River Basin Management (RBM) in North Savo - issues related to nutrient loading

Waterpro final seminar 22.5.2019

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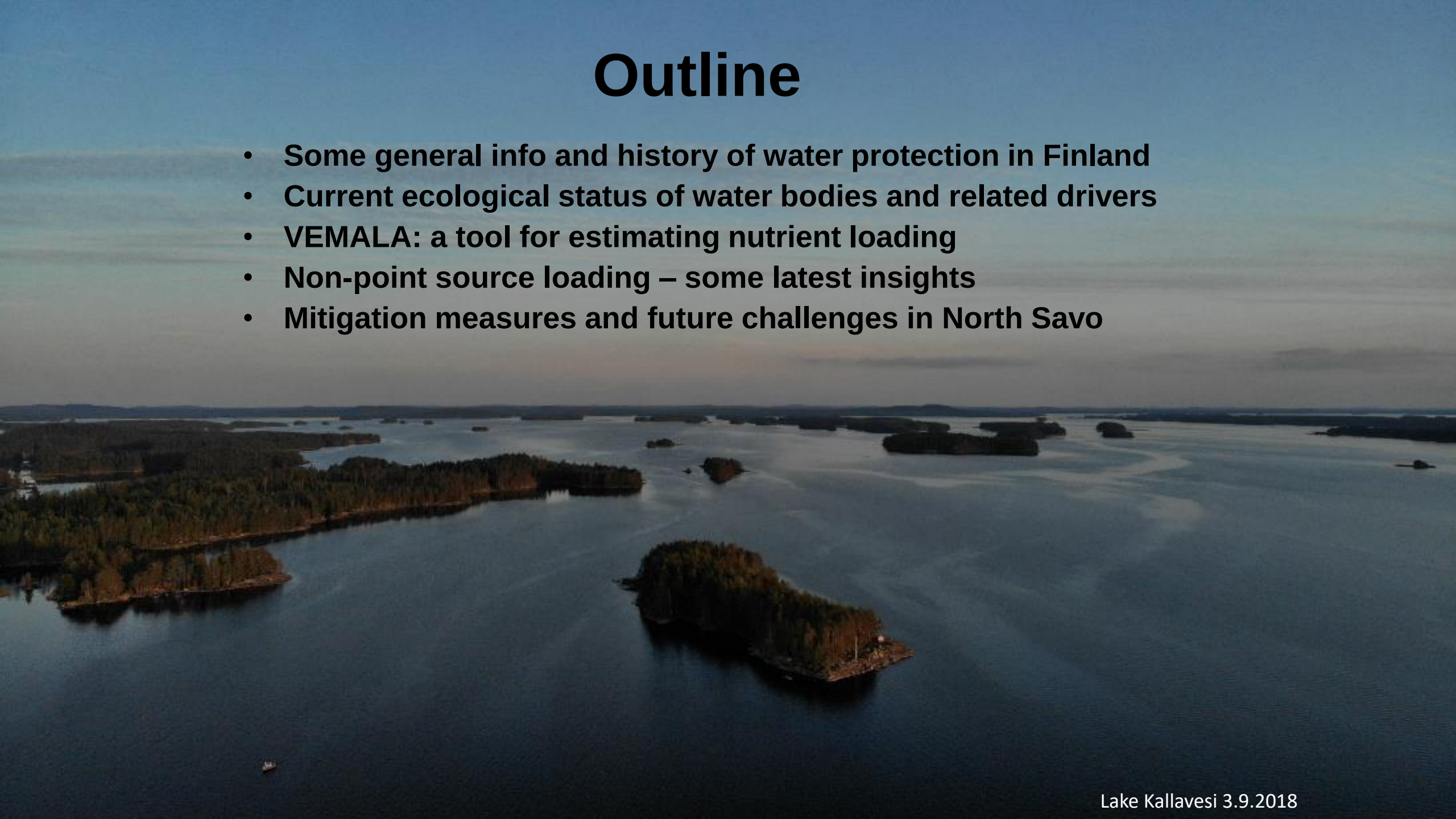
Antti Kanninen, hydrobiologist, PhD

North Savo Center for Economic Development, Transport and the Environment

Outline

- Some general info and history of water protection in Finland
- Current ecological status of water bodies and related drivers
- VEMALA: a tool for estimating nutrient loading
- Non-point source loading – some latest insights
- Mitigation measures and future challenges in North Savo



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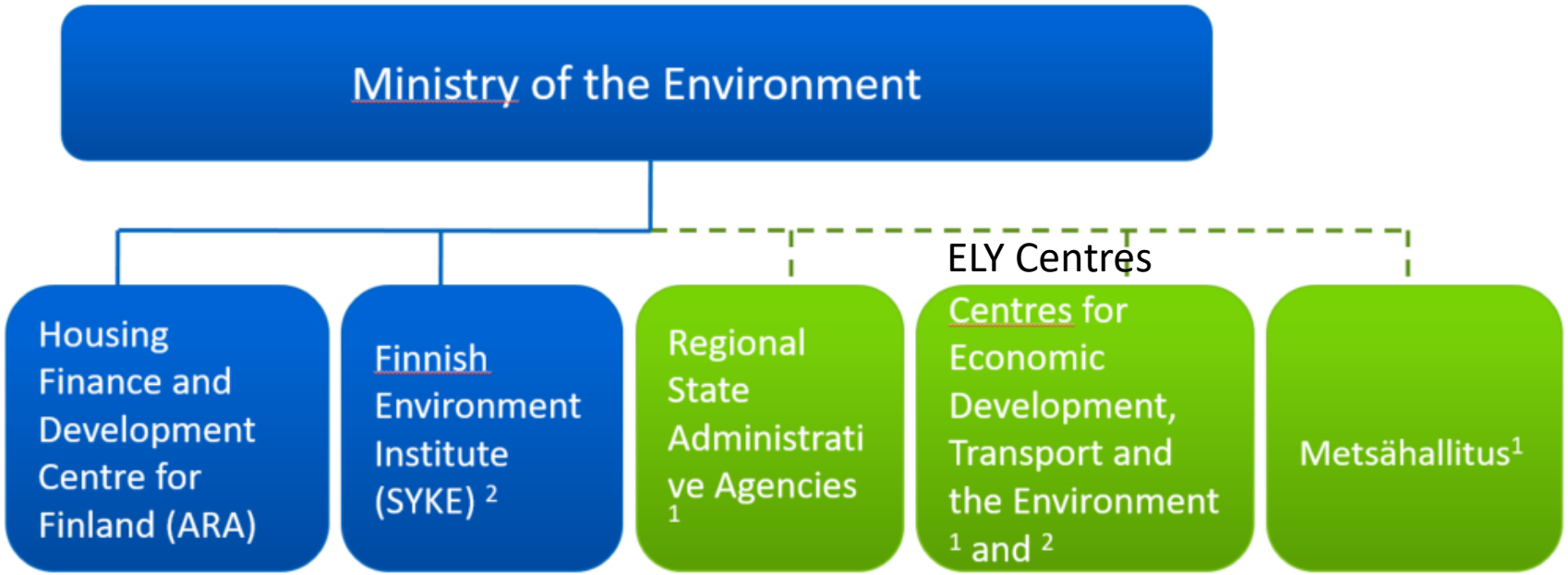
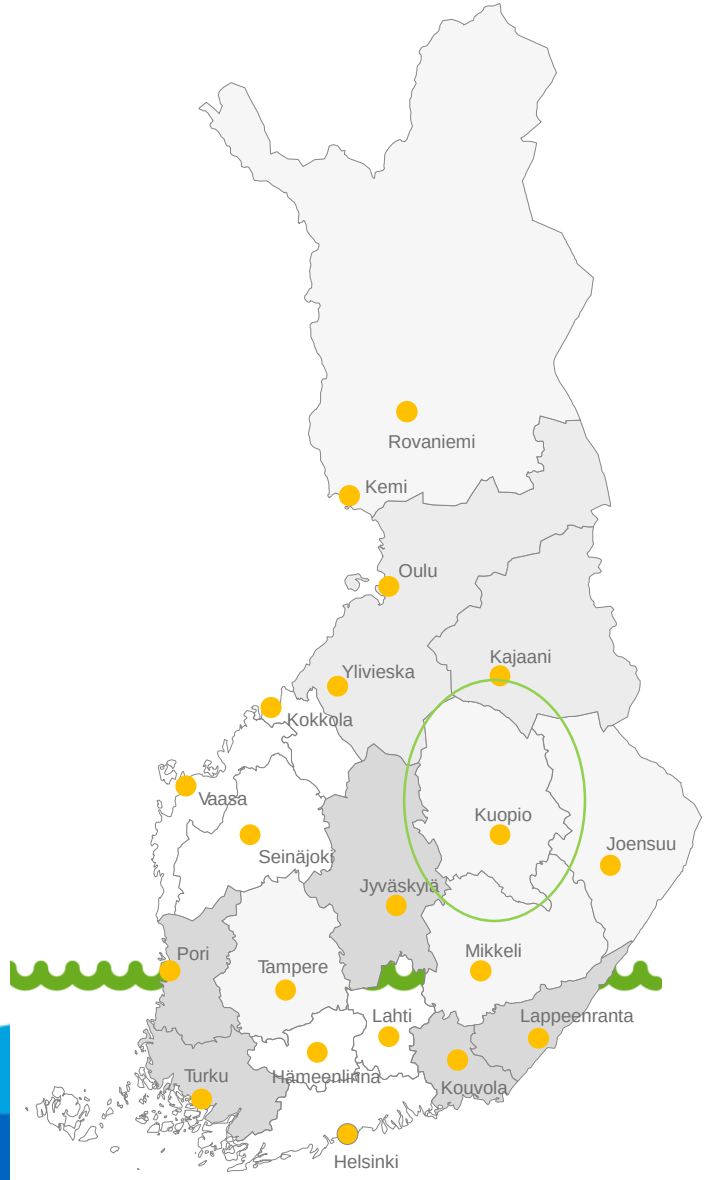
Finland's environmental administration



1) The Ministry of the Environment guides the work related to environmental issues of the Regional State Administrative Agencies and the Centres for Economic Development, Transport and the Environment. Additionally, the Ministry guides the nature conservation work of the Natural Heritage Services Unit for Metsähallitus.

