EU Life+ MONIMET

LIFE12 ENV/FI/000409

Vulnerability assessment of nitrates in drinking water in near future

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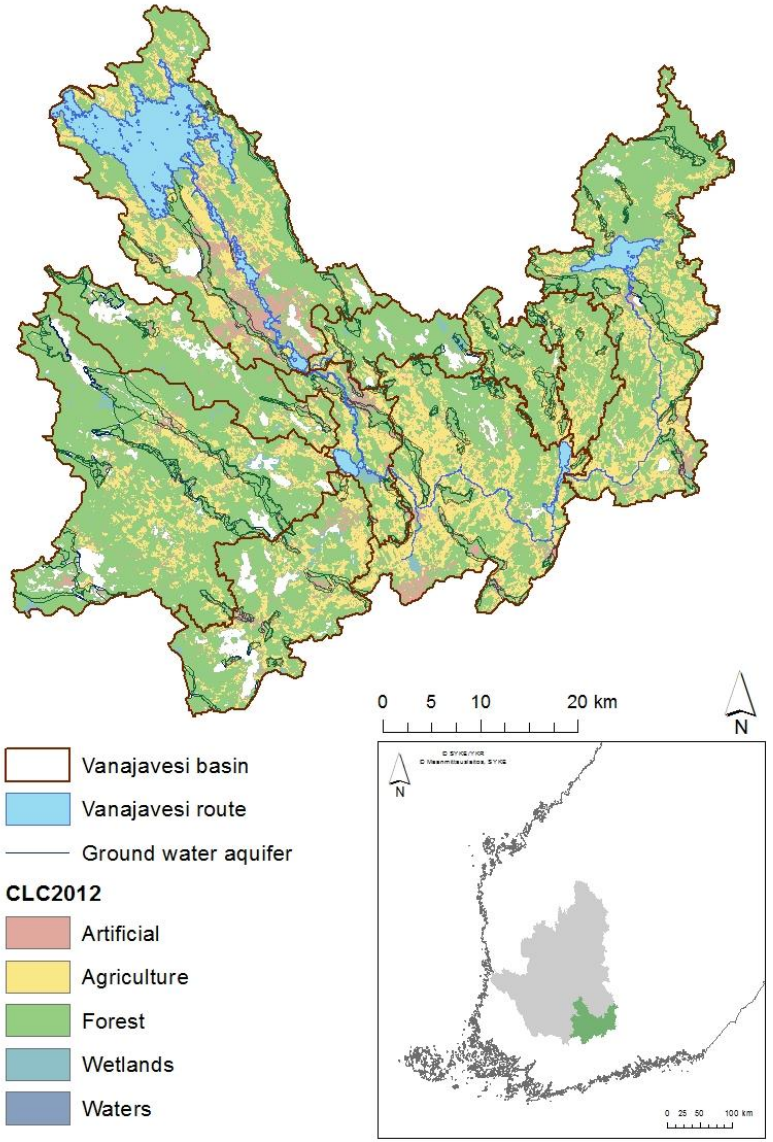
Vulnerability assessment

