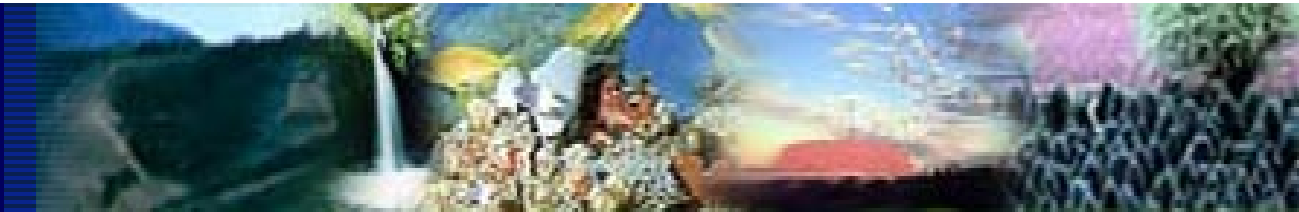
The UN Global Environmental Monitoring System for Water (GEMS/Water) Programme - Global Water Quality Monitoring, Assessment and Research

UNEP

GEMS Water



UNEP GEMS/Water Objective

To determine whether the water quality of lakes, reservoirs, rivers and ground waters improving or deteriorating?

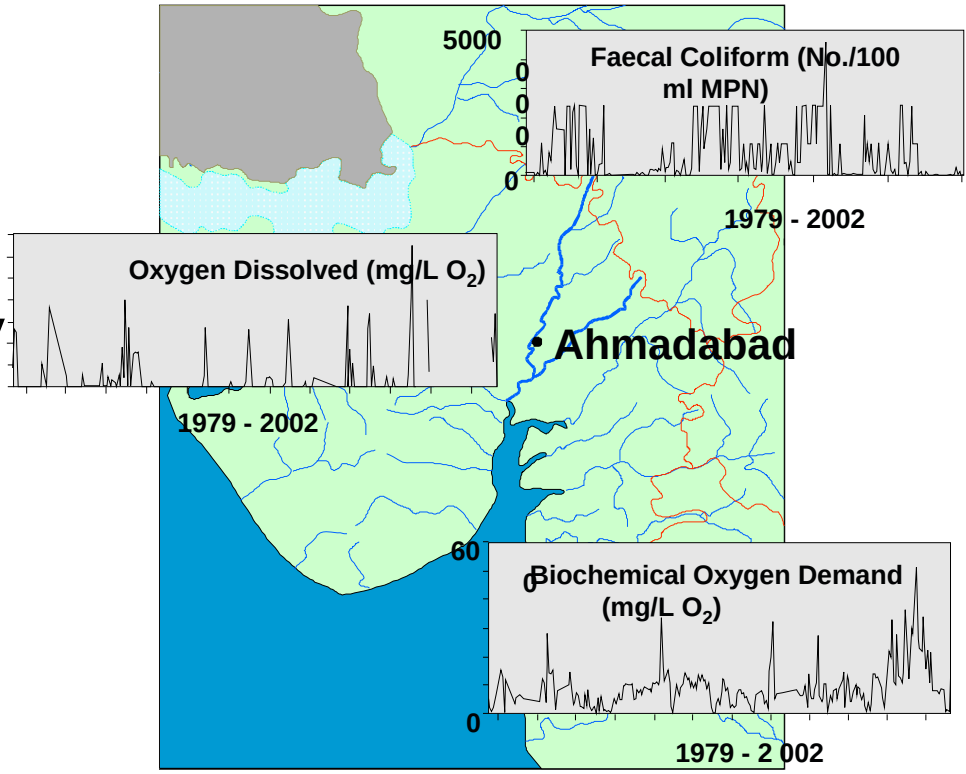
What does GEMS/Water do?

- Provides value to national-level data by integrating it with data from other countries so that it can be used in large geographic scale analyses
- Undertakes research and analysis, working with partners to enhance data sharing, use, and application to a diversity of issues globally.

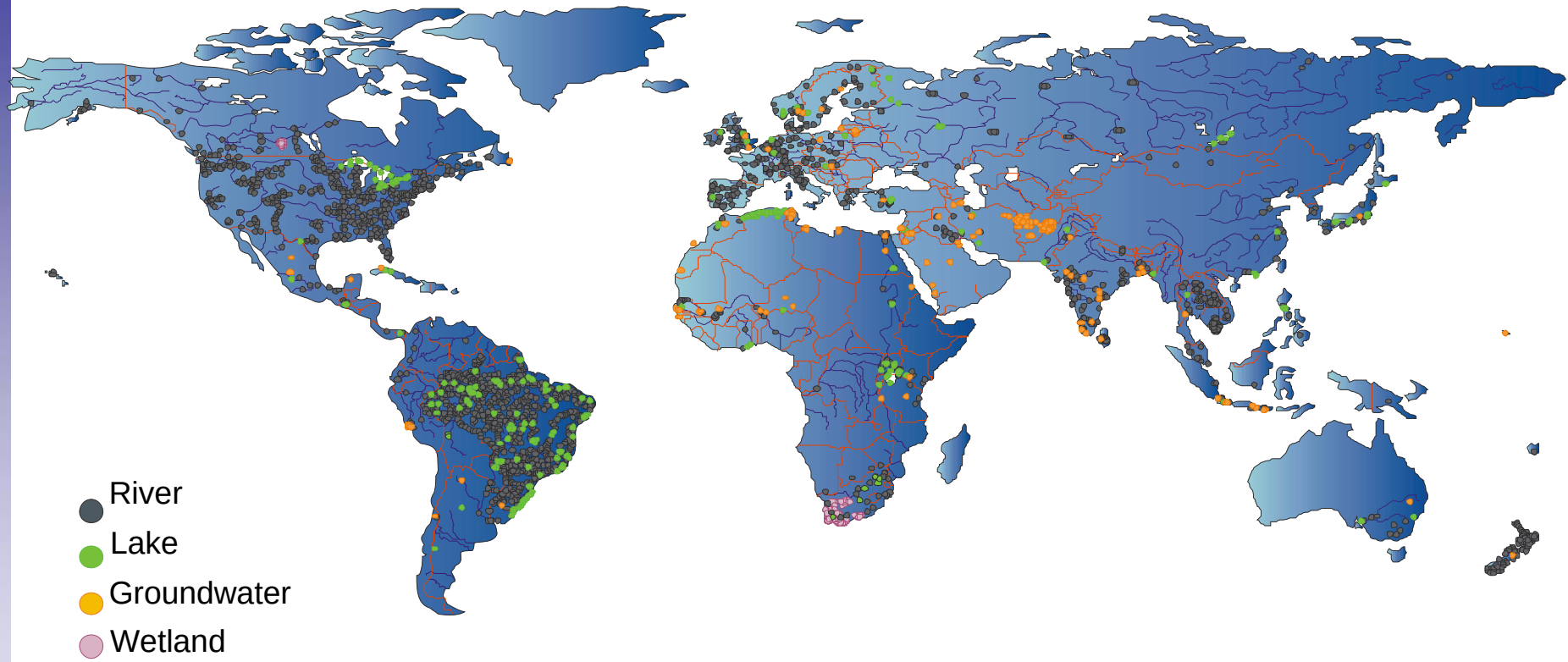
A Network of Networks

GEMS/Water has created a network of more than 100 participating countries that provide data to a central global database.

More recently, universities and other organizations are providing water quality data sets to GEMS/Water.

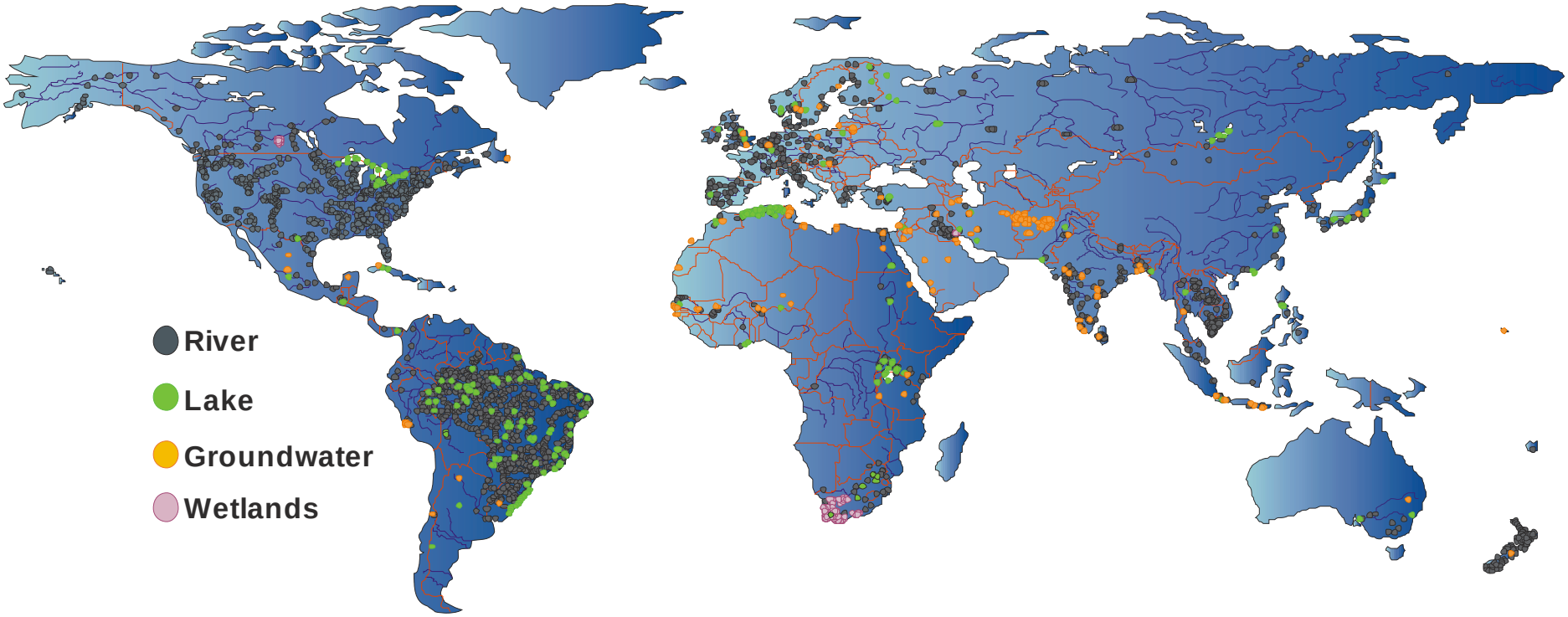


UNEP's GEMS/Water Global Network



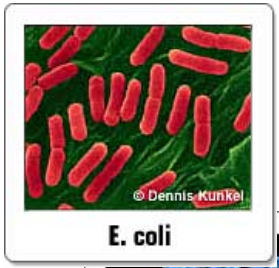
Region	Africa	Americas	Asia	Europe	Oceania	Totals
# of Stations	285	2051	441	343	95	3215
# of Values	277662	1743233	686843	943631	355061	4006430
Date Range	1977-2009	1965-2006	1971-2009	1978-2007	1979-2008	1965-2009

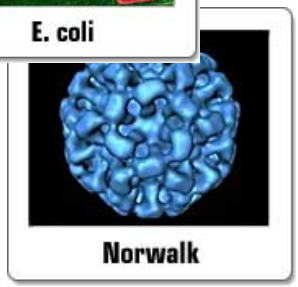
Global Water Quality Network



Region	Physical / Chemical	Nutrients	Major Ions	Metals	Organic Matter	Organic Contaminants	Micro-biology	Hydrological & Sampling Variables	Date Range
Africa	70330	74241	109179	10177	6517	1915	4944	313	1977-2009
Americas	199278	224449	242825	309067	40782	594582	21267	13523	1965-2006
Asia	219708	120721	152807	84299	48992	8817	38239	12373	1971-2009
Europe	254579	149363	138140	191389	73462	29436	40416	66846	1978-2007
Oceania	212037	89718	11160	3199	14248	1438	5261	18000	1979-2008
Total	955932	658492	654111	598131	184001	636188	110127	111055	1965-2009

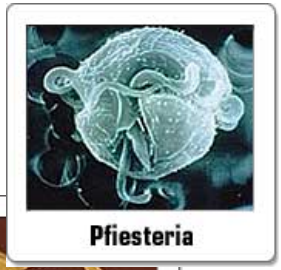
Pathogens Database





The pathogens database is a parallel structure with the existing freshwater database allowing for a broader scope in water analysis assessment. Emphasis will be place on gathering and assessing water data for developing countries particularly for populations under stress from urban development of large cities.

