

SUFFICIENT AND RELIABLE NUTRINET LOADING DATA

– the River Daugava catchment area

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Background of project proposal:

- Incomplete and uncertain data on the nutrient inputs complicate the setting of Country Allocated Reduction Targets (CART) defined in HELCOM Baltic Sea Action Plan (BSAP)
- Missing and uncertain input data may result in reduction targets that do not reflect the real nutrient loads:  As a consequence some countries may have to reduce more and others respectively less than they should according to allocation principle
- Uncertainties in input data impede the evaluation of progress in fulfilling the reduction targets, and may lead to inappropriate and costly measures, which necessarily do not result in targeted environmental objectives in the Baltic Sea

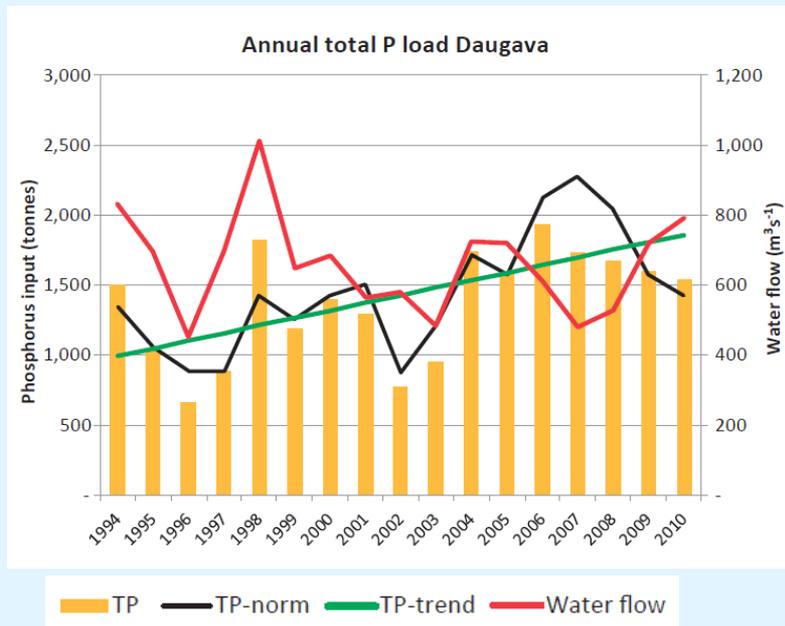
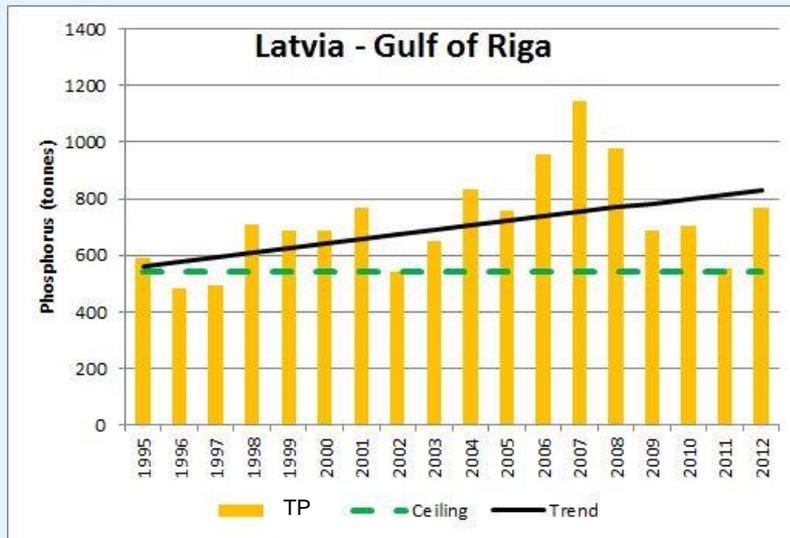
Evaluation of fulfillment of CART (Country Allocated Reduction Targets) for phosphorus

