ICP Waters

International Cooperative Programme Assessment and Monitoring Effects of Air Pollution on Rivers and Lakes

Activities and plans 2014

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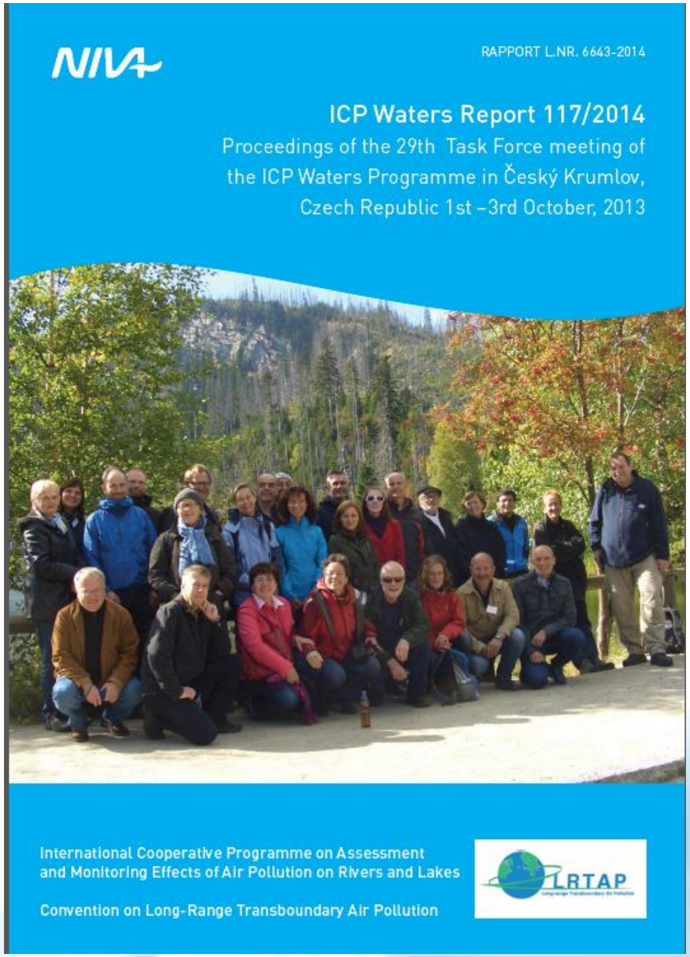
Programme aims

- Assess the degree and geographic extent of the impact of atmospheric pollution, in particular acidification, on surface waters
- Collect information to evaluate dose/response relationships
- Describe and evaluate long-term trends and variation in aquatic chemistry and biota attributable to atmospheric pollution

Task Force meeting October 2013

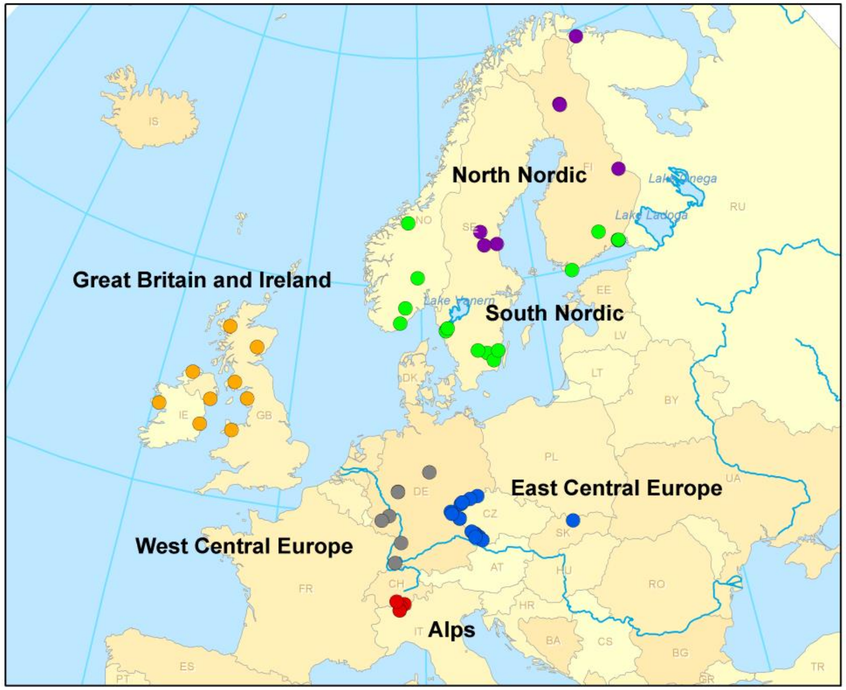
- Cesky Krumlov, Czech Republic
  - Ecosystem services
  - Biodiversity
  - Chemical and biological recovery
  - Mercury
  - Dynamic modelling