2) The Ministry of Agriculture and Forestry is responsible for the work related to water resource management of the Finnish Environment Institute and the Centres for Economic Development Transport and the Environment.

ELY Centres and offices



Finnish legislation on prevention and control of water pollution

Environmental Protection Act

Water pollution

- UWWT
- Industry
- Peat production
- Agriculture etc.

Specific Acts or degrees on

- River basin management plans
- Marine protection
- Flood risk management plans
- Water services
- Discharge of nitrates
- Waste water in rural areas

Water Act

Use of water resources

- Water abstraction
- Water regulation
- Hydropower
- Water related construction etc.

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EU Water Framework Directive

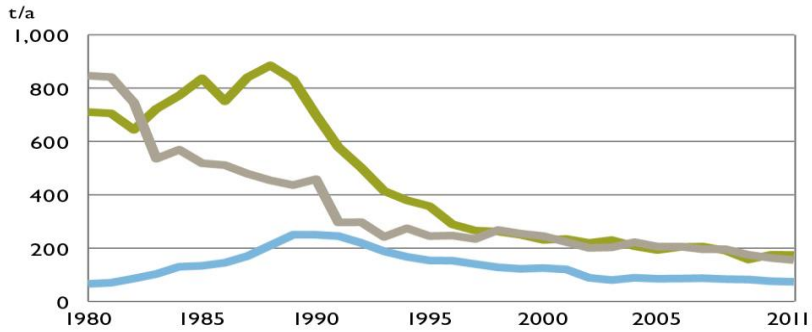
- Adopted 2000
- Goal: **Good ecological status across the EU**
- Has created positive momentum for freshwater status across EU
- The WFD is a framework and approach on **ecosystem health**
  - ambitious and ground-breaking
  - fits closely to global biodiversity and sustainable development goals (e.g. UN)
- WFD is an integrated monitoring, management and policy framework that **operates at a landscape scale** – River Basin Management (RBM)

Additional policy instruments

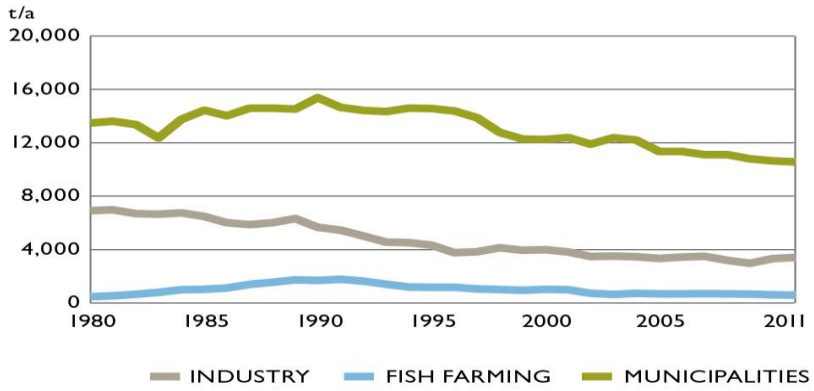
- **Long term target setting**
  - Integrated water resources management plans in the 1970`s and 1980`s
  - Four national Water Protection Programmes since 1974, the latest adopted in 2006
  - River Basin Management Plans covering all surface and groundwater areas
- **Economic Instruments and Financing**
  - Agri-environment subsidy in Rural Development Programme
  - Water and waste water charges
  - Rehabilitation of water bodies
  - Construction of connecting wastewater and water supply networks
- **Information, education and research**
- **International co-operation and agreements**
  - HELCOM - governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area" or “Helsinki Convention”
  - Transboundary co-operation (EU, ECE)
    - Bilateral agreements with Sweden, Norway and Russia

Legislation + policy = many success stories

Phosphorus discharges into surface waters from point sources 1980–2011



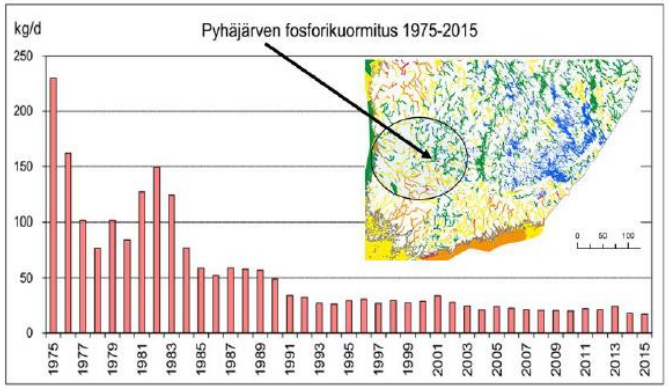
Nitrogen discharges into surface waters from point sources 1980–2011



Source: The Compliance Monitoring Data system, VAHTI. 2013.

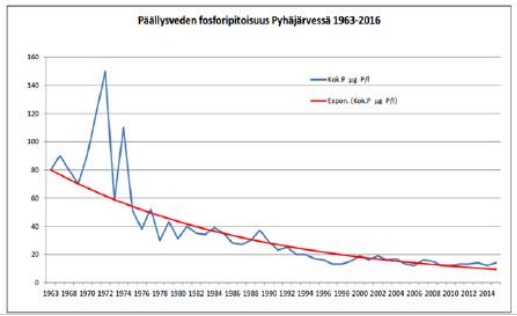
Investments for wastewater purification has resulted improved water quality

P loading has decreased by 90%



P is a <u>key nutrient causing eutrophication!</u>

P conc has decreased > 80%



Oravainen 2017

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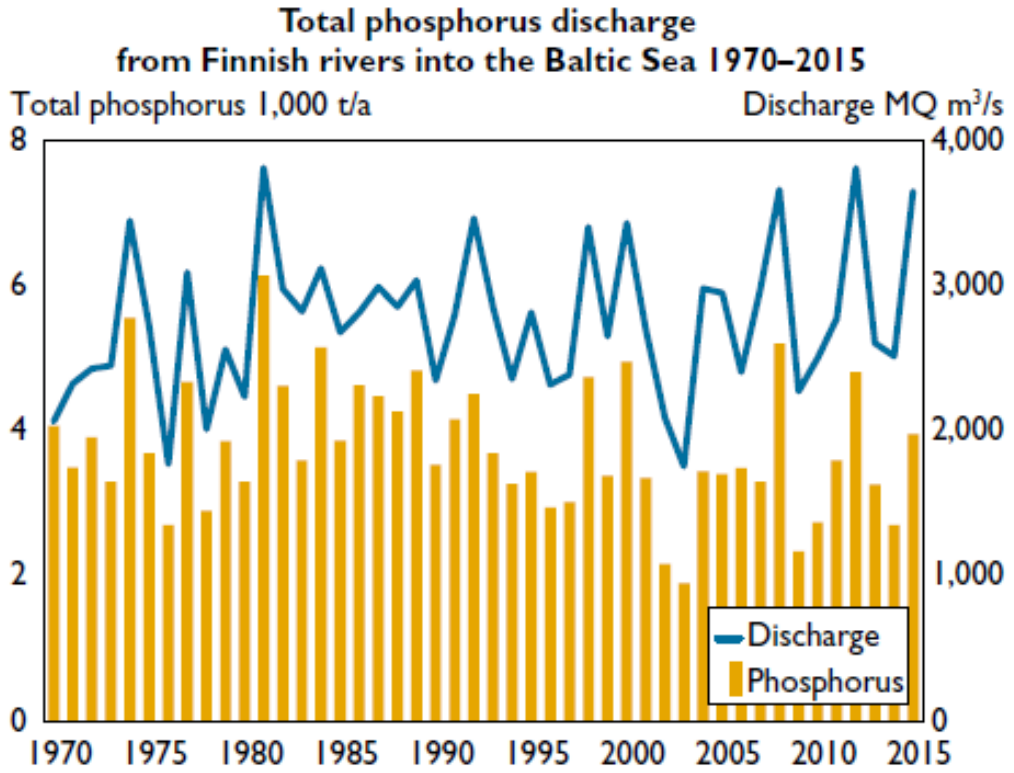
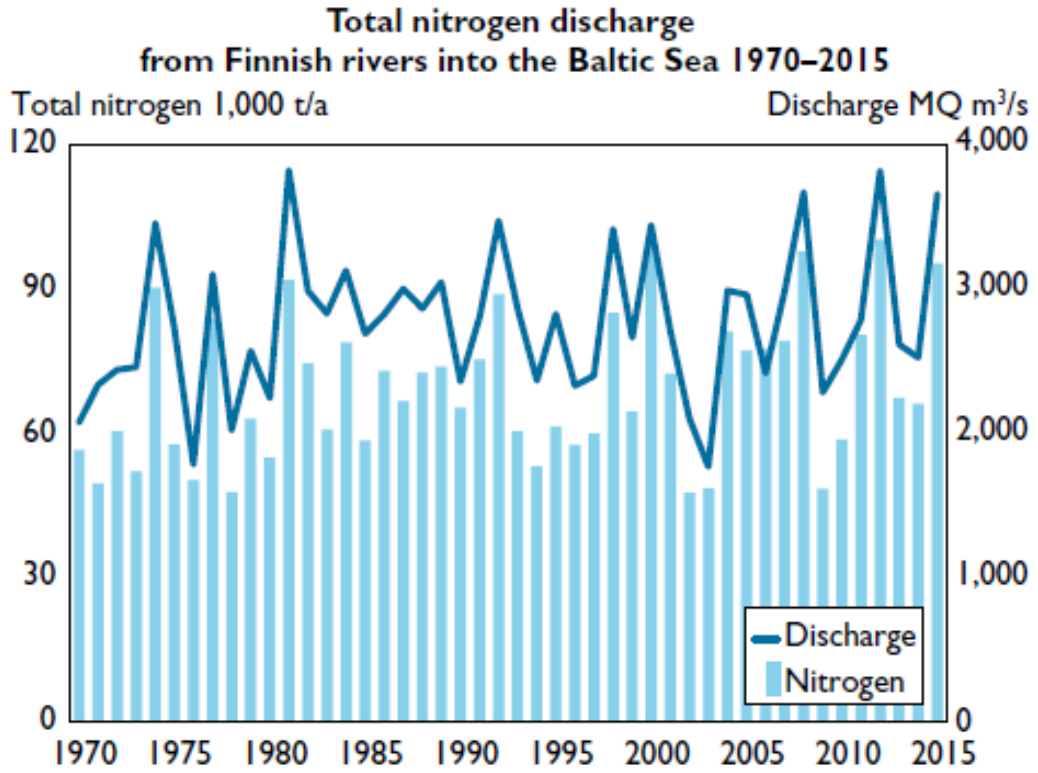
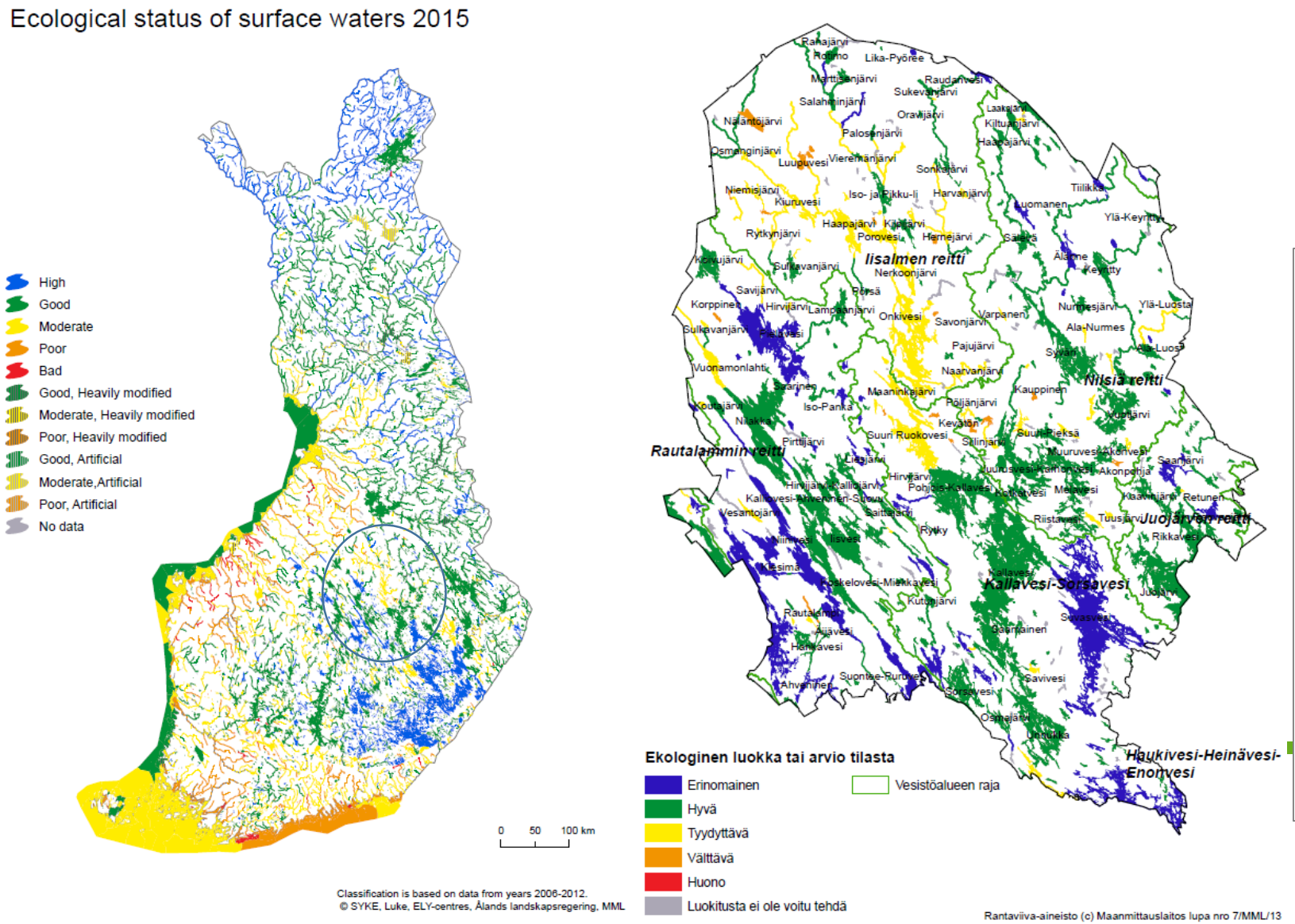
Total nutrient loading has not changed significantly

