

Water Sciences Forum:
Cutting Edge Technologies for
Water Services: Applications in
Africa

Necessary Factors for Sustained Access to
Safe Drinking Water & Sanitation Services in
Developing Communities

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Capacity Factors

Institutional	Policies, programs, procedures, jurisdiction
Human Resources	Professional, skilled/unskilled, Literate/IL
Technical	Supply chain, services, HW/SW
Economic, Financial	Opportunity cost, instruments, public & private providers
Environmental, Natural Resource	Stocks, recharge rates, background conc., short & long term variability
Energy	Quantity, intensity, accessibility, footprint
Socio-cultural	Participation: Gender, caste, class,...
Service	Quantity, quality, accessibility

Integrated Water and Sanitation



WASAN

Drinking Water Supply – DWS

Wastewater & Sewage Treatment – WST

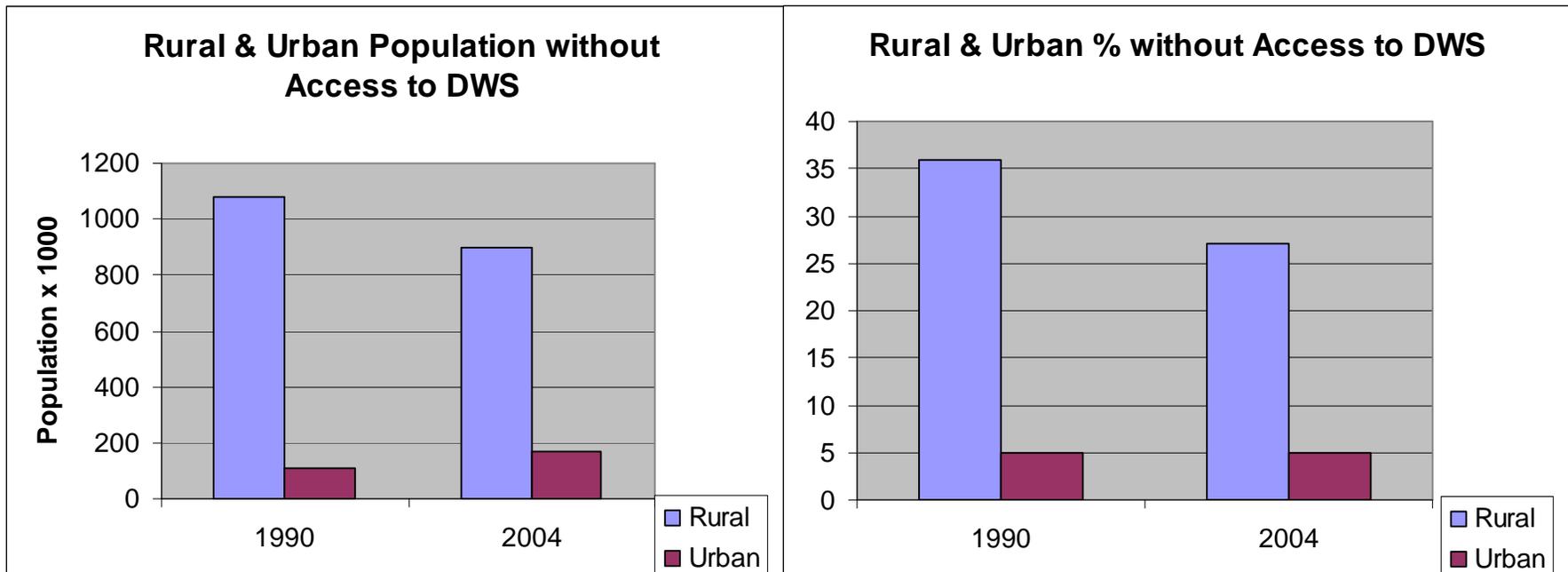
Management of Solid Waste - MSW

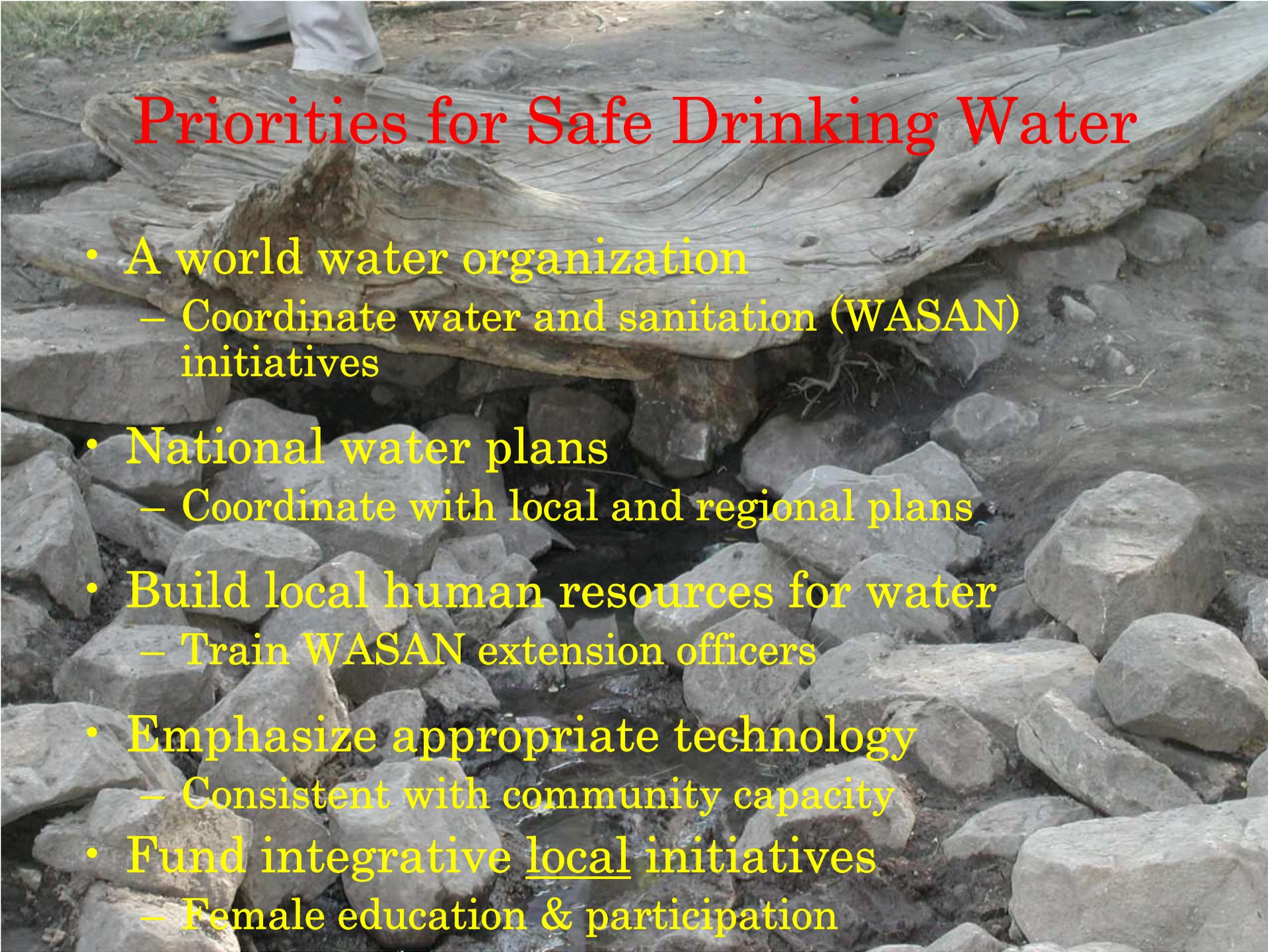
Integrated DWS, WST, MSW

- **Quantity**
 - Driven by source issues: availability, access
 - Procurement, storage, distribution
- **Quality**
 - Driven by use issues: health, risk perception
 - Treatment, distribution, point of use



Rural Areas Most Affected





Priorities for Safe Drinking Water

- A world water organization
 - Coordinate water and sanitation (WASAN) initiatives
- National water plans
 - Coordinate with local and regional plans
- Build local human resources for water
 - Train WASAN extension officers
- Emphasize appropriate technology
 - Consistent with community capacity
- Fund integrative local initiatives
 - Female education & participation

More Priorities for Safe Drinking Water

WATER WASHES AWAY POVERTY

- Use opportunity loss in investment decision
 - Economic valuation of inadequate services
 - Health, economic, environmental
- Stress stewardship
 - Sweat equity construction and operation
 - User fees pay costs
 - Community “mortgage”



