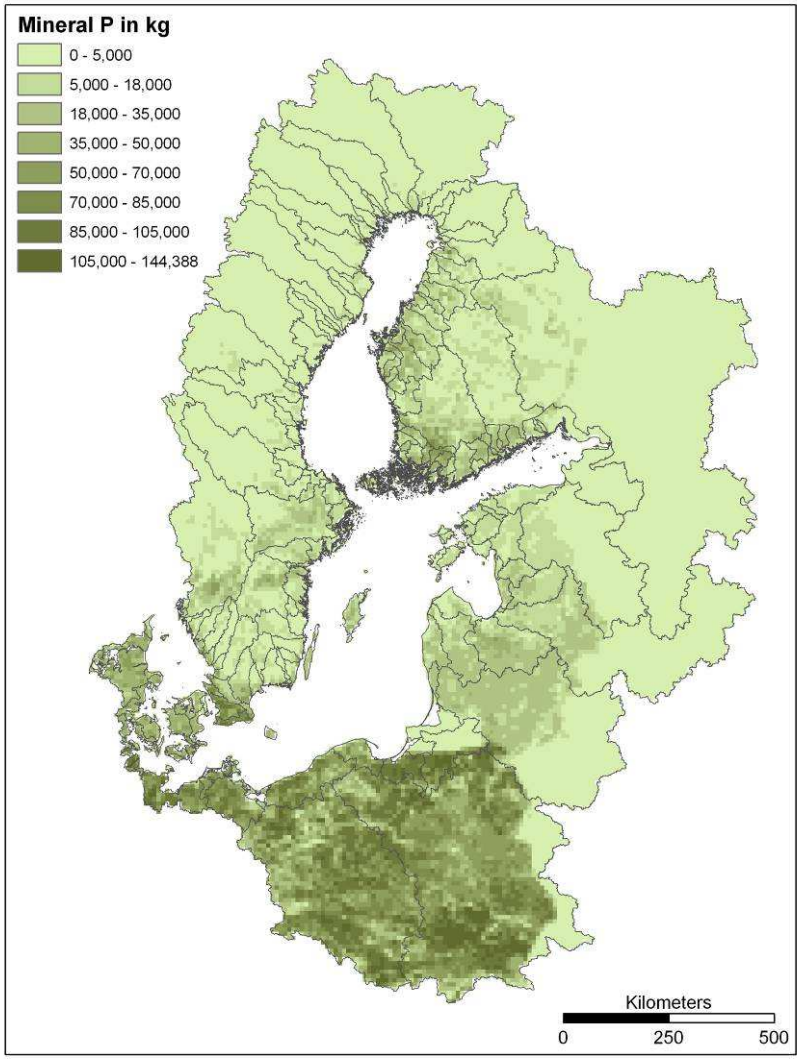

Meteorological data 50k grid
Kilometers
0
250
500

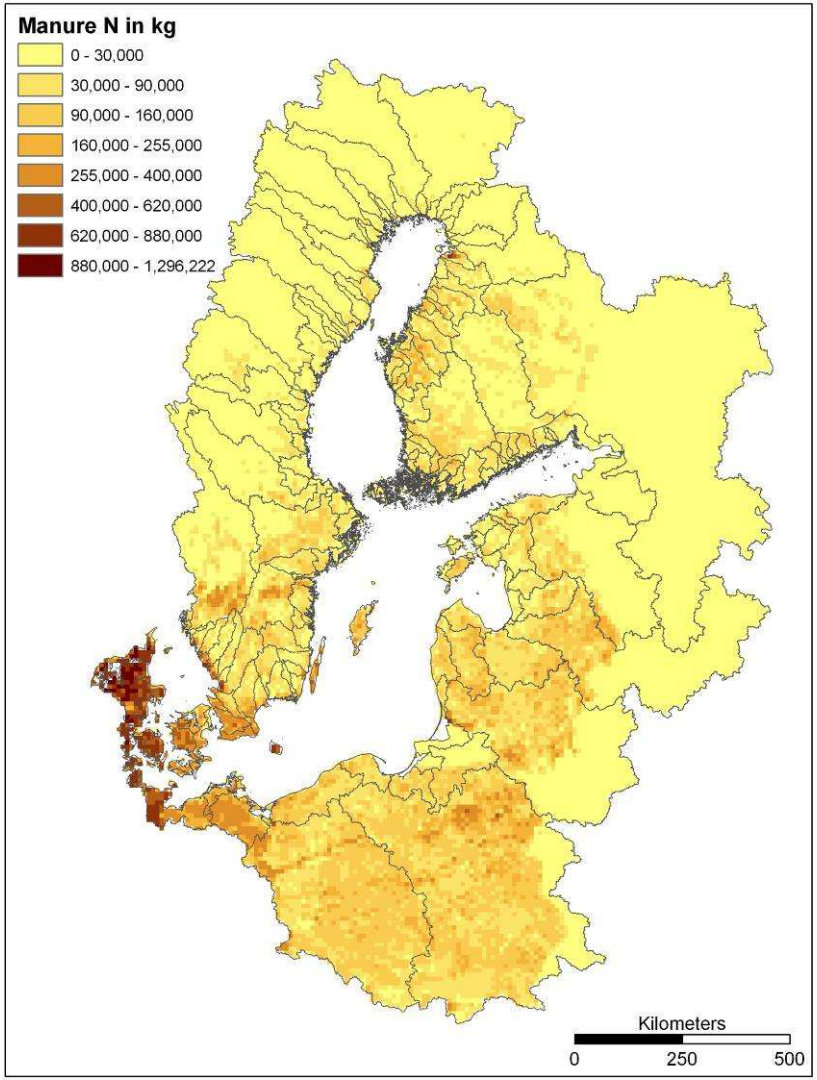

Legend
Artificial surfaces
Cultivated areas
Pastures
Permanent crops
Scrub and/or herbaceous areas
Deciduous forest
Mixed forest
Coniferous forest
Tree Cover, burnt
Bare areas
Snow and ice
Inland water
Inland wetlands
Marine waters
Marin wetland
0
150
300
