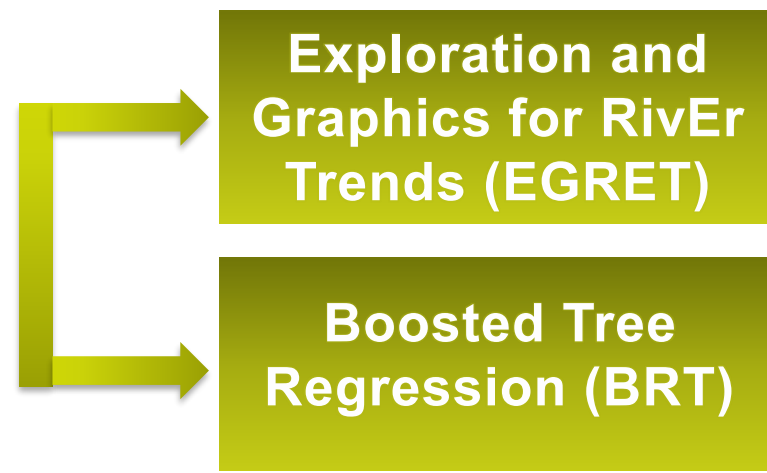


Changes in Organic carbon concentrations in correlation with climate and land use changes in Northern **Finland's** river catchments

- Total Organic Carbon (TOC) has shown an increasing trend in boreal regions
- The disturbances created by climate change, deposition, mineralization, rising temperature and land use change are provoking that the TOC storages gradually become sources of TOC instead
- Our study includes four northern catchments sparsely populated and mildly impacted by agriculture and industry

Statistical analysis



- Three periods according to Corine Land Cover inventory: 2000-2006 / 2007-2012 / 2013-2018

| Catchment | Area (km ²) | Artificial (%) | Agriculture (%) | Forest (%) | Wetlands (%) | Water Bodies (%) |
|-----------|-------------------------|----------------|-----------------|------------|--------------|------------------|
| Iijoki | 14179.32 | 0.12 | 1.06 | 82.34 | 11.14 | 5.33 |
| Simojoki | 3157.21 | 0.09 | 1.32 | 78.96 | 14.43 | 5.19 |
| Kemijoki | 51086.43 | 0.25 | 0.52 | 77.43 | 17.67 | 4.14 |
| Paatsjoki | 14686.46 | 0.10 | 0.00 | 76.04 | 12.07 | 11.79 |

| River | Period | TOC [mg/l] | Change [%] | Q [m ³ /s] | Change [%] |
|---------------|-----------|------------|------------|-----------------------|------------|
| Kiiminginjoki | 2000-2006 | 14.54 | | 37.13 | |
| | 2007-2012 | 17.34 | 16.15 | 48.77 | 23.87 |
| | 2013-2018 | 17.04 | -1.76 | 50.22 | 2.89 |
| Iijoki | 2000-2006 | 10.05 | | 157.3 | |
| | 2007-2012 | 12.02 | 16.39 | 179.31 | 12.27 |
| | 2013-2018 | 12.38 | 2.91 | 190.12 | 5.69 |
| Simojoki | 2000-2006 | 11.69 | | 41.84 | |
| | 2007-2012 | 13.69 | 14.61 | 43.22 | 3.19 |
| | 2013-2018 | 11.83 | -15.72 | 44.9 | 3.74 |
| Paatsjoki | 2000-2006 | 2.72 | | 158.32 | |
| | 2007-2012 | 2.81 | 3.20 | 167.12 | 5.27 |
| | 2013-2018 | 2.69 | -4.46 | 169.83 | 1.60 |

Legend: Increase (Green), Decrease (Red)

Changes in TOC and Discharge

- Paatsjoki and Iijoki are regulated rivers
- TOC samples were taken, approximately, twice a month, whilst discharge measurements are taken daily
- Simojoki shows the largest decrease in TOC during the period 2013-2018
- At Paatsjoki, TOC and discharge variations are the lowest of all the studied catchments
- Temperature has been constantly increasing during the studied period in all catchments (0.4 – 2 °C)

| | 2000-2006 | | 2006-2012 | | 2012-2018 | | Total |
|---------------|-----------|------|-----------|------|-----------|------|-------|
| | ha | % | ha | % | ha | % | |
| Kiiminginjoki | 4745 | 1.25 | 4020 | 1.06 | 3673 | 0.96 | 3.26 |
| | 3613 | 0.95 | 1919 | 0.50 | 6047 | 1.59 | 3.04 |
| Iijoki | 19884 | 1.40 | 22298 | 1.57 | 17624 | 1.24 | 4.22 |
| | 21234 | 1.50 | 16453 | 1.16 | 24100 | 1.70 | 4.36 |
| Simojoki | 1851 | 0.59 | 2455 | 0.78 | 1878 | 0.59 | 1.96 |
| | 5042 | 1.60 | 5804 | 1.84 | 2597 | 0.82 | 4.26 |
| Paatsjoki | 4563 | 0.31 | 2213 | 0.15 | 1435 | 0.10 | 0.56 |
| | 1714 | 0.12 | 1885 | 0.13 | 5559 | 0.38 | 0.62 |