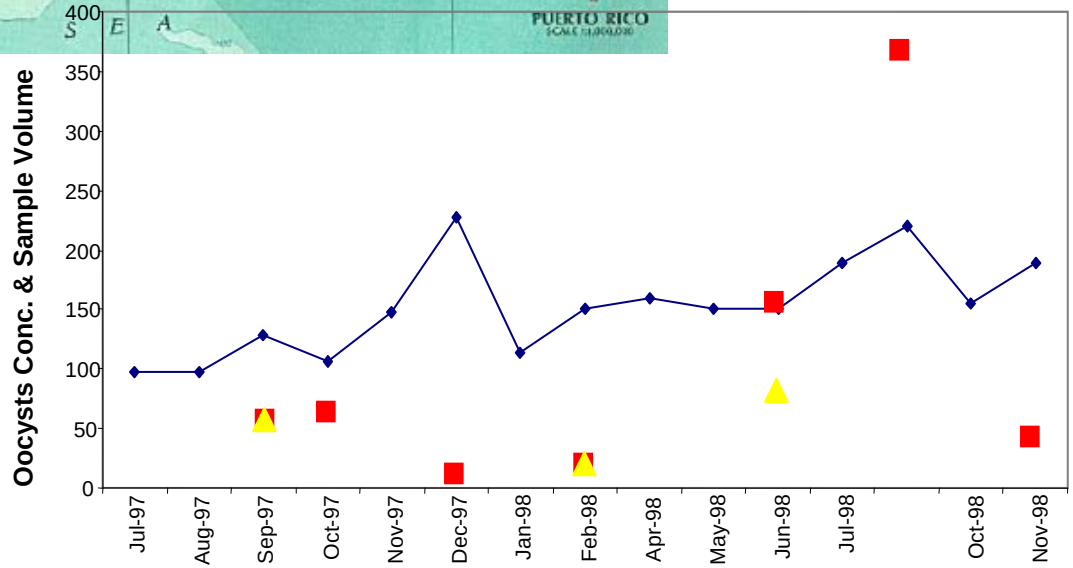
- US EPA Information Collection Rule Auxiliary 1 Database
  - ~ 500 water treatment plants across the US
  - July'97–Dec.'98
  - multiple sampling points within the WTP's
  - WTP ancillary data along with water quality parameters
  - species: Viruses, Giardia, Fecal Coli, Cryptosporidium, E.Coli, Protozoa
- World Health Organization - Occurrence of Pathogens in Surface Water and their Relationship with Indicator Parameters
  - ~ 230 collected references – global
  - concentrations of pathogens and indicators
  - characteristics, source of contamination, measurement methods, health outcomes, public health relevance
  - species: 87 bacteria, 63 viruses, 70 parasites, 12 fungi



Pathogens - Islands

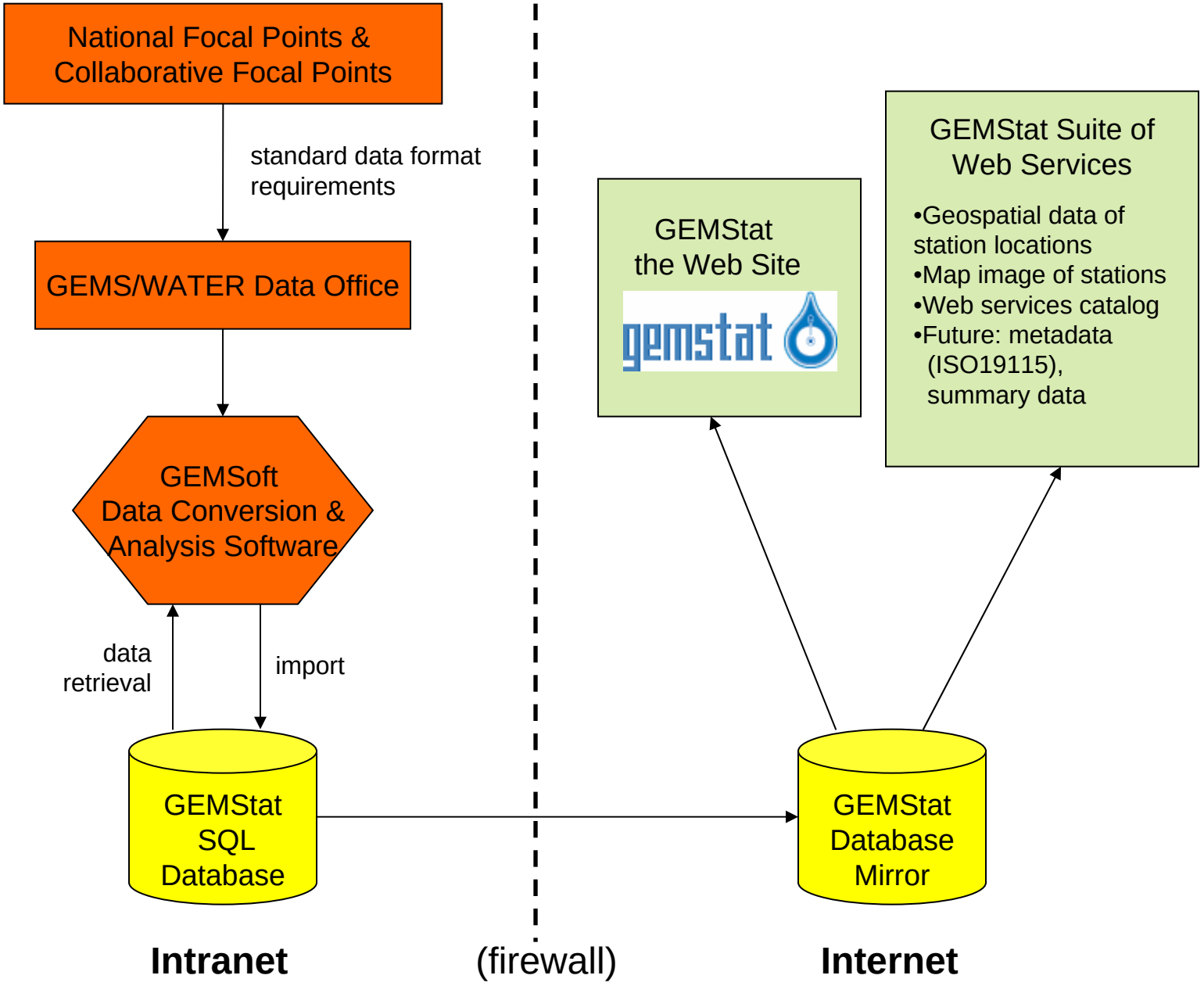
Puerto Rico

Las Quebradillas / Turabo River Influent Sample Point

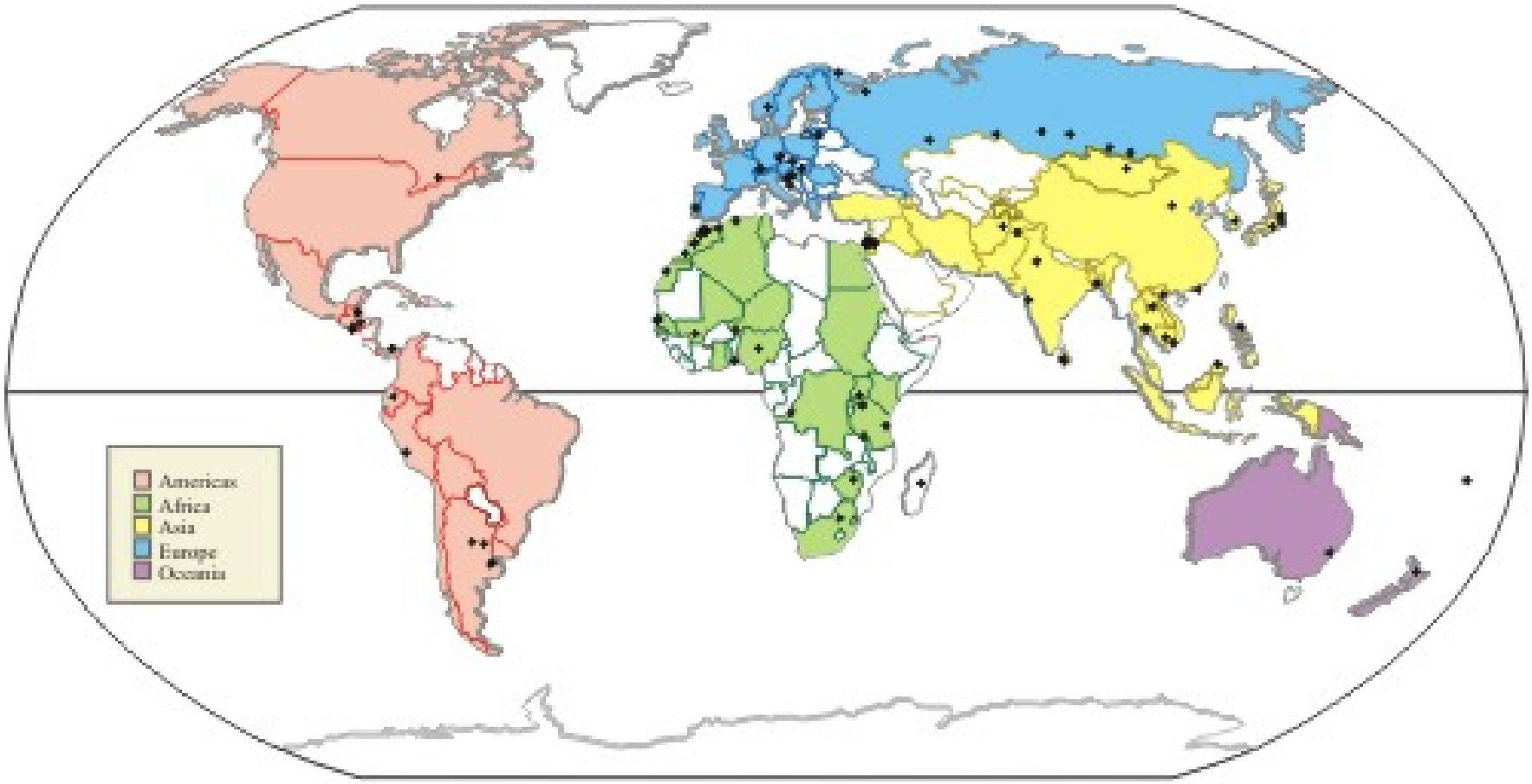


- Protozoa Volume Collected (litres)
- Giardia Concentration (#cysts/100L)
- Cryptosporidium Concentration (#Oocysts/100L)