Phosphorus load to GUR increasing

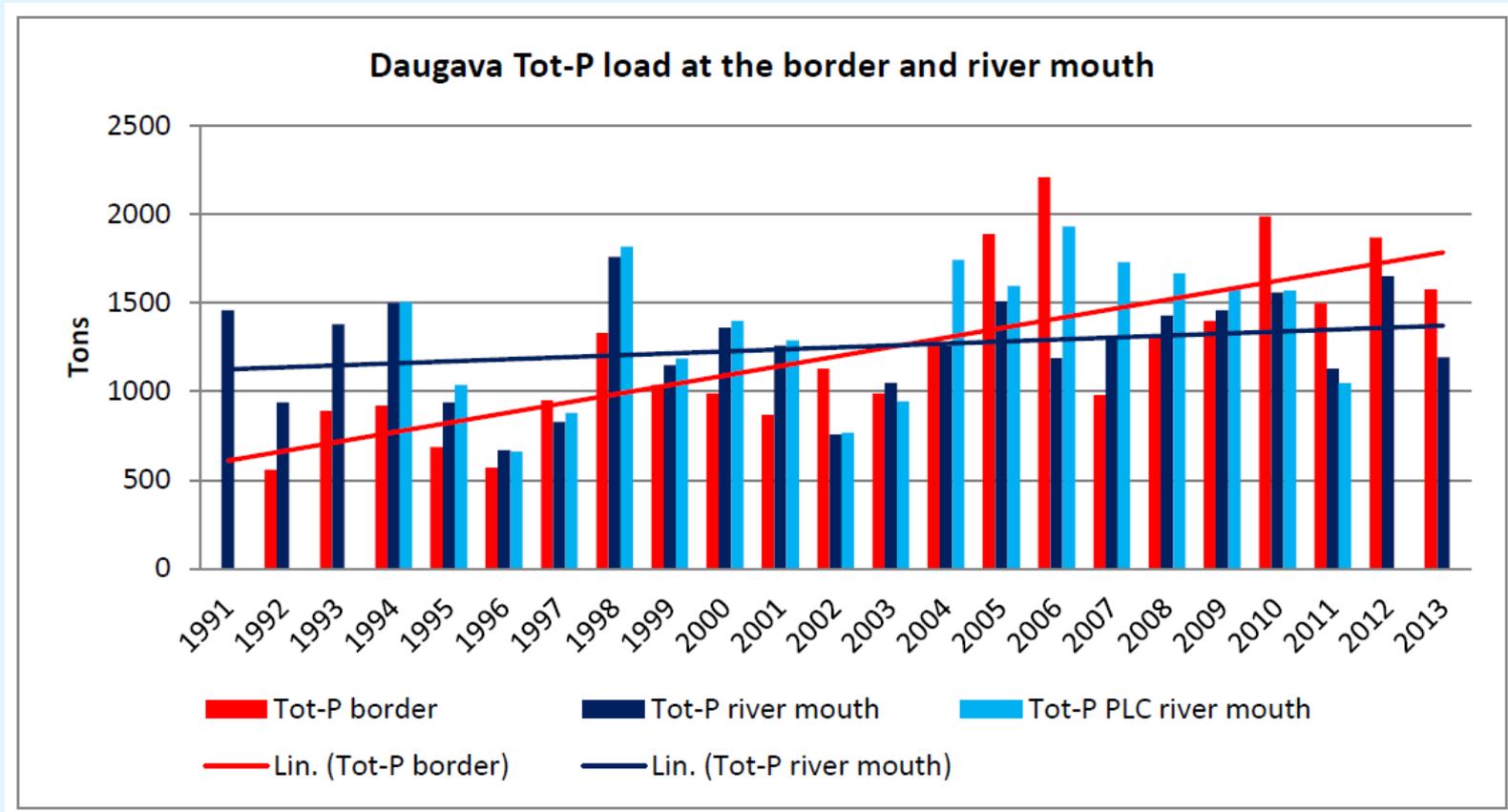
Country/basin	Bothnian Bay	Bothnian Sea	Baltic Proper	Gulf of Finland	Gulf of Riga	Danish Straits	Kattegat
Denmark			↓		↓	↓	↓
Estonia					↓		
Finland		↓					
Germany						↓	
Latvia			↑		↑		
Lithuania			↓		↑		
Poland			↓				
Russia					↑		
Sweden		↓	↓			↓	
Belarus			↓		↑		
Czech Republic			↓				
Ukraine			↓				
Baltic Sea shipping							
Other countries							
MAI		↓	↓			↓	↓

