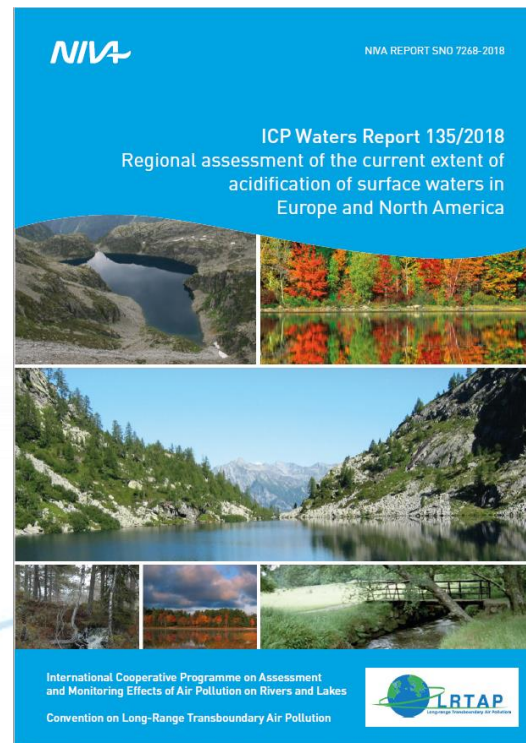


Regional assessment of the current extent of acidification of surface waters in Europe and North America

Kari Austnes, Julian Aherne, Jens Arle, Marina Čičendajeva, Suzanne Couture, Jens Fölster, Øyvind Garmo, Jakub Hruška, Don Monteith, Max Posch, Michela Rogora, James Sample, Brit Lisa Skjelkvåle, Sandra Steingruber, John L. Stoddard, Rafał Ulańczyk, Herman van Dam, Manuel Toro Velasco, Jussi Vuorenmaa, Richard F. Wright, Heleen de Wit

35th ICP M&M Task Force meeting
Madrid 2-4 April 2019



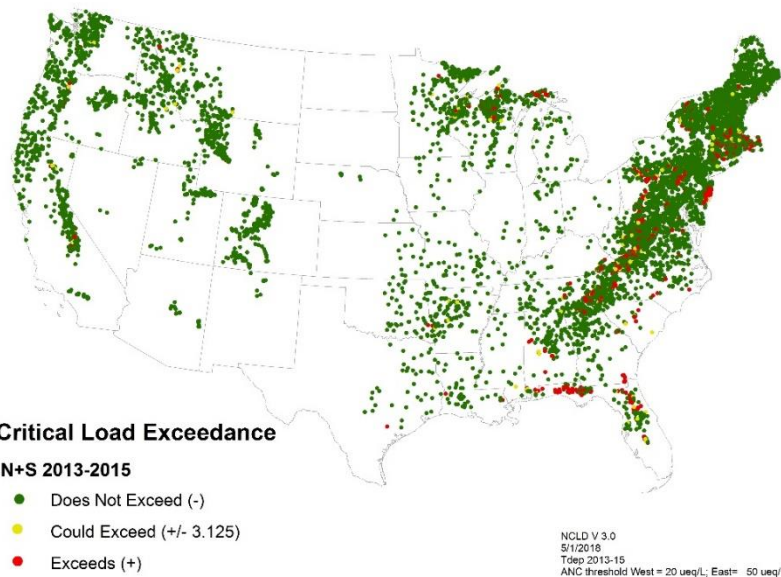
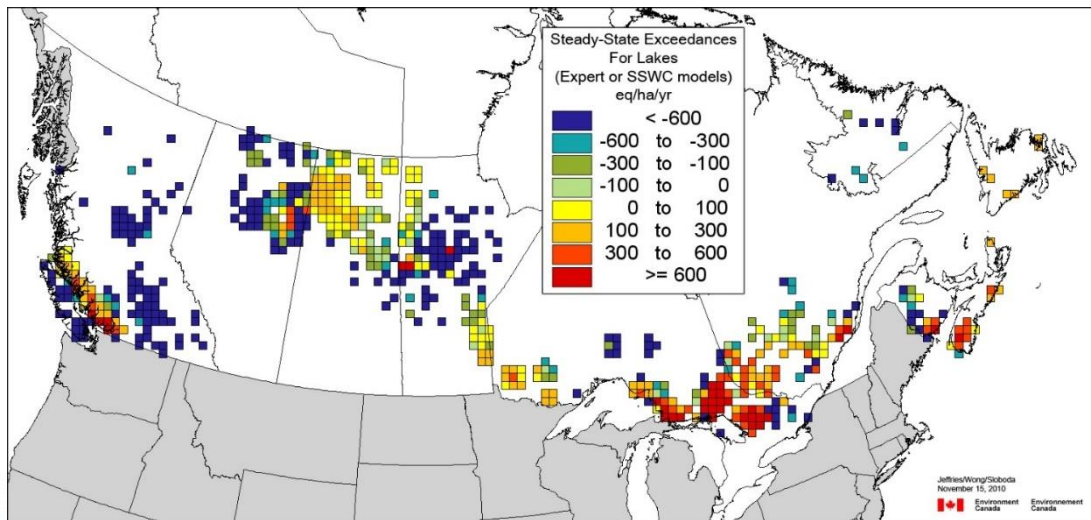
Background