GEMS/Water System Architecture

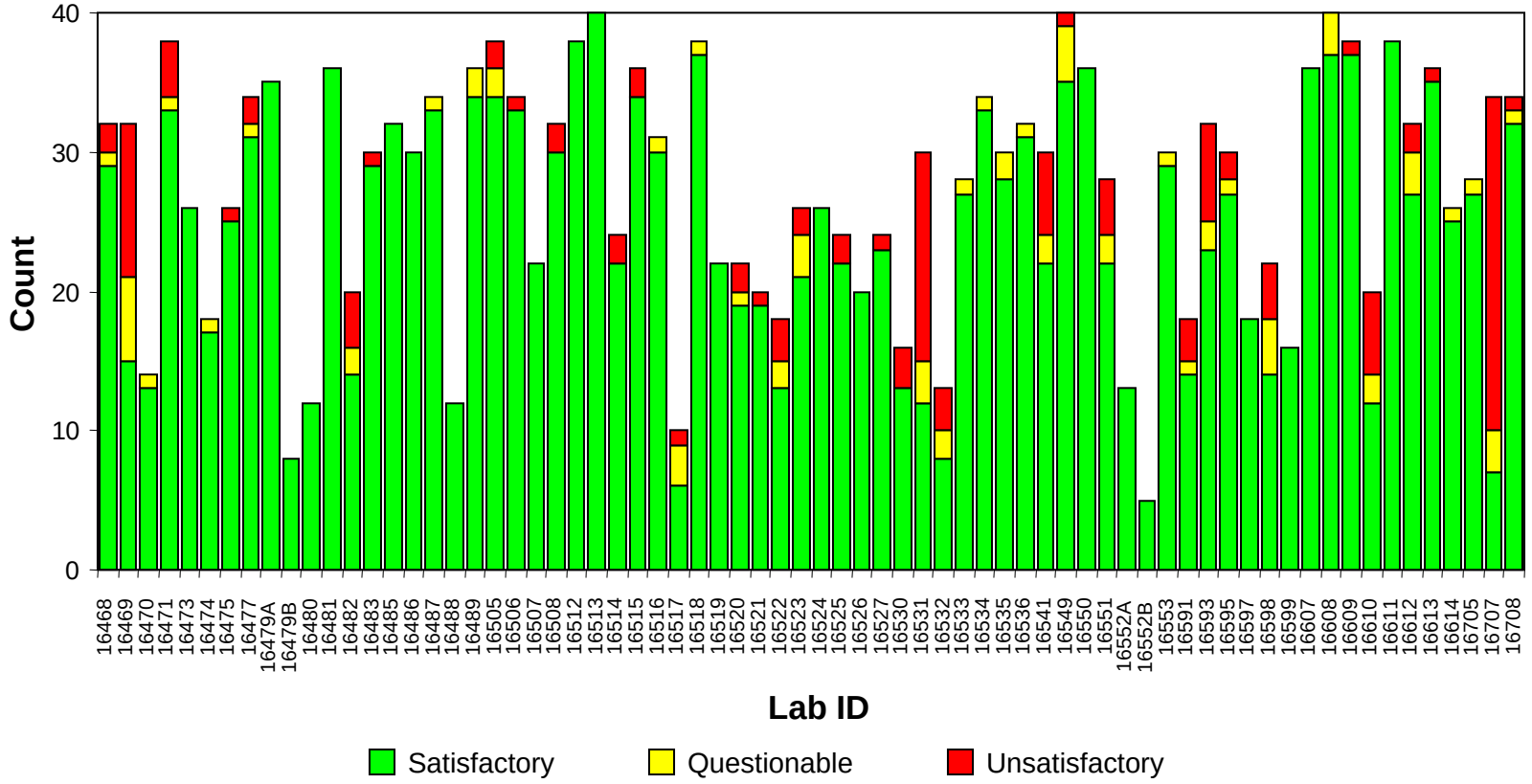


Participation in Laboratory PE Study No. 6

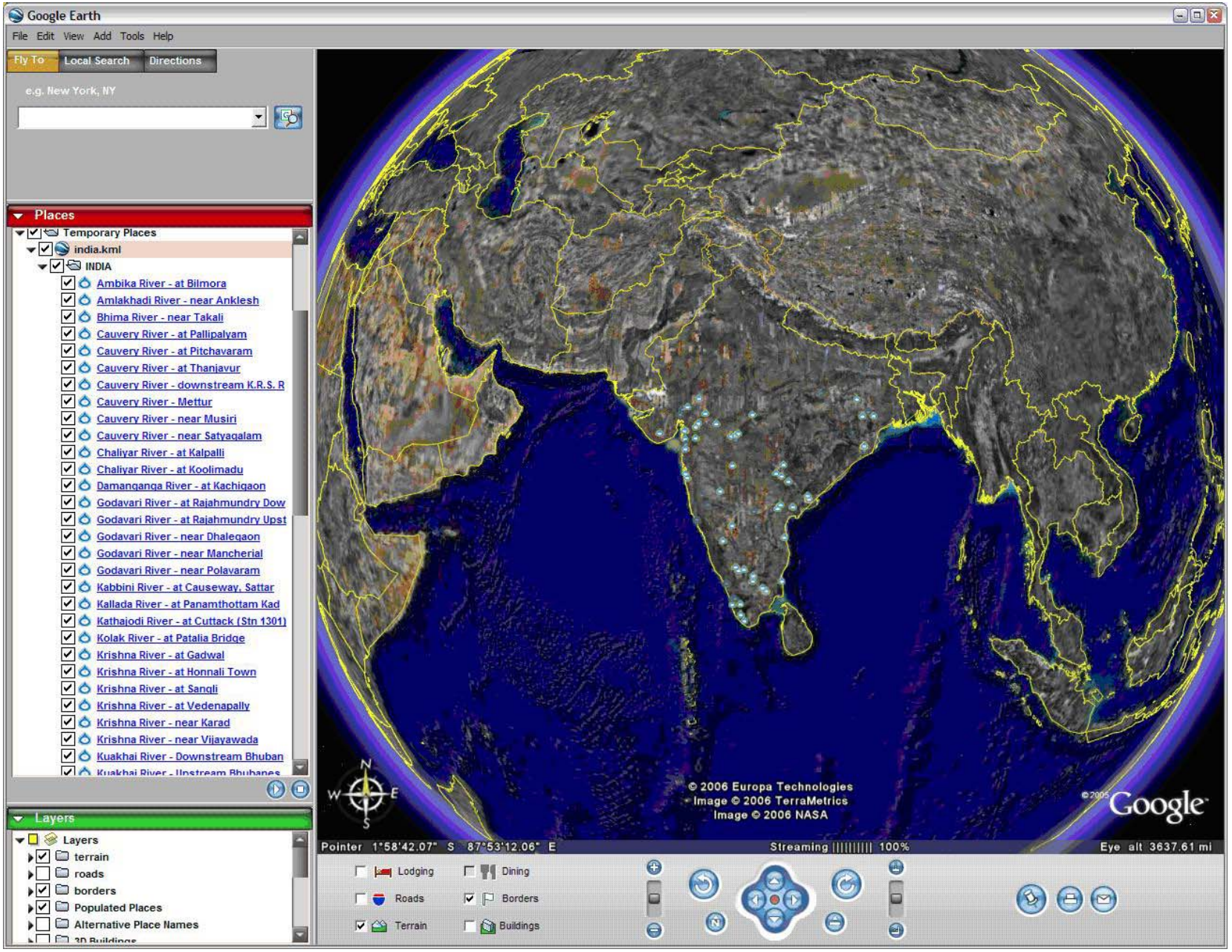


99 laboratories from 52 countries

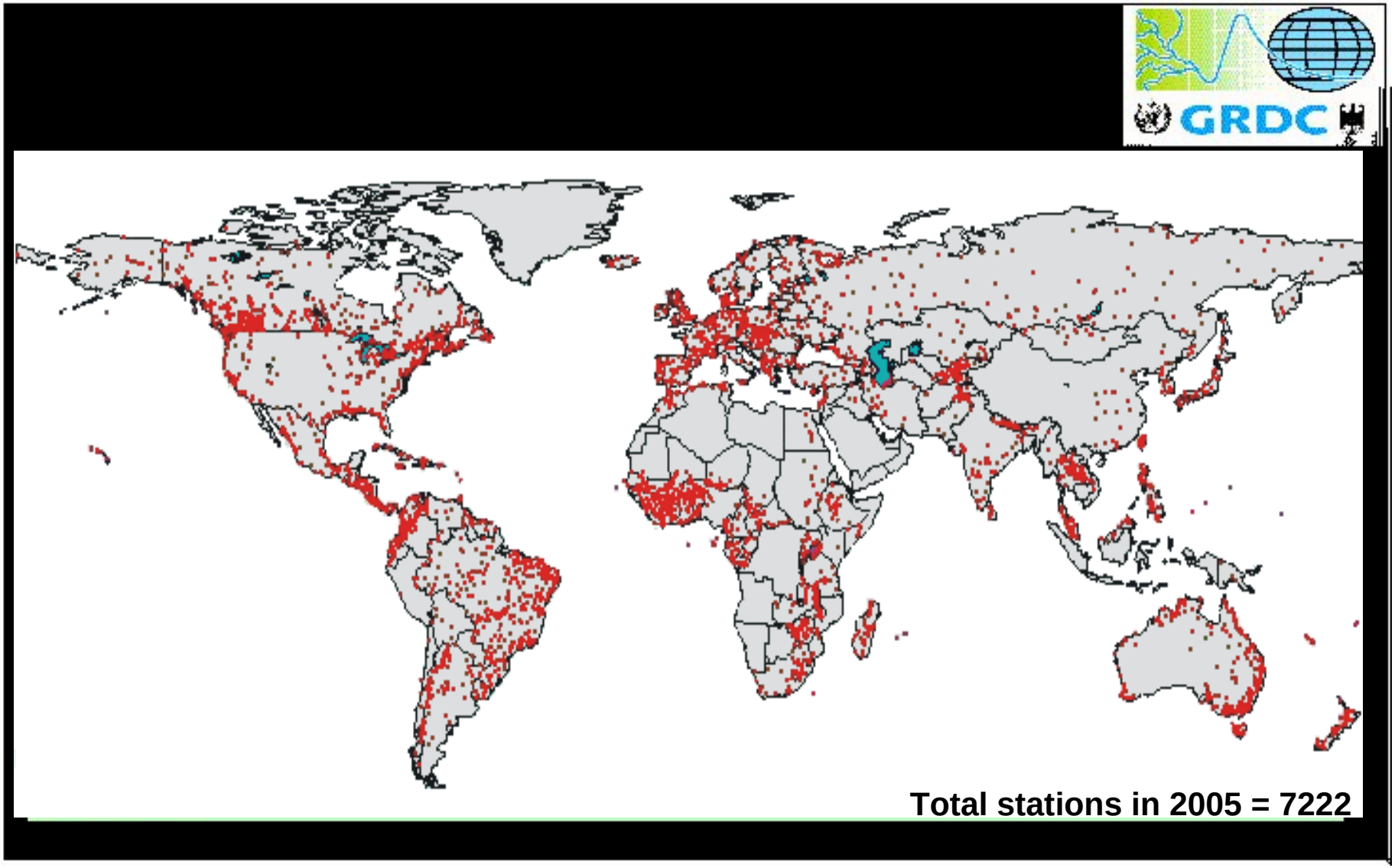
Performance in Laboratory PE Study No. 5 was good