Based on statistically estimated 2012 inputs

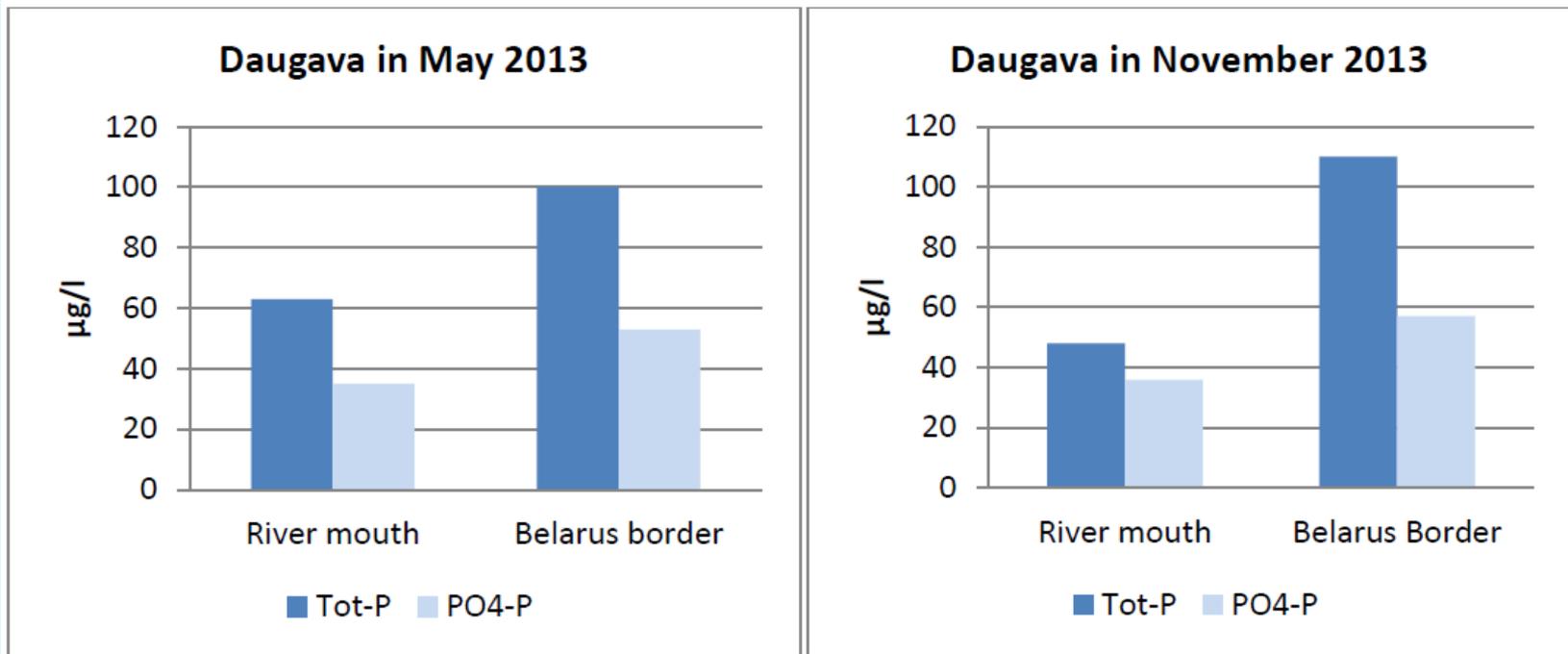
Normalized annual net inputs of phosphorus (TP) from Latvia to the Gulf of Riga in 1995-2012, and annual phosphorus load of the Daugava in 1994-2010



Total phosphorus load of the Daugava in 1991-2013 measured at the river mouth and at the Belarussian border



Total (Tot-P) and dissolved (PO₄-P) phosphorus concentrations measured in the Daugava during pilot samplings in 2013



Plan for implementation (preliminary work packages) of the project:

