

# Water

Monitoring methods, parameters, frequency,  
and reporting

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## ICP Waters

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



# About ICP Waters

Check out [www.icp-waters.no](http://www.icp-waters.no) for information about the work we do and overview of some of the data available from participating countries.

Contact: [hwi@niva.no](mailto:hwi@niva.no) or [oga@niva.no](mailto:oga@niva.no) if you have questions

# Impacts considered

Acidification, eutrophication and ozone damage are the air pollution impacts considered in this first phase of monitoring under the NECD.

Acidification and possible effects of nitrogen as a nutrient are relevant for rivers and lakes.

# Methods – sampling (water chemistry)

- Lakes
  - *Grab (bottle) sampling of mid-lake upper layer or lake outlet*
- Rivers
  - *Grab (bottle) sampling of river water.*
- Sensors deployed in situ can be a useful supplement in both rivers and lakes

# Methods – analysis (water chemistry)

CEN or ISO standard methods that are suitable for dilute waters should be used.

Exceptions:

- If no international standard exists
- If there are long time series based on other adequate methods used for the sites in question

# Chemical parameters - minimum

Parameter	Why it is important
Sulphate	Exposure indicator. Sulphur deposited in the catchment leaches to surface waters predominantly as sulphate.
Nitrate	Exposure indicator. Inorganic nitrogen leaches to surface waters predominantly as nitrate
Chloride	Used to estimate marine contribution of ions. Also exposure indicator (hydrochloric acid).
Calcium	Indicator of catchment sensitivity to acidification.
Magnesium	The 3 acid anions and 4 base cations listed in this table are used to calculate acid neutralising capacity (ANC)
Potassium	
Sodium	

# Chemical parameters – minimum (cont.)

Parameter	Why it is important
Alkalinity	Neutralising capacity determined through titration. Complementary to ANC.
DOC	Humic substances are natural acids. Also many other important effects.
pH	Intensity factor. Indicates the impact of acid deposition. Directly related to toxic effects of acidification
Conductivity	Indicator of ionic strength of the solution. Also used for assessing the quality of the analytical work.

# Other useful parameters for assessing the effects of air pollution (nitrogen and sulphur )

- Aluminium (labile or inorganic monomeric fraction)
- Total nitrogen and phosphorous
- Ammonium
- Discharge
- Temperature

# Biological indicators

Should be included in at least some sites to improve information about:

- Impacts of air pollution
- Recovery time when impacts are reduced
- Critical loads

# Biological parameters - suggestion

Measurement	Parameters	Frequency	Method	Data to be reported
<b>Biological indicators of air pollution (acidification). Benthic invertebrates in rivers and lakes.</b>	Presence/absence or number of individuals of particular groups/species	Seasonal to annual	Kick samples, littoral sampling or core samples. See Chapter 4. WFD methods are based on CEN and ISO-standards, and these are adequate.	Qualitative or quantitative data. <a href="http://www.icp-waters.no/data/submit-data/">http://www.icp-waters.no/data/submit-data/</a> Indexes such as MultiClear in lakes and Acidification index 2 for rivers, which are intercalibrated across EU

**Other groups such as fish, diatoms and periphyton can also be used as bioindicators of acidification.**

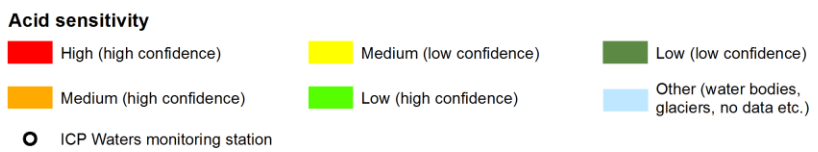
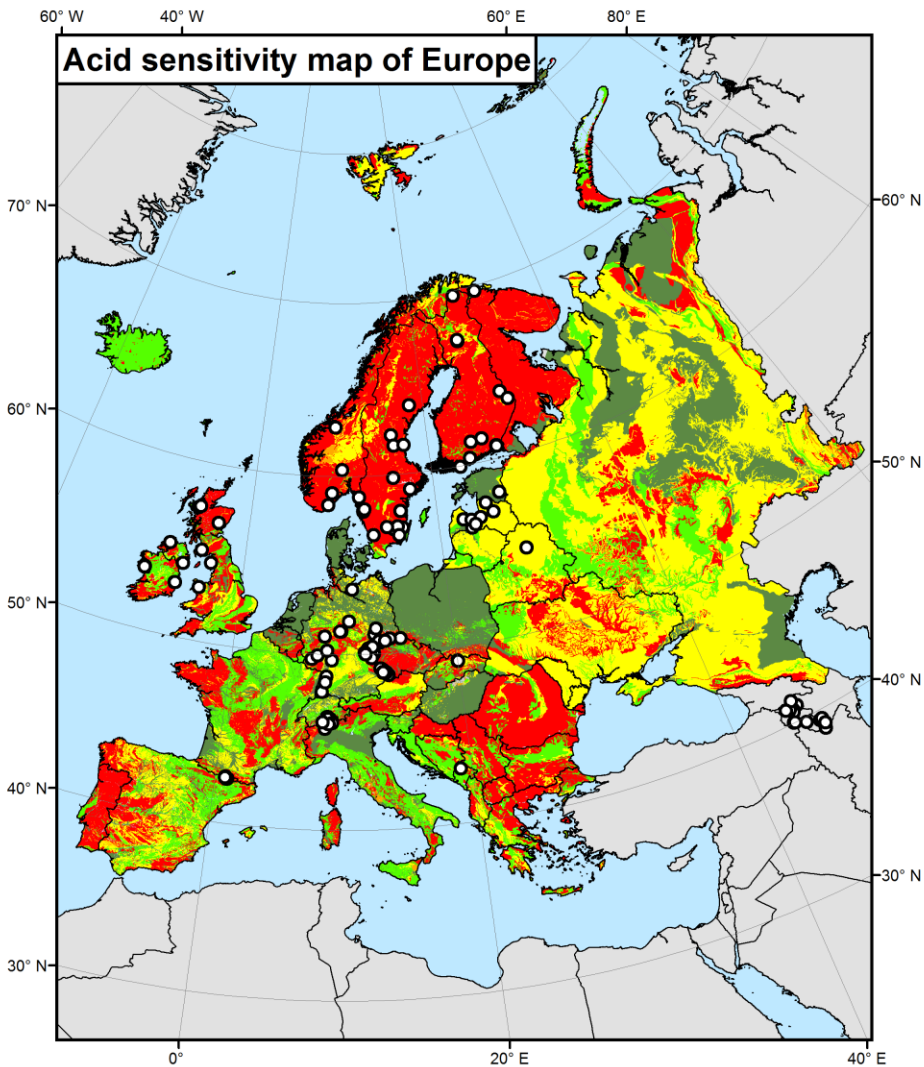
# Frequency of sampling