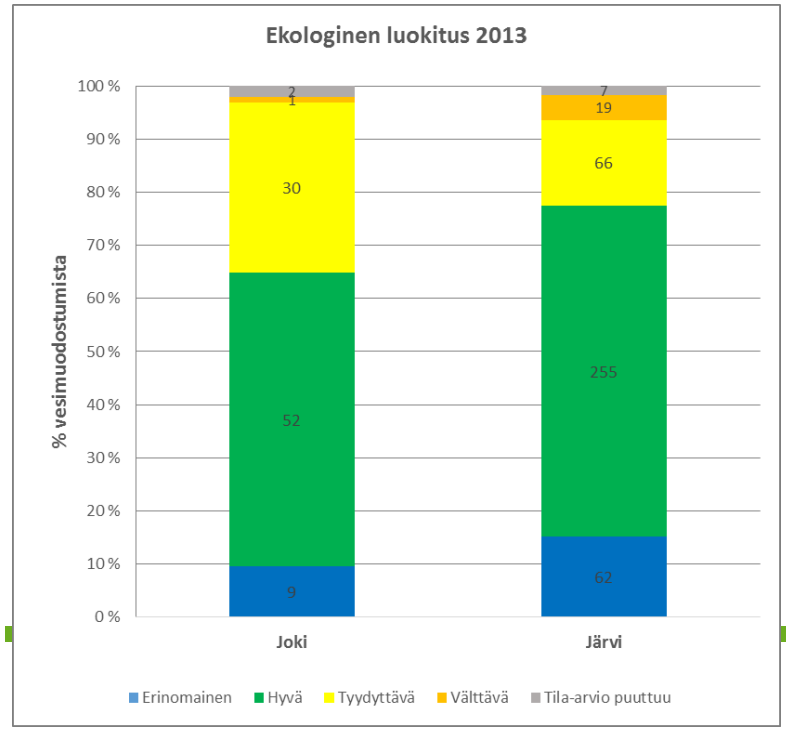




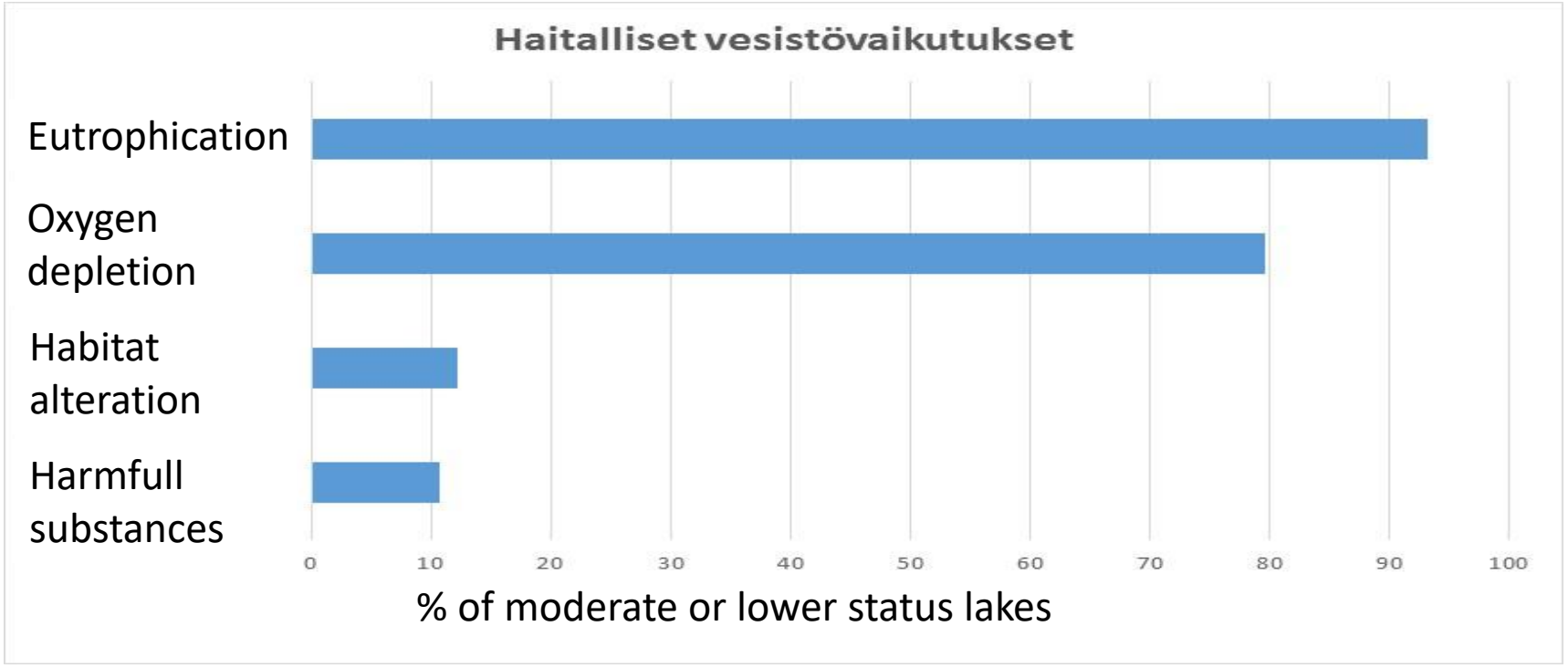
The ecological status of surface waters in Finland