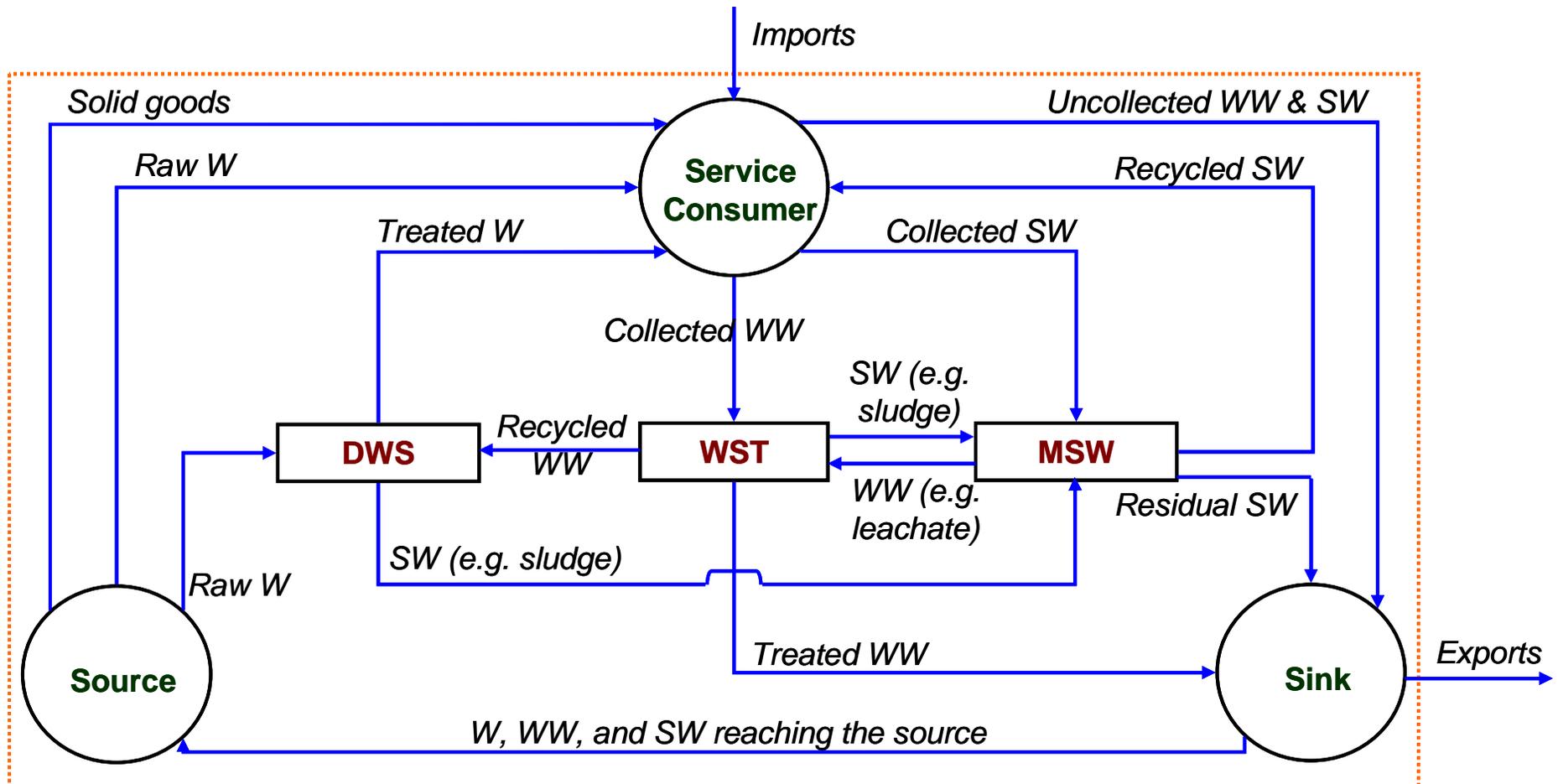
Terminology

- **Developing community**
 - Lacks capacity to provide basic service
- **Drinking water**
 - Drink, cook, personal hygiene – 10L pcd
- **Sanitation**
 - Sewage (feces, urine, blood, related solids/liquids)
 - Wastewater (graywater, industrial*, irrigation runoff)
 - Solid waste (non-hazardous, not medical/infectious)
- **Sustained access**
 - Adequate quantity & quality to meet planned demand (including contingency)