- Deposition has declined and the extent and severity of surface water acidification is reduced
 - What is the current situation on a broad regional scale?
 - Is the information sufficient for all relevant areas?
- Exceedance of critical loads for surface water acidification is reduced
 - Acidification may still prevail due to lag effects
 - Is the current legislation sufficient to reach non-exceedance?

Approach

- Potentially acidified surface waters
 - Exceedance of critical loads
 - Acid-sensitivity and deposition maps
- Acidification status
 - Data from national monitoring programmes
 - Data reported under the Water Framework Directive
- Country reports
- Literature review

CL exceedance North America

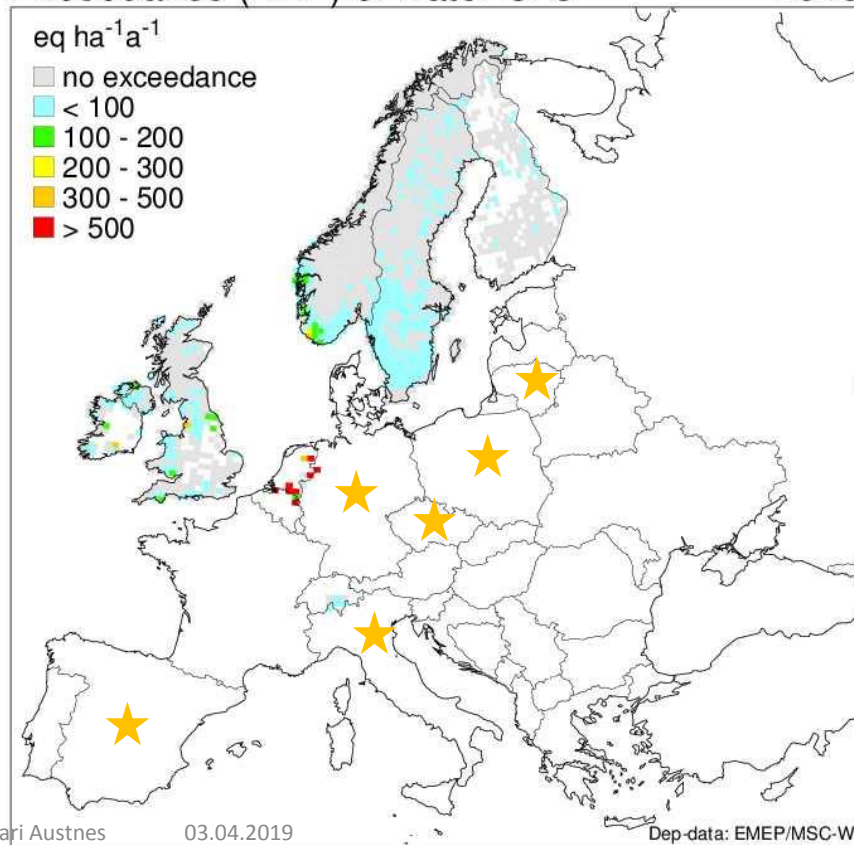


- Exceedance limited to certain regions, but large areas
- Used as background information only – good data on current status

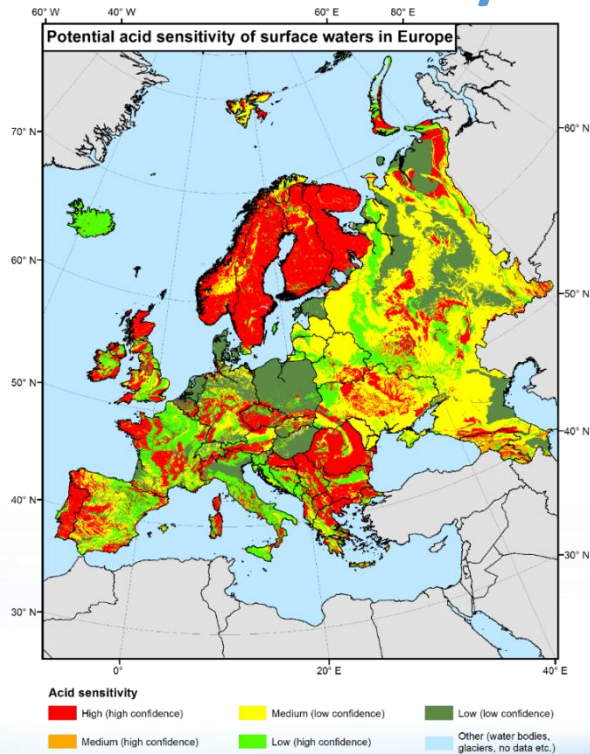
Potentially acidified areas in Europe

- CLs for water available from 7 countries only
- Country reports from an additional 6 countries

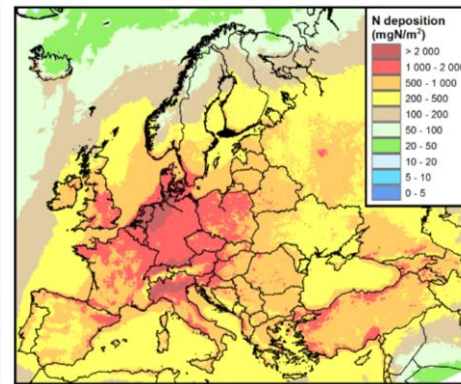
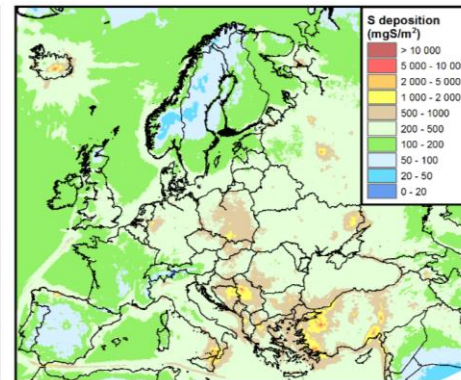
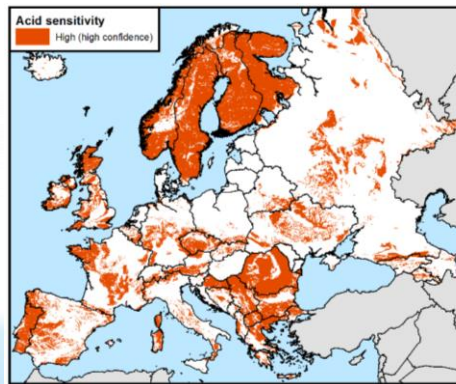
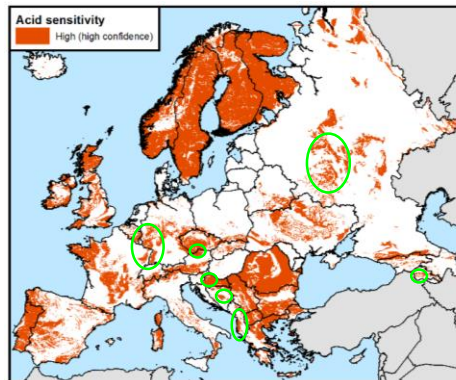
Exceedance (AAE) of water CLs 2015