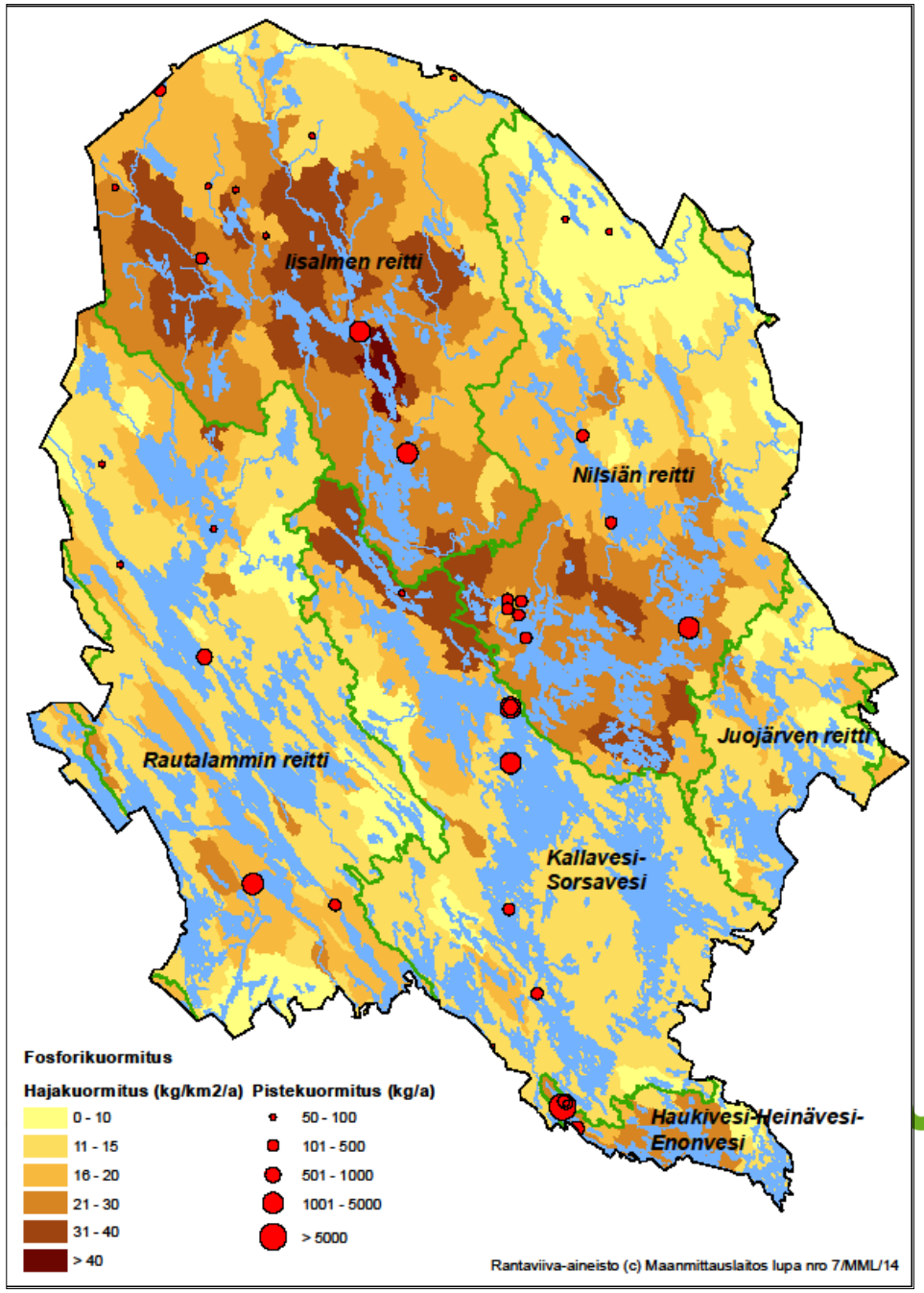
- North Savo



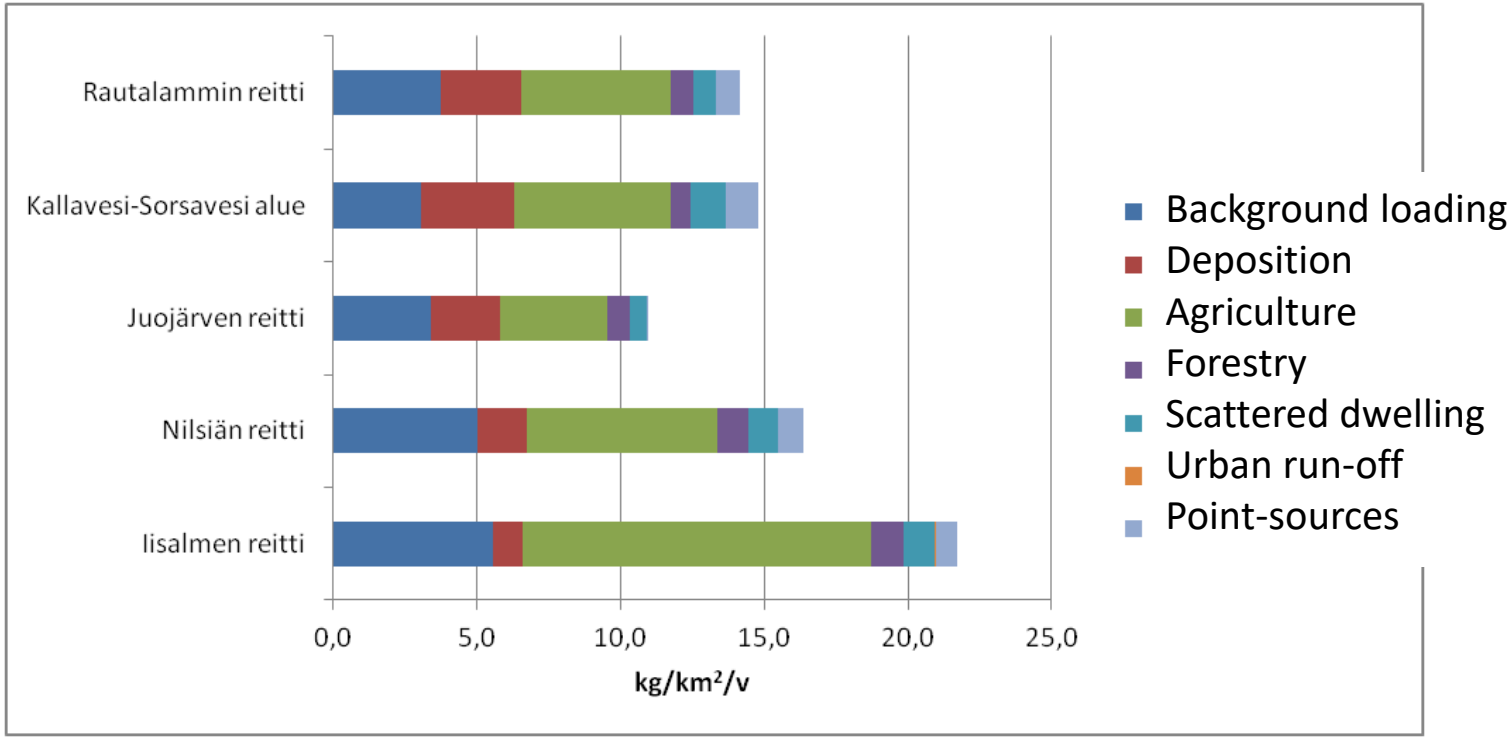
The causes of deterioration of ecological status of lakes in North Savo



The amount and sources of external nutrient loading in North Savo

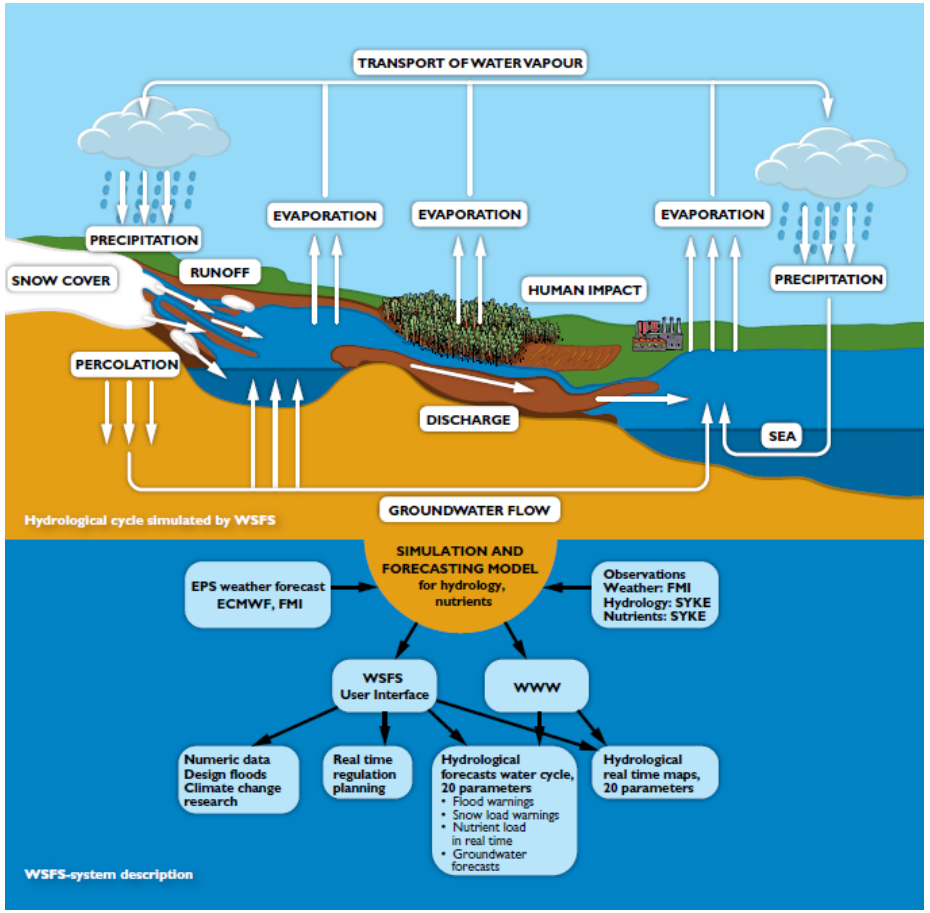


P-loading of different watercourses (VEMALA 2006-2011)



Nutrient load estimation with VEMALA

- VEMALA simulates nutrient loading, transport and retention in rivers and lakes
- Covers whole Finland. Provides estimates for about 6400 WFD water bodies. Part of the Watershed Simulation and Forecasting System WSFS (Finnish Environment Institute).
- Provides scenarios for nutrient loading:
  - Mitigation actions - especially agricultural practices
  - Effects of changing climate
- VEMALA can also be used for estimation of the transport of harmfull substances