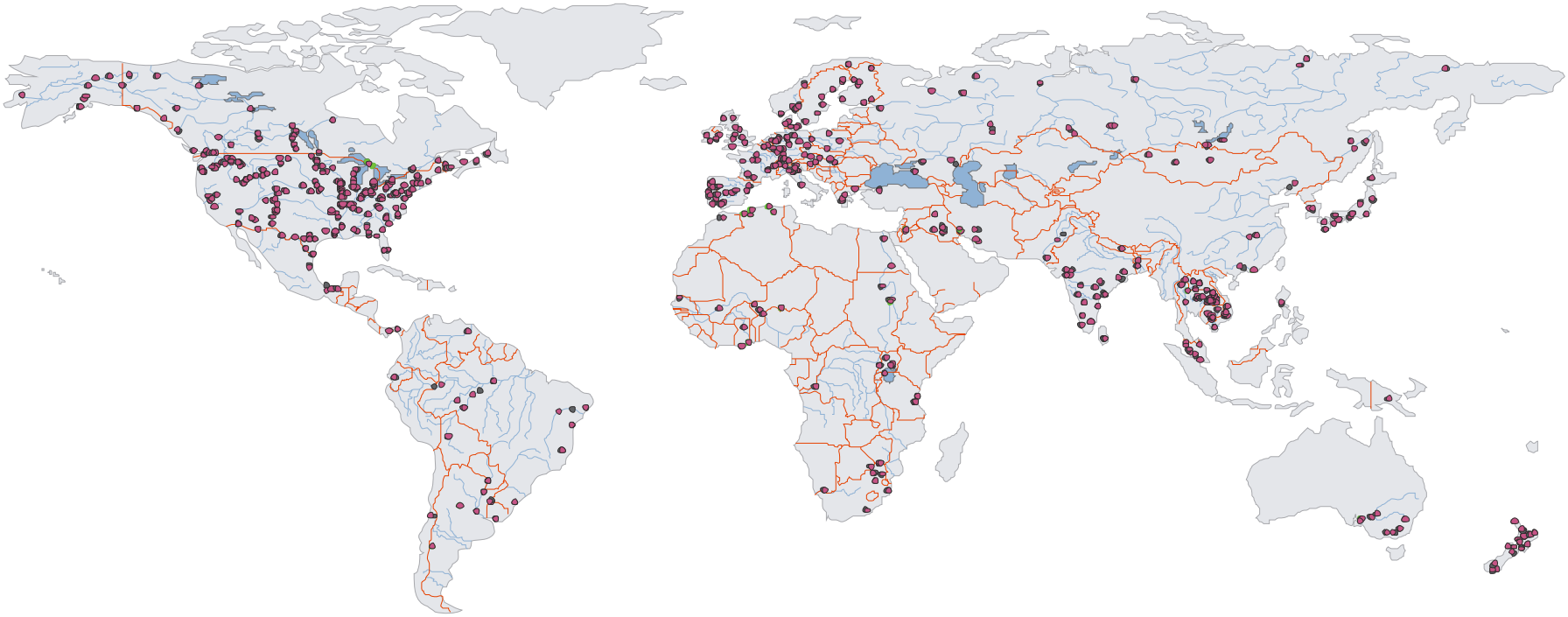
GEMS/Water and Google Earth



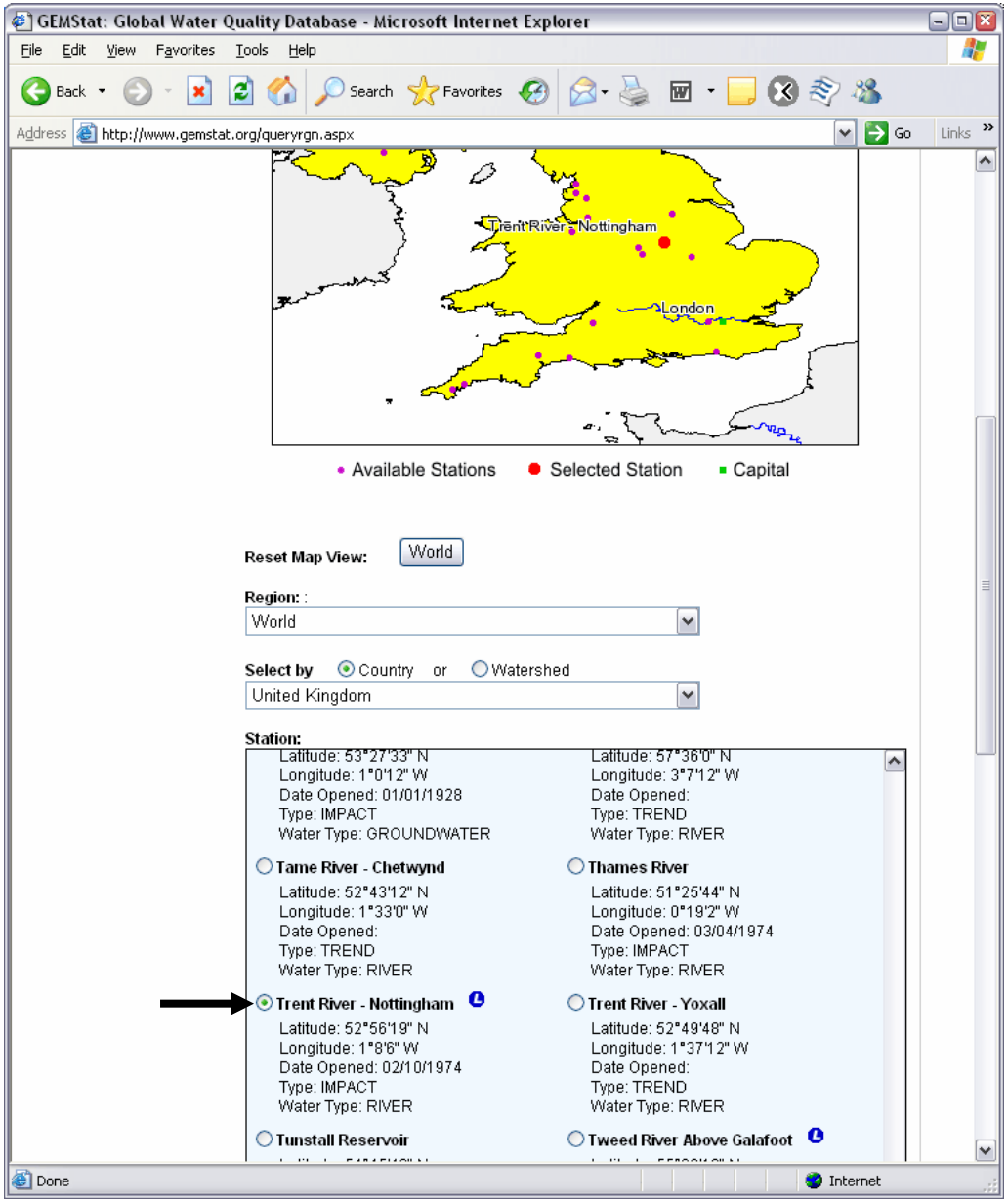
Global Runoff Data Centre
Koblenz, Germany