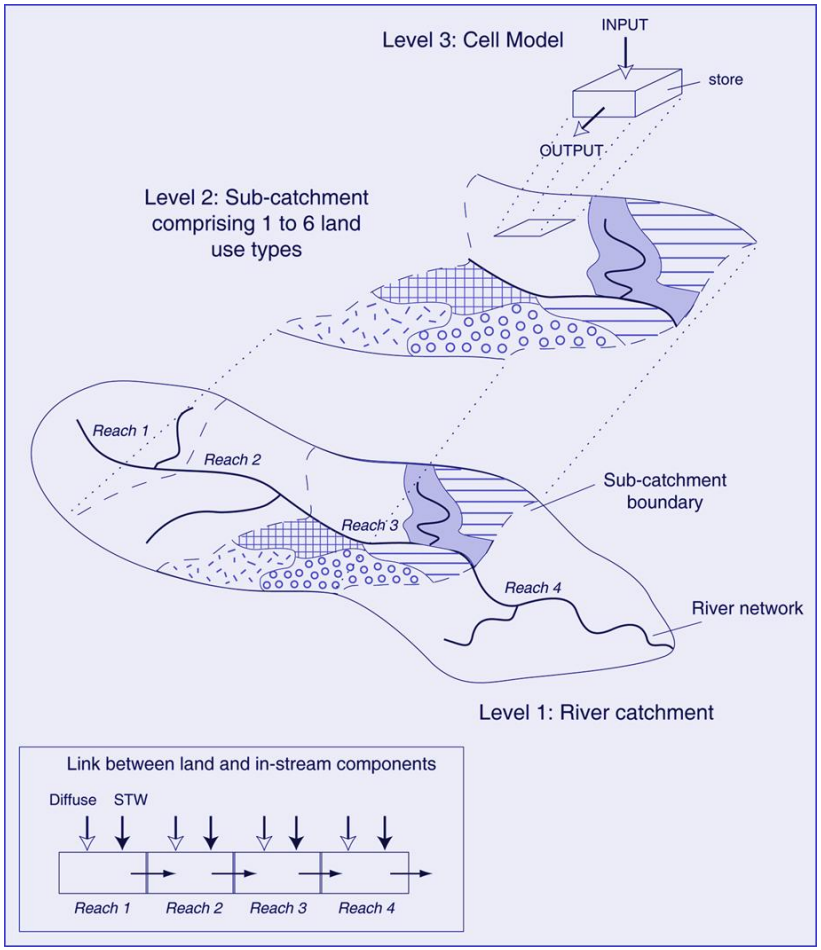
- The properties and processes of the ecosystems regulate water flow and retain nutrients
- The functioning of the ecosystem processes depends on temperatures and precipitation patterns

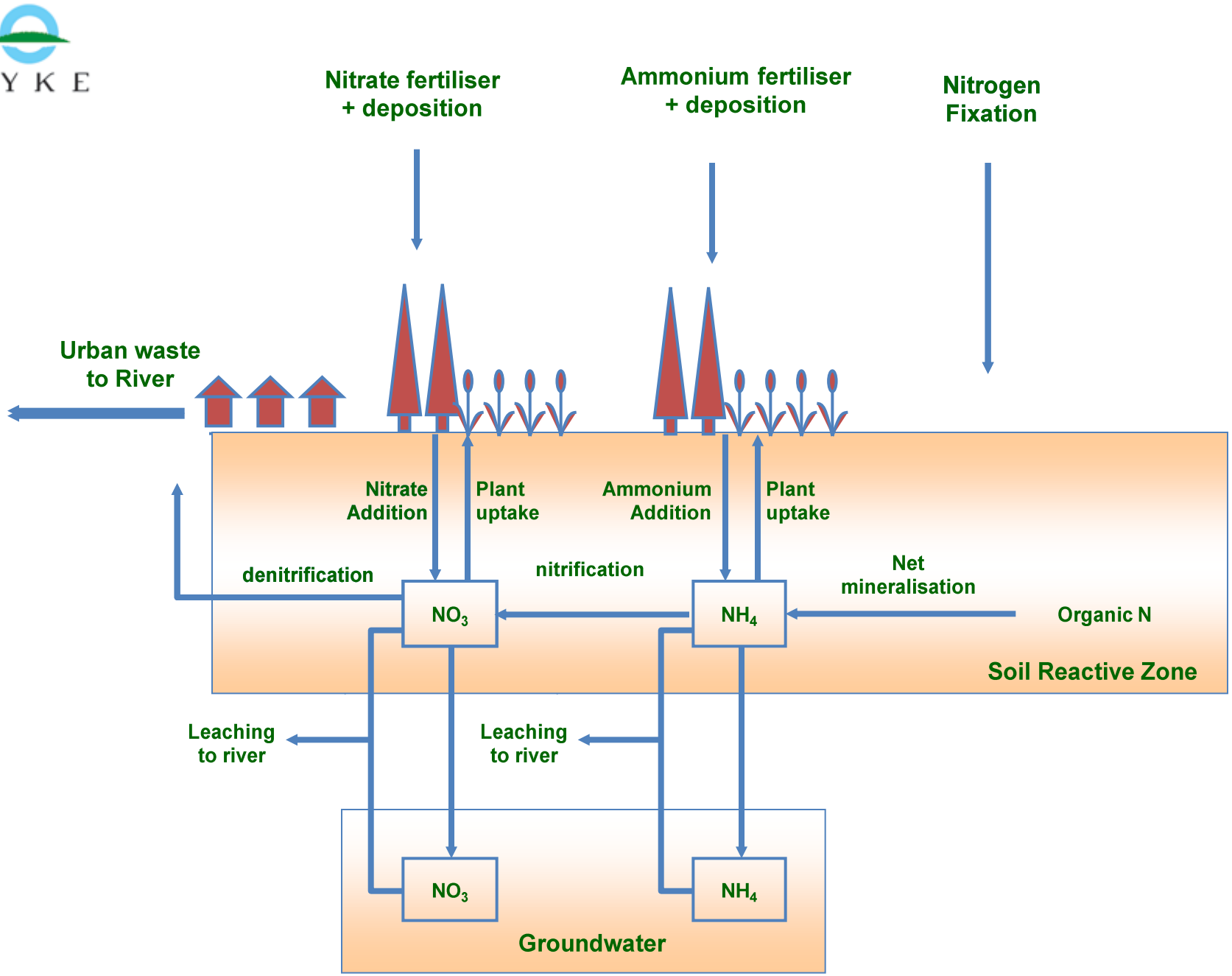
- Nitrate limit for drinking water is 50 mg/l
- Problem especially in private wells
- Study area Vanajavesi basin