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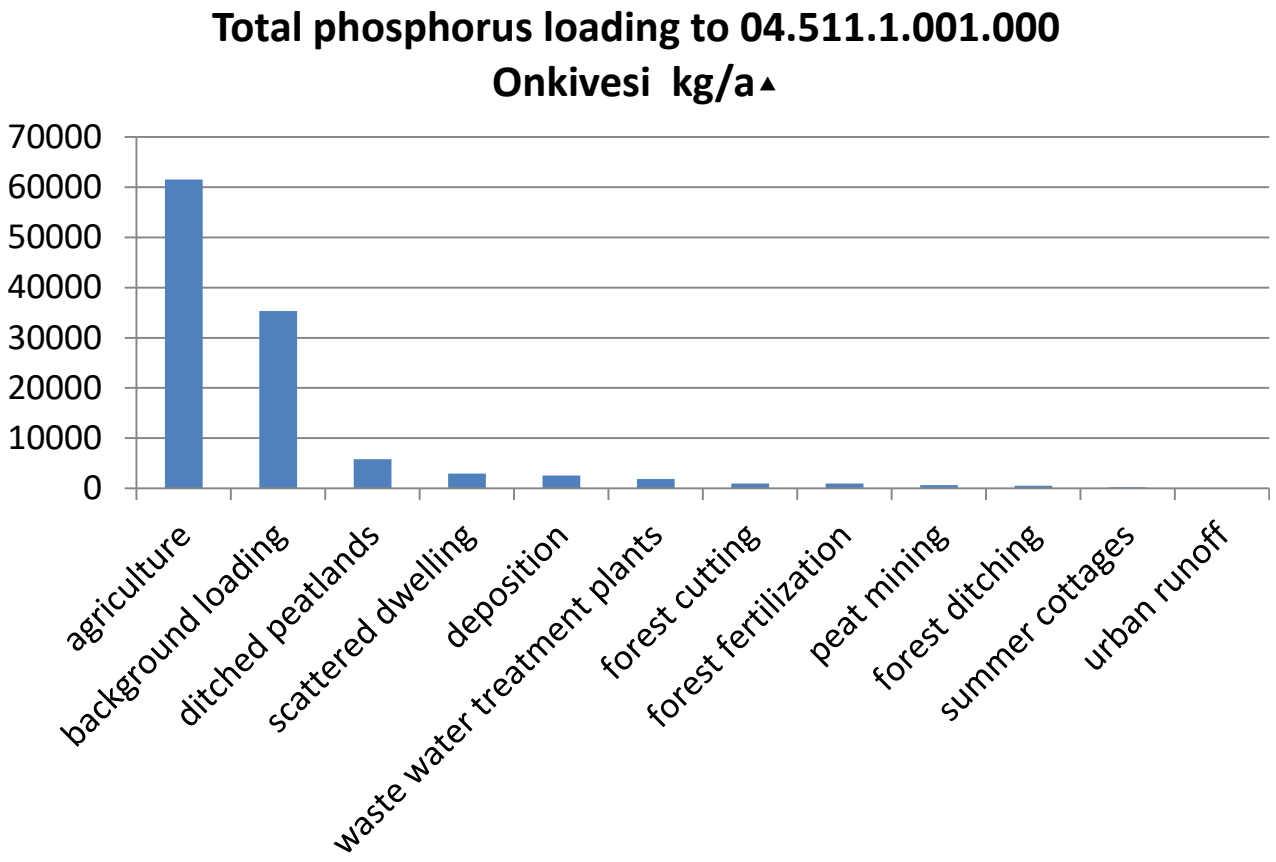
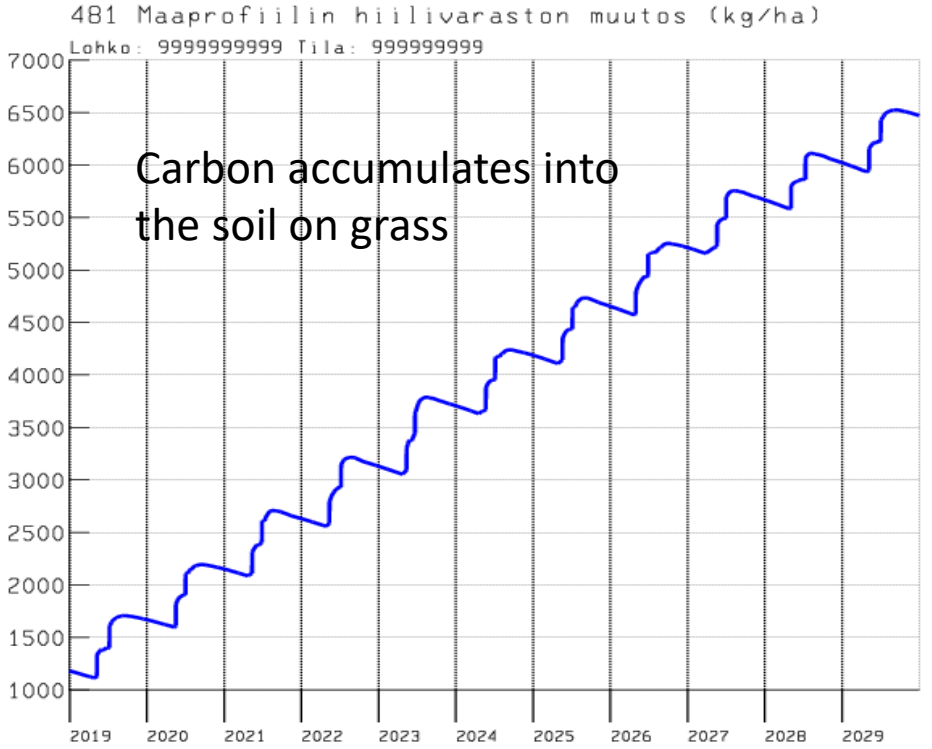
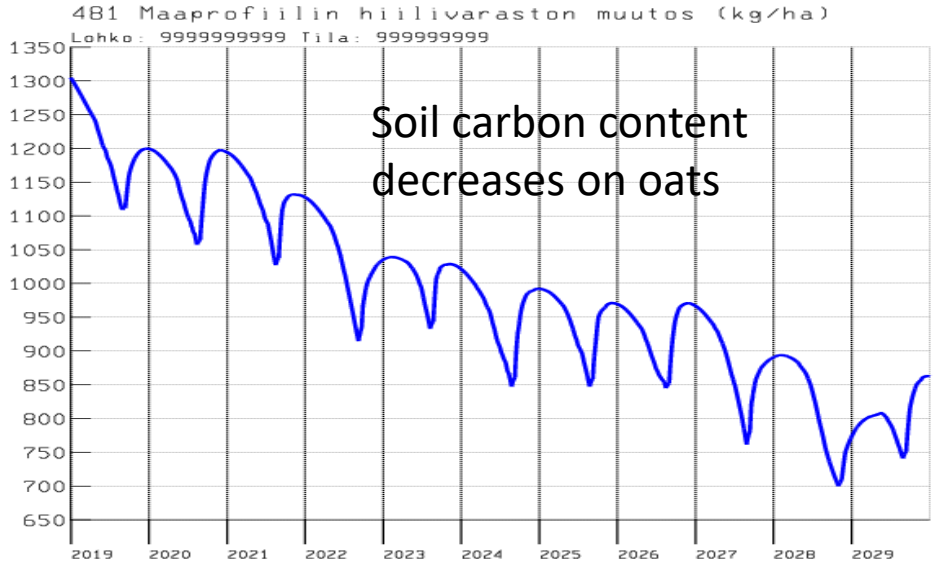
Source apportionment of loading using VEMALA



Field scale ICECREAM modelling

- In VEMALA nutrient loading from agriculture is simulated with field scale ICECREAM model
- ICECREAM is used also as a separate tool for estimation of the effect of farming actions
- In Northern Savo ProAgria and some other organizations provide the use of this tool for farmers





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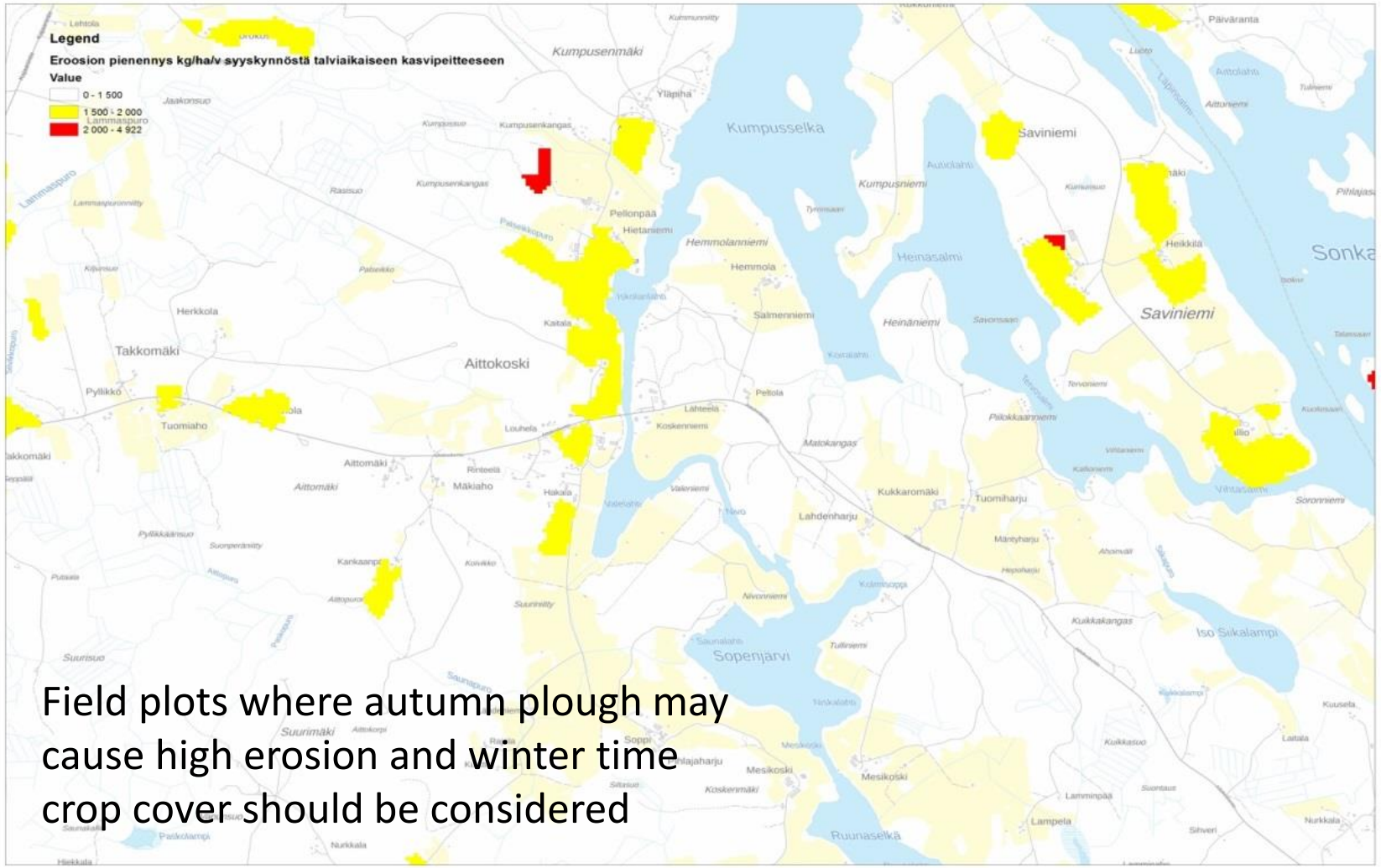
Where to place mitigation actions ?