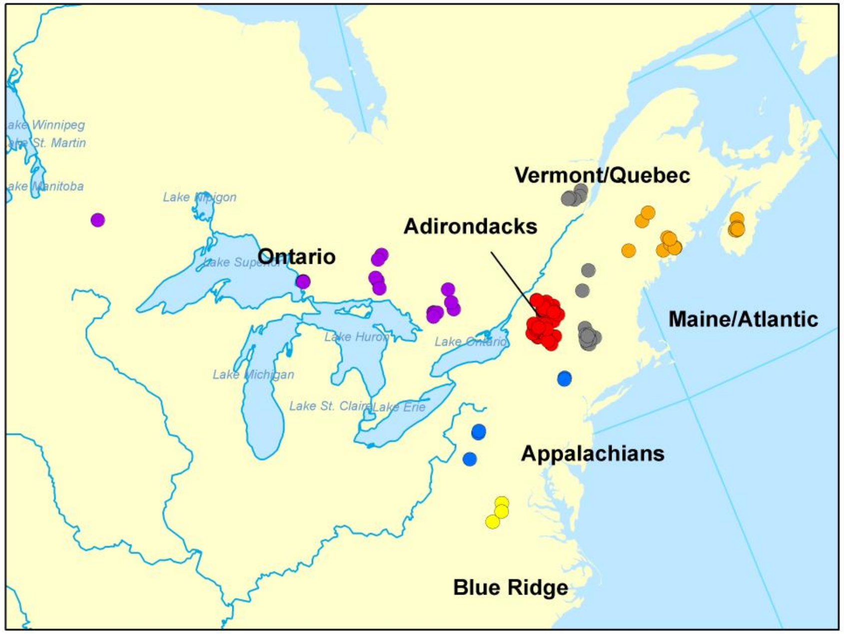


Status of participation October 2013

Armenia	Ireland
Austria	Latvia
Belarus	Montenegro
Canada	Norway
Croatia	Poland
Czech Republic	Russia
Estonia	Spain
Finland	Sweden
France	Switzerland
Germany	UK
Italy	USA

22 countries





	Chemical data	Biological data	Participation in TF meetings 2011-2013	Participating in chemical intercomparison	Participating in biological intercalibration 2011-2013
Armenia	2013		•		
Austria	2013		•	•	
Belarus	2012				
Canada	2012		•	•	
Croatia			•		
Czech Rep.	2013	2011	•	•	•
Estonia	2013		•	•	•
Finland	2013		•	•	
France				•	
Germany	2013	2010	•	•	•
Ireland	2013	2012	•	•	
Italy	2013		•	•	
Latvia	2013	2012	•	•	•
Montenegro	2012				
Netherlands			•	•	
Norway	2013	2012	•	•	•
Poland	2013		•	•	
Russia			•	•	
Spain	2012		•	•	
Sweden	2013	2012	•	•	•
Switzerland	2013	2011	•	•	•
UK	2013	2010	•	•	•
USA	2012		•	•	
Total	**19**	**8**	**20**	**19**	**8**