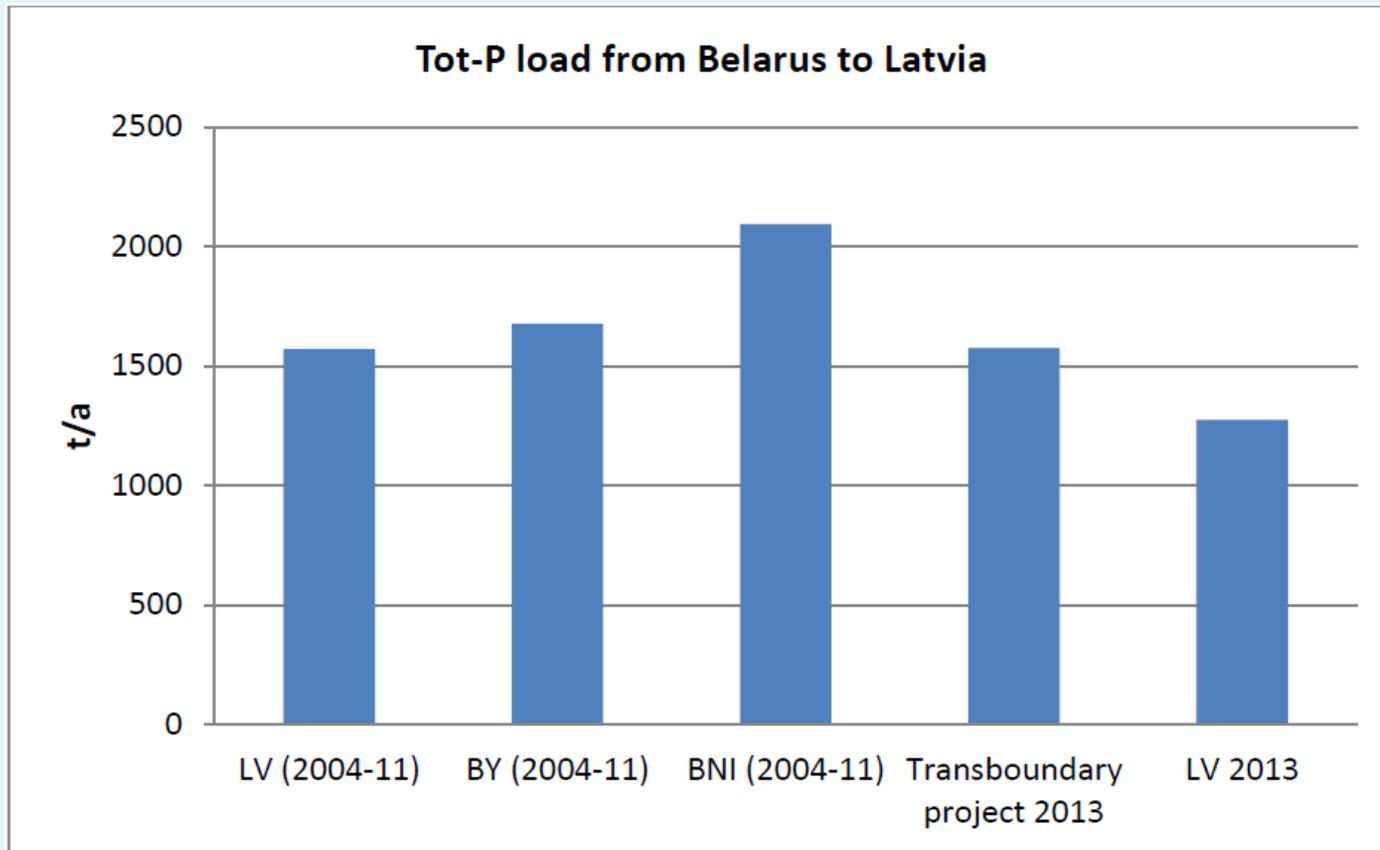
- Collection, description and analysis of existing monitoring data and all other data needed for load calculations and modelling
- Carrying out necessary additional monitoring needed for modelling, calculation of riverine loads and source-apportionment
- Introduction of SYKE's VEMALA model for estimating nutrient transport and retention in the Daugava catchment area
- Source apportionment of the nutrient loads entering the Gulf of Riga according to the primary nutrient sources in the catchment area

The main observation points in terms of nutrient transport and retention calculation

