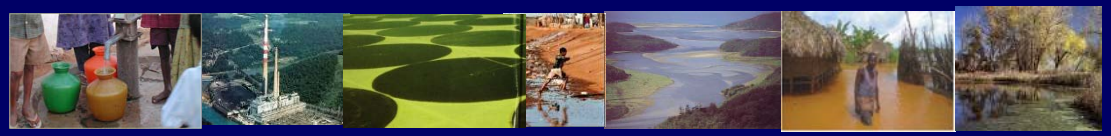
Six Assertions about the Global Water Quality Challenge



Futures of European Waters

Workshop on “Shortcutting Historical Pollution Trends”

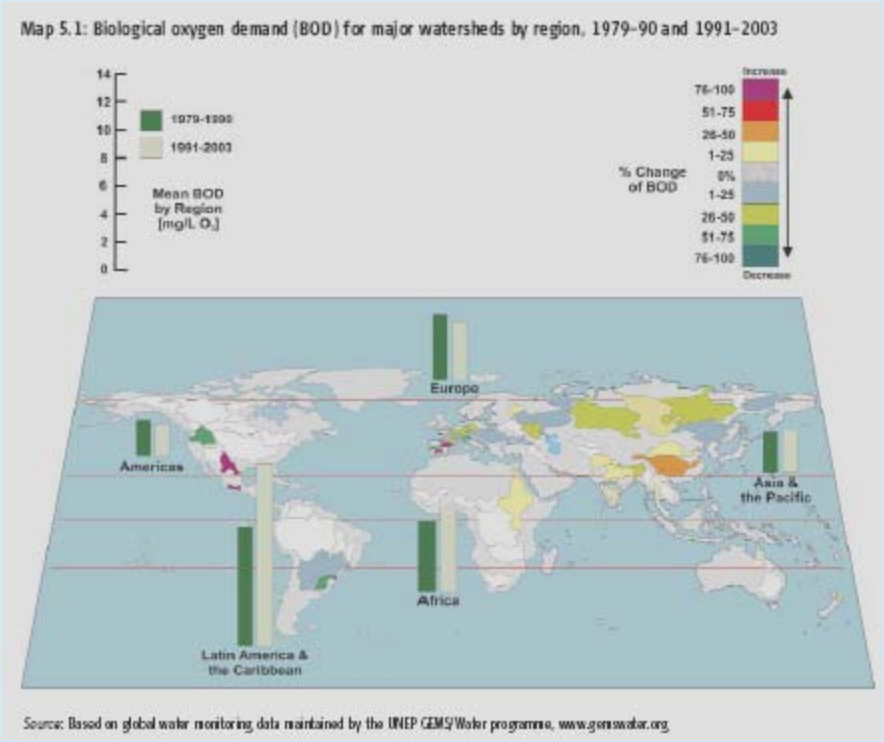
25 March, 2011

Joseph Alcamo, UNEP Chief Scientist

The global water quality challenge: Six assertions

Assertion 1. Worldwide water quality degradation has many causes and its not always clear which factor will predominate where.

1. Water quality degradation has many causes



Change in BOD (mg/l) between 1980s and 90s

Decreasing BOD in the industrialized countries

Increasing BOD in developing countries

- New public water supply systems concentrate sewage, returned to lakes and streams without treatment; domestic & industry
- Population growth
- Increasing per capita water use
- Increased industrial activity

Source: GEO-4, GEMS/Water

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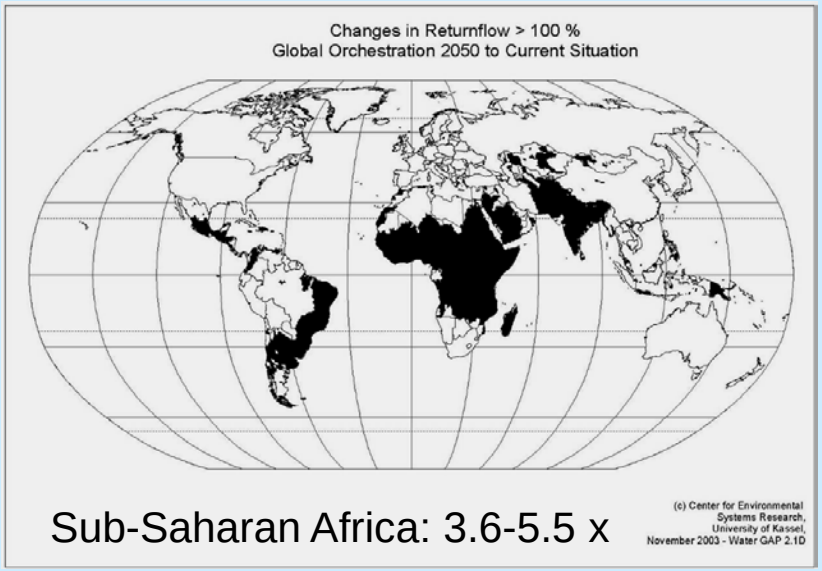
1. Water quality degradation has many causes