INCA-N model

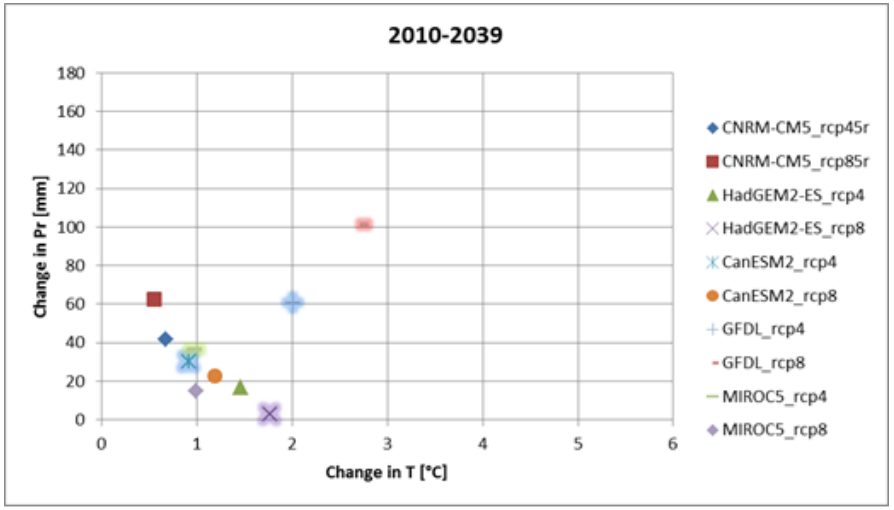
- Dynamic
- Process-based
- Semi-distributed
- Calculates inorganic N load from terrestrial environment to waters