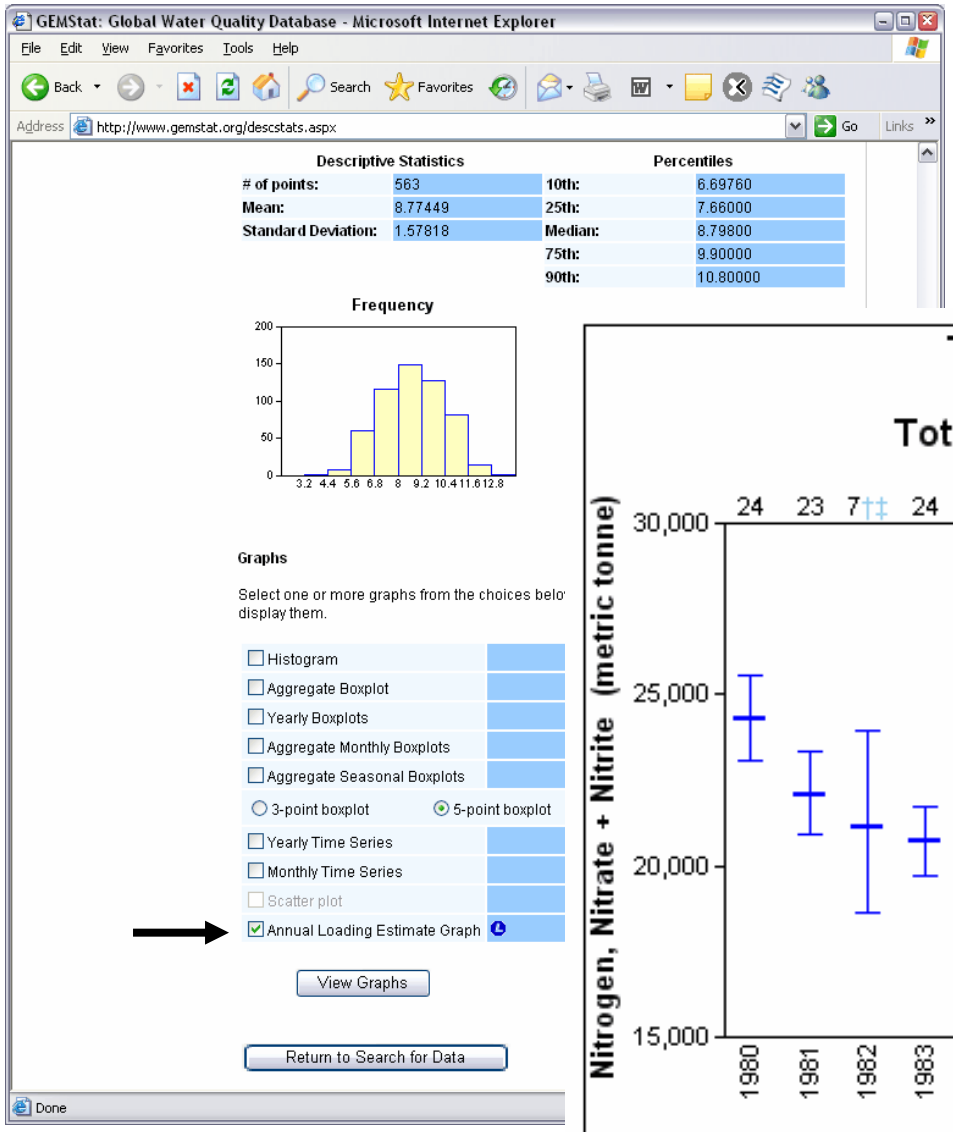
GEMS/Water and GRDC Stations

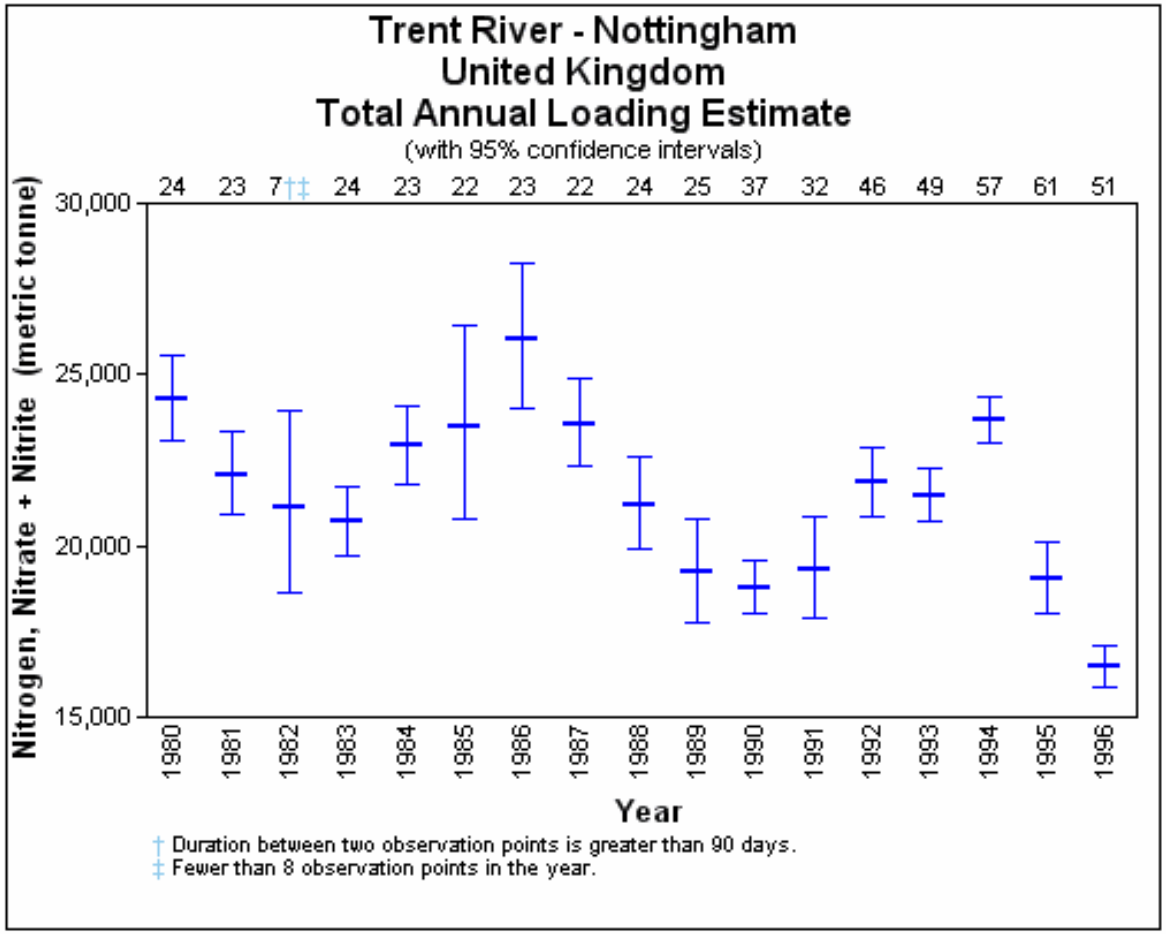


GEMStat – Loading Estimate



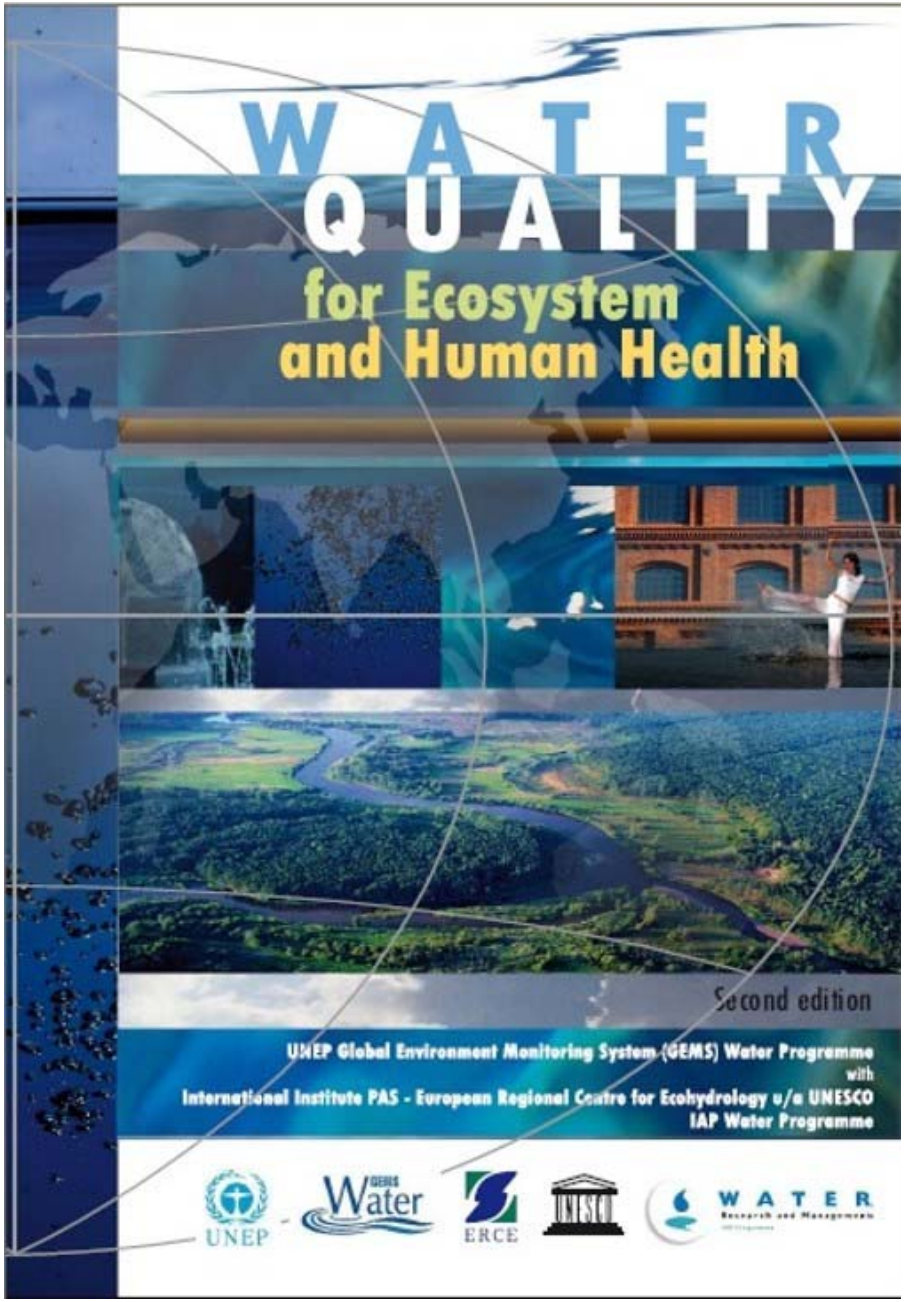
GEMStat – Loading Estimate





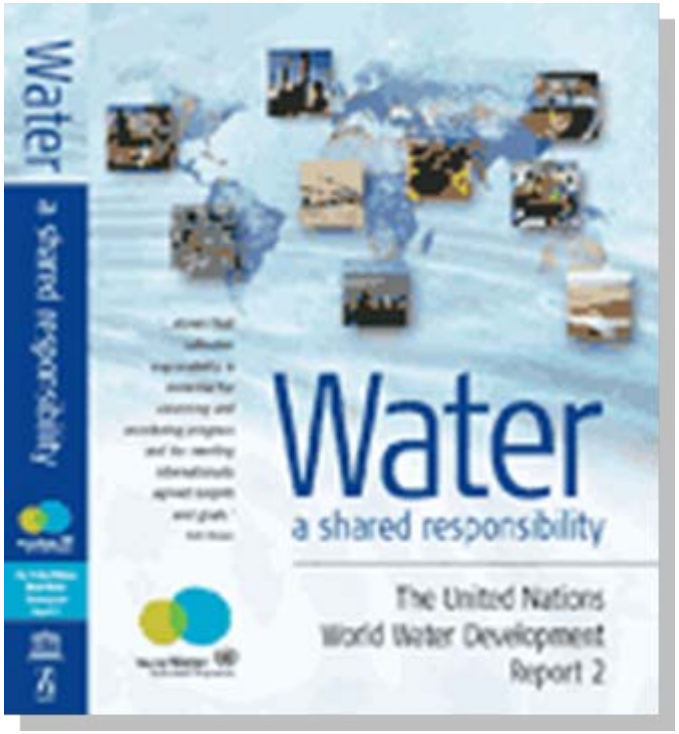
Global assessments:

- WQ assessment primer and background.
- Analytical and assessment examples from around the world.
- Figures to be linked to GEMStat and Google Earth.

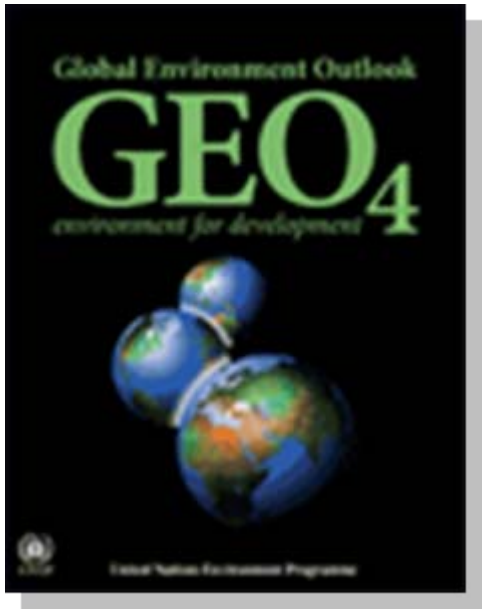


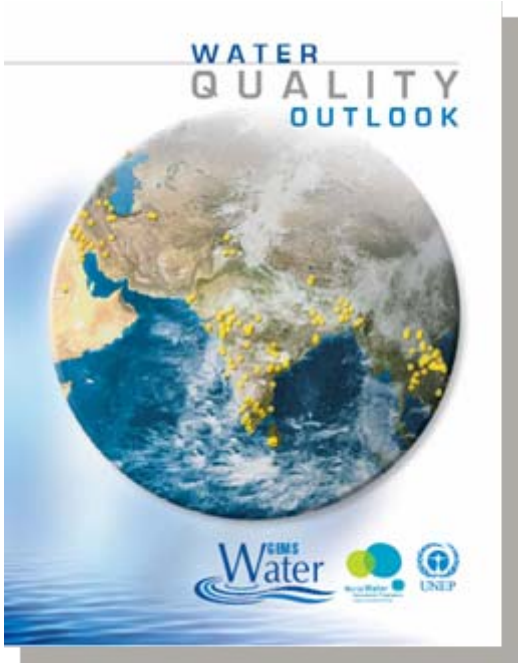
Global assessments:

- Water Quality Outlook
- World Water Development Reports
- Global Environment Outlook
- Global Biodiversity Outlook