Safe Drinking Water Supply (DWS) & Sanitation Services

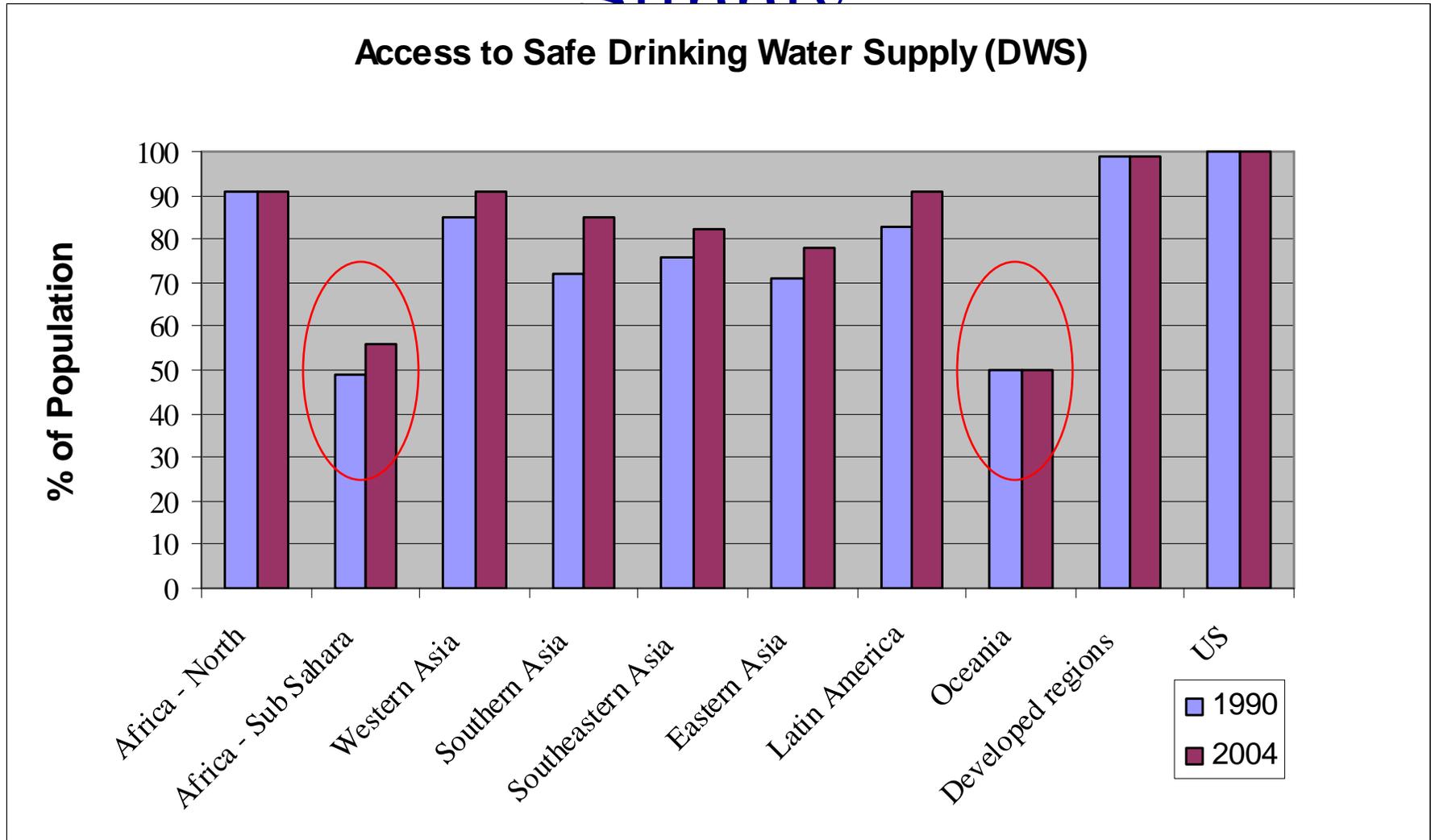
- Contains biological, chemical, physical, and aesthetic contaminants at concentrations consistent with WHO drinking water standards
 - Maintain human health
 - Minimize environmental risk