600
Kilometers

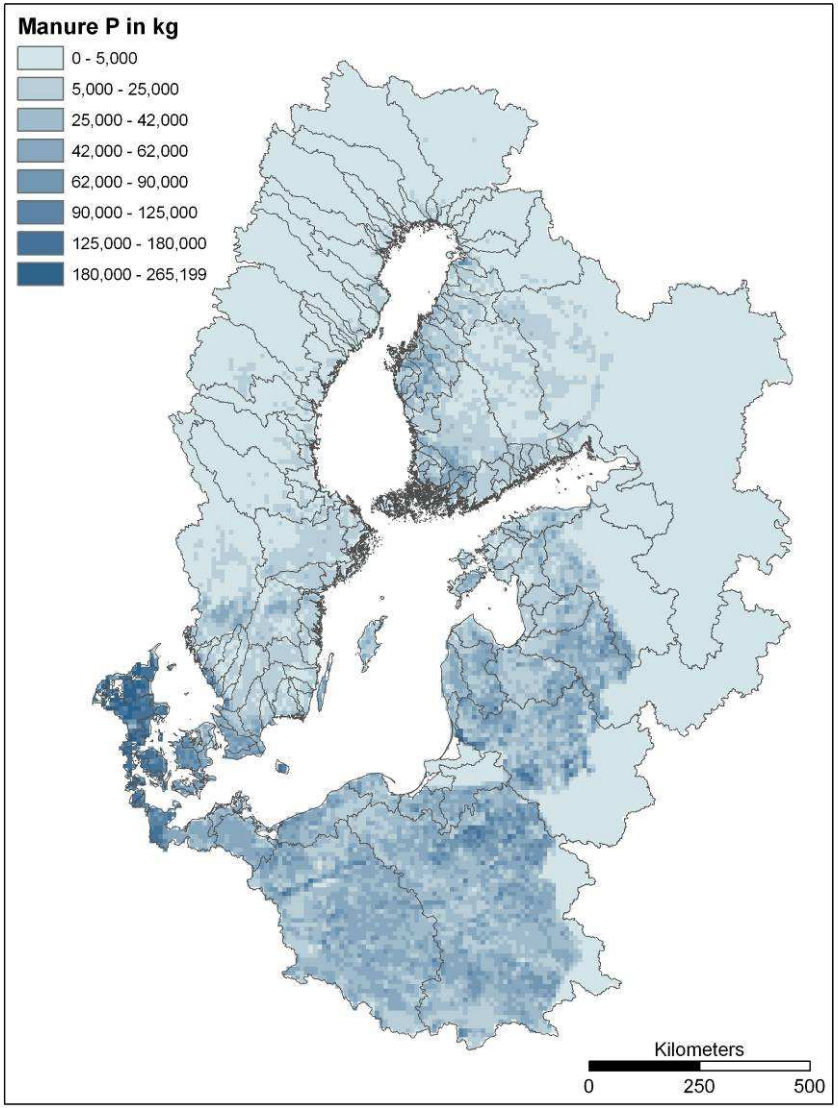

Agricultural area in ha
0 - 200
200 - 400
400 - 1,000
1,000 - 1,800
1,800 - 2,800
2,800 - 3,800
3,800 - 5,000
5,000 - 6,200
6,200 - 7,500
7,500 - 10,000
Kilometers
0
250
500


Population
0 - 500
500 - 2,000
2,000 - 10,000
10,000 - 50,000
50,000 - 100,000
100,000 - 250,000
250,000 - 450,000
450,000 - 641,971
Kilometers
0
250
500