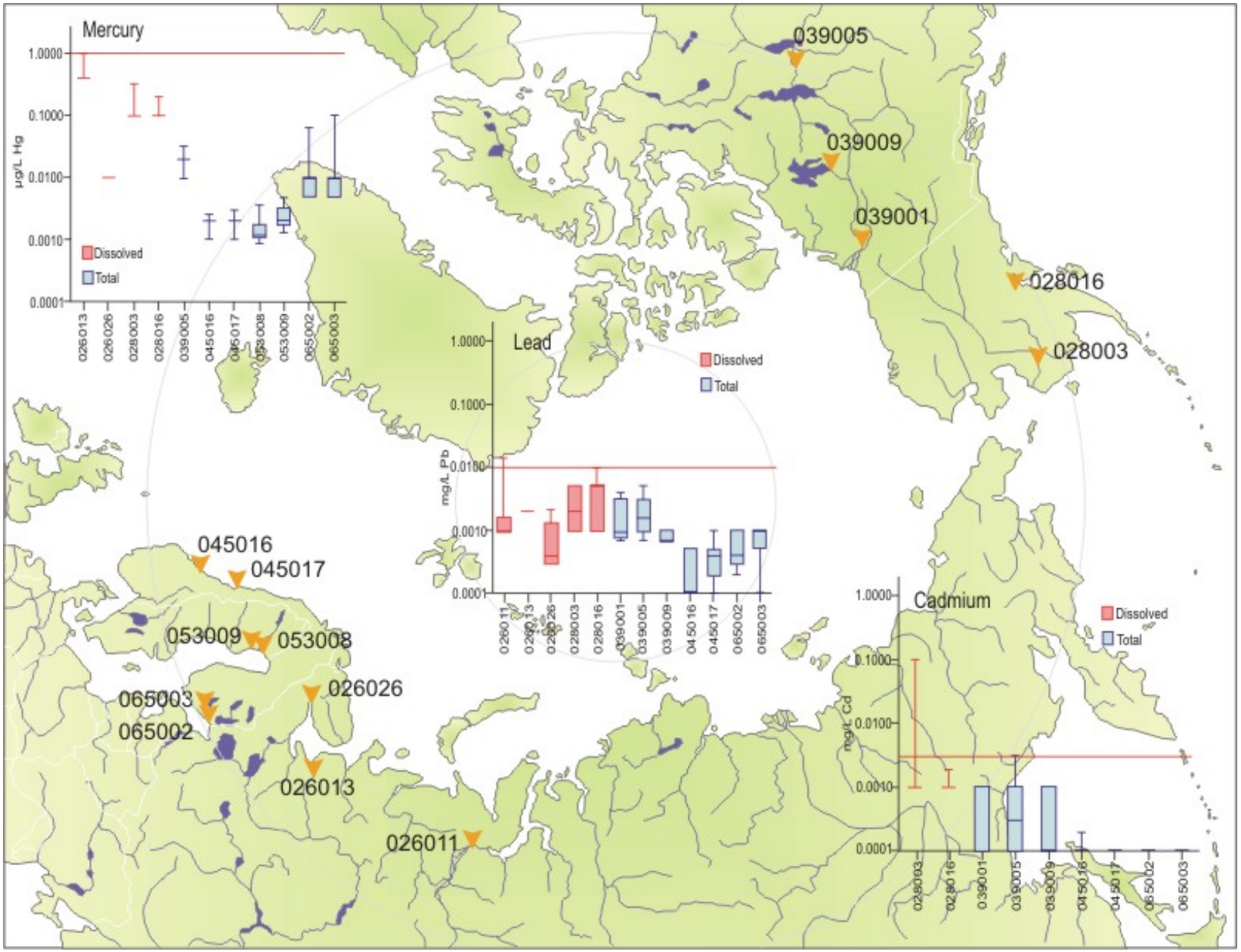


Convention on Biological Diversity

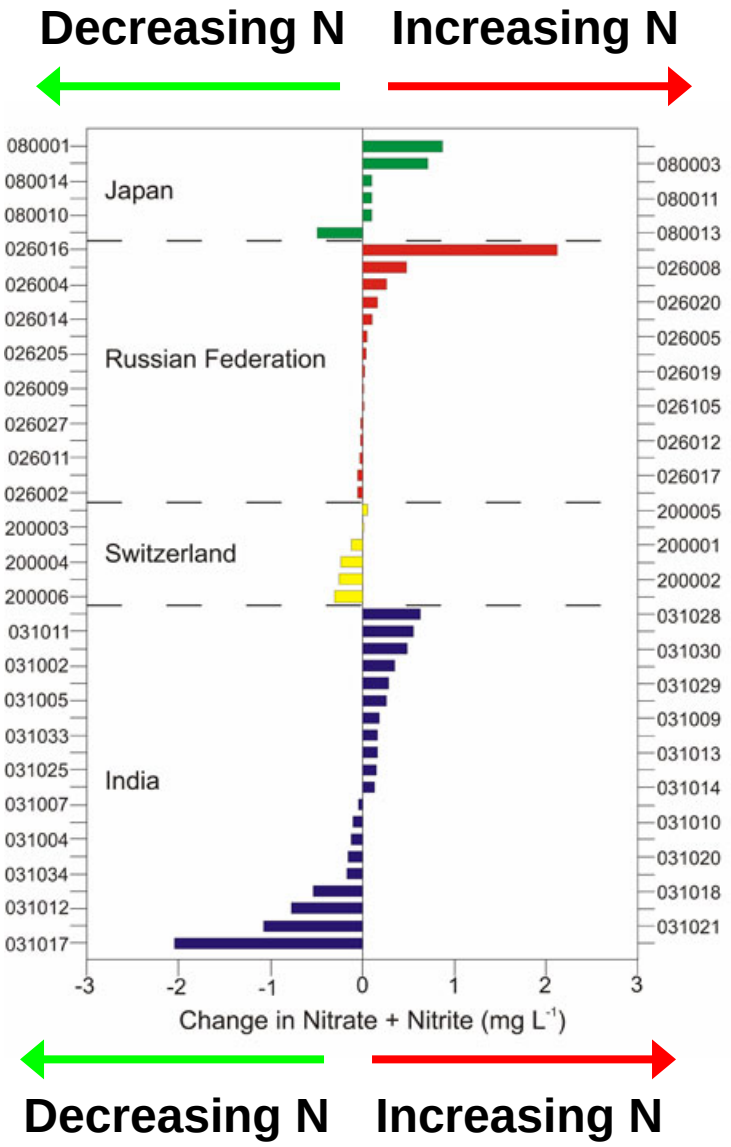


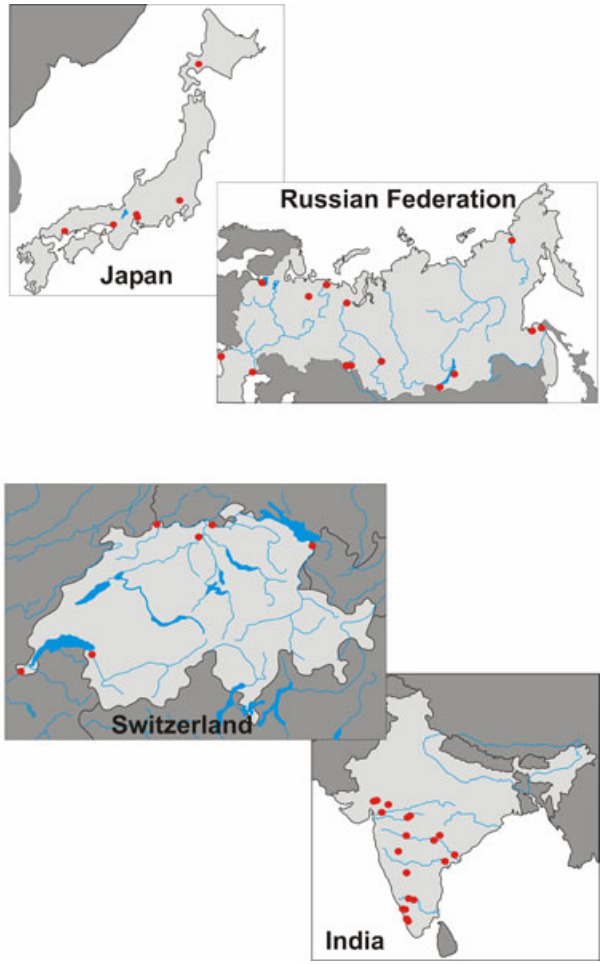


Heavy Metals in the Arctic

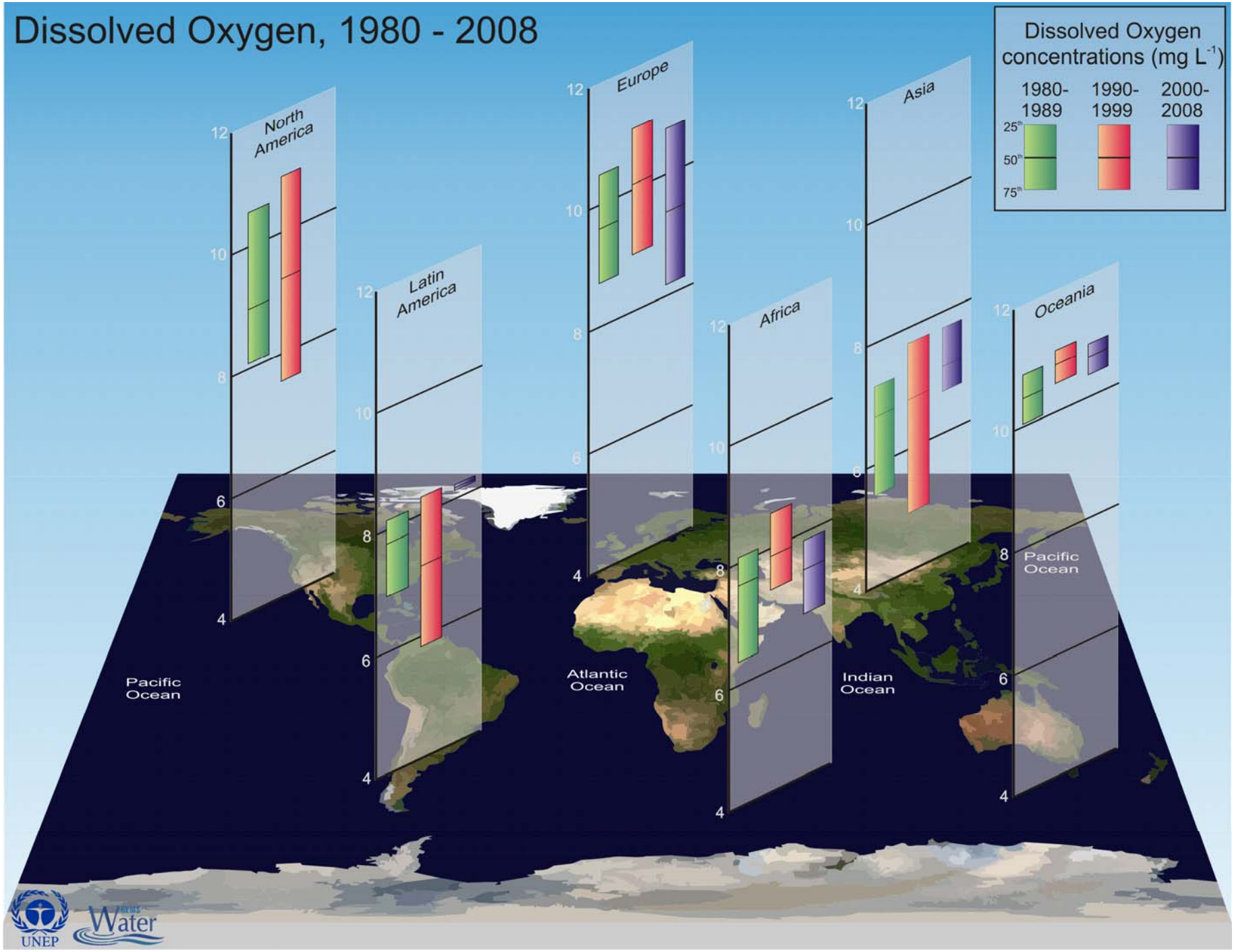


Eutrophication in Rivers: Changes in N over 20 years





Dissolved Oxygen, 1980 - 2008



Index Development

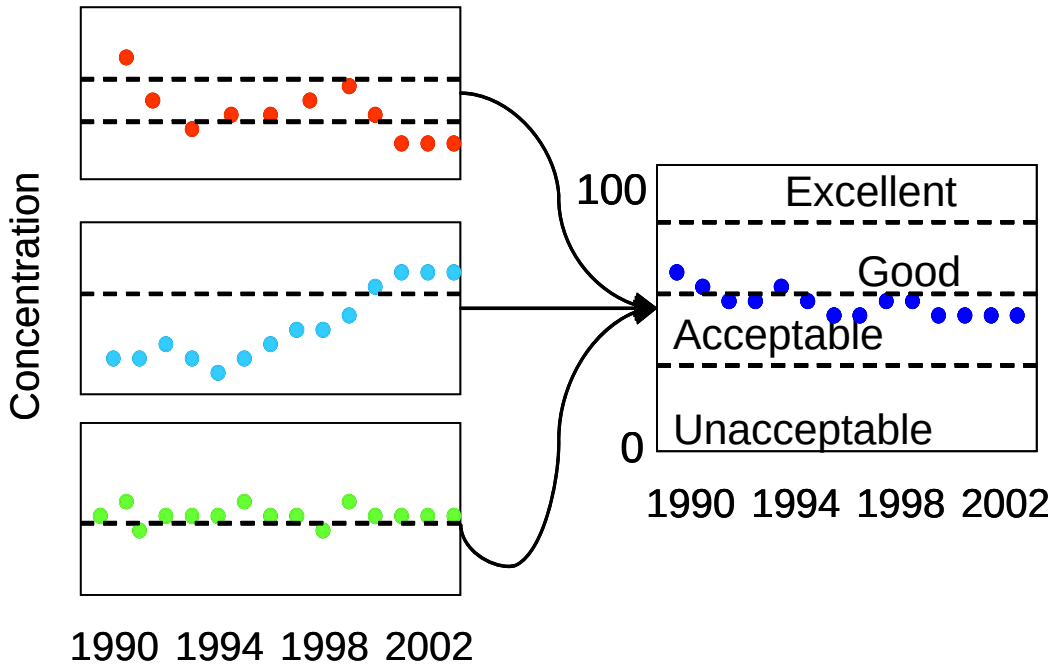
Composite indicators of water quality:

- Source Drinking Water Quality Index
- Environmental Performance Index
- Biodiversity Indicators Partnership

Water Quality Index Calculation

Important WQ variables compared to appropriate guidelines; results combined to produce a single number categorizing WQ as excellent, good, fair, marginal, poor.

$$\textit{WQ Index} = 100 - \frac{\sqrt{(F_1^{\,2} + F_2^{\,2} + F_3^{\,2})}}{1.732}$$



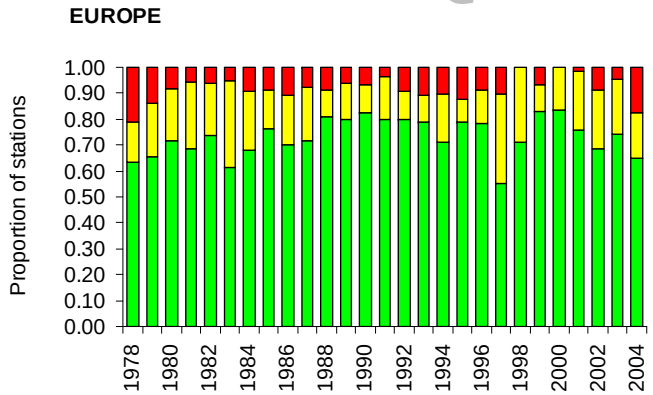
Where:

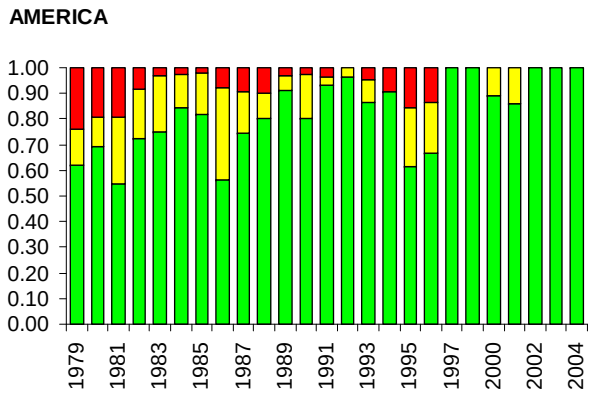
F1 = percentage of failed variables (scope)