Potentially acidified areas in Europe

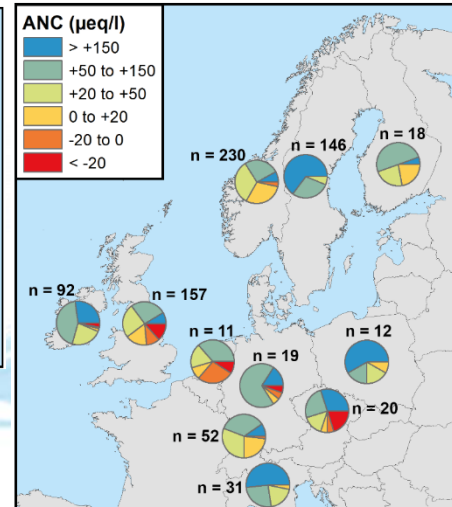
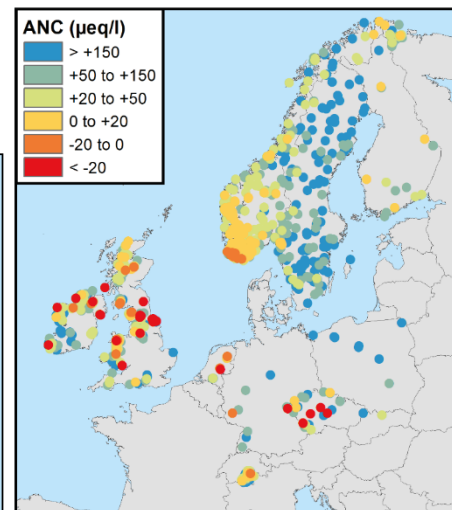
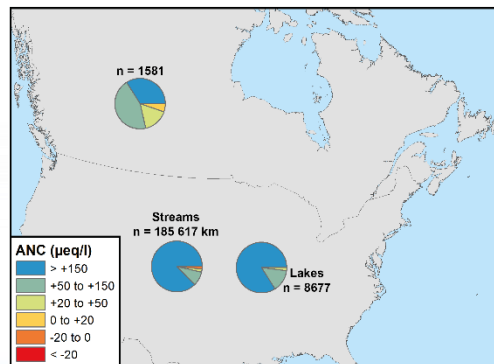
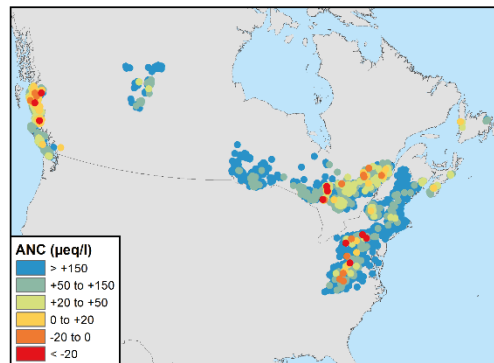


Based on lithological classifications from Hartmann J & Moosdorf N. 2012. *The new global lithological map database GLIM: a representation of rock properties at the Earth surface*. *Geochemistry, Geophysics, Geosystems* 13, 12. DOI: 10.1029/2012GC004370.