Mineral N in kg
0 - 50,000
50,000 - 160,000
160,000 - 280,000
280,000 - 400,000
400,000 - 510,000
510,000 - 625,000
625,000 - 800,000
800,000 - 1,224,072
Kilometers
0
250
500


Mineral P in kg
0 - 5,000
5,000 - 18,000
18,000 - 35,000
35,000 - 50,000
50,000 - 70,000
70,000 - 85,000
85,000 - 105,000
105,000 - 144,388
Kilometers
0
250
500


Manure N in kg
0 - 30,000
30,000 - 90,000
90,000 - 160,000
160,000 - 255,000
255,000 - 400,000
400,000 - 620,000
620,000 - 880,000
880,000 - 1,296,222
Kilometers
0
250
500

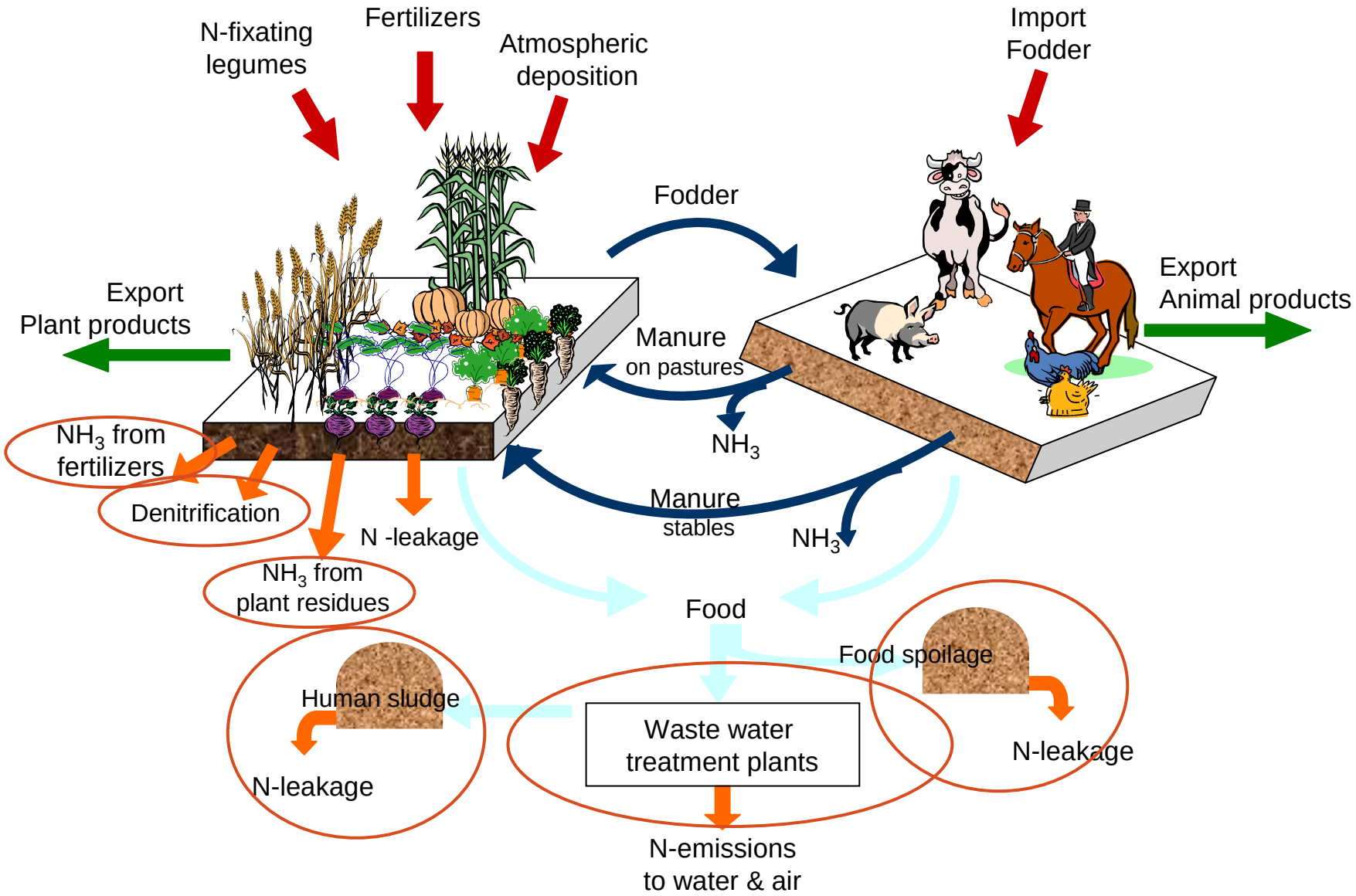

Manure P in kg
0 - 5,000
5,000 - 25,000
25,000 - 42,000
42,000 - 62,000
62,000 - 90,000
90,000 - 125,000
125,000 - 180,000
180,000 - 265,199
Kilometers
0
250
500

Watershed Nutrient Budgets as a solid base for the scientific and economic analyses