Publication of trend analysis

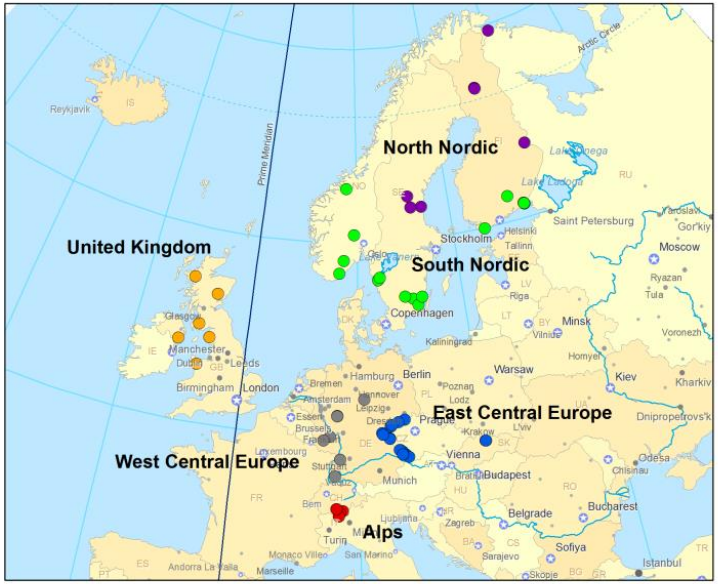
Water, Air, & Soil Pollution
February 2014, 225:1880

Trends in Surface Water Chemistry in Acidified Areas in Europe and North America from 1990 to 2008

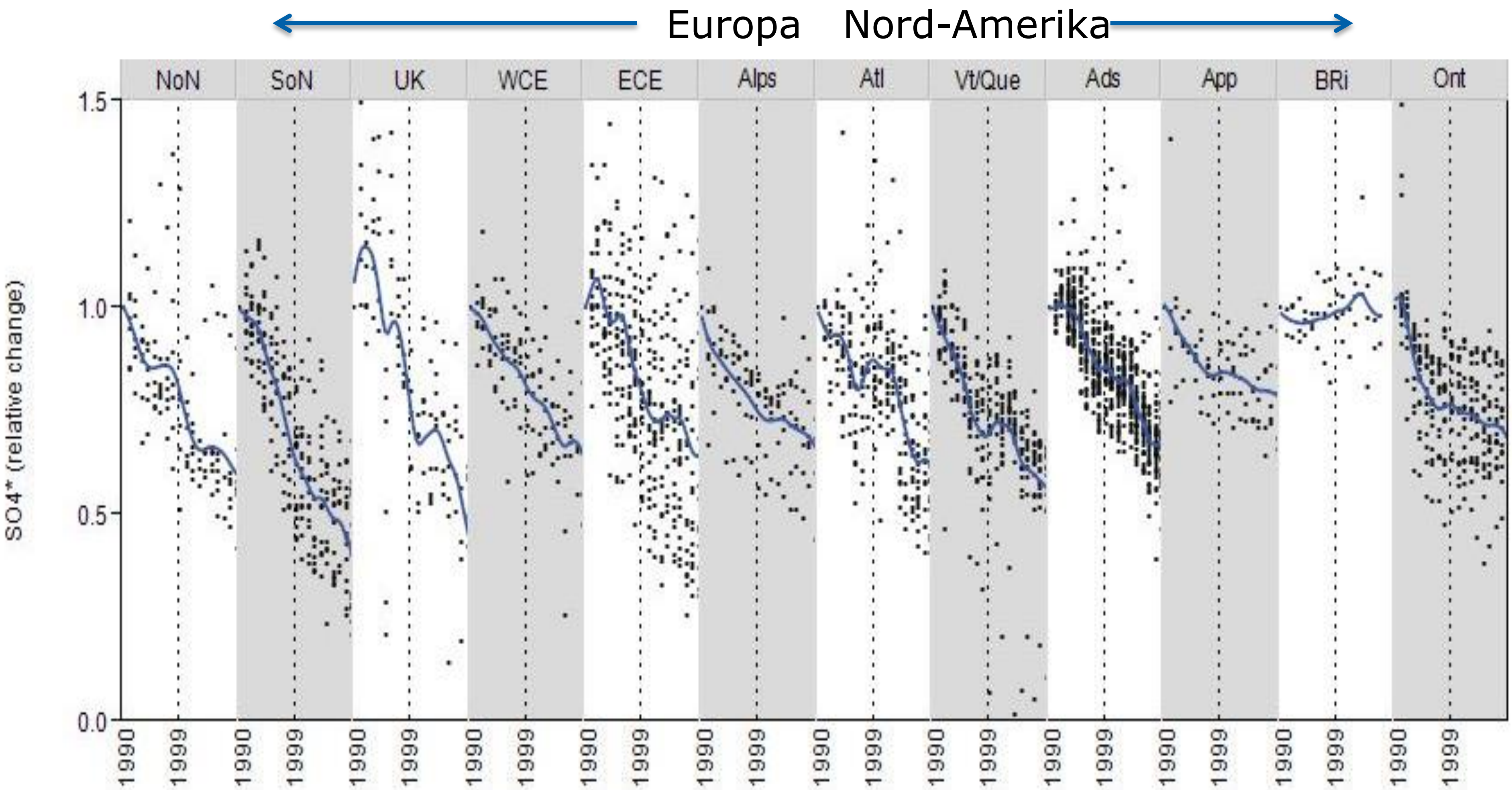
Øyvind A. Garmo, Brit Lisa Skjelkvåle, Heleen A. de Wit, Luca Colombo, Chris Curtis, Jens Fölster, Andreas Hoffmann, Jakub Hruška, Tore Høgåsen, Dean S. Jeffries, W. Bill Keller, Pavel Krám, Vladimir Majer, Don T. Monteith, Andrew M. Paterson, Michela Rogora, Dorota Rzychon, Sandra Steingruber, John L. Stoddard, Jussi Vuorenmaa, Adam Worsztynowicz