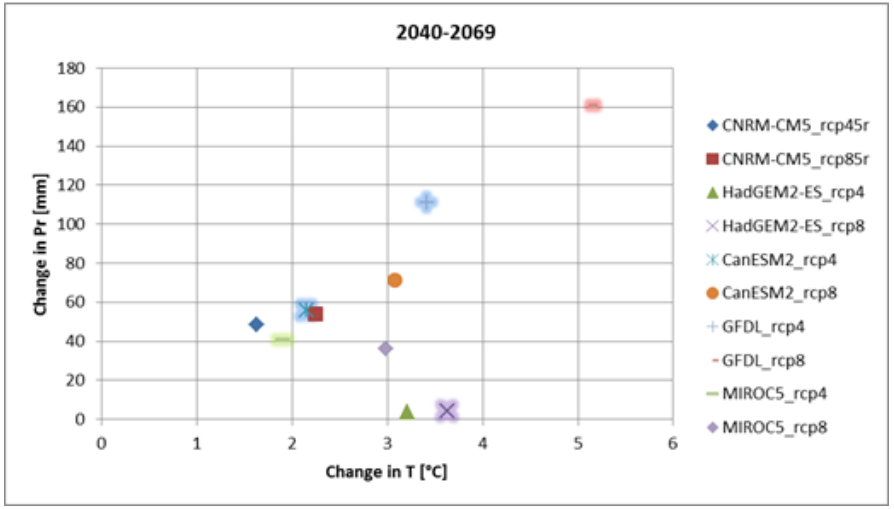



SYKE
Nitrate fertiliser + deposition
Ammonium fertiliser + deposition
Nitrogen Fixation
Urban waste to River
Nitrate Addition
Plant uptake
Ammonium Addition
Plant uptake
denitrification
nitrification
Net mineralisation
Organic N
NO3
NH4
Soil Reactive Zone
Leaching to river
Leaching to river
NO3
NH4
Groundwater

Climate change scenarios

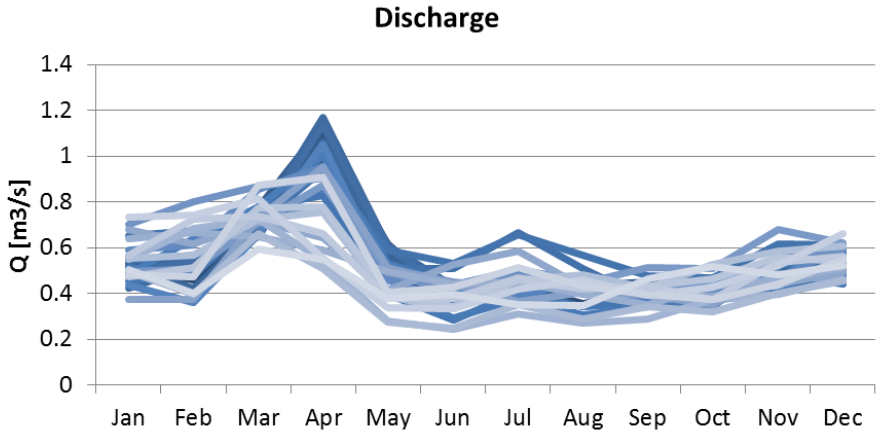
- Both temperature and precipitation will increase in future
- There is difference between scenarios
- Difference is smaller in near future than in far future