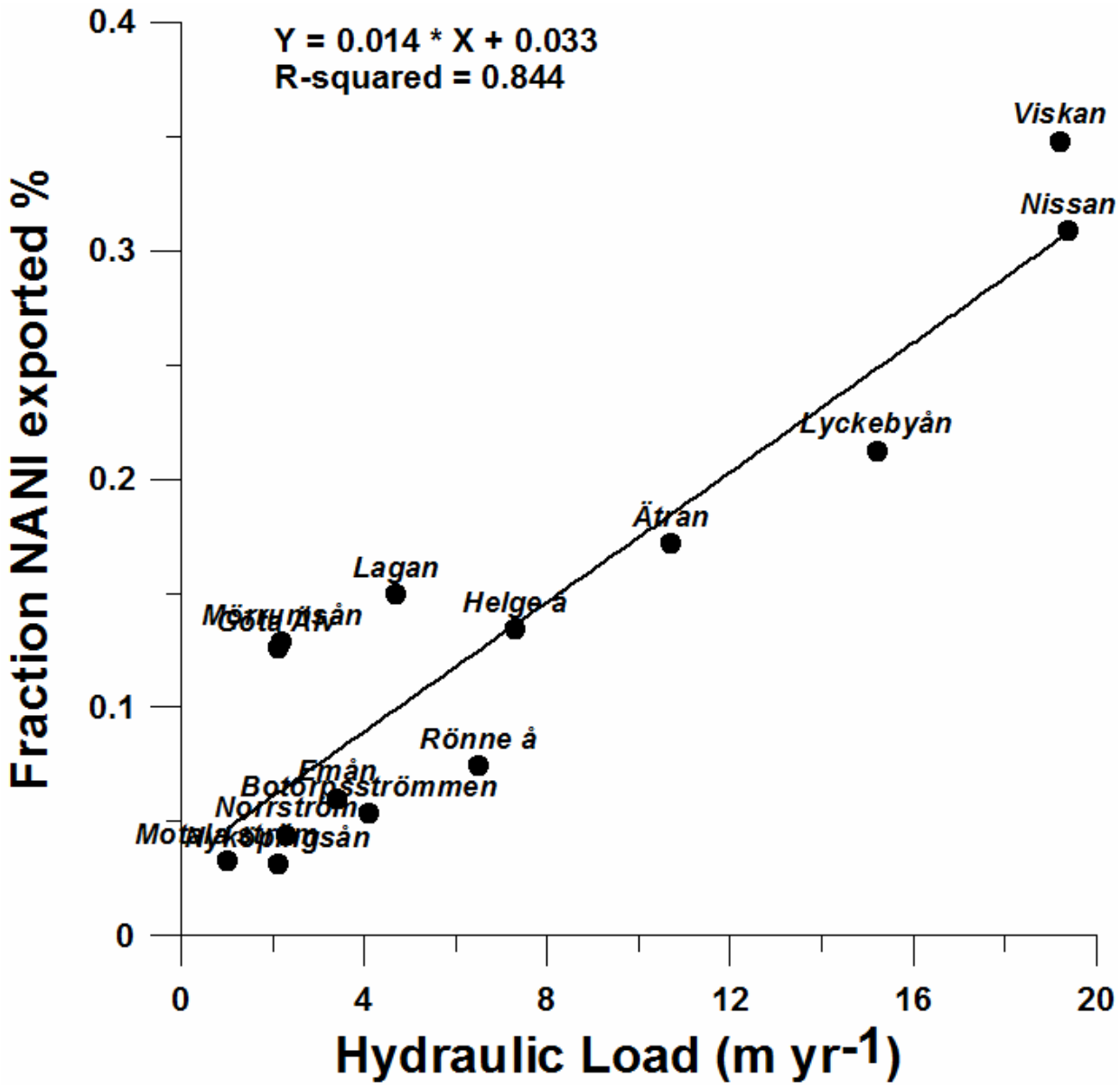
NANI=Net Anthropogenic Nutrient Input

Howarth et al. 1996; Boyer et al. 2002

NANI = Food and Feed budgets + N-fixation + Fertilizer Use+ Atmospheric Deposition