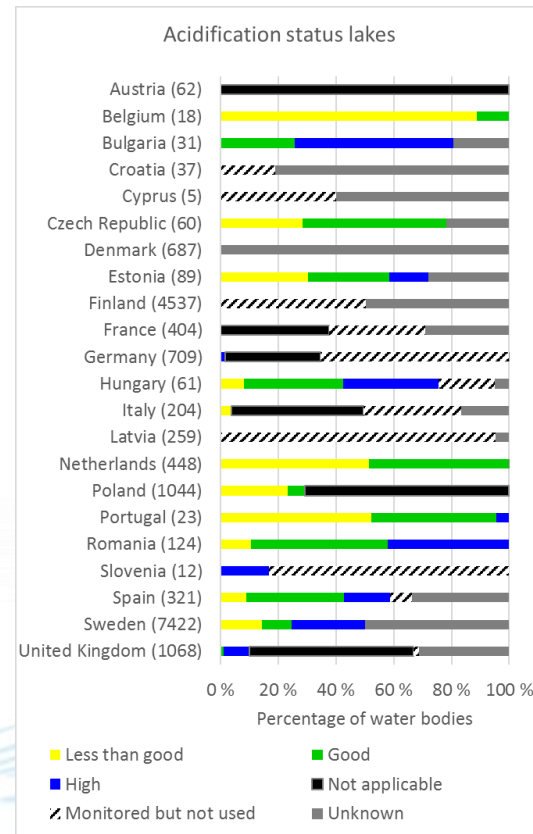
National monitoring data

- From acid-sensitive regions only
- Critical limit depends on lake/stream type
 - Usually 0-50 $\mu\text{eq/l}$
- Not directly comparable: Range from representative to targeted monitoring
- Extent vs severity
 - Regional issue and/or local hot-spots
- Acidification still widespread