DWS is part of a system



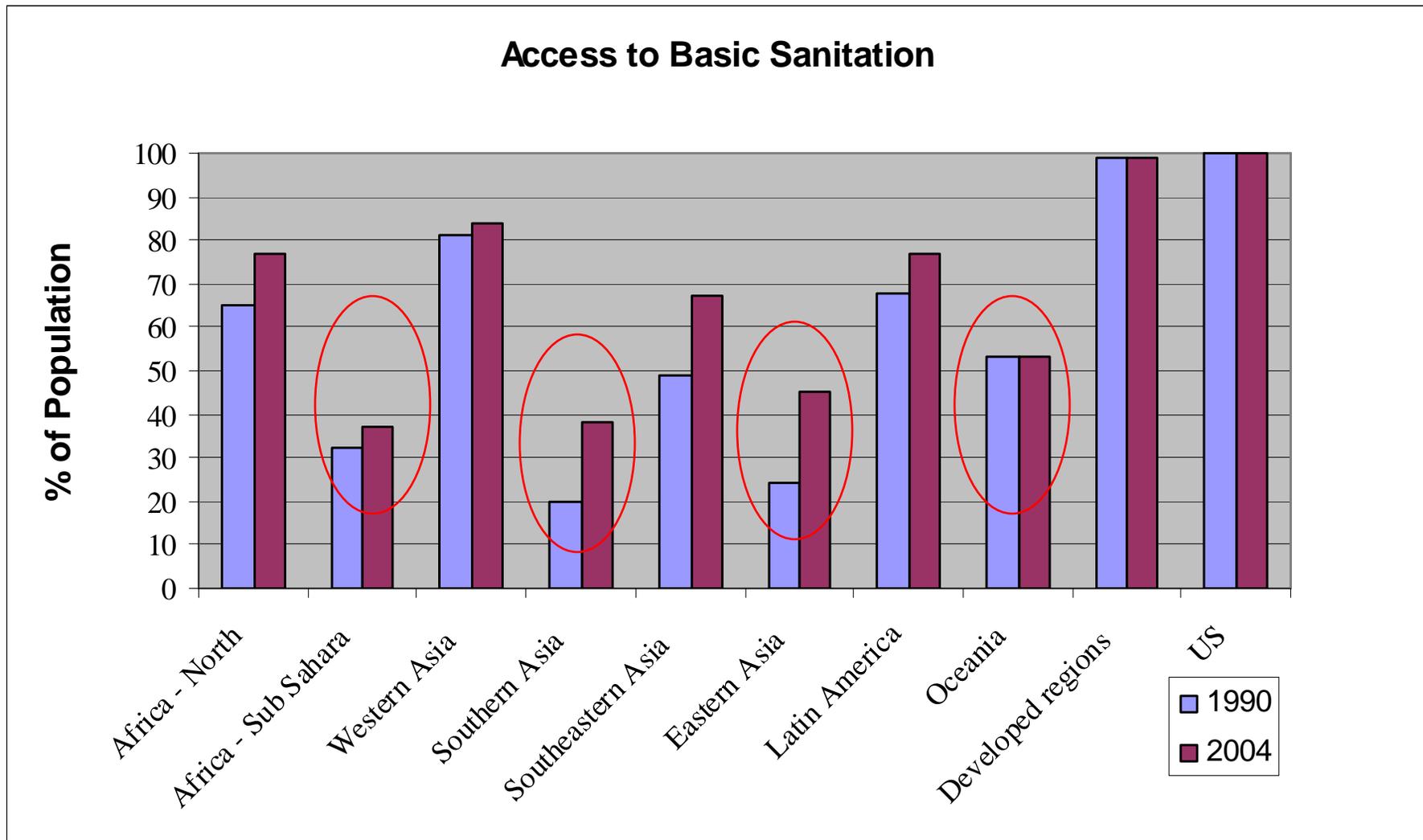
SDW = Water and Sanitation

Access to Safe Drinking Water Supply



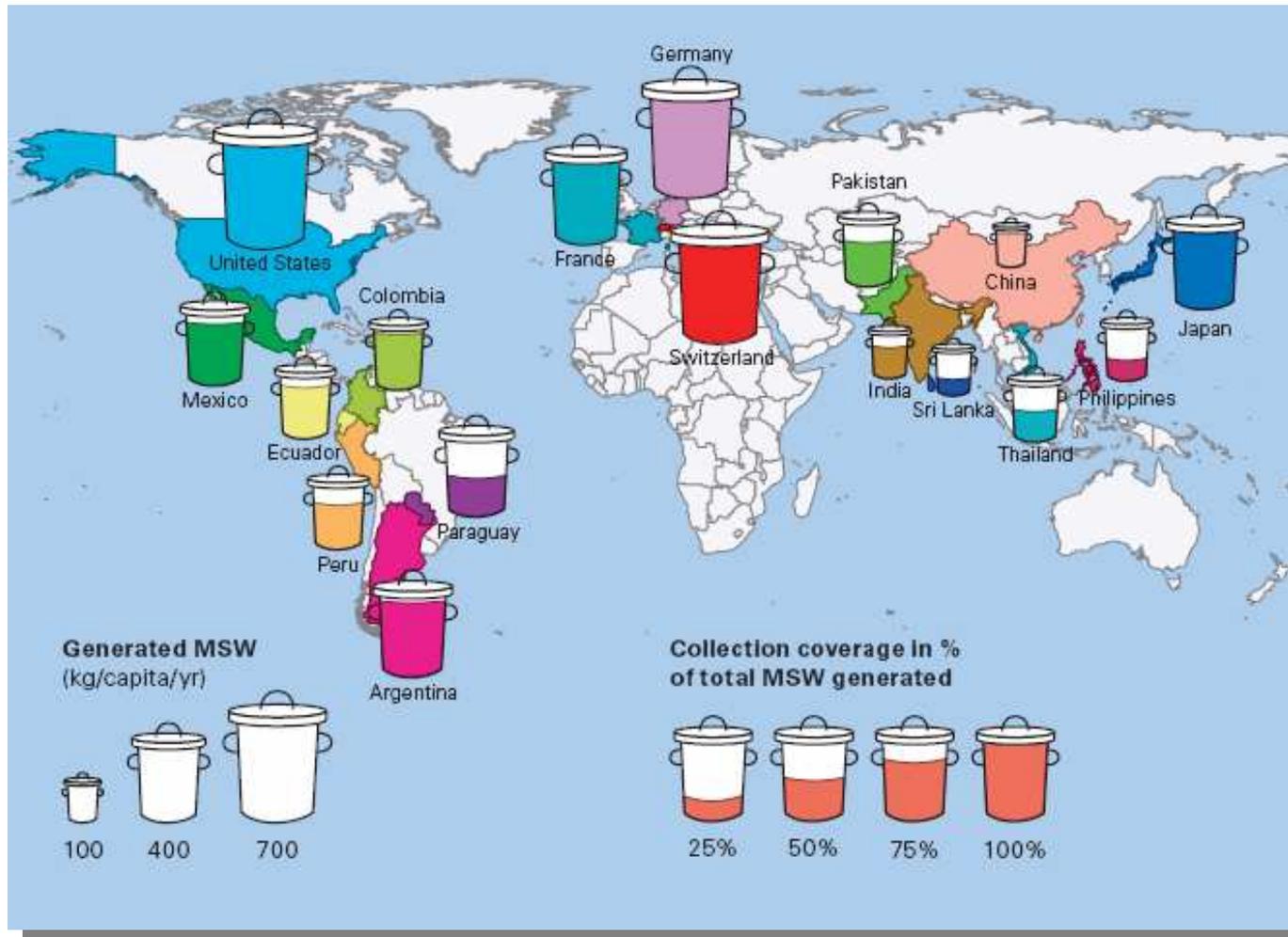
Source: WHO and UNICEF, 2006

Access to Sanitation



Source: WHO and UNICEF,

Access to MSWM



Source : Global waste challenge, EAWAG/Sandec , 2008

Urban and Rural Access to DWS

Metric	1990		2004	
	Rural	Urban	Rural	Urban
# Without Access (in millions)	1 080	107	899	170
% Without Access	36	5	27	5