Dynamic description of retention



Modelling nutrient losses at three nested levels

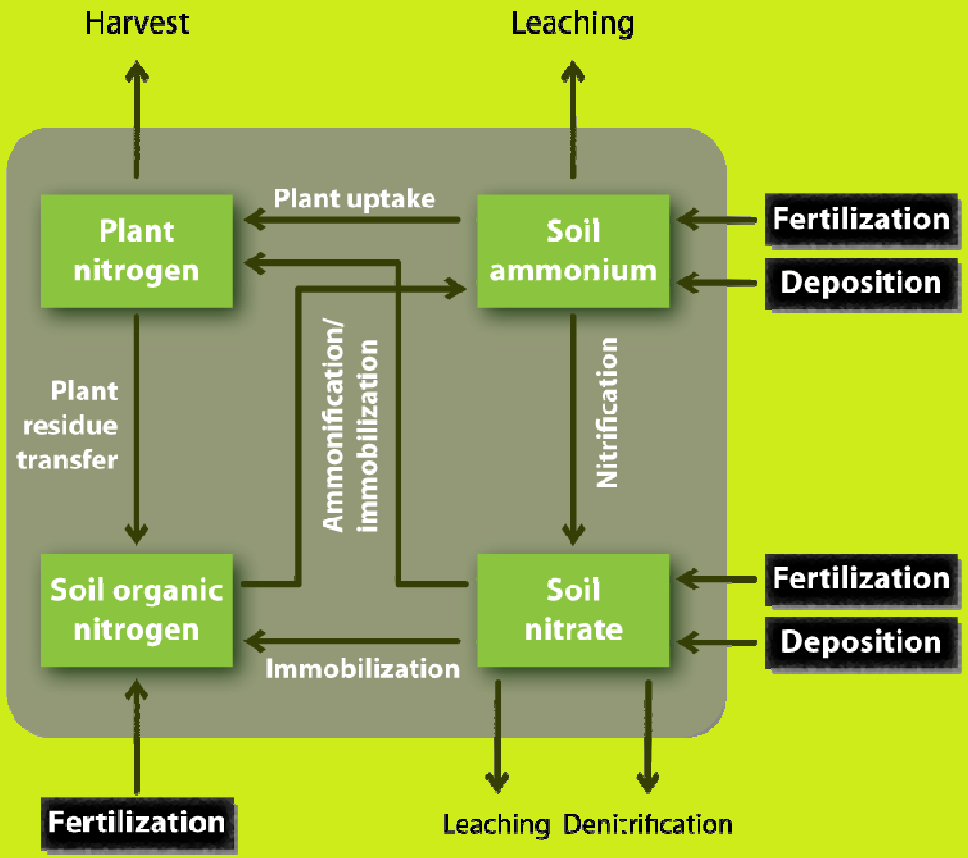
- Type farms (DAISY)
- Type river basins (SWAT)
- The entire drainage area to the Baltic Sea (CSIM)

Type farms modeled with DAISY

- Representing soils, geology, regional climate, landuse, management practices
- Provide type concentrations for SWAT, CSIM
- Calculate effects of mitigation measures, to be combined with cost estimate

The Daisy Model

- **1-dimensional dynamic model**
- **Simulation in agricultural soil of:**
  - **1. Crop production**
  - **2. Development in soil organic matter**
  - **3. Water and nitrogen dynamics**
- **Well tested/documented and an open software system**