Wastewater discharge at least doubling by 2050



Sub-Saharan Africa: 3.6-5.5 x

Source: Millennium Ecosystem Assessment; WaterGAP Model, CESR, University Kassel

Low current rate of wastewater treatment in developing countries

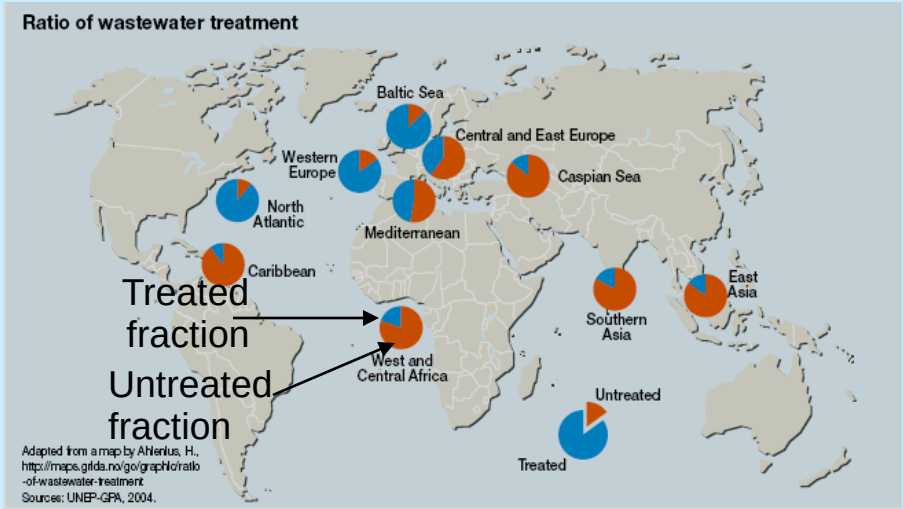


Figure 17: The ratio of treated to untreated wastewater reaching water bodies for 10 regions. An estimated 90 per cent of all wastewater in developing countries is discharged untreated directly into rivers, lakes or the oceans (UN Water, 2008).

rem 10-20%

1. Water quality degradation has many causes

Causes of increasing water quality degradation:

1. Wastewater discharges decreasing in North, but increasing in South

New water supply systems concentrate sewage, returned to lakes and streams without treatment; domestic & industry

2. Runoff from land: sediment, fertilizer, pesticides

In developing countries: deforestation & modernization of agriculture cause pollution loadings to rivers and lakes (solids, N, P, pesticides, …)

3. Climate change

Impacts on water temperature, self-purifying capacity, runoff of pollutants & sediment.

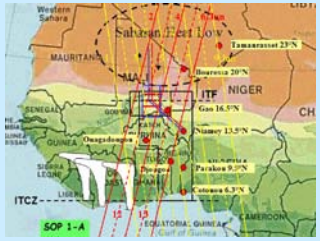
4. Air pollution deposition

Transport & deposition of air pollutants (sulfur dioxide, POPs, ...) in local & distant watersheds

5. New pollutants

e.g. Endocrine disruptors – Interfere with proper functioning of endocrine system of aquatic organisms

2. The water quality challenge is global



Assertion #2. Water quality degradation has global dimensions

Global drivers of water quality degradation

- International food & biofuels trade → crop patterns → deforestation & agricultural runoff
- Climate change
- Long range transport of air pollution
- International consumer products & trade → new pollutants

