

Modelling of water and matter balances under global change in the Western Siberian corn-belt

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Project SASCHA

SASCHA “Sustainable land management and adaptation strategies to climate change for the Western Siberian corn-belt”

- BMBF-Research Programme “Sustainable Land Management” Module A
- Aim: Provision of basic knowledge, practical management tools and adaptation strategies to cope with recent and future ecological change and landscape transformation in the Tyumen region, Western Siberia
- Focus: interacting effects of climate and land-use change on natural resources and ecosystem functions in the Pre-Taiga and Forest-Steppe ecotone

Subproject; Aims

Subproject „Modelling of water and matter balances under global change“

- Aim: analysis and assessment of regional water and matter balances

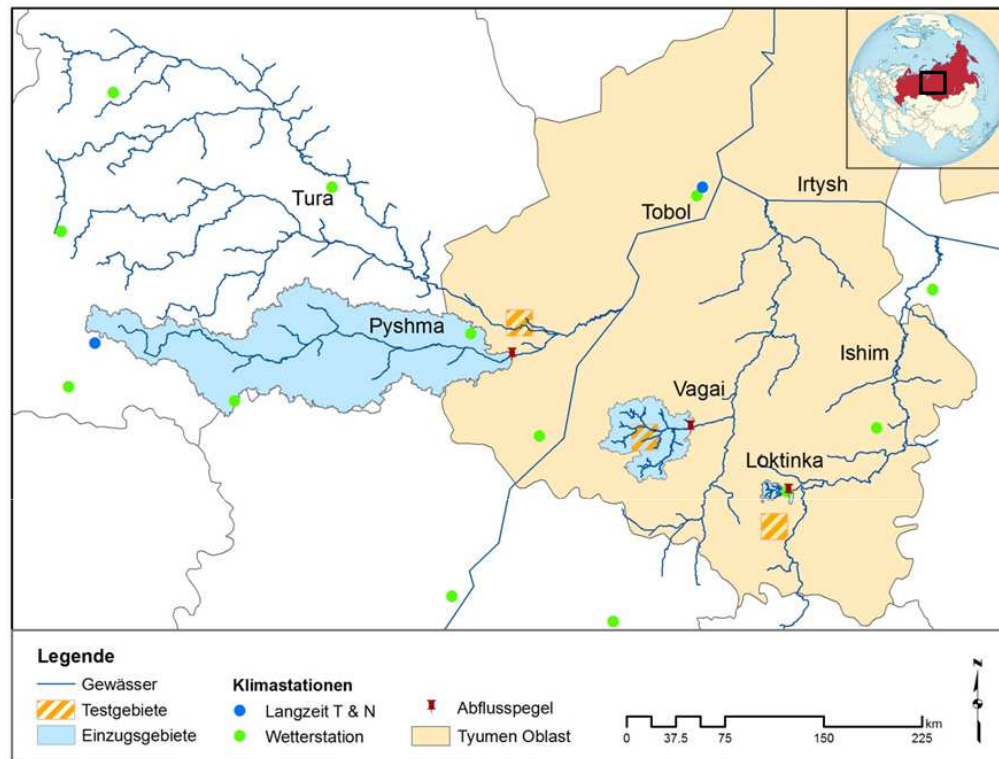
PLOT

- How do temperature and water balance differ depending on land use?
- What kind of effects can be expected from climate and land use change on soil water?

CATCHMENT

- What are the impacts on water quality and quantity at catchment scale?
- Can they be reduced by adaptation of the soil management?