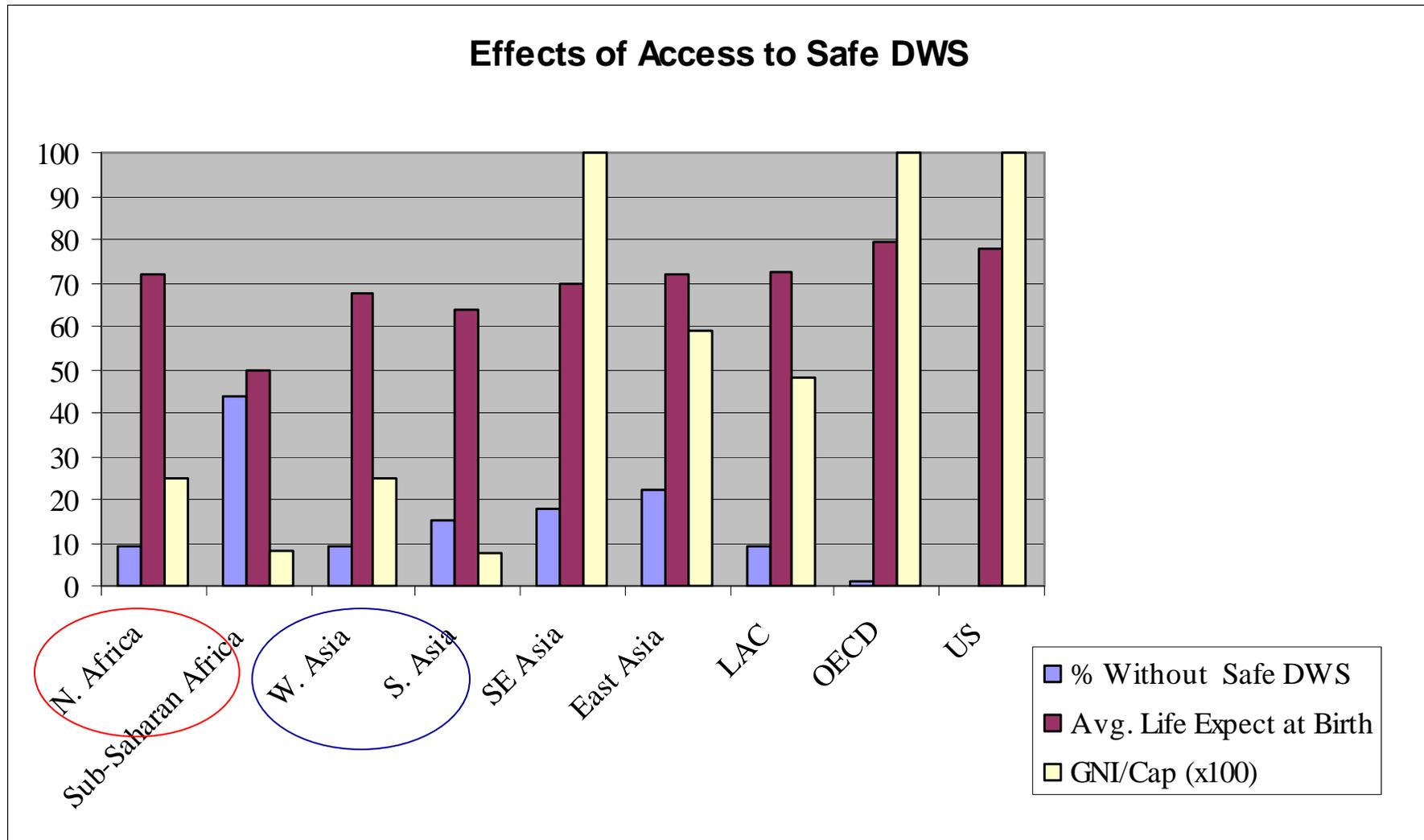
Source : (UNICEF & WHO, 2006)