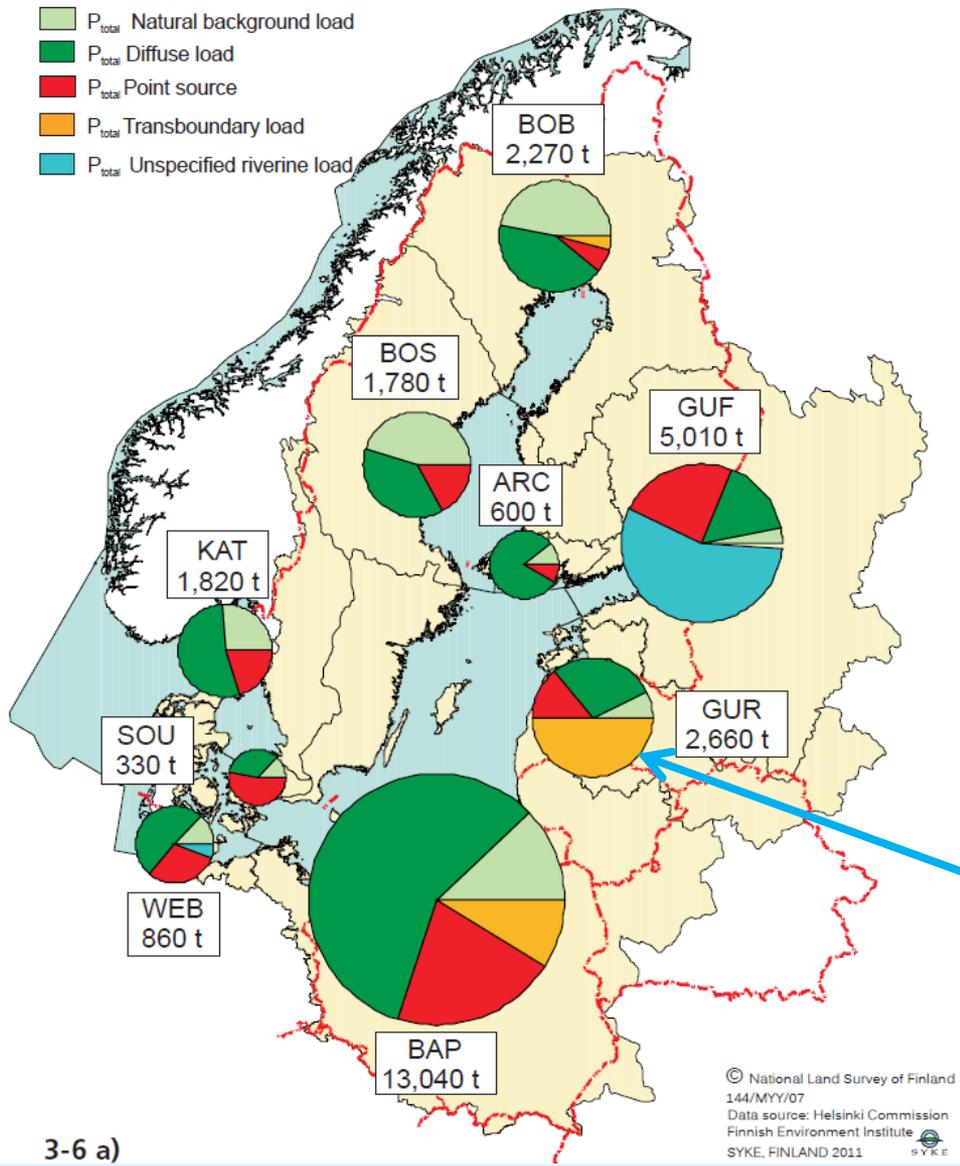


Source: <https://commons.wikimedia.org/w/index.php?curid=16175929>

Phosphorus load measured at the border between Latvia and Belarus



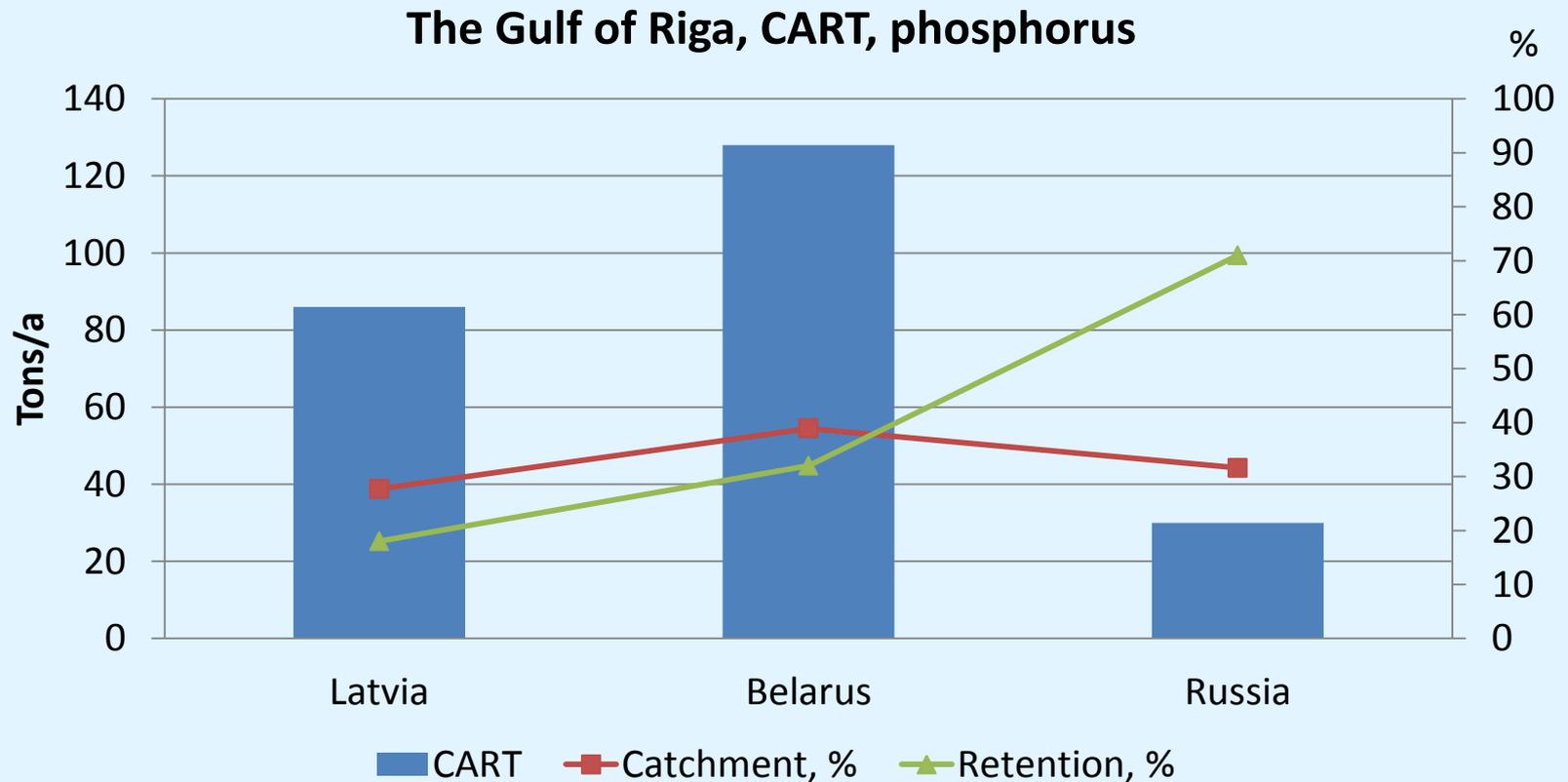
Source apportionment of total waterborne phosphorus load (in tonnes) into the Baltic Sea by country in 2006



Gulf of Riga

3-6 a)

Country Allocated Reduction Targets (CART) for phosphorus load into the Gulf of Riga vs. share of the catchment area