Global impacts of water quality degradation

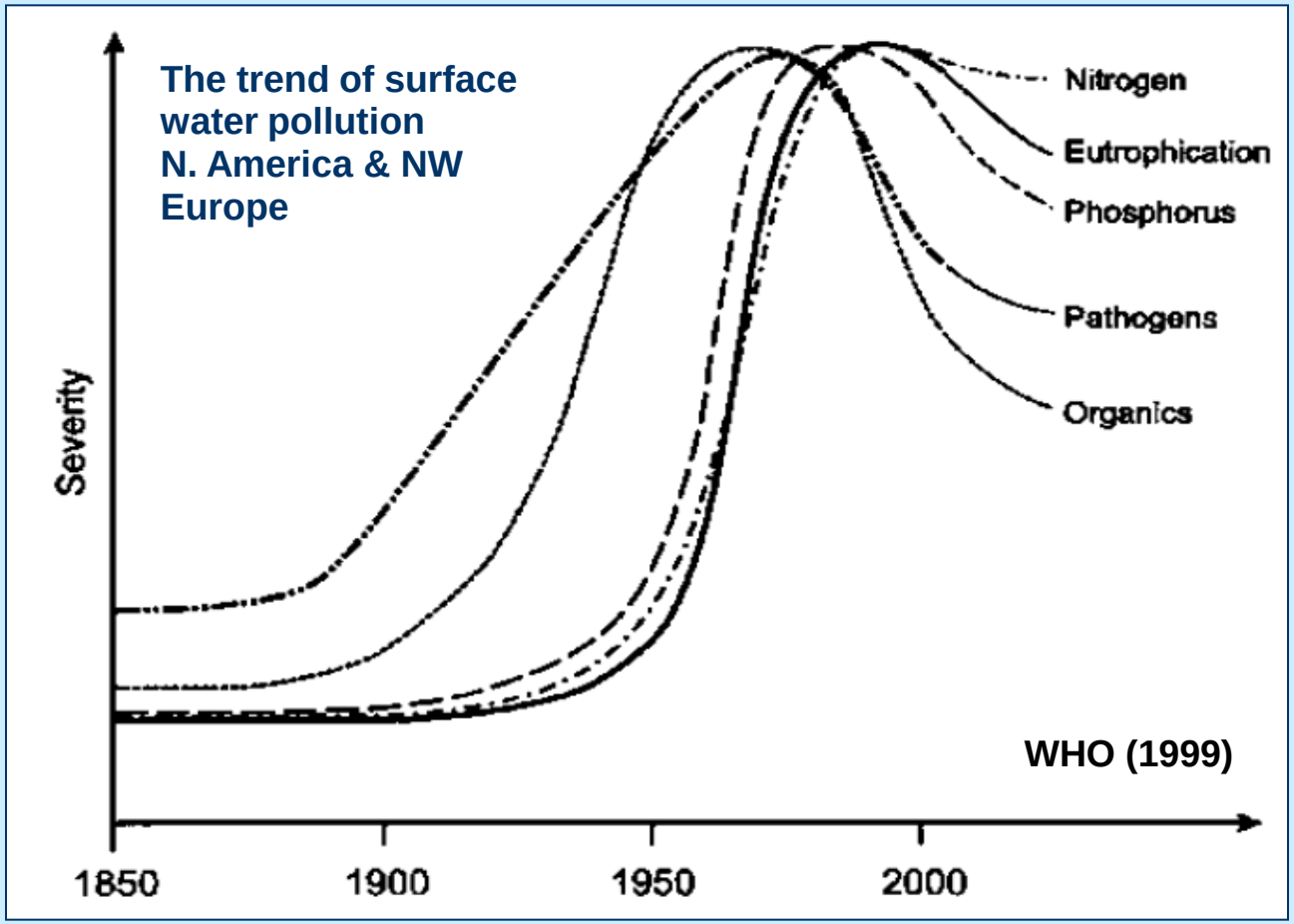
- coastal “dead zones”
- biodiversity
- food security

Global institutions influence water quality

- biodiversity and other conventions affect entire global freshwater ecosystem
- global water programs of donors
- international water companies

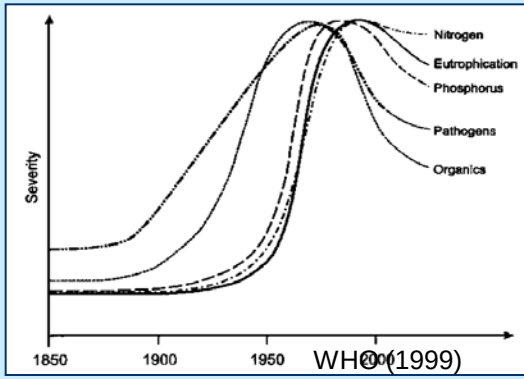
overfish, nutrients, extinct.

3. Shortcutting the trend



3. Shortcutting the trend

Assertion #3. Developing countries have many policy options for shortcutting historical trends of surface water pollution.



WHO (1999)

Ecologically-based water technology & management → *Green Economy*

I. *Reducing the discharge* of pollution – wastewater treatment

e.g. Ecologically-based wastewater treatment. Artificial wetlands, “constructed wetlands“

II. *Reducing the source* of pollution

e.g. “Cleaner Industrial Production“

III. *Stopping the source* of pollution

e.g. High tech variant **St Petersburg, Florida, US**
First municipal wastewater treatment system → zero effluent discharge to surrounding surface waters

4. Needed: A global/regional assessments

Assertion #4. We cannot identify the right policy options until we know what the problem is. But the water quality situation is not well understood throughout much of the world: A **global/regional assessment** of water quality would be very timely.