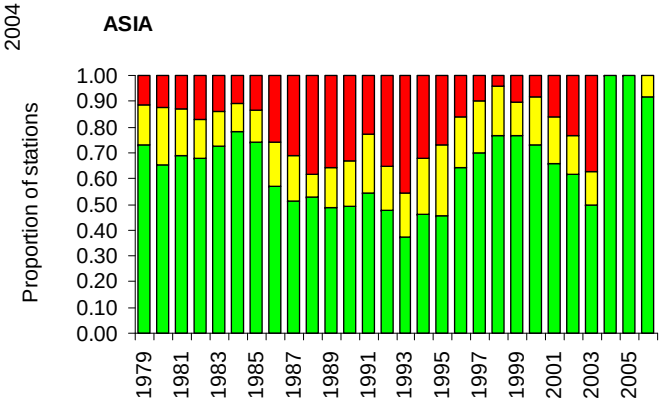
F2 = percentage of failed tests (frequency)

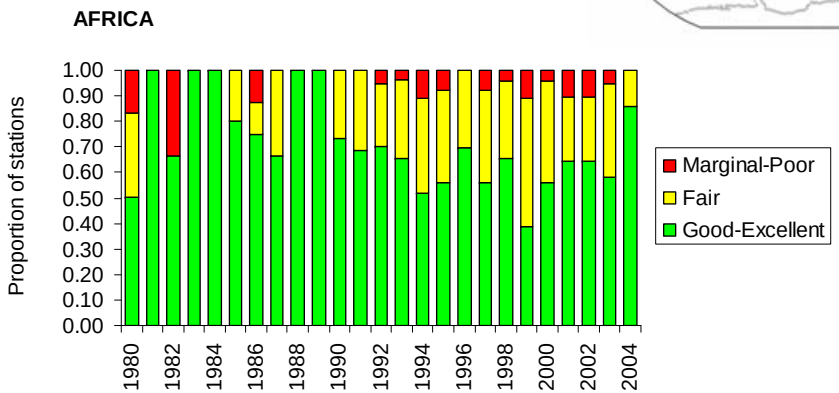
F3 = amount by which failed tests exceed guidelines (magnitude)

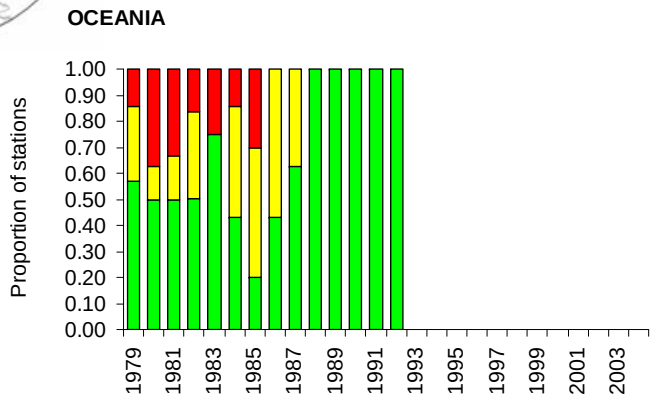
Source Water Quality Index







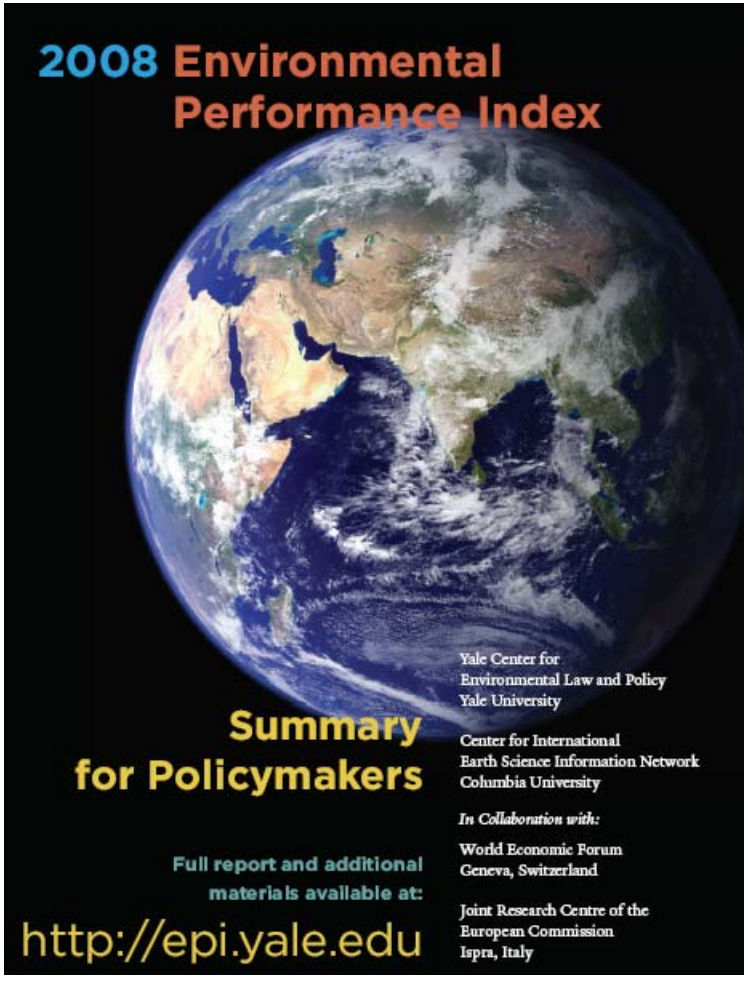




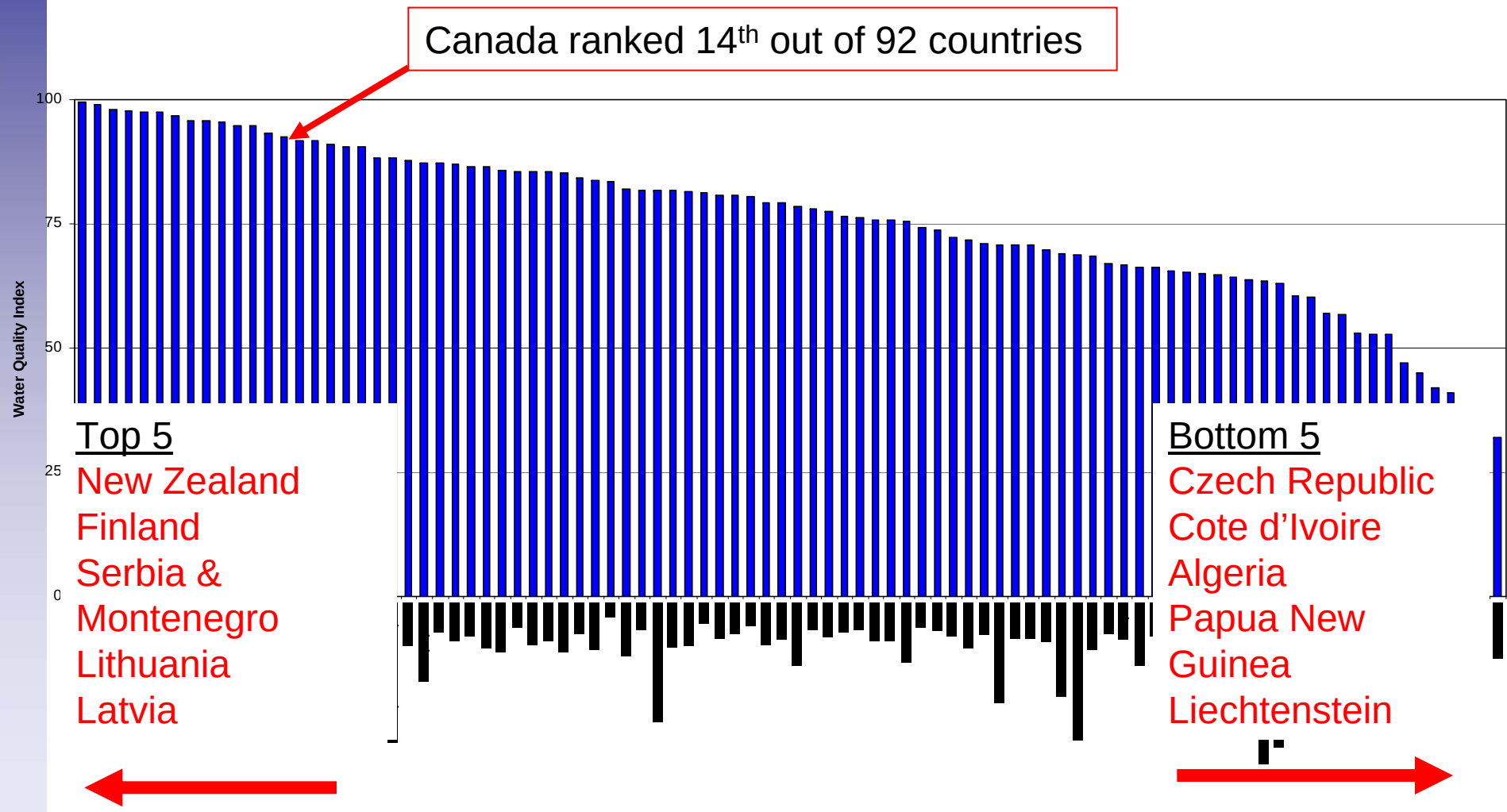
Proportion of stations

2008 Environmental Performance Index

- Composite index based on national-scale environmental performance of 25 indicators
  - Climate change, agriculture, fisheries, forestry, biodiversity, water, air pollution, etc.
- Need for national level investment in environmental data monitoring, indicators, and reporting stressed
- Released at World Economic Forum, Jan 2008

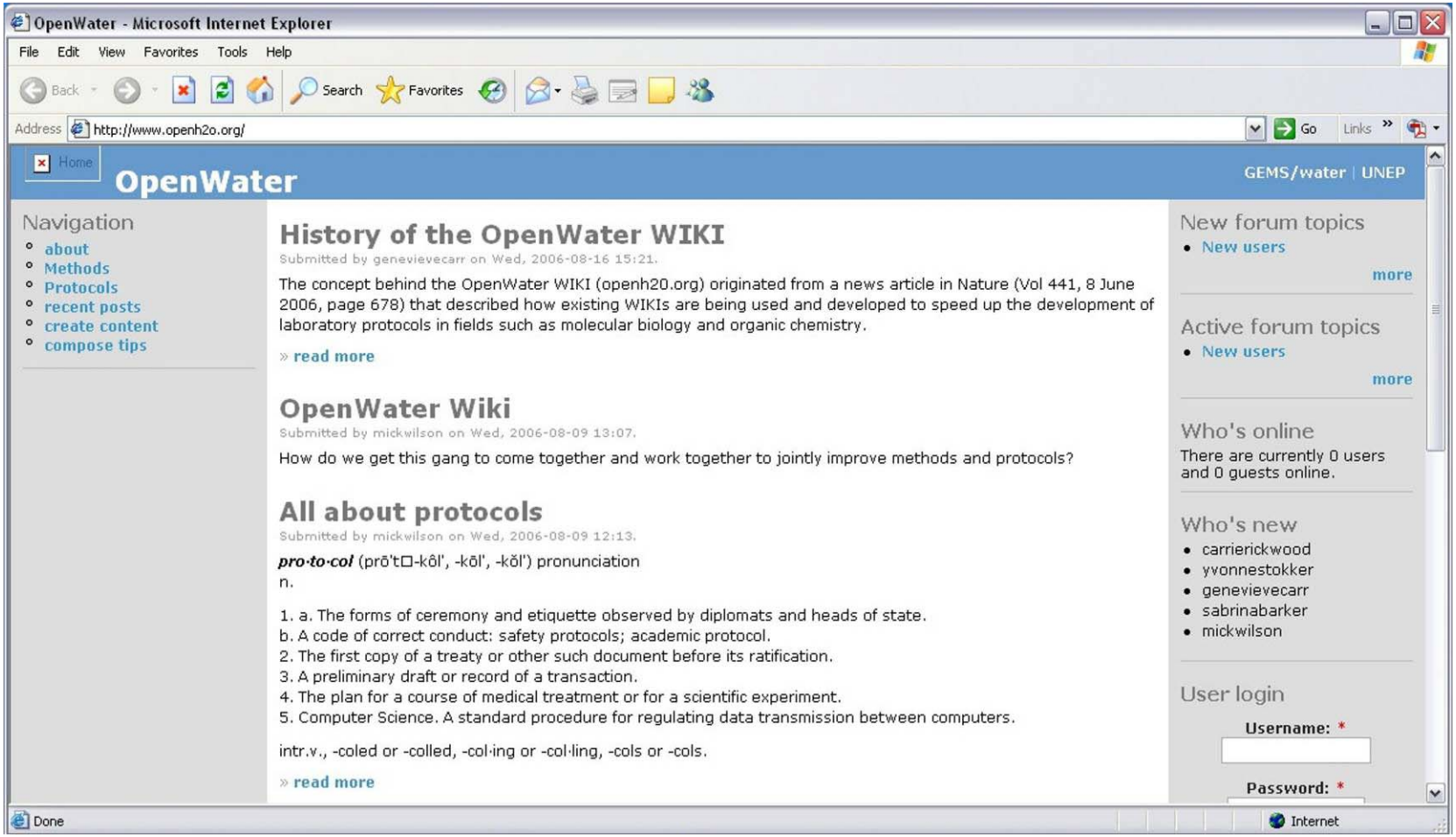


2008 Environmental Performance Index: Water Quality



www.ungiwg.org/openwater

For sharing water quality analytical methods with users.