Publication of trend analysis

- Trend analysis of >170 stations in acid-sensitive regions in North America and Europe
- Key components of water chemistry 1990-2008



Downward trends in sulfate



Clear improvement water quality

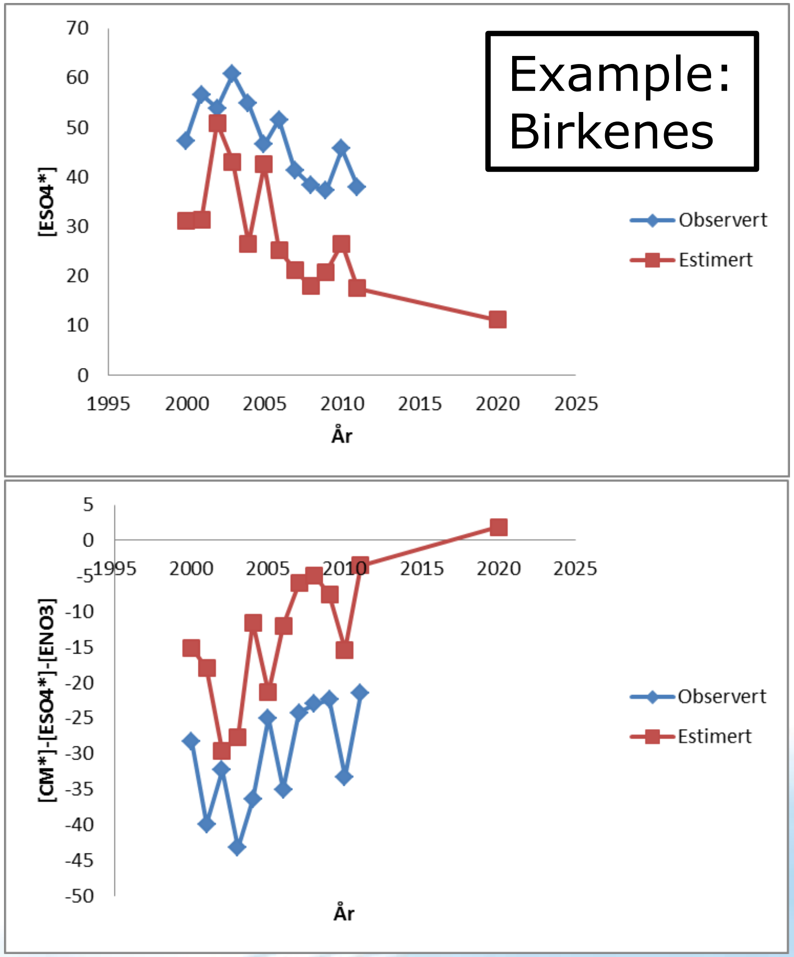
- Positive trends in pH, alkalinity, ANC
- Tendency to slower improvements after 2000
- Many regions remain clearly acidified
- Some biological recovery can be expected