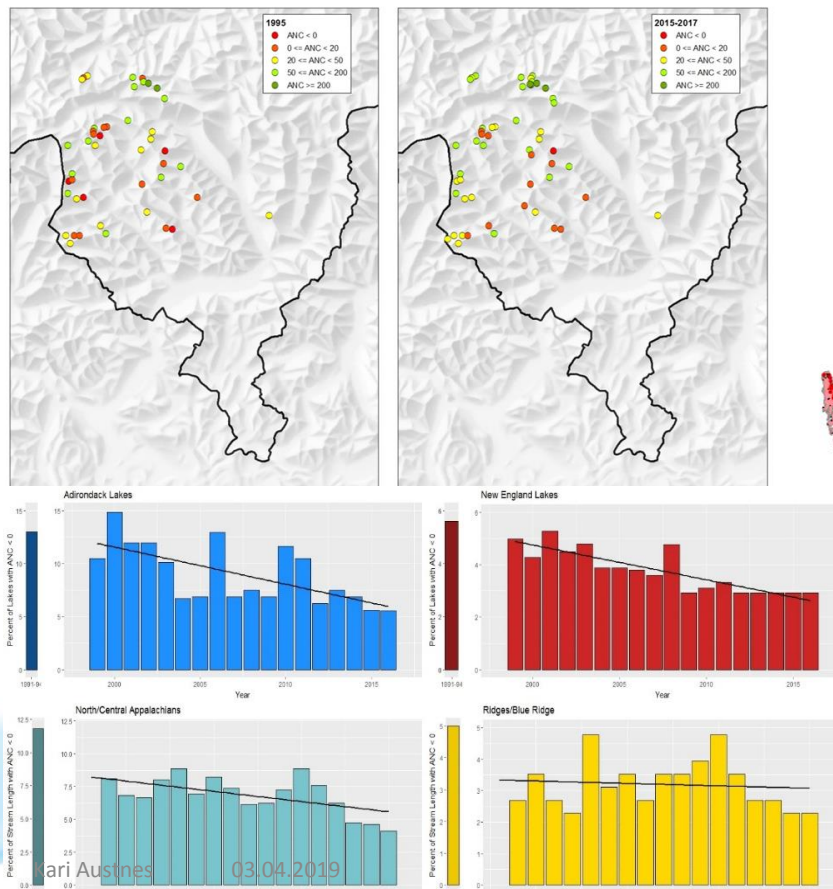
Water Framework Directive

- Addresses larger water bodies
- Ambiguous and uncertain source of information on acidification status
 - Lack of reporting
 - Criteria unclear and variable
 - Mismatch information on ecological status, acidification status, acidification impact and atmospheric deposition pressure
- Limited value in assessing current extent of acidification, despite good coverage



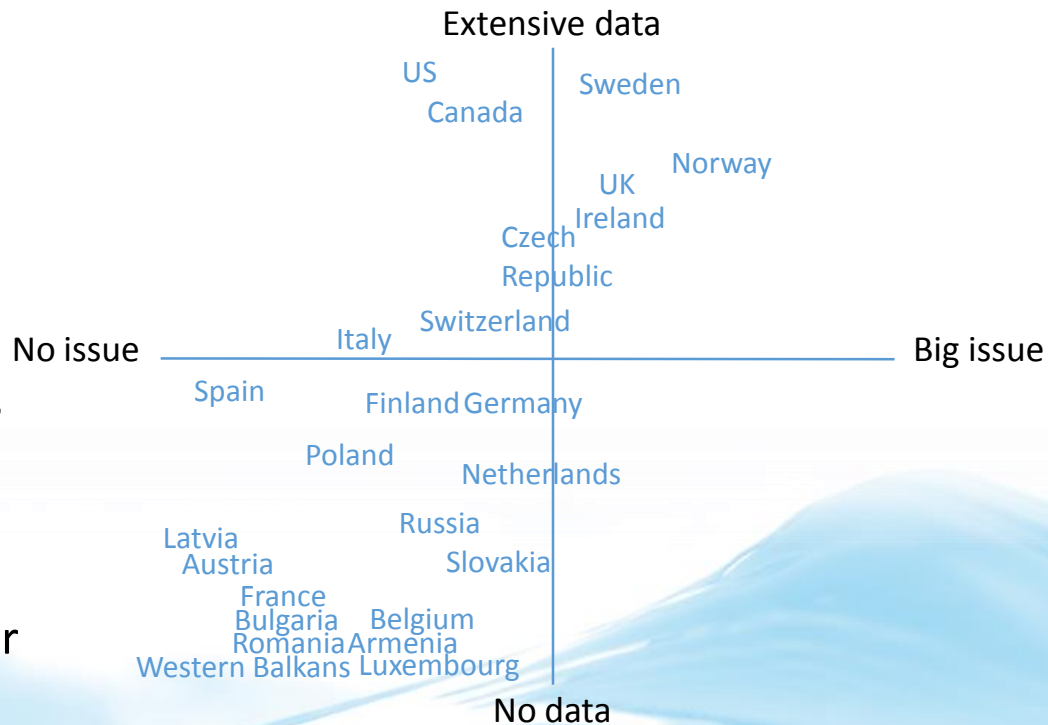
Country reports

- More detailed information on acid sensitivity
- Current status in different regions
- Case studies, trends, modelling, outlook



Current extent of acidification

- Rough summary across all information sources
- Potential issues in some of the countries not submitting data/reports, but limited information
 - No recent studies
 - Single studies, but no regular monitoring (?)