Legend: Forest to Scrub (Cutting) (Blue), Scrub to Forest (Growth) (Green)

Land use change

- I. SO₄ concentration and temperature are the most influential factors on changes in TOC concentration
- II. Changes in TOC are mostly found in catchments with higher forest cover, unlike expected, as wetlands are considered to be more influential on TOC changes
- III. Simojoki presents the largest difference between cutting and forest growth
- IV. Forest ditching is the individual forestry measure that has high impact in increase of TOC concentration
- V. However, in the whole of Finland, there is a balance as reforestation and 70% of the ditched peatlands currently have forest status

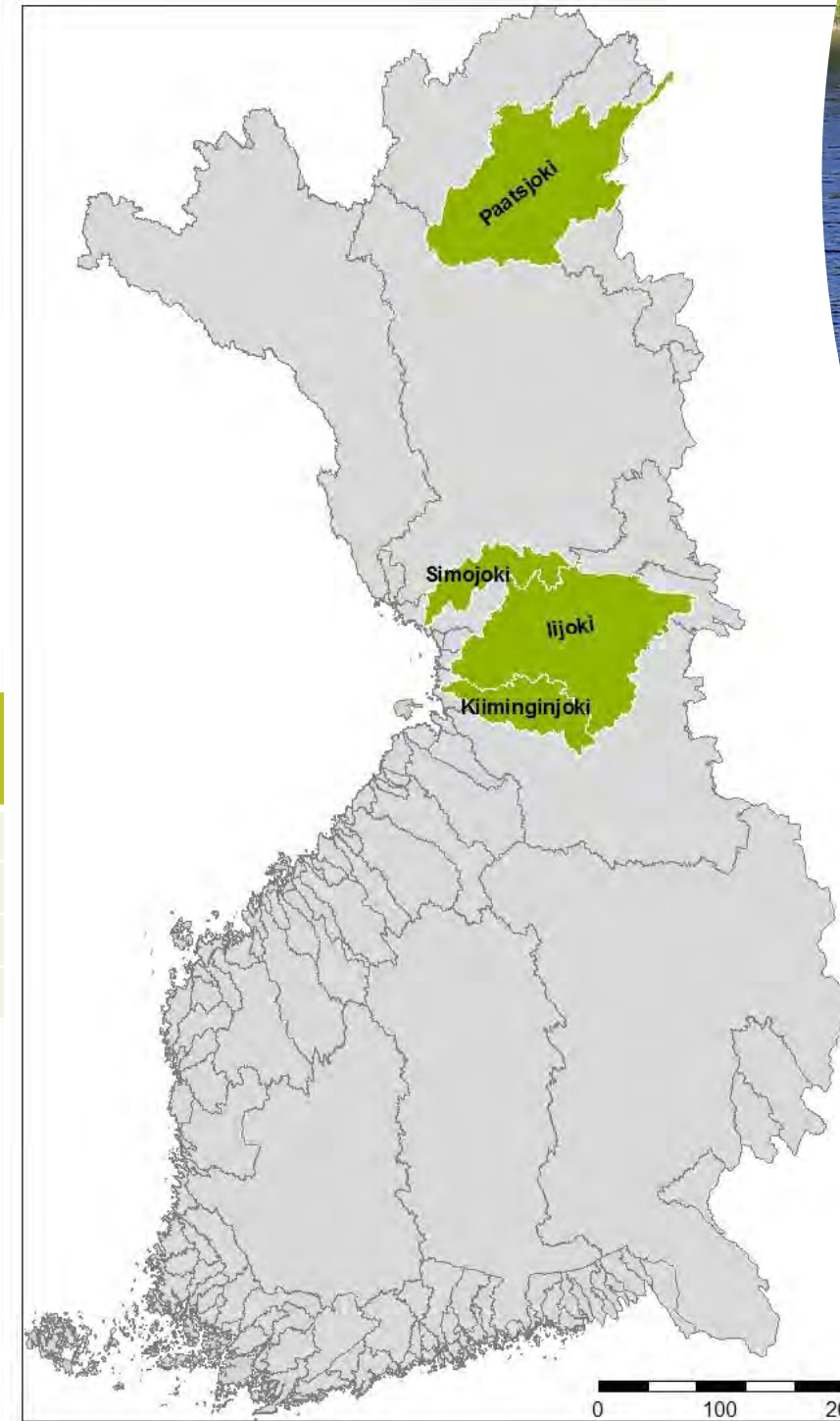
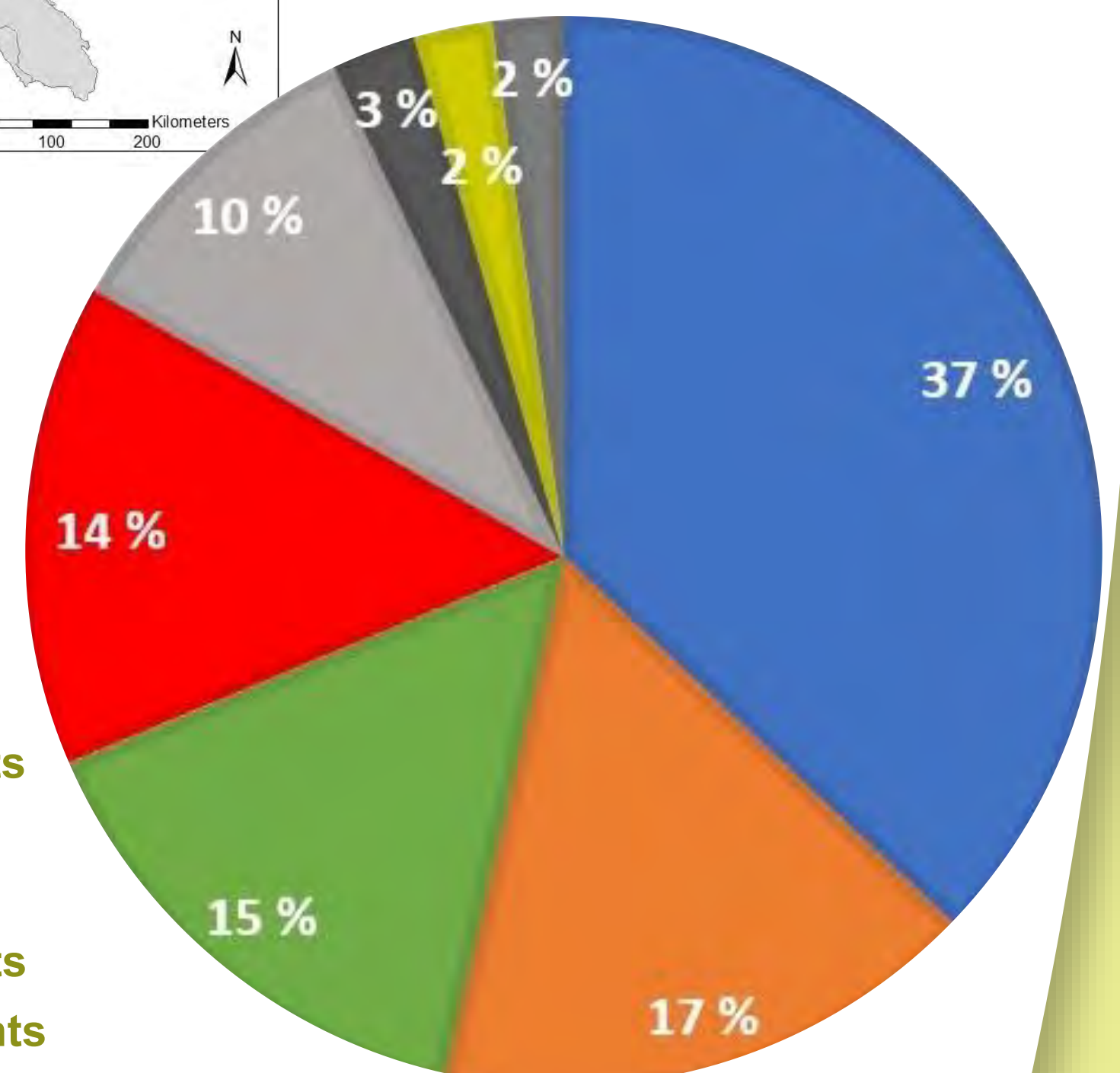


Photo: José Enrique Cano Bernal



Legend for Influence on TOC concentration: SO₄ Concentration (Blue), Temperature (Orange), Lake (Green), Agriculture (Red), Ditching (Grey), Precipitation (Dark Grey), Forest to Scrub (Yellow), Wetlands to Forest (Dark Blue)