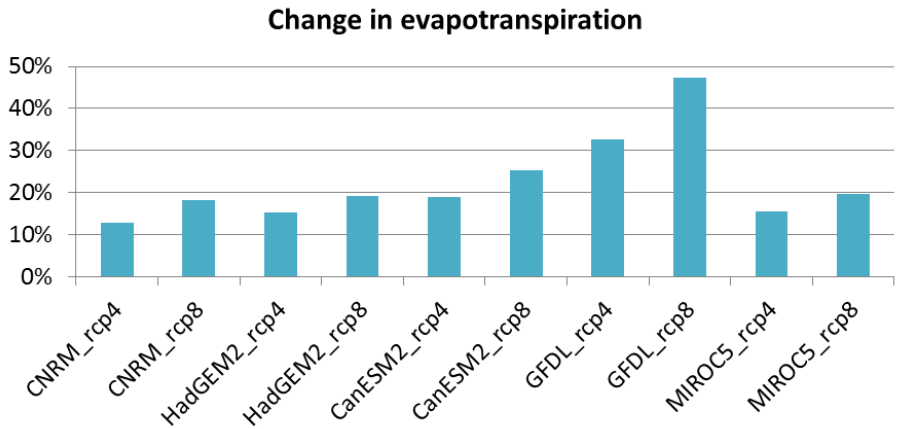




Hydrology

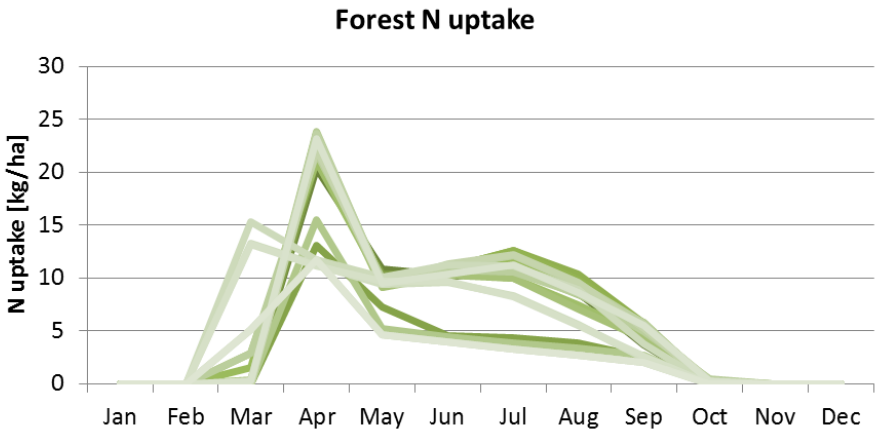
- Current snow-melt induced discharge peak in April shifts to (late) winter
- All climate change scenarios result to increase in evapotranspiration
- Total annual runoff do not change