Study area



- Western Siberian lowland
- Oblast Tyumen
- 3 plots, 3 catchments
- Semi-humid/semi-arid continental climate
- Mean yearly precipitation: 400-500 mm
- Mean temperature: 0°C

Field campaign

PLOT scale



TSA

Measured parameters

Soil temperature

Water content

Soil profile

Vegetation

C/N soil

3 land uses, 2-3 depths

May-Aug 2012

CATCHMENT scale



Measured parameters | Water quality

In-situ (O₂, T, pH, EC)

Nitrogen (NO₃, NH₄, TN)

Phosphorus (PO₄)

Carbon (dissolved & particular)

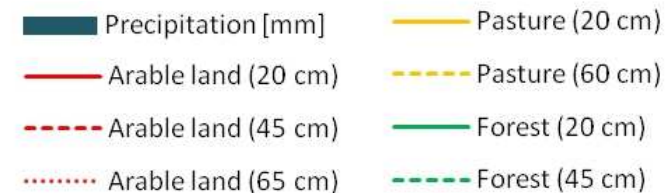
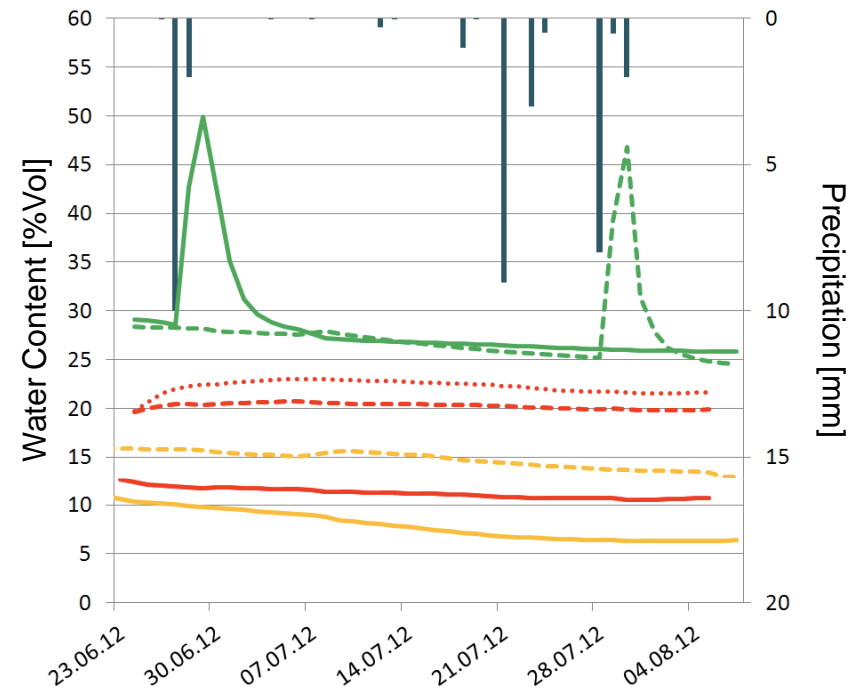
26 points Vagai & Loktinka

Jun-Jul 2012

Plot scale | Soil water content



- Varied between 6 and 29 % Vol.
- Showed little variation within the particular horizons and a decreasing trend over time (summer)
- Peaks (forest) after rain events
- Decreased from:
forest > arable land > pasture



Field campaign

PLOT scale



Measured parameters

Soil temperature

Water content

Soil profile

Vegetation

C/N soil & vegetation

3 land uses, 2-3 depths

May-Aug 2012

CATCHMENT scale



Measured parameters | Water quality

In-situ (O_2 , T, pH, EC)

Nitrogen (NO_3 , NH_4 , TN)