http://code.google.com/p/daisy-model/

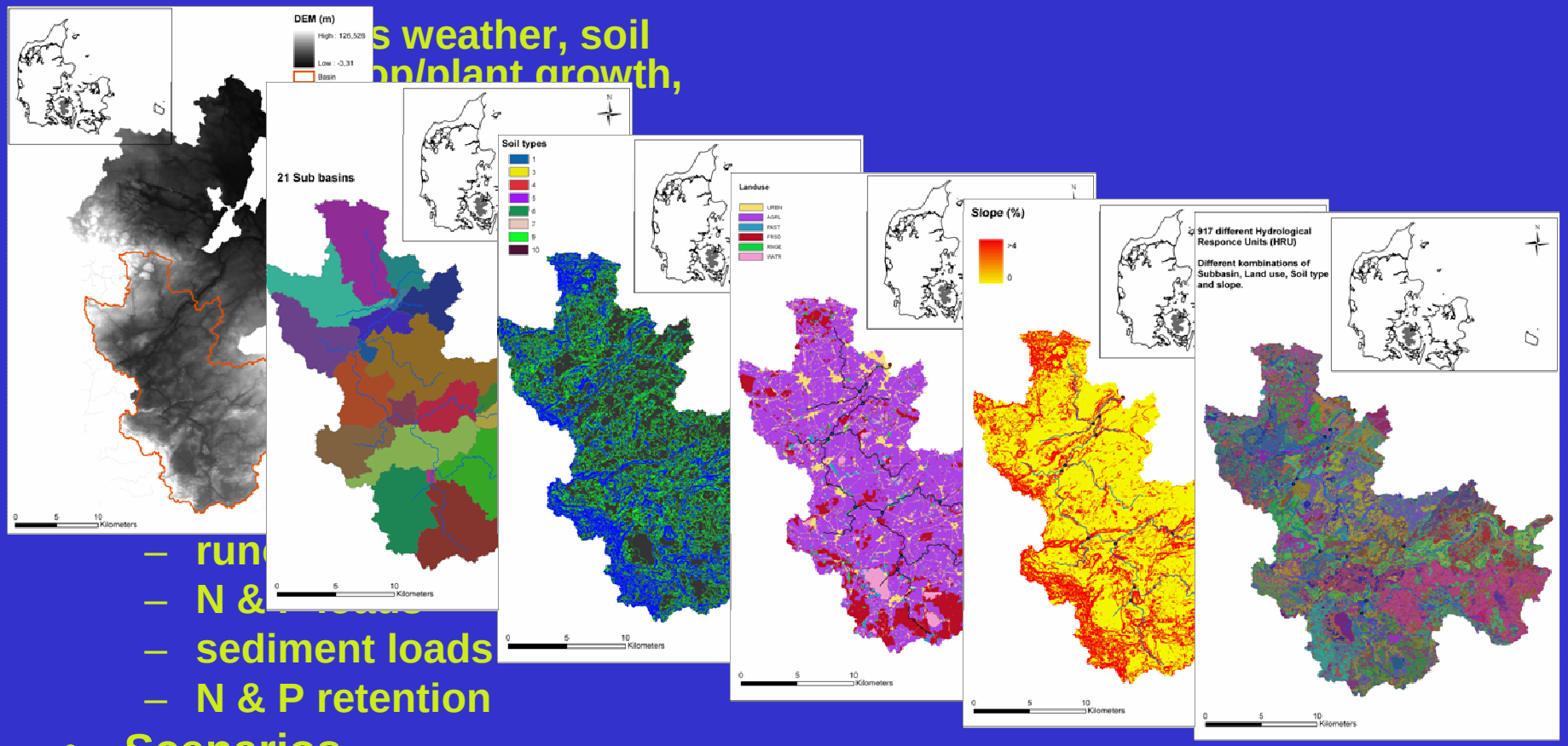
Calibration/validation

The model can be calibrated/validated on:

1. Soil water nitrogen concentrations e.g. from suction cups
2. Nitrogen concentration and water discharge in tile drains
3. Harvest yields
4. Groundwater level

SWAT model

- **Soil Water Assesment Tool**
  - **s weather, soil**
  - **op/plant growth,**
  - **run**
  - **N &**
  - **sediment loads**
  - **N & P retention**
- **Scenarios**
  - **land use changes**
  - **management changes**
  - **climate change**