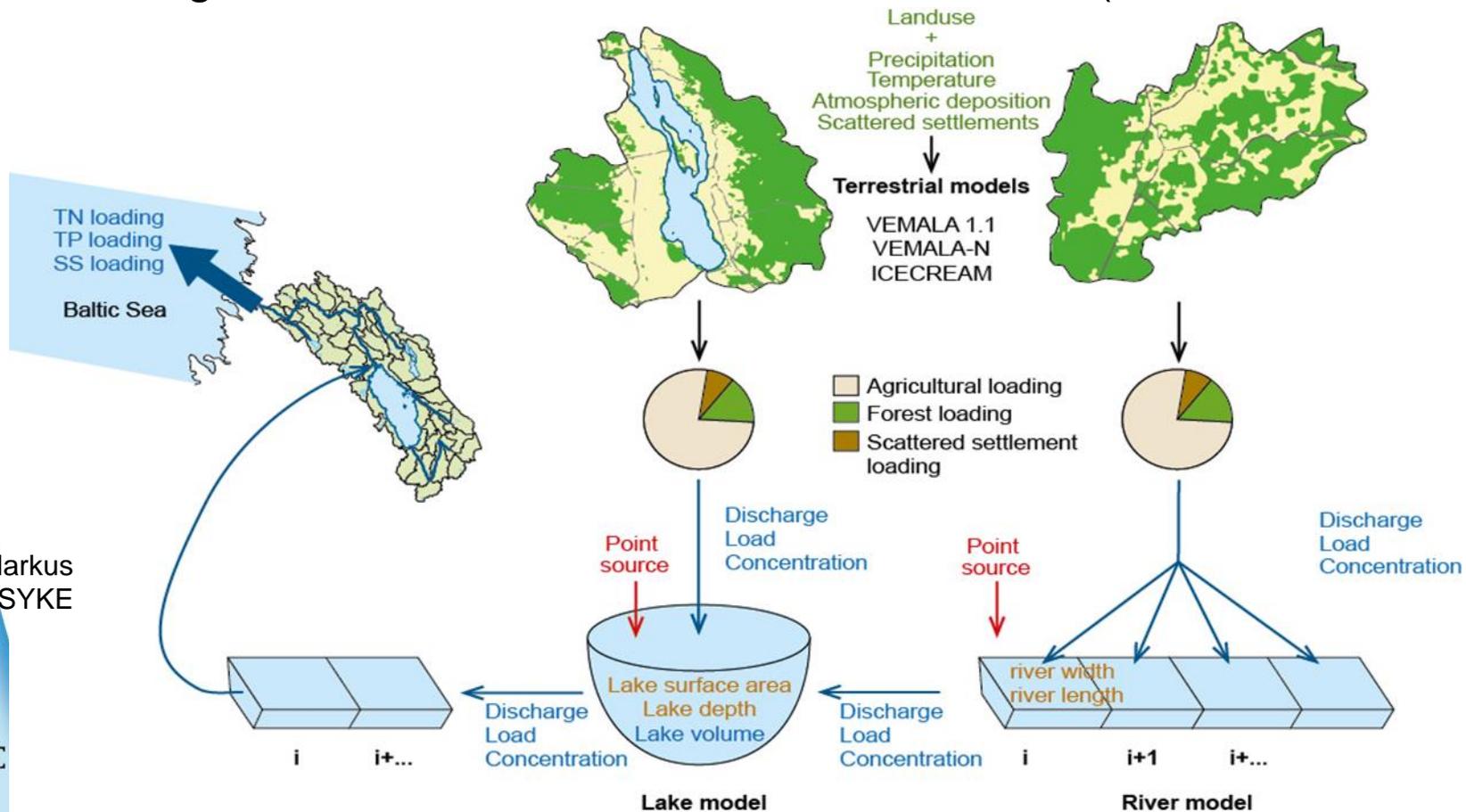
Dynamical nutrient load modelling of Daugava

- Modelling provides:
 - Coherent catchment wide description of nutrient processes
 - Online estimate of the loading to the Sea
 - Support for deciding timing and frequency of sampling
- Modelling is based on:
 - Characteristics of the basin, dimensions of river channels
 - Approximately known limits for process rates (sedimentation etc)
 - Calibration to observations
- Model explains for nutrients and suspended solids:
 - Loading into river-lake network
 - Transport and retention in river-lake network
 - In 1 day or even in 1 hour time step
 - Effect of hourly regulation on sedimentation in reservoirs
 - Earlier modelling in 1 month time step (Andrea Wallin)