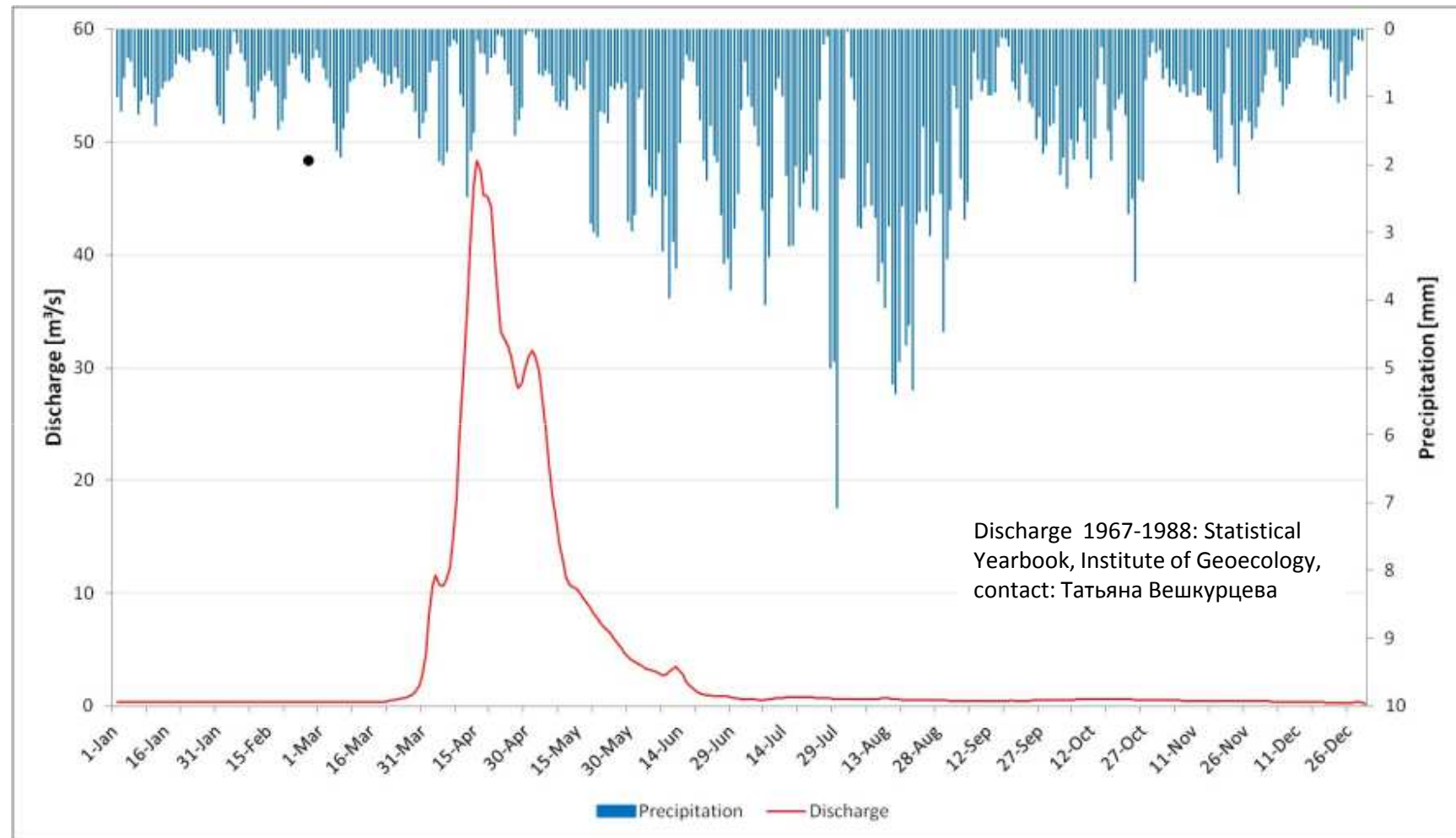
Phosphorus (PO_4)

Carbon (dissolved & particular)