SWAT modeļa shēma

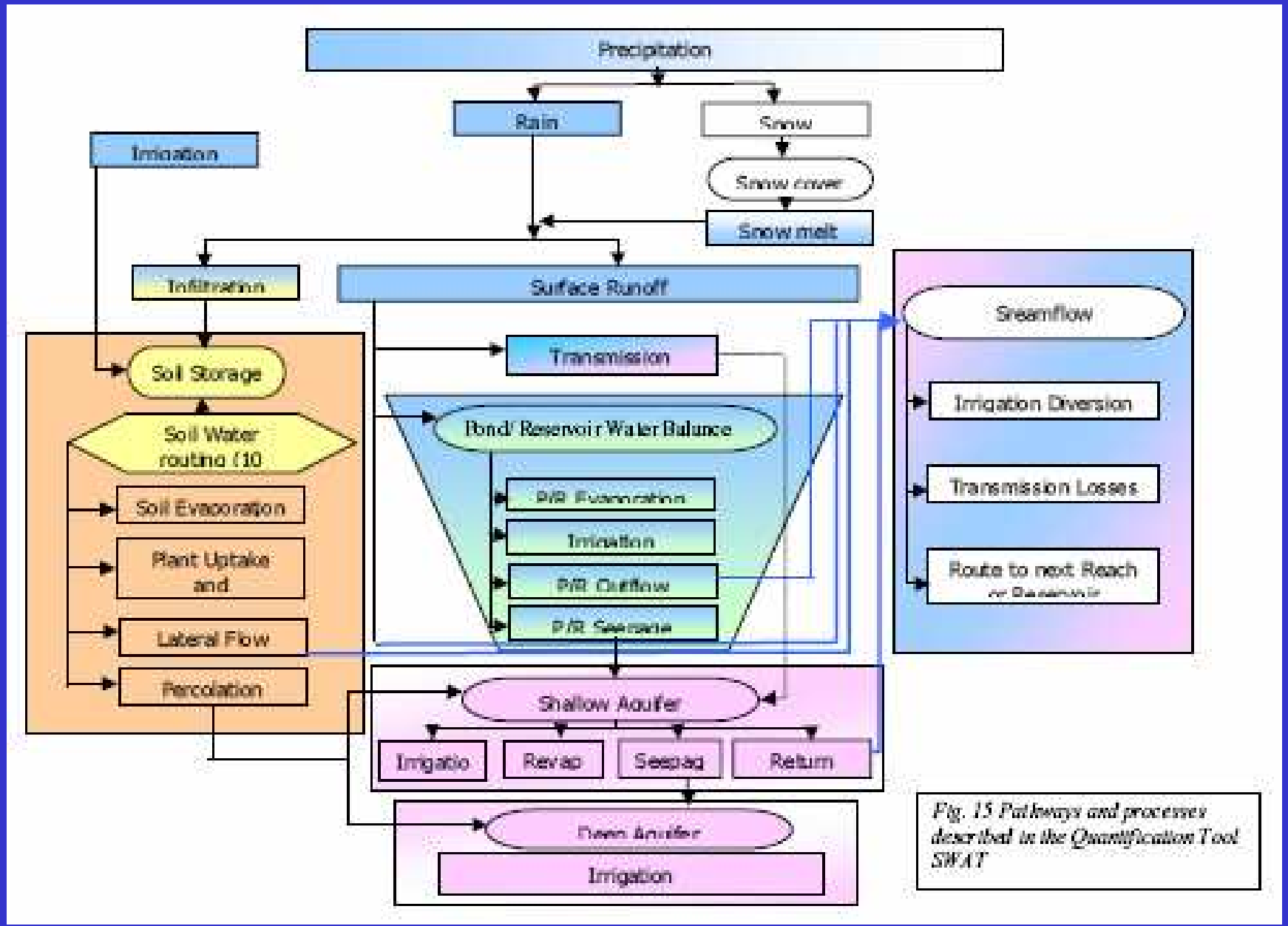
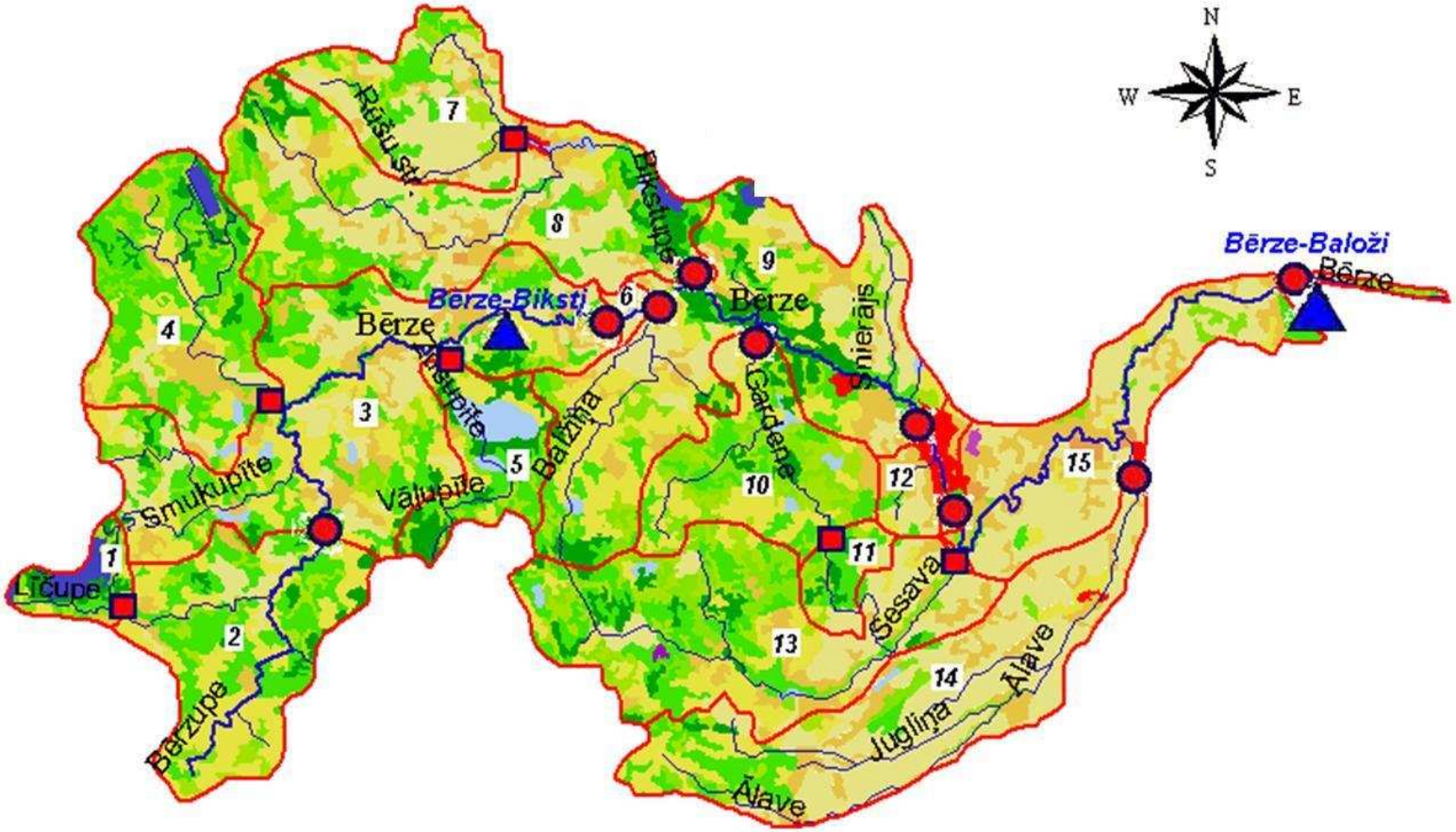