2014: New report water chemistry in Europe and North America

- Key questions:
  - If all emission reductions are implemented, what will be the state of acid-sensitive surface waters?
  - Do data and model predictions agree?
- Approach
  - Calculate recent (2000-2012) and expected water chemistry in 2020 given emission reduction scenarios, using steady-state model
  - Comparison of observed (2000-2012) and modelled trends in water chemistry for ca 200 sites

Data

- Input data:
  - water chemistry, estimated average runoff (1960-1990), estimated trends and scenarios for deposition of S and N (EMEP; CCE)
- Co-operation ICP IM
  - Include ICP IM acid-sensitive sites
  - Optional: validation of approach in separate chapter
    - ICP IM has site-specific data



Trends: common item for (all?) ICPs

- In 2015, a common report for all ICPs will be prepared with focus on trends in effects related to long-range transported air pollution

New reports:

- **ICPW 114/2013.** Biodiversity in freshwaters: temporal trends and response to water chemistry
- **ICPW 115/2013.** Effects of long range transported air pollution (LRTAP) on freshwater ecosystem services
- **ICPW 116/2014.** Intercomparison 1327: pH, Conductivity, Alkalinity, NO3-N, Cl, SO4, Ca, Mg, Na, K, TOC, Al, Fe, Mn, Cd, Pb, Cu, Ni and Zn
- **ICPW 117/2014.** Proceedings of the 28th TF meeting of ICP Waters in Cesky Krumlov, Czech Republic, October 1 – 3, 2013.
- **ICPW 118/2014.** Biological intercalibration: Invertebrates 1713

Other activities in 2014

- Data harmonisation and quality control
  - Chemical intercomparison
  - Biological intercomparison
- Preparation of 2015 report on biodiversity and climate
  - Biodiversity indices and acidification indices
- Evaluation of critical load maps for surface waters
  - In co-operation with focal point ICP M&M
  - Guidance document: Areas at risk for acidification in Norway - 2%
    - Disagreement with national estimates of CL exceedance
    - Does use of modelled EMEP deposition result in a systematical bias in calculation of exceedance of critical loads?
  - Comparison critical load maps under CLTRAP and WFD

ICP IM and ICP Waters

Possible areas of cooperation

- Trend analyses (ongoing)
- Hg?
- Coordination of work plans?
- Common/back-to-back TF-meetings?
- ?
- ?

Comparison of CLTRAP and WFD (Water Framework Directive) approach to protect surface waters from acidification– a Norwegian case study

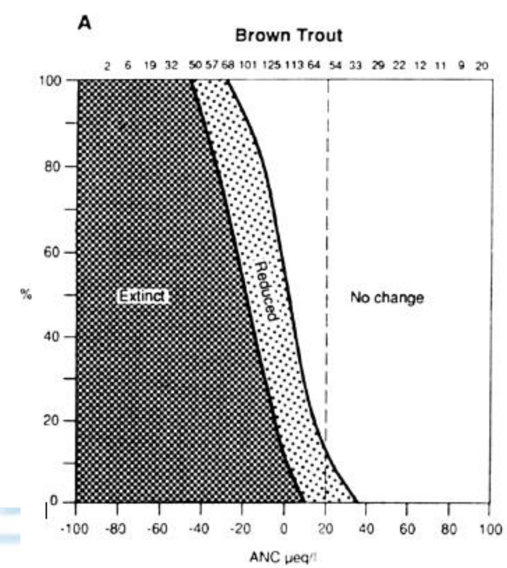
Kari Austnes, NIVA
(Norwegian NFC for ICP M&M)