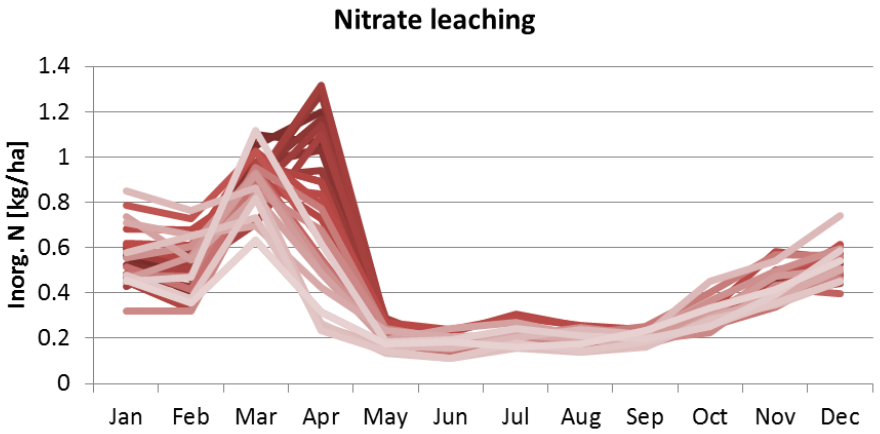




N processes

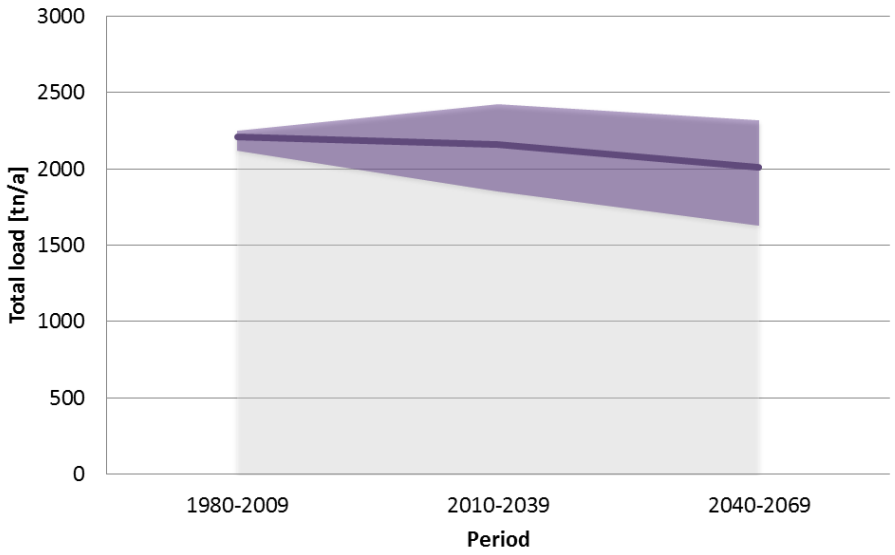
- Nitrate leaching follows runoff, so that there is a shift from snow melt induced leaching in April to more continuous leaching in winter
- Vegetation uptake will start earlier as well





N loading from Vanajavesi basin

- As a result N loading from Vanajavesi basin do not change remarkably
- Though there is variation between different climate scenarios

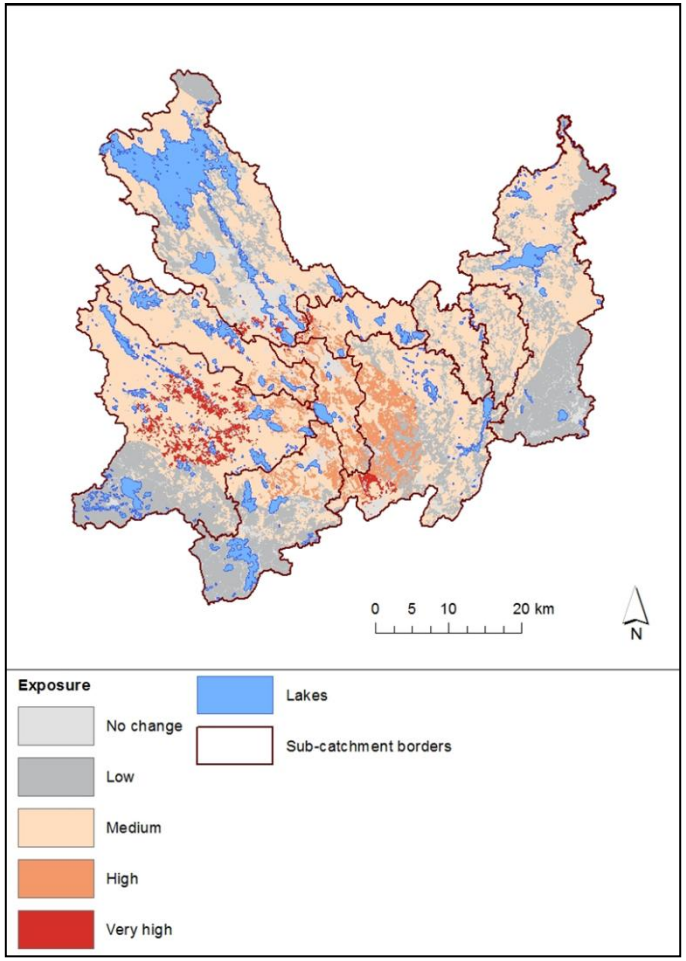


Vulnerability map

- Land use specific loading value shows in map the risk areas for N loading
- Vulnerability map combines N loading with population density in future