Source: Markus Huttunen/SYKE

Our modelling approach: WSFS-VEMALA

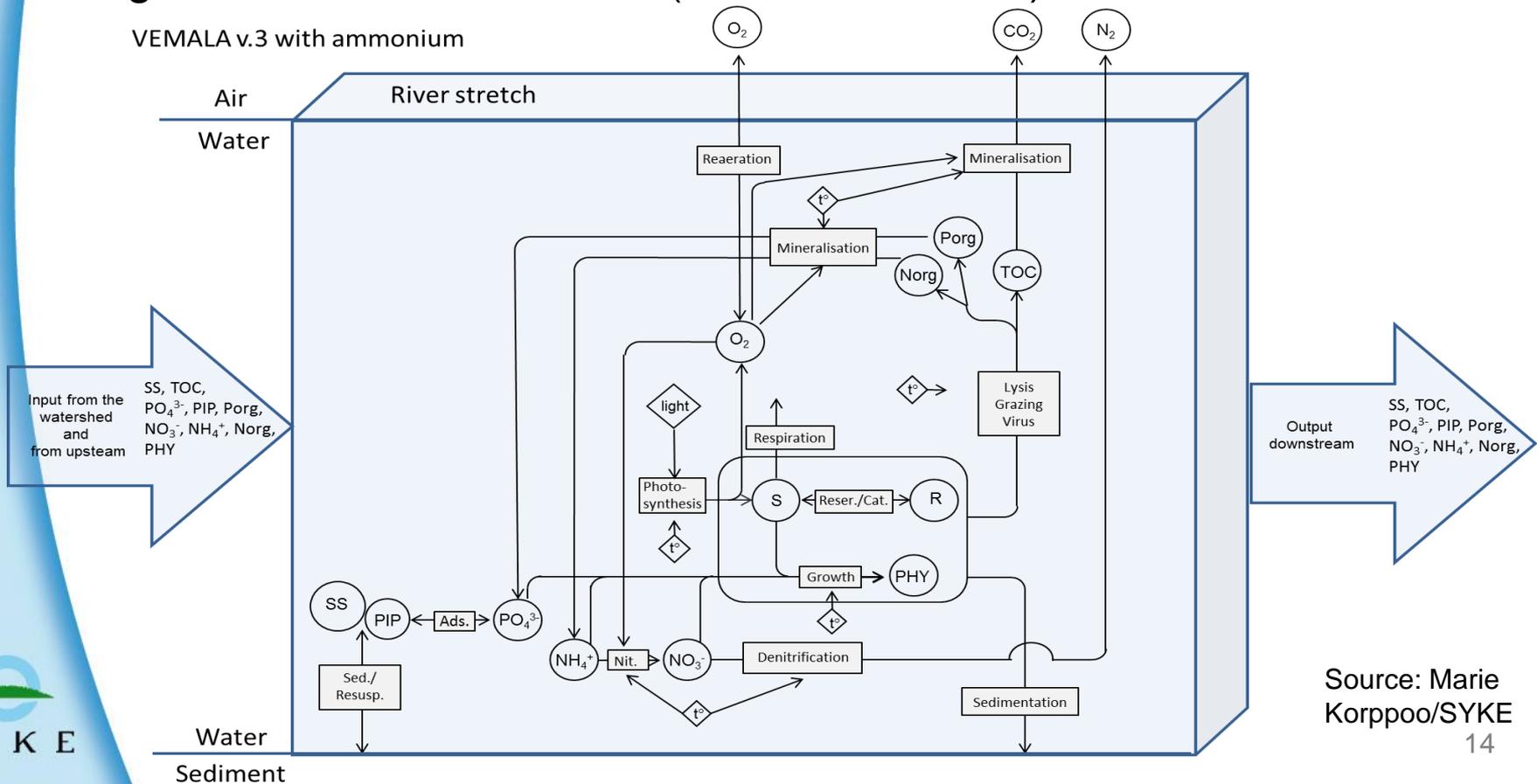
- Applied for whole Finland, provides online estimate of the loading to the Baltic Sea from Finland
- Submodels by land use and river-lake network description
- Simulates also transport of accidental leaks
- Existing sub-models of the basin can be included (field, forest, river,...)



Source: Markus Huttunen/SYKE

VEMALA v.3

The river and lake sub-model in VEMALA v.3 is a deterministic biogeochemical model using enzyme-catalysed reactions to simulate the interactions between nutrients and the algal biomass. It is based on the phytoplankton sub-model AQUAPHY (Lancelot et al., 1991), and the biogeochemical model RIVE (Billen et al., 1994).



Source: Marie Korppoo/SYKE

Expected results of the project:

- Sophisticated methods to produce reliable/more accurate input data for purposes of HELCOM PLCs (Pollution Load Compilations) and follow-up the implementation of WFD River Basin Management Plans and MSFD Programme of Measures
- Solutions to bottlenecks in monitoring and modeling; promotion of coherent catchment wide assessments of nutrient inputs and retention, including transboundary sources
- Fair, scientifically sound and high quality Country Allocated Reduction Targets (CART) in shared catchments, supporting the implementation of the HELCOM BSAP

The Daugava in Krāslava, near to the border between Latvia and Belarus

Thank you!

Photo: Seppo Knuuttila