Added value of assessment:

- Better understanding about which water quality problems are important where …
- Insight into intensity of water quality problems at various locations
- Better understanding of appropriate policy options within a country
- Input to setting donor priorities

5. Filling in the data gap

Assertion #5. The world water quality situation is poorly understood because of a lack of data. But a global assessment needs data. It is time to make a **major effort to fill in the gap in world water quality data**.

Motivation:

- To understand the state of water quality and its causes.
- To understand recent trends
- To validate/test models – Identification of effective policy options
- As foundation for scenarios – Better understanding of: future consequences of not acting now, future benefits of current policy action, steps towards restoring water quality

5. Filling in the data gap

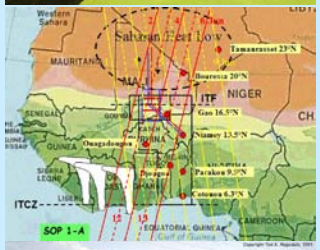
What is the gap?

Reporting stations in GEMS-Water

	No. of Stations *	Stations per 100,000 km^2
Europe	318	3.07
Asia	332	0.74
Africa	138	0.46

* GEMS-Water website, GEMS = Global Environment Monitoring System

5. Filling in the data gap



Constituent	Industrial Countries	Rapidly Developing Countries	Other Developing Countries
Sediment			
Bedload	(+) 0	0	0
Total suspended (TSS)	+++	++	+
Carbon	+++	++	+
Dissolved Inorganic (DIC)	+++	++	+
Dissolved Organic (DOC)	++	+	0
Particulate Organic (POC)	+	0	0
Nitrogen			
Ammonium (NH_4)	+++	++	+
Nitrate (NO_3)	+++	++	+
Dissolved Organic (DON)	+	0	0
Particulate Organic (PON)	0	0	0
Phosphorus			
Phosphate (PO_4)	+++	++	+
Dissolved Organic (DOP)	0	0	0
Total (TP)	++	+	0
Metals			
Dissolved	++	+	0
Total	+	0	0
Particulate	+	0	0
Major dissolved constituents[a]	+++	++	+
Discharge	+++	++	+

[a] SO_4, Cl, Ca, Mg, K, Na, SiO_4, CO_3.

Table 7.6. Data Assessment of Existing Monitoring Programs Worldwide. The entries relate to the quantity of available data, indicated by the number of + symbols. For the purposes of this assessment, data quantity is an aggregate measure of station network density, spatial coverage, frequency of data collection, and duration of monitoring programs. (Updated from Vörösmarty et al. 1997b)

What is the gap?

Water quality parameters measured

Source: Millennium Ecosystem Assessment (2005)

Gap-#, what

5. Filling in the data gap

Why are water quality data from developing countries not available?

Hypothesis:

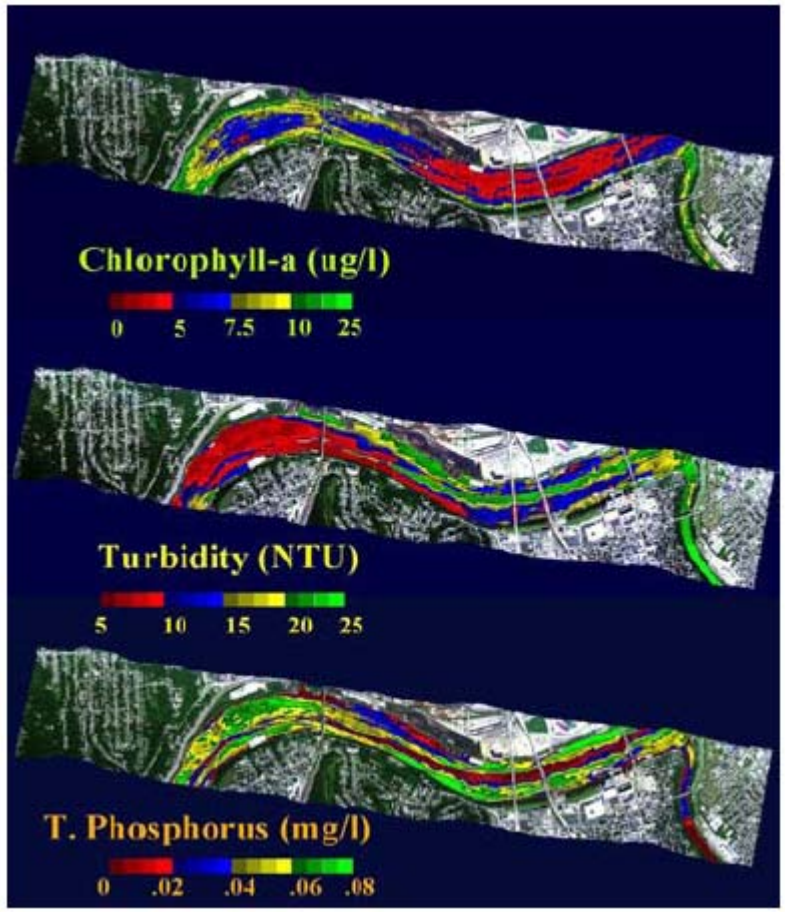
- They exist but not in digital, transferable form
- They exist but not ready to be shared
- They don’t exist