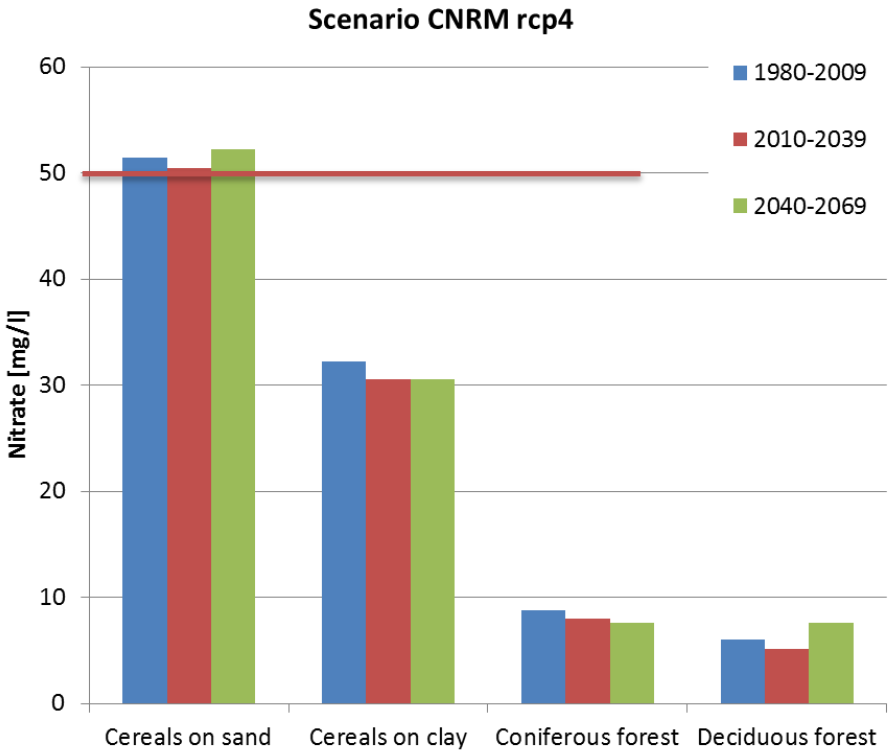
Vulnerability =

Change in N load * population density



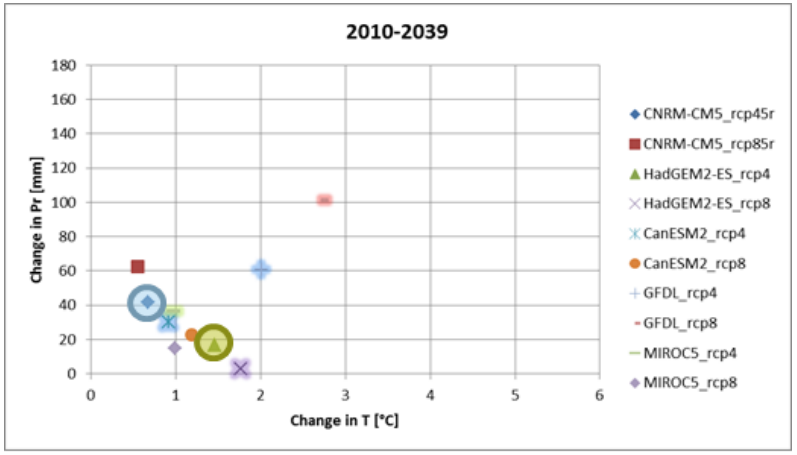
Soil water concentration

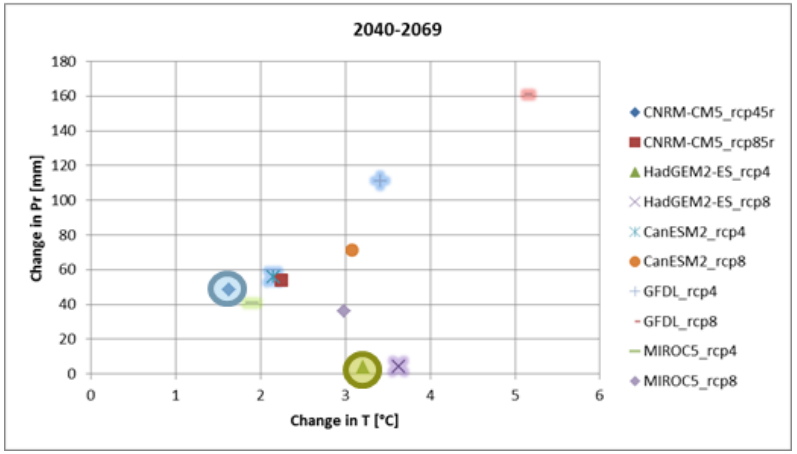
- Risk to exceed 50 mg/l limit is already now highest on spring cereal fields on sandy soils
- Climate change do not increase/decrease the risk considerably