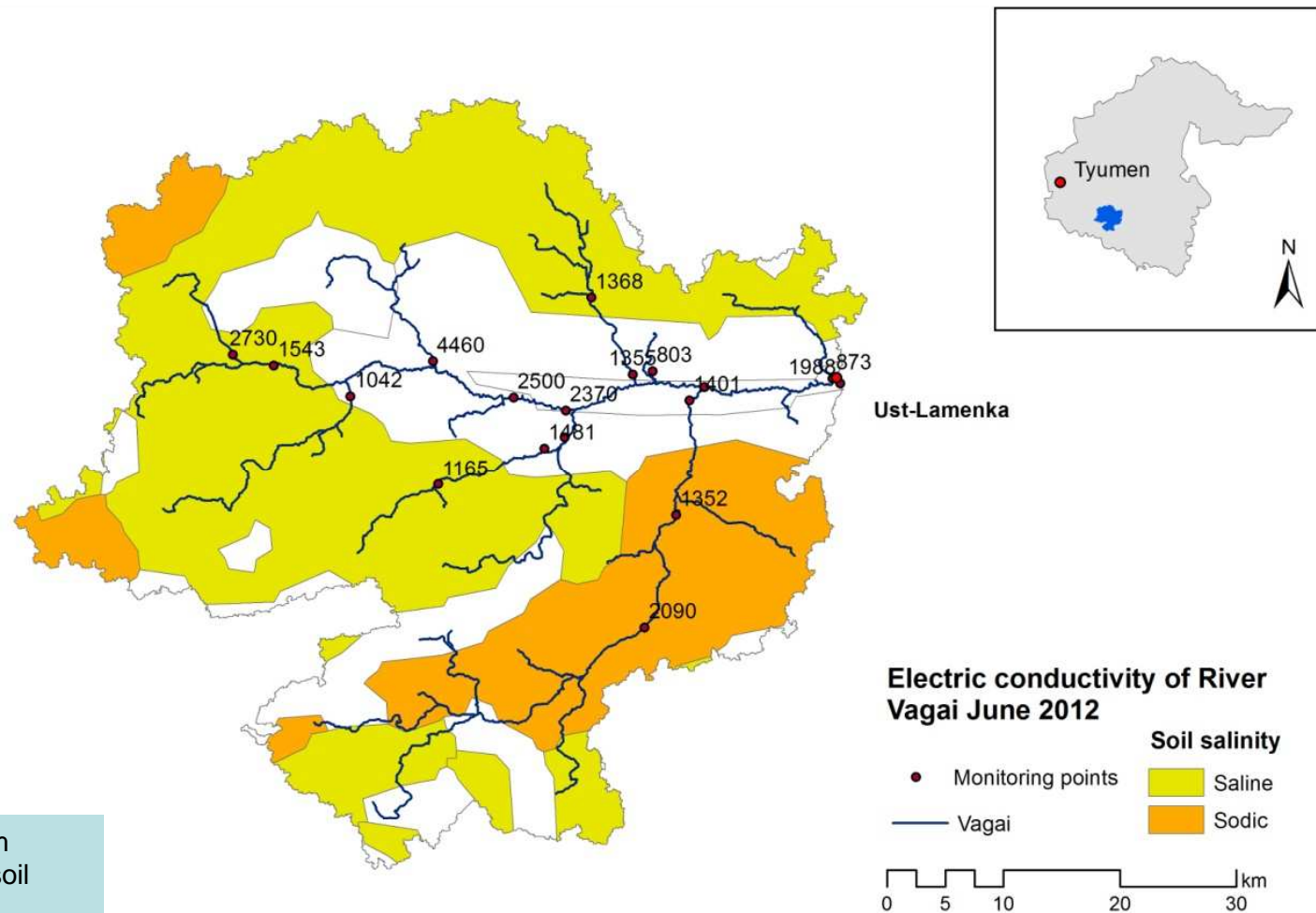
26 points Vagai and Loktinka

Jun-Jul 2012

Daily discharge| Vagai

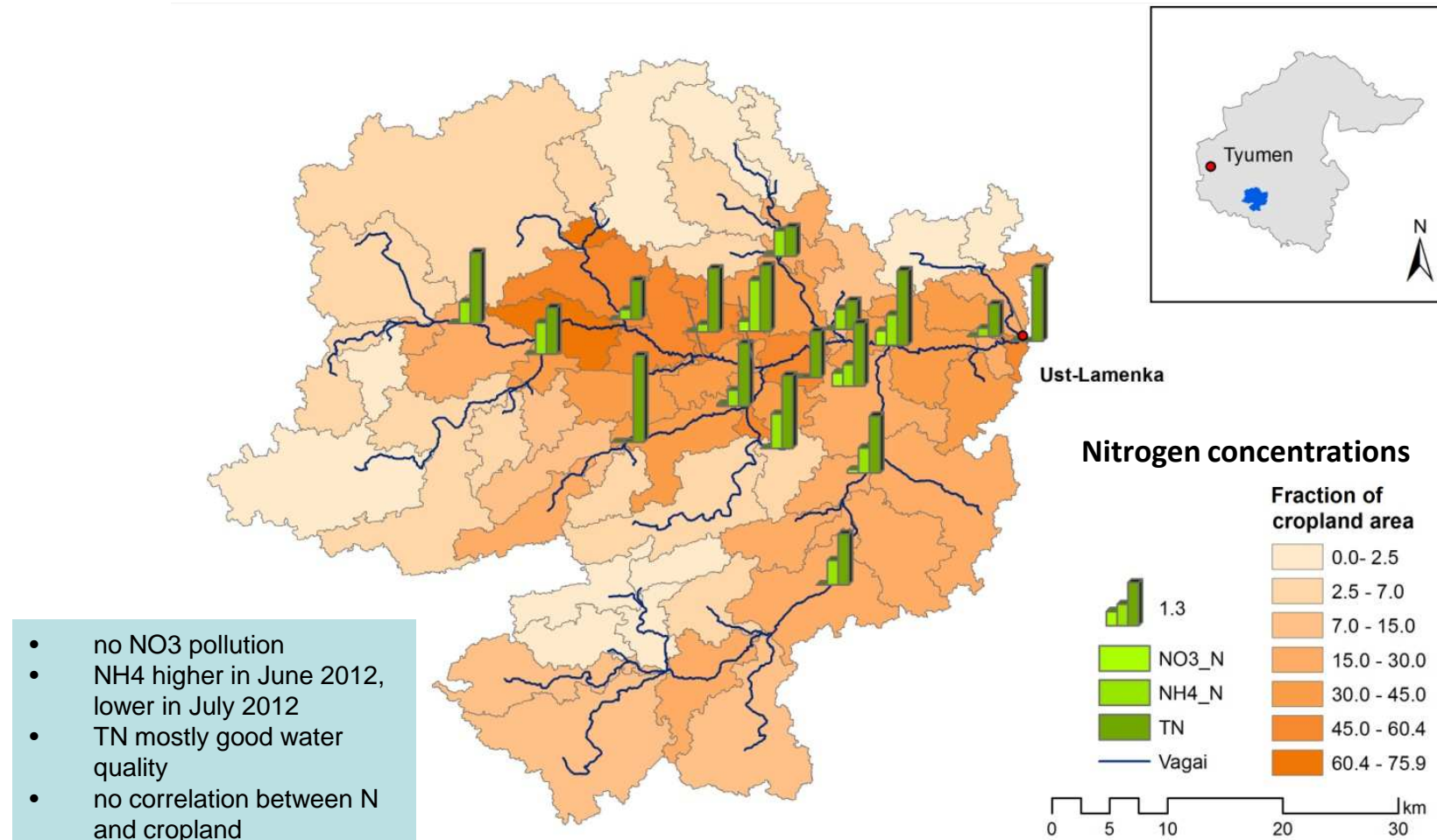


Electrical conductivity | Vagai

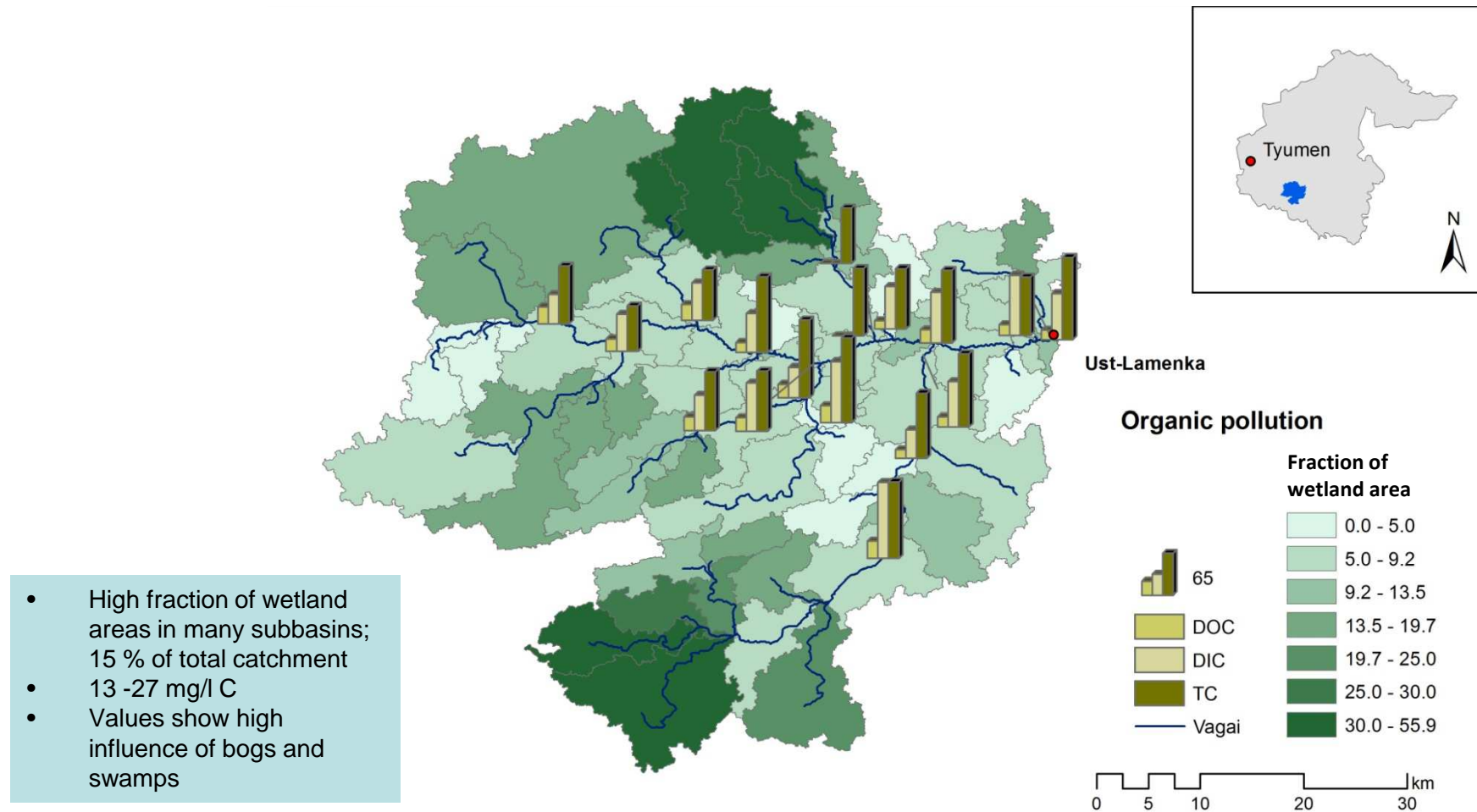


- mostly $>1000 \mu\text{S/cm}$
- not explainable by soil salinity

Nitrogen concentrations | Vagai



Carbon concentrations | Vagai



- High fraction of wetland areas in many subbasins; 15 % of total catchment
- 13 -27 mg/l C
- Values show high influence of bogs and swamps

Conclusions

- field monitoring (May-Aug. 2012) at 3 plot sites and 2 catchment areas
- soil water content decreased from forest to arable land to pasture; showed little variation within the particular horizons
- high values of electrical conductivity
- no NO₃ pollution
- NH₄ higher in June 2012, lower in July 2012
- TN mostly good water quality
- no correlation between N and cropland
- carbon concentrations show high influence of bogs and swamps

Outlook

- further field monitoring at plot sites and catchments areas (2013)
 - analysing soil texture
 - including melting period
 - considering salt concentration; identifying source of high EC
 - considering drainage of peatland
- parametrization of the 1D model CoupModel (3 land uses)
- parametrization of the ecohydrological model SWAT (3 catchments)
- calibration of the models (2014)
- climate and land use change scenario runs for establishing sustainable integrative river basin strategies

Thank you for your attention!

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