5. Filling in the data gap

How to fill in the gap?

The water quality data situation	Options for International Community
Data exist but not in digital, transferable form	Provide on-site support for retrieving and digitizing data.
Data exists but not ready to be shared	Arrange with holders of data to exchange data for later data products. (For example, work with country in using their water quality data as input to a regional assessment of status of inland fishery, freshwater biodiversity, or baseline water quality.)
Data don't exist	• Support baseline surveys of basic water quality parameters for priority lakes and rivers. • Retrieve available remote sensing data. • Stimulate further development of remote sensing collection.

5. Filling in the data gap
Potential for remote sensing of water quality



Water quality parameters map of Ohio River at the confluence of Licking River near Cincinnati, Ohio, USA

Based on hyperspectral remote sensing

Source: Naseer et al.

6. Needed: a benchmark

Compound		CCME Guideline	
		µg/L	ng/L
Metals	Arsenic	5	5,000
	Copper	2	2,000
	Mercury	0.026	26
	Nickel	65	65,000
	Lead	2	2,000
	Zinc	30	30,000
Pesticides	Atrazine	1.8	1,800
	Metolachlor	7.8	7,800
Polycyclic Aromatic Hydrocarbons (PAHs)	Fluorene	3	3,000
	Phenanthrene	0.4	400
	Fluoranthene	0.04	40
	Pyrene	0.025	25

Assertion #6. A global assessment needs a benchmark for judging good or bad water quality. Therefore, develop ***international water quality guidelines for freshwater ecosystems*****,** regionally-tuned

- Most countries have water quality guidelines for drinking water
- Few countries outside EU have guidelines for ecosystems
- Guidelines provide *guidance* (are not prescriptive) to countries in setting own standards

Six assertions about the global water quality challenge

1. different causes and lack of clarity
2. global dimensions
3. new policy options for shortcutting
4. global/regional assessments
5. the data gap
6. international water quality guidelines for freshwater ecosystems

What can Europe do to help meet the global water quality challenge ?

1. Help organize and support *global assessment of water quality*. Transfer data and methodology

2. Help *plug the most urgent data gaps* → synoptic monitoring of water quality in developing countries.

3. Help develop *international water quality guidelines for freshwater ecosystems*, regionally-tuned.

4. Help developing countries shortcut historical trends in water pollution by assisting with …

→ *development and transfer of ecologically-based, forward looking technology and management*

UNEP

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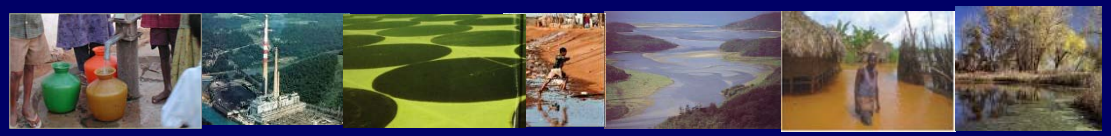

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Six assertions about the global water quality challenge

1. Worldwide water quality degradation will have many different causes and it is not always clear which factor will predominate where.

2. Water quality degradation has global dimensions

3. Developing countries have many policy options for shortcutting historical trends of surface water pollution.

4. We cannot identify the right policy options until we know what the problem is. But the water quality situation is not well understood throughout much of the world: *A global/regional assessment of water quality would be very timely!*

5. The world water quality situation is poorly understood because of a lack of data. But a global assessment needs data. *It is time to make a major effort to fill in the gap in world water quality data.*

6. A global assessment needs a benchmark for judging good or bad water quality. Therefore, develop *international water quality guidelines for freshwater ecosystems*, regionally-tuned.