New Services from GEMS/Water

Review and advise on:

- Monitoring strategies
- Monitoring program design and implementation
- Analytical techniques and methodologies
- QA/QC procedures
- Data handling, interpretation, and reporting

EVALUATION SERVICES FOR

National Water Quality Monitoring Programmes and Laboratories

Clean water is life

As a service to national water quality monitoring agencies, UNEP's GEMS/Water Programme undertakes specialized auditing activities. These include a review and evaluation of the efficiency, technical rigor and scientific credibility of all aspects of the water quality monitoring programme, from design to implementation.

GEMS/Water also provides national laboratories with the technical basis to judge their own ability to address departmental water quality monitoring responsibilities. As well, GEMS/Water can assist laboratories to prepare for international accreditation to ISO/IEC 17025.

Contact

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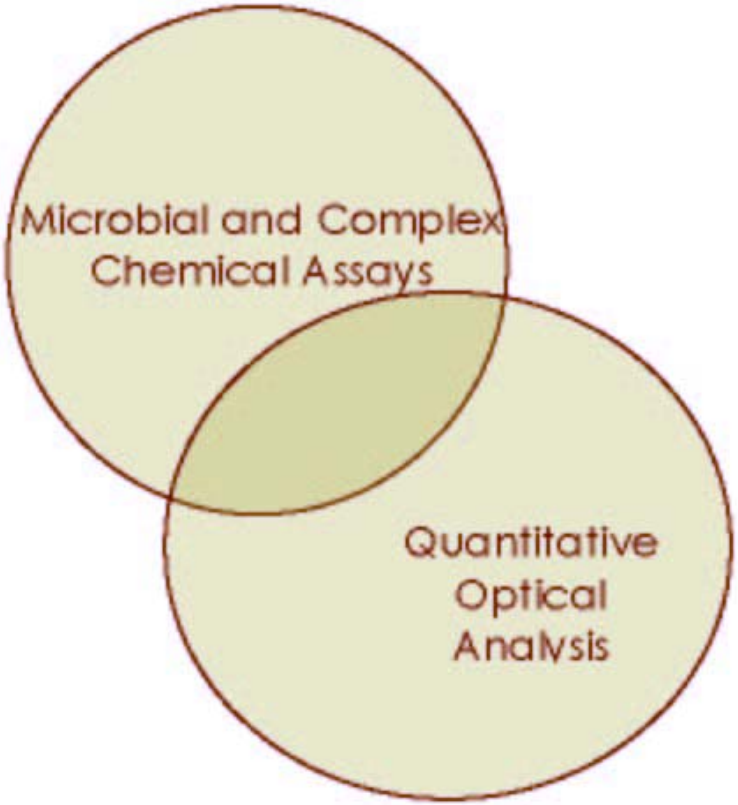
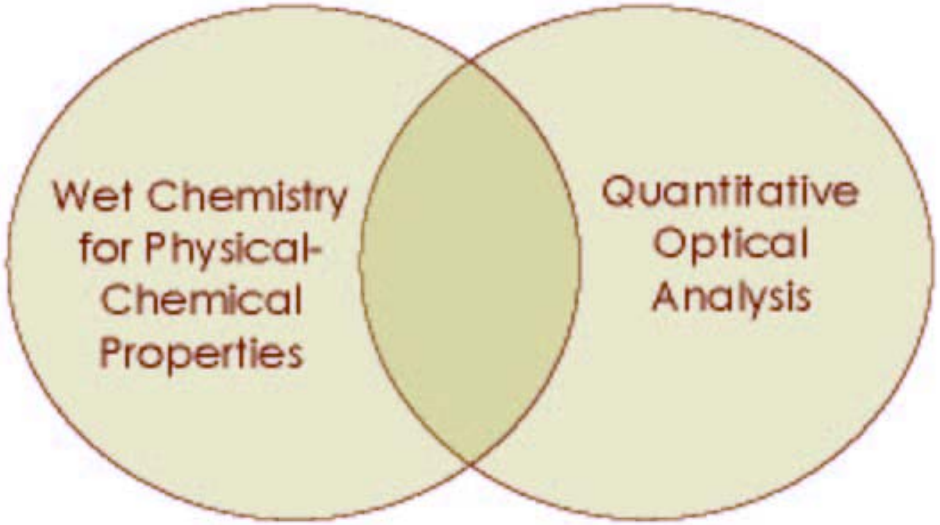
www.gemstat.org

UNEP

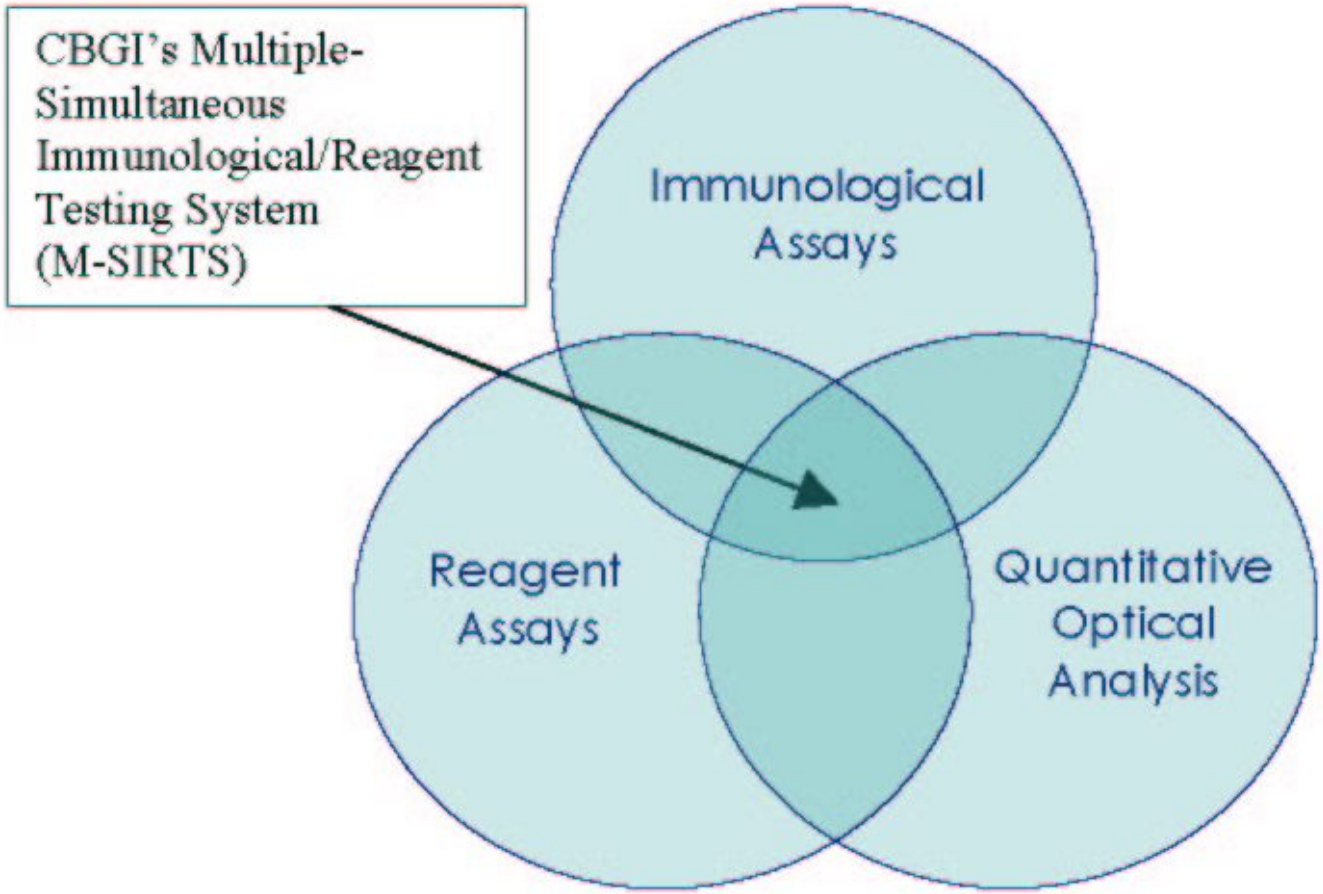
GEMS Water

Current approaches for water quality monitoring



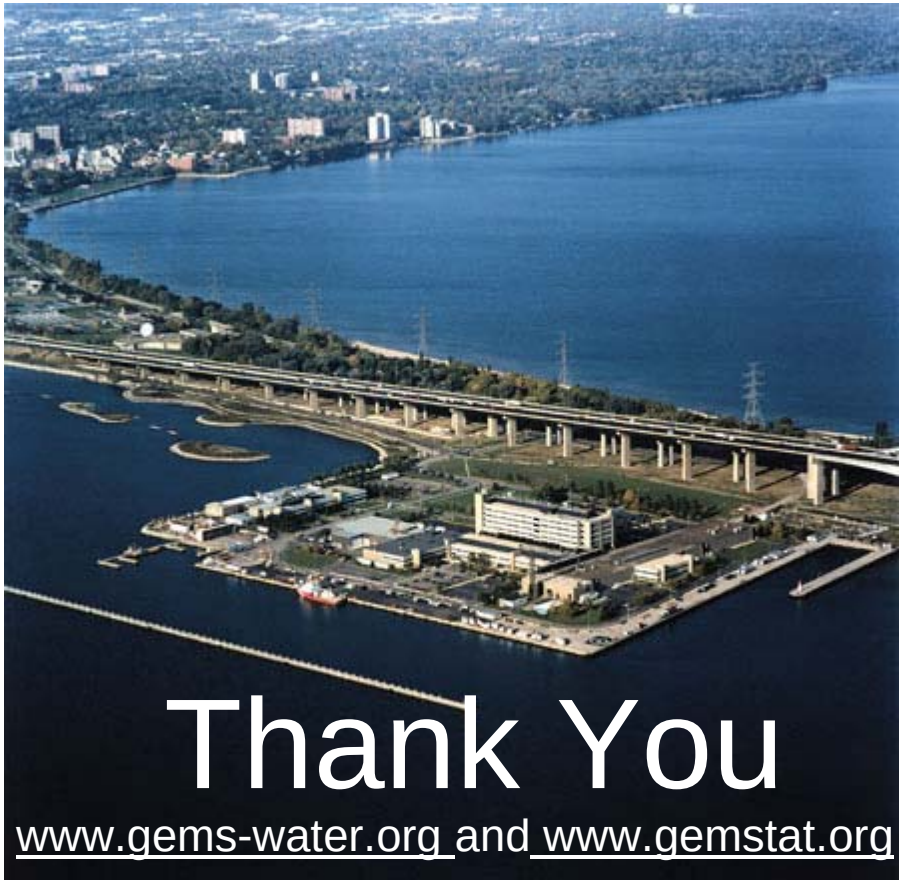


New approach for water quality monitoring



New approach for water quality monitoring

UN GEMS/Water Programme



Canada, UNEP Nairobi