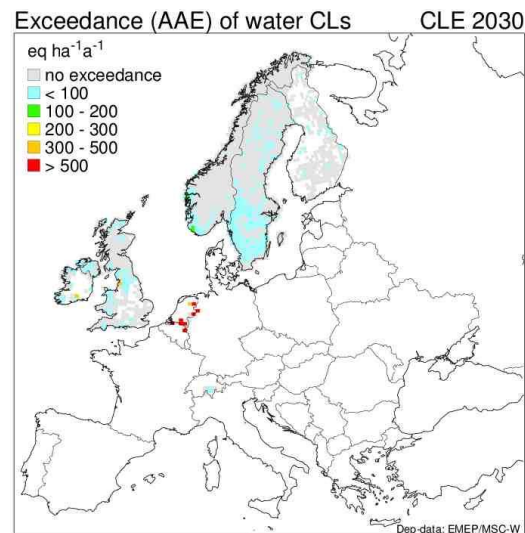
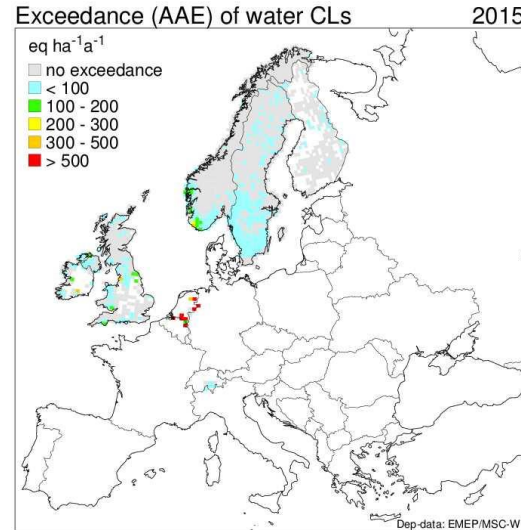
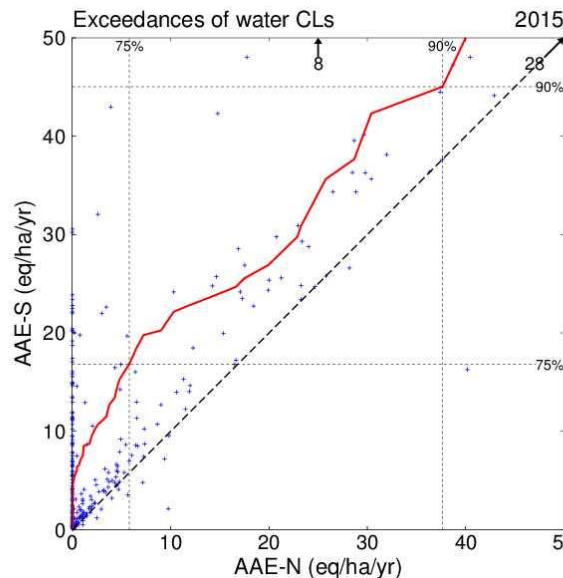


Do we have sufficient information?

- Low/reduced monitoring in some countries
 - Large-scale surveys rare
- More information needed from identified potentially acidified regions
- WFD monitoring not sufficient
- NEC Directive monitoring essential
 - Targeted at potentially sensitive water bodies
 - Can reverse decline in monitoring

Outlook – critical loads

- CLs for water still exceeded
 - In most cases not very large exceedance
 - S dep constitutes the largest part of the exceedance
- Critical loads still exceeded in 2030
- Water CLs for more countries would be beneficial



Outlook – surface water acidification

- Recovery is observed, but is far from complete
 - Lag time in chemical recovery due to slow base cation replenishment
 - Biological recovery requires
 - Stable chemistry above critical limits
 - Species dispersal
 - Climate change and intensified forestry may counteract recovery
- Deposition below CLs will increase the *rate* of recovery
- Posch et al. 2019 ES&T (just out!): Target loads for 2050
 - Target loads lower than critical loads at 15% of the sites (n=848)
 - 5% of the sites still acidified in 2050 even if deposition reduced to zero in 2020
- Further emission reductions needed!