Background

- Two ways of protecting acid-sensitive surface waters from acidification
  - LRTAP: Acid deposition < the critical load (CL)
    - International approach with national variations, focus: international policy for reduction of emissions
  - WFD: Ecological indicators (quality elements) > boundary values for achieving good ecological status
    - International & national approaches, focus: local policy to protect waters
- Acid Neutralizing Capacity (ANC) is central chemical criterion linking water chemistry to biological effects
  - Aim: Compare two approaches by calculating area where critical loads (CLRTAP) or good/moderate limit values (WFD) are exceeded

CLTRAP: Critical loads (CL) for surface waters

- ANC_{limit} is link chemistry-biology
  - $CL(A) = BC_0 - ANC_{limit}$
    - BC_0: Flux of (non-marine) base cations from catchment in pre-acidification times
- ANC_{limit} is conceived as (fixed) 'system property'
  - Minimum ANC to avoid harmful effects on selected biota
    - Originally a fixed limit at 20 μeq/l
  - Adaptation - ANC can be variable
    - In catchments with very low BC_0 – can result in negative CL
      - Lower ANC_{limit}
    - In systems with high TOC
      - Organic acidity contributes to total acidity
      - Therefore a lower CL, and a higher ANC_{limit}

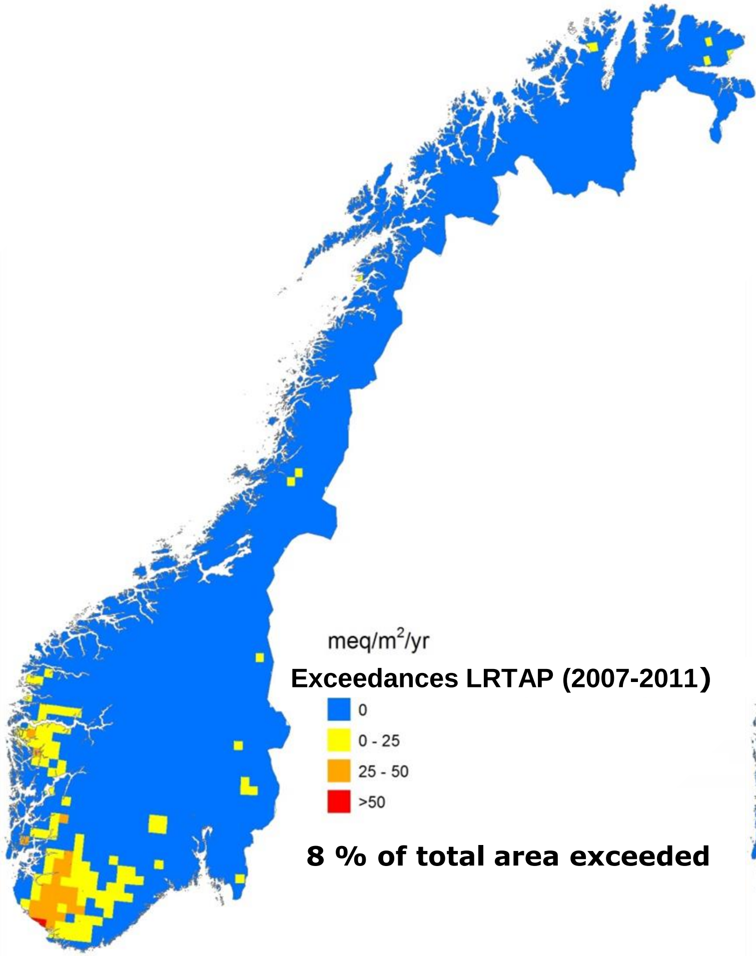


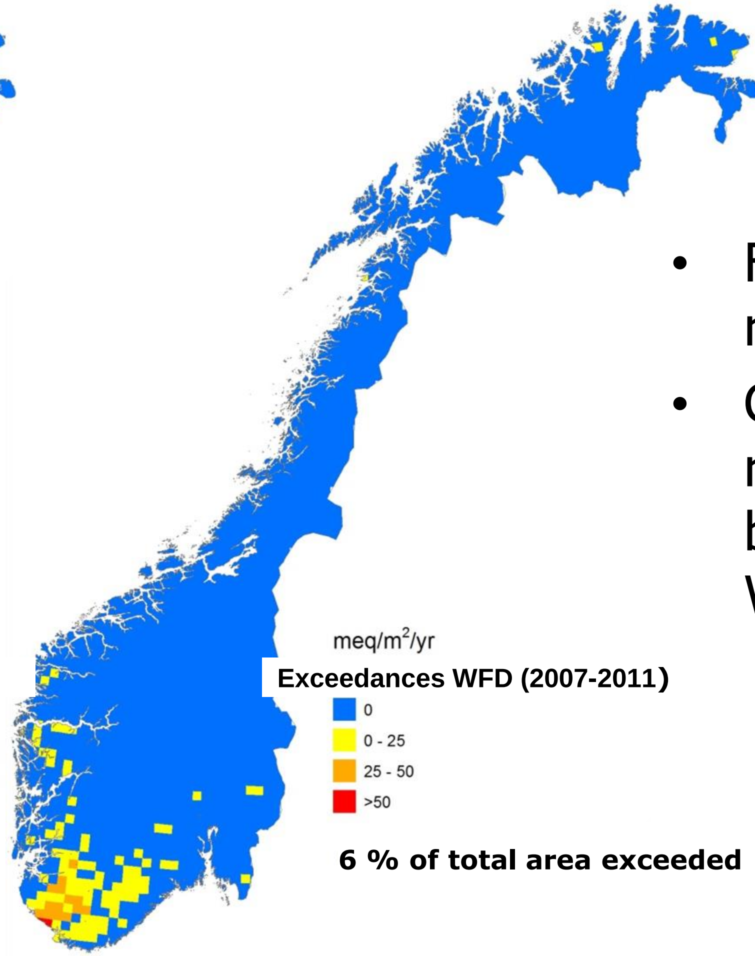
Lien et al. (1996)

WFD: boundary values

- Ecological status of surface waters evaluated based on quality elements and their boundary values
- Acidification: ANC
  - Reference status is 'natural conditions'
  - Different types of water bodies have different boundary values
    - Example: Clearwater and humic lakes
  - Five status classes from high to bad
  - Good status environmental target → the good/moderate (G/M) boundary essential
- Approach under WFD is under development in Norway