Two examples

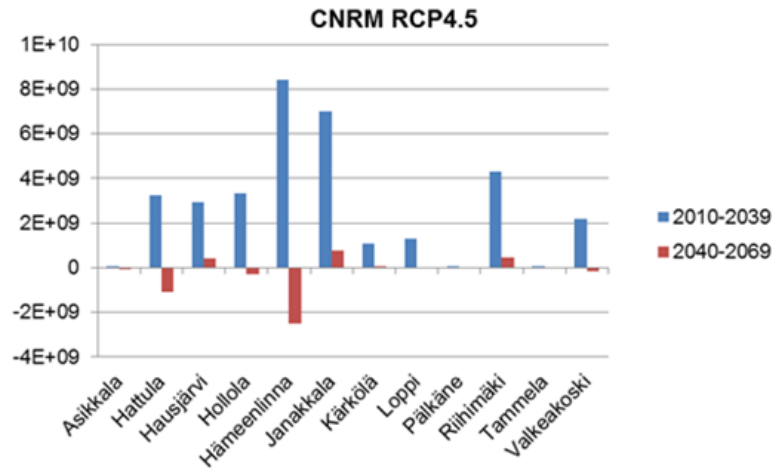
- CNRM rcp4 2010-2039
  - Temperature increase < 1°C
  - Precipitation increase 40 mm
- CNRM rcp4 2040-2069
  - Temperature increase >1.5°C
  - Precipitation increase 50 mm
- HadGEM2 rcp4 2010-2039
  - Temperature increase < 1.5°C
  - Precipitation increase 20 mm
- HadGEM2 rcp4 2040-2069
  - Temperature increase > 3°C
  - Precipitation increase 0 mm

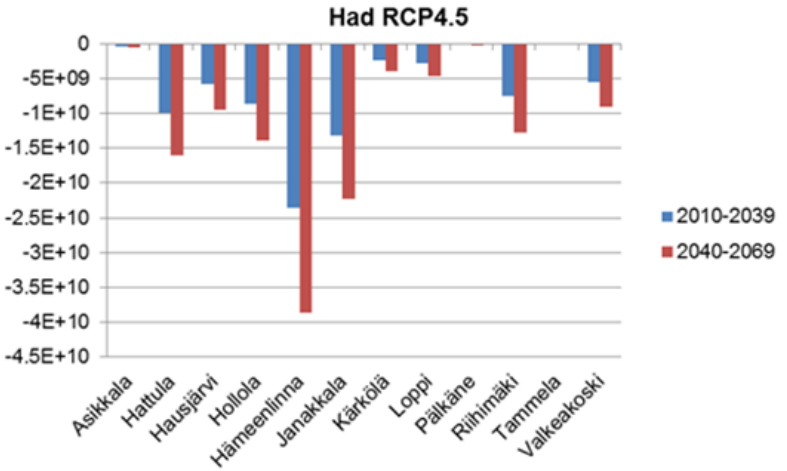




Two examples

- Low increase in temperature and high increase in precipitation combined with population growth lead to increased vulnerability
- Most of the scenarios show rather decrease than increase in vulnerability





Conclusions

- Ecosystem functioning is changing
  - Temperature and precipitation are increasing
  - Runoff and N leaching are shifting from early spring to winter
  - Evapotranspiration and vegetation N uptake increases

- Ecosystem purification capasity is not becoming dangered
- Vulnerability for nitrates in drinking water (in Vanajavesi) is rather decreasing than increasing
- Variation between scenario results is high

SYKE

Thank you!

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