- VEMALA together with ICECREAM provide estimates of the effect of several actions to reduce nutrient loading



Field plots where autumn plough may cause high erosion and winter time crop cover should be considered

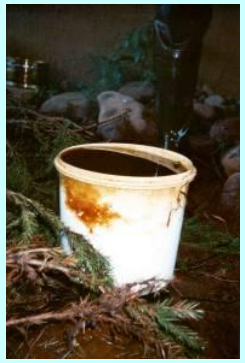
The loading to Finnish rivers is mainly land use derived non-point source pollution

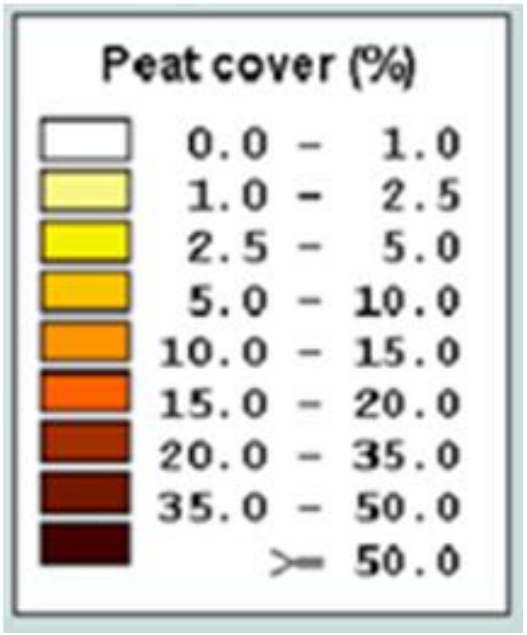
Agriculture

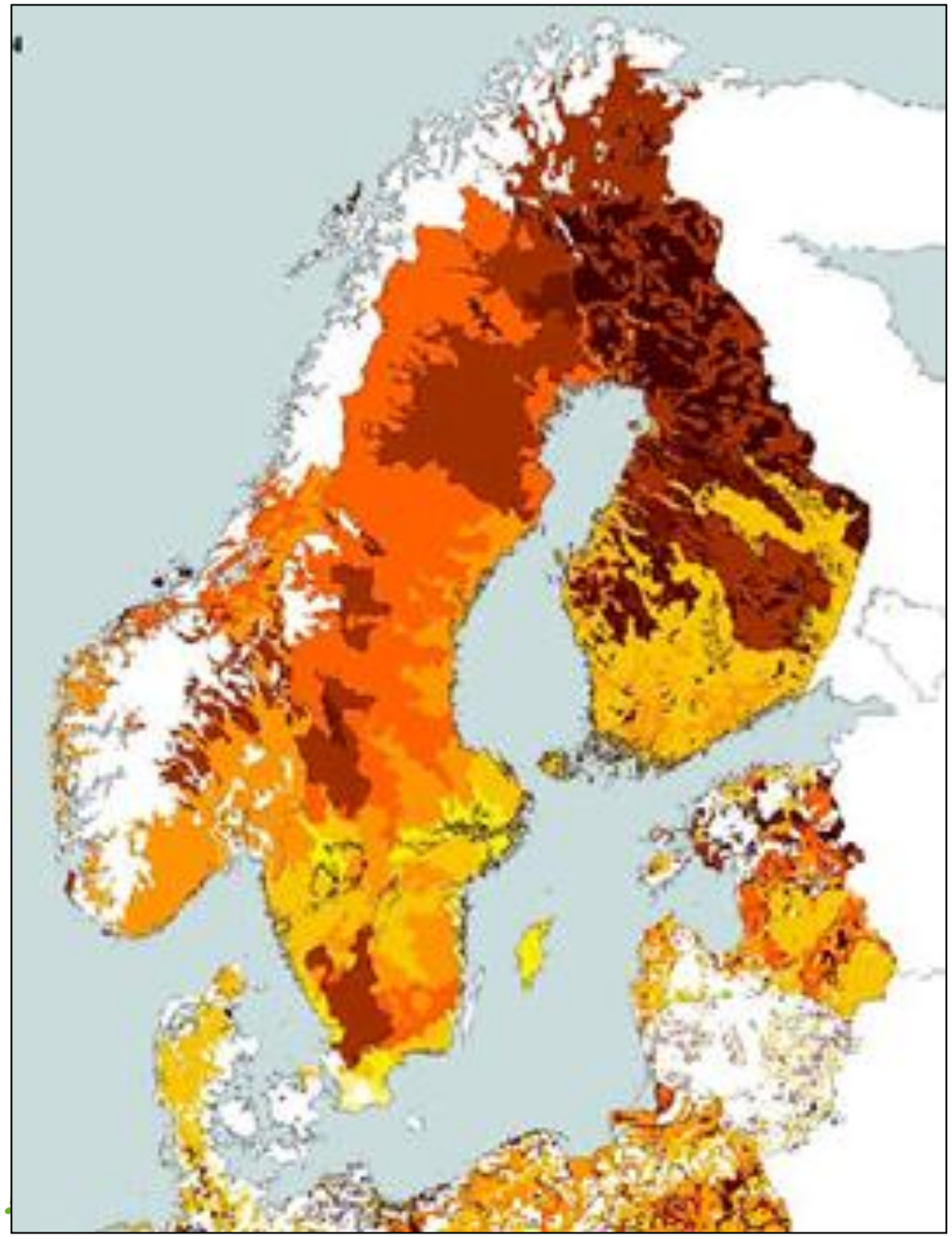
Forestry

- Nitrogen
- Phosphorus
- Organic matter
- Iron, aluminium
- Suspended solids

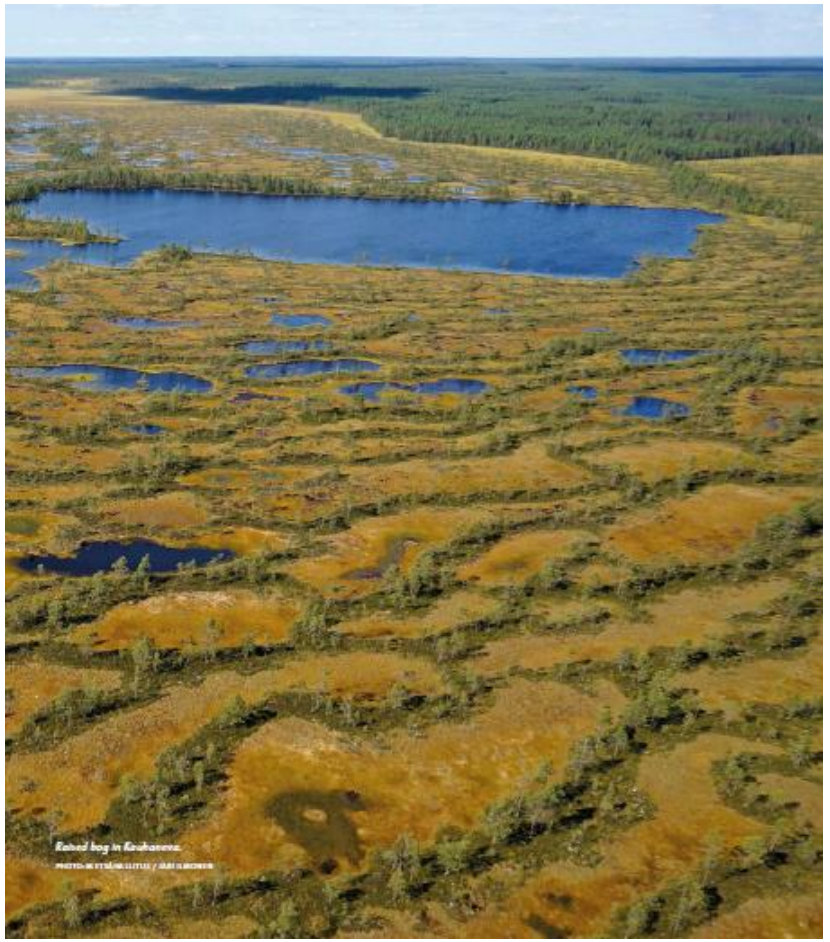
River bed deterioration
Eutrophication