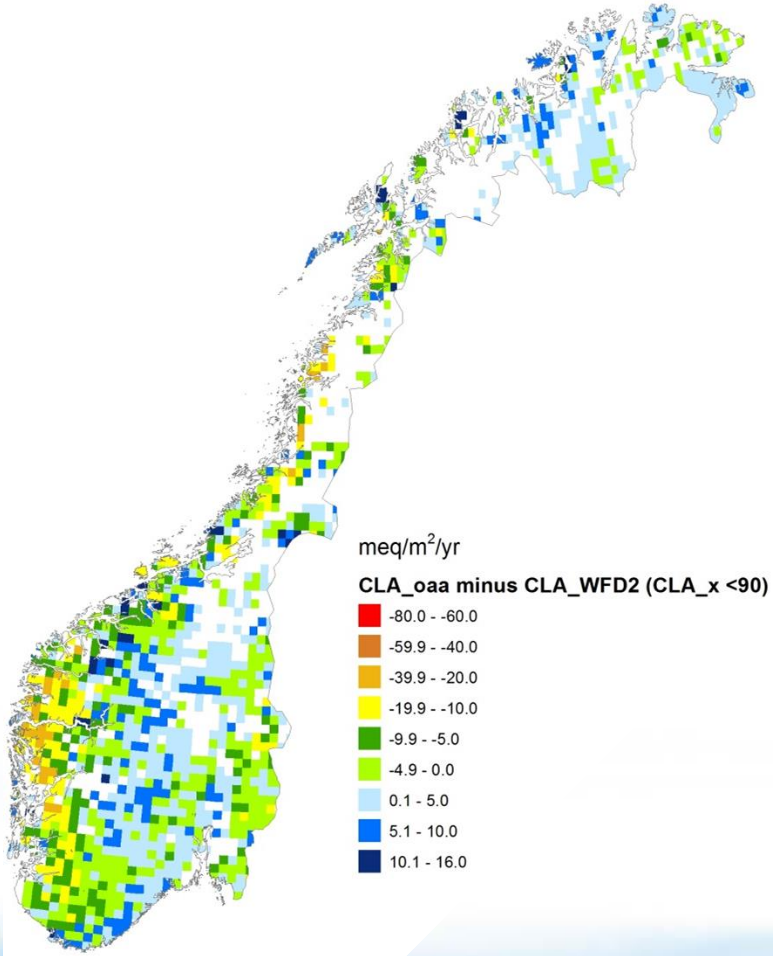
Critical load exceedance 2007-11: Comparison





- Fairly similar results
- CLTRAP requirements a bit stricter than WFD approach

Pixel-wise comparison of critical loads: CL_{cltrap} - CL_{WFD}

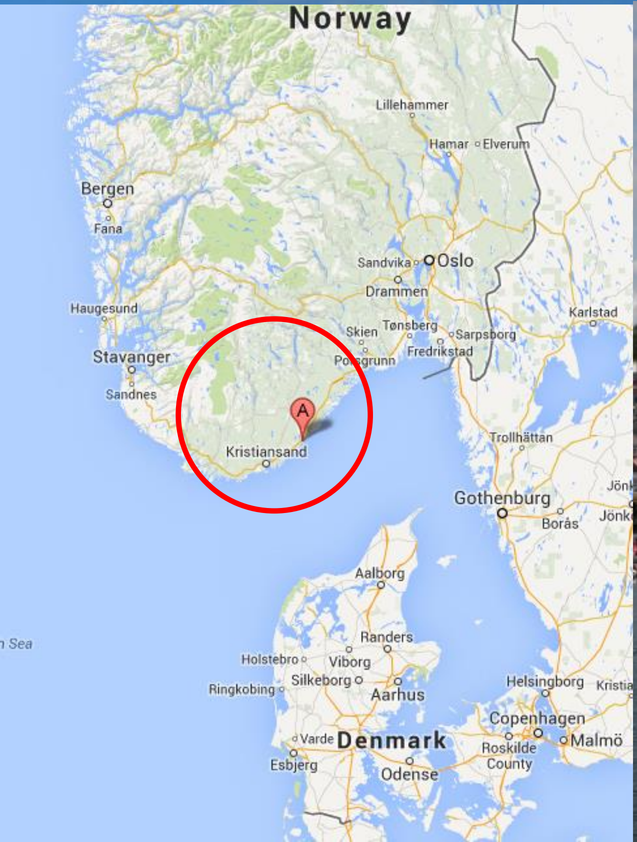


- Often CL_{cltrap} < CL_{WFD}
- Highest differences for high TOC surface waters and for low BC surface waters
- Slightly more strict requirements under CLTRAP than under WFD

Conclusion

- In Norway, WFD and CLTRAP approach for protection of acid-sensitive waters to acid deposition results in fairly similar exceedances of CLs (6% and 8%, resp.)
- However, for high-TOC lakes WFD appears to be ‘more lenient’ than CLTRAP
- Each country has their own WFD appraoch
  - How are acid-sensitive waters in UK, Ireland, Finland, Sweden… protected under WFD as compared with CLTRAP?

NIVA



Welcome to 2014 Task Force meeting, October 4-6 in Grimstad in Norway