- Lakes
  - *Depends on the flush rate of the lake*
  - *Rapid exchange of water → more frequent sampling*
  - *Seasonal to annual (autumn turnover)*
- Rivers and streams
  - *Monthly*

# Frequency and parameter selection – tiered approach

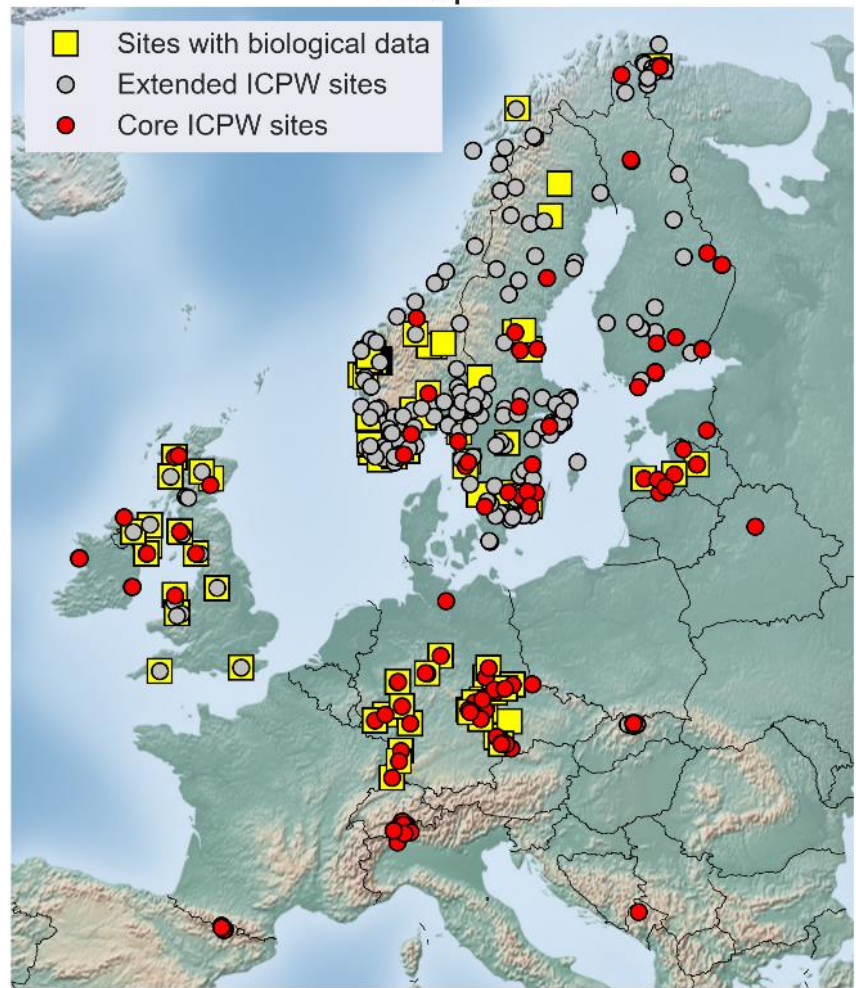
From Chapter 3.3 of the draft guidance:

For MS with many sensitive *rivers and lakes*, a tiered approach to monitoring may be appropriate, with wide-ranging monitoring of a relatively simple parameter set reinforced by more targeted and in-depth monitoring



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.

## Europe



# Reporting

- Information about the site
  - *Coordinates*
  - *Type (river or lake)*
  - *Catchment properties*
  - *Climate*
- Data
  - *ICP Waters provide suitable templates for reporting chemical parameters and benthic invertebrates.*