Relative cover (%) of peat and peat-topped soils of the land area



Raised bog in Kauhaneva
Photo: Metsähallitus/ Jari Ilmonen

SYKE
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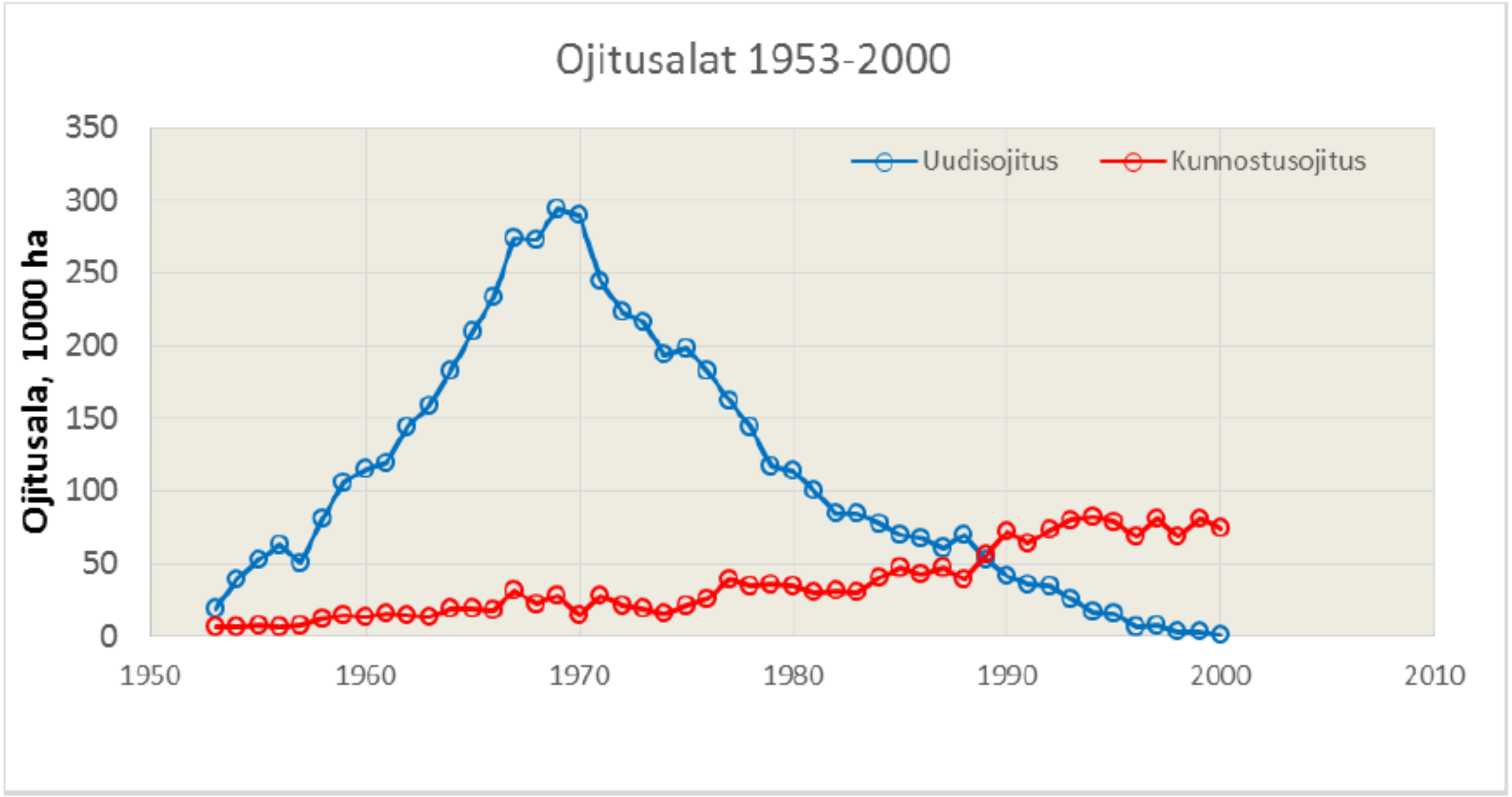
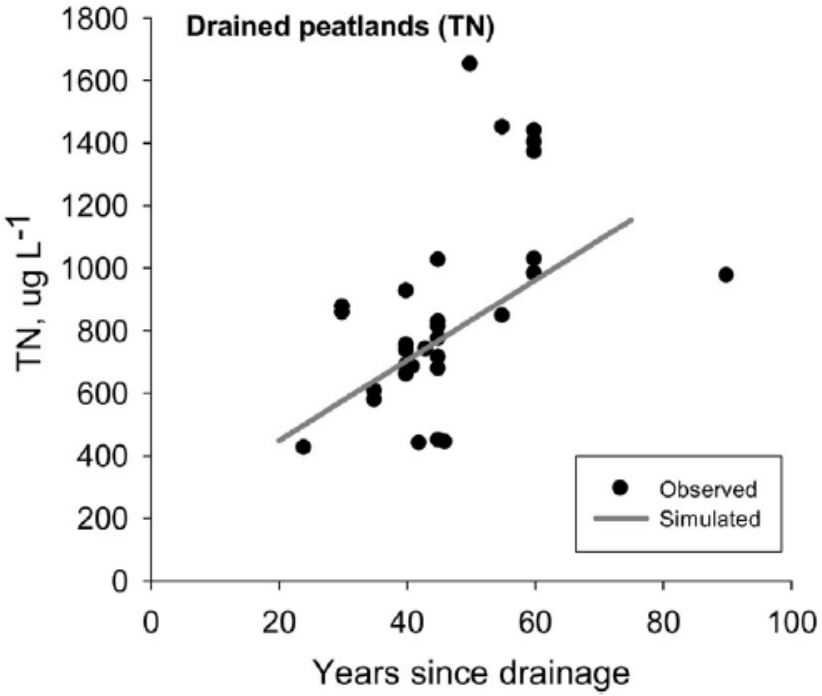
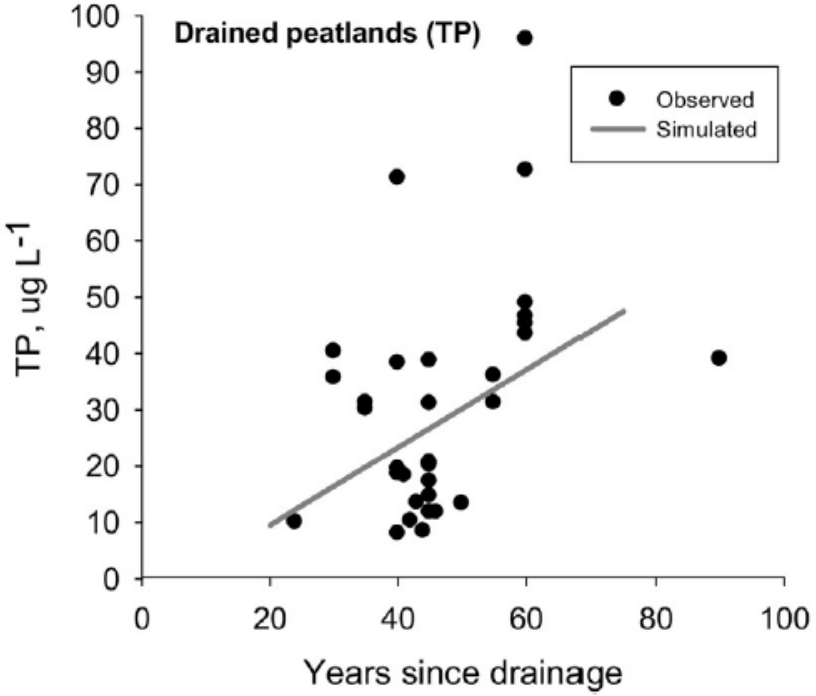
Intensive ditching of peatlands



High nutrient loading from old drained peatlands?



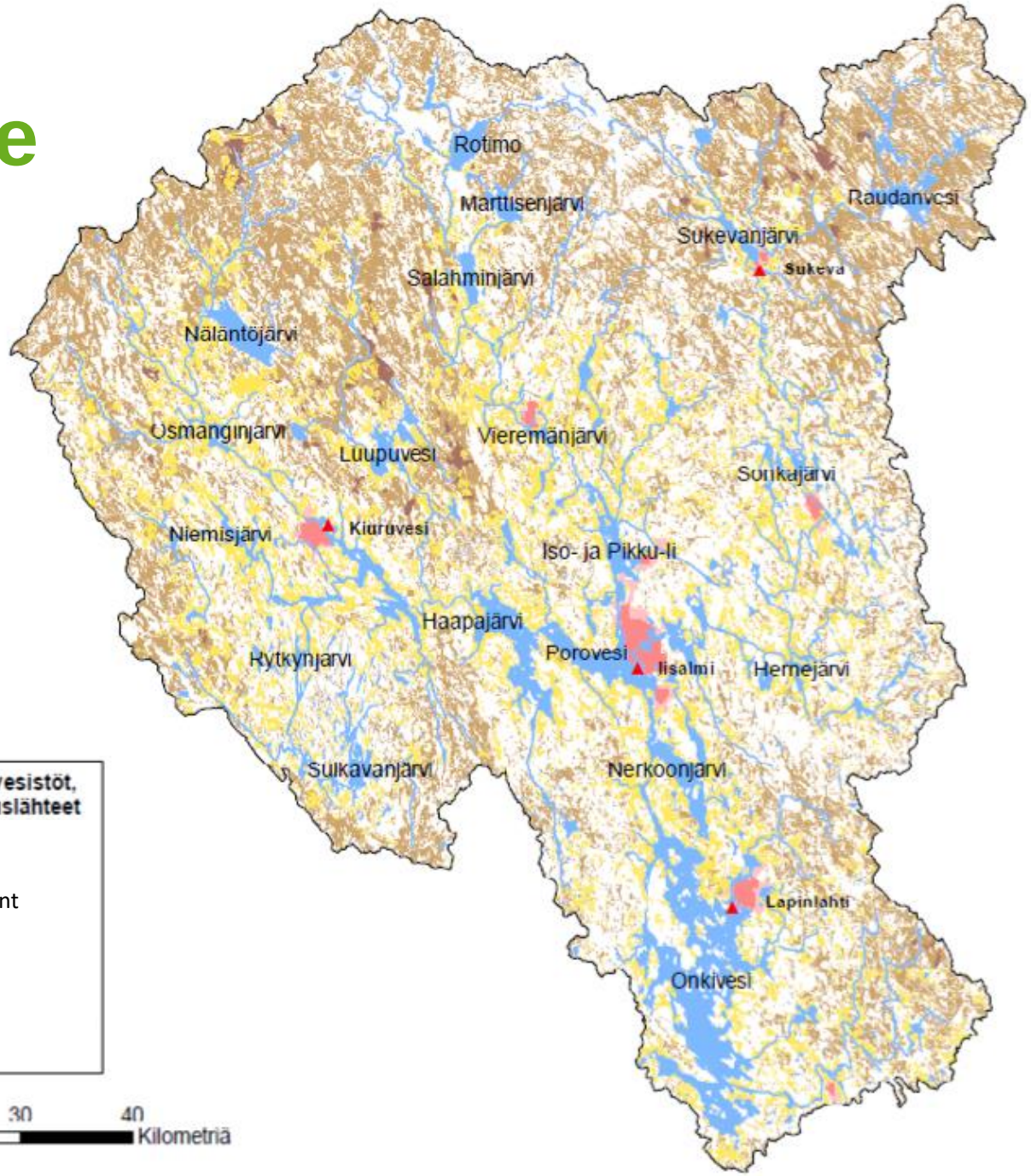


Recent research has revealed that loading originated from old drained peatlands increases by ageing (Nieminen et al. 2017, 2018)

- phosphorous and nitrogen loading CAN be tenfold compared to earlier estimations!