Fig. 15 Pathways and processes described in the Quantification Tool SWAT

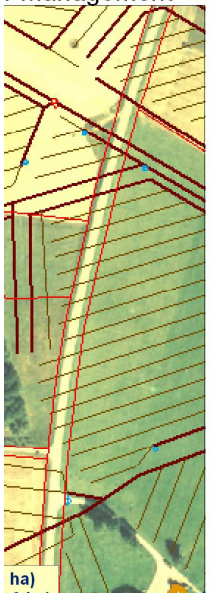
Type river catchments (type farms / fields)

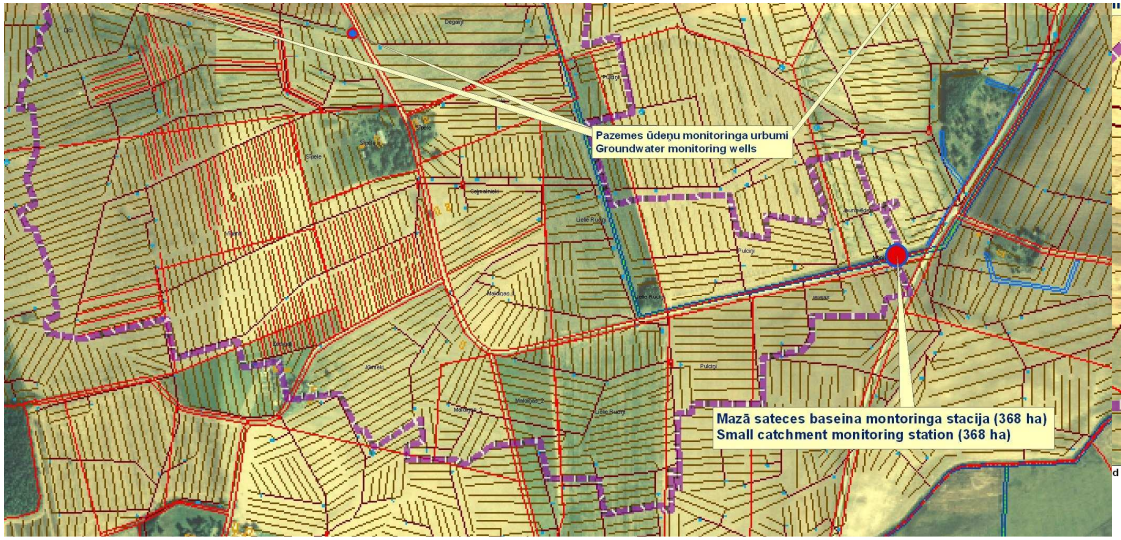
- Berze Latvia – cultivated, transitional
- Pärnu Estonia - cultivated, transitional
- Nevezis Lithuania - cultivated, transitional
- Plonia Poland - cultivated, transitional
- Odense Denmark – heavily cultivated, old EU-member type
- Norrström Sweden – mixed boreal cultivated, old EU-member type
- Kalix Sweden – relatively unperturbed, boreal
- Kokenmäenjoki Finland – mixed boreal cultivated, old EU-member type

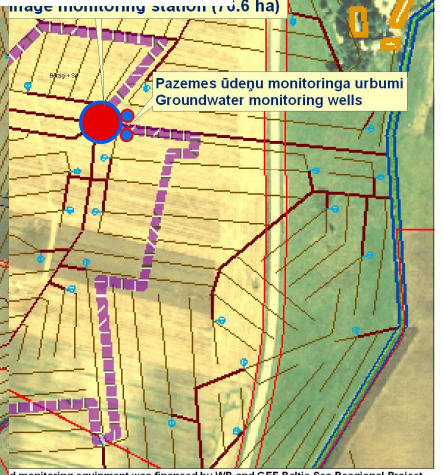
Catchments represents landscape types, regional climates, agricultural practices and degree of urbanisation in the Baltic Sea drainage area



r Management







d monitoring equipment was financed by WB and GEF Baltic Sea Reagional Project.

The economic part of RECOCA

- The model development will build on former cost-minimisation models built in MARE/BNI – the COST-model in the NEST model system
- The new model will be more disaggregated, and new types of scenarios adressed, including uncertainty and importance of riverine loads on cost-functions
- Regional costs- allocations and implications of international targets will be explored

Road Map

- Kick-off 2-3 February
- Common data base (month 12) and NANI budgets (month 20)
- Type river basins modelled by SWAT and DAISY (first runs month 18)
- Type river basins economical analyses (month 18)
- New generation of COST and CSIM models in NEST month 34
- Scenario analyses and country allocation schemes (month 36)

Paldies par uzmanību