Iisalmen reitti -watercourse

- The region of North Savo with most water quality problems
- High external loading from arable land and forestry (draided peatlands)
- High proportion of grassland farming (dairy and beef cattle)
- Internal loading of P important
- Also naturally eutrophic lakes



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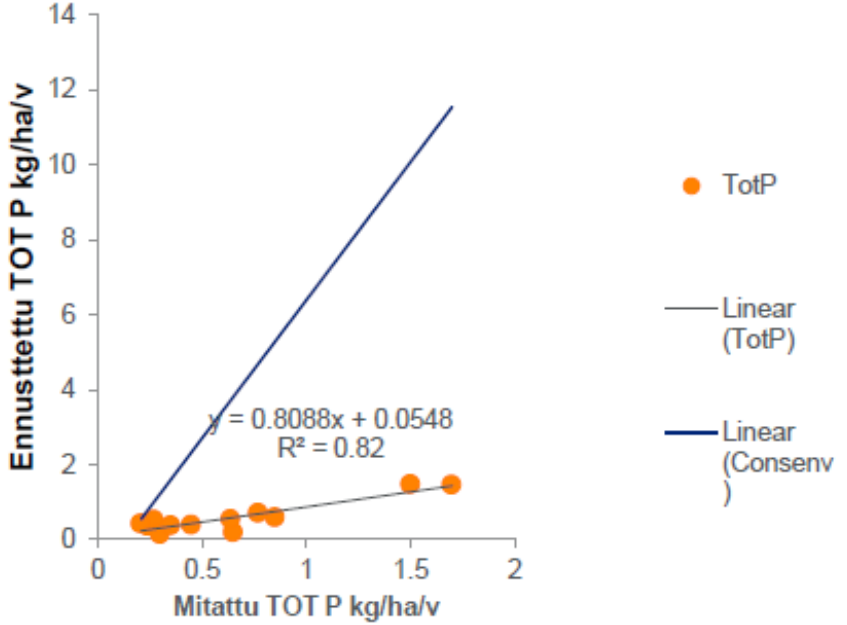
Nutrient loadind from grassland farming

- New estimates of phosphorous runoff from grassland farming significantly lower than previously modelled

- Uusi malli Kiertovesi –hankkeessa: huuhtoutumin oletettua pienempää (keskinm **0,43 kg/ha/v**
  Kokonais-P (vrt vertailuarvo keskimäärin peltohehtaarille **1,17** kg/ha/v)



Aikaisempi suomalainen malli ennustiaa huomattavasti suuremman kuormituksen

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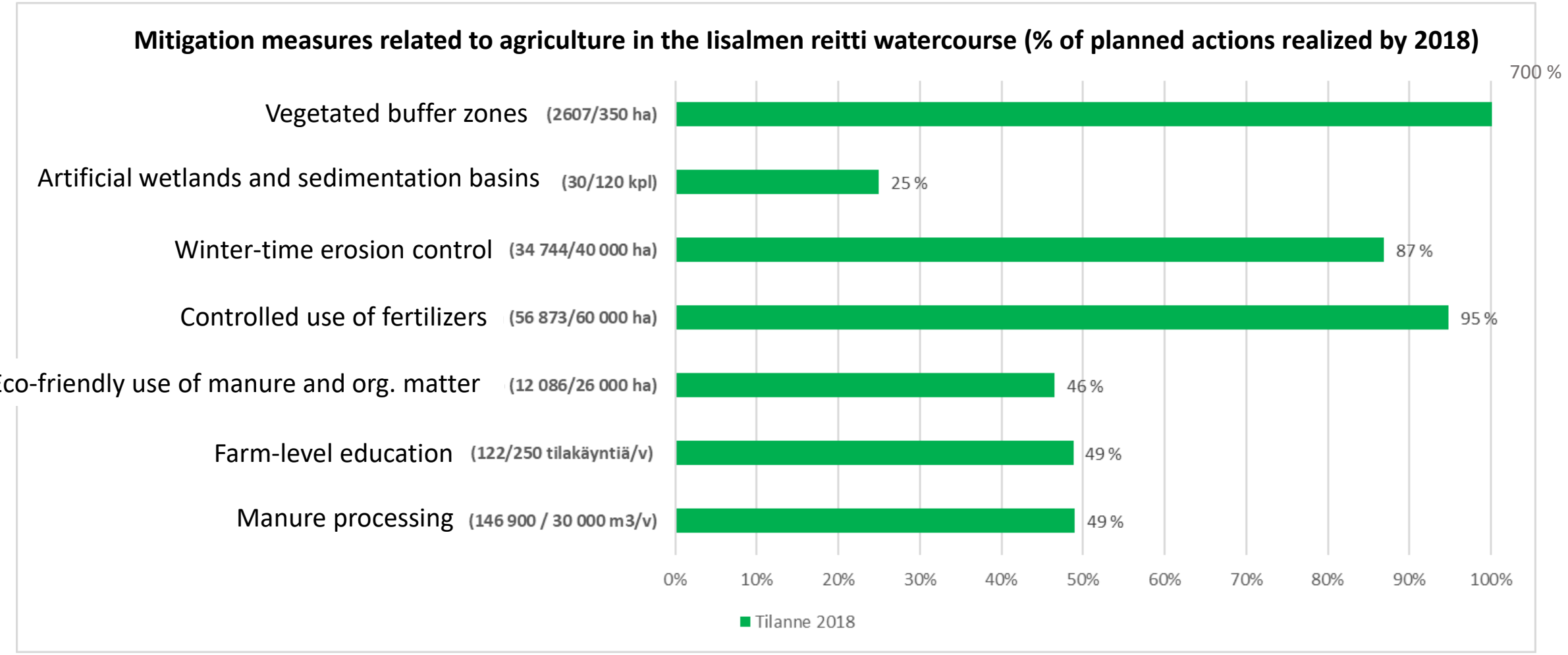
Agriculture: mitigation measures (RBM-plans)



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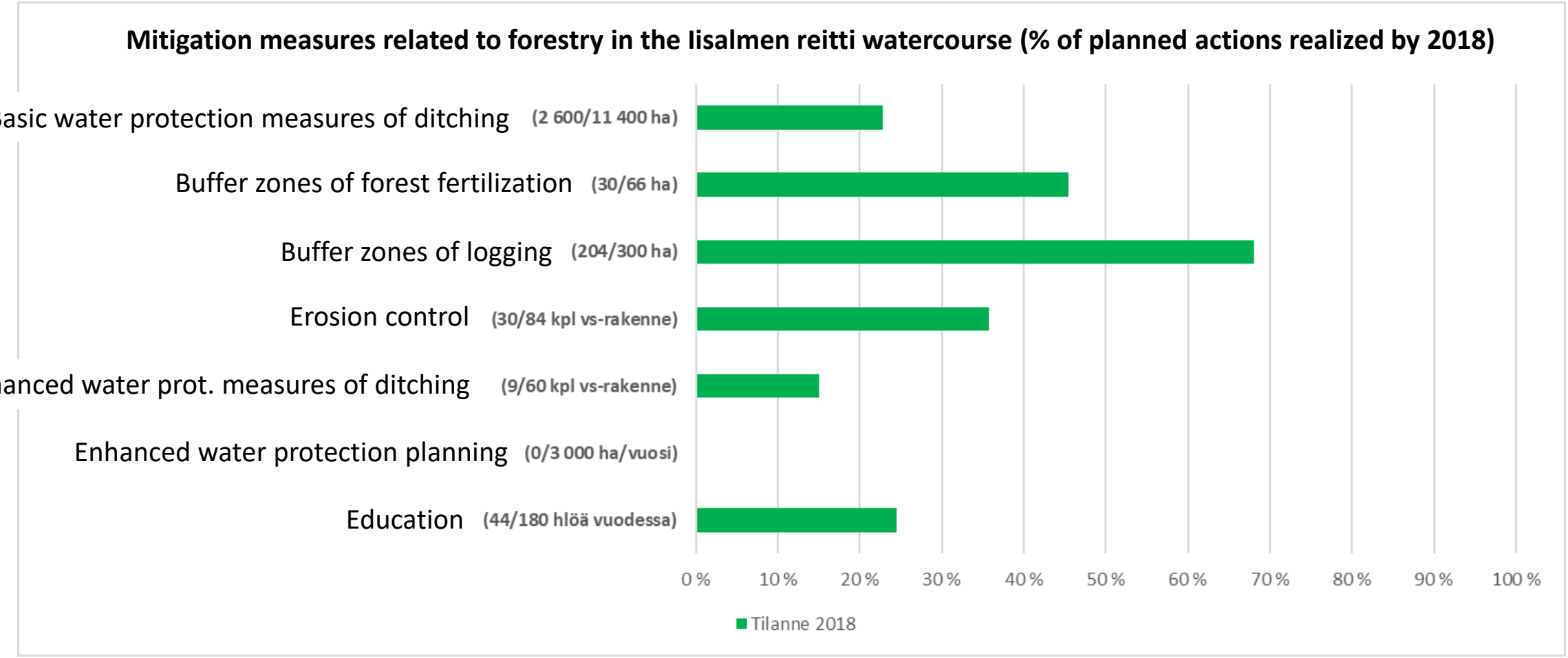
Forestry: mitigation measures (RBM-plans)



Future challenges of RBM related to nutrient loading?

- New methods needed to cut loading: research > policy > practice?
- New knowledge on loading: re-focus of the mitigation measures?
- Internal loading will ”resist” change in lakes
- Increased use of forests, ”bioeconomy boom” vs. water protection
- Climate change – increased diffuse loading and productivity
- Local (but often challenging) issues with the mining sector

Acknowledgements

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