Access to Safe DWS and Sanitation

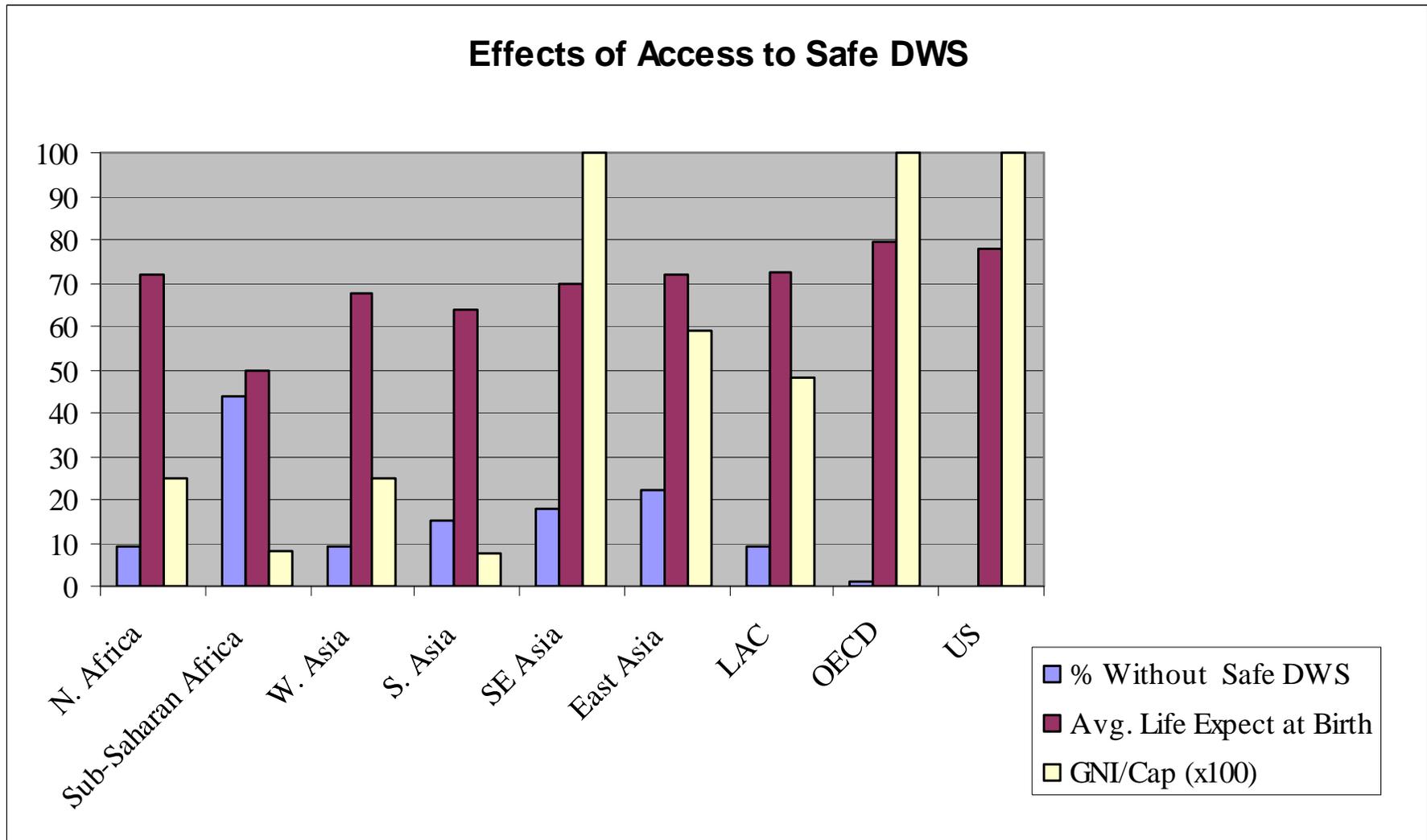
World regions	Access to Safe DWS (in millions)		Access to Basic Sanitation (in millions)	
	1990	2004	1990	2004
Africa - North	108	138	77	117
Africa - Sub Sahara	253	411	166	272
Western Asia	117	177	111	163
Southern Asia	846	1 299	235	581
Southeastern Asia	334	450	216	368
Eastern Asia	871	108	294	625
Latin America	368	504	302	426
Oceania	3	4	3	5
Developed regions	924	993	924	993
US	256	295	256	295

Source: WHO and UNICEF, 2006

Risks from Poor Access to WASAN



Implications of Access to Safe DWS



GNI/Cap: SE Asia (\$14,610), OECD (\$36,600), US (\$44,710)
 WHO, 2008

Implications of Access

Regions	% Without Access to DWS (2004)	Life Expectancy at Birth (2000-2005) ¹	GNI/cap (2006) ²
Africa - North	9	70.4-73.5 (Algeria, Libya, Egypt, Morocco, Tunisia)	2,507 (Middle East and N. Africa)
Africa - Sub Sahara	44	49.6	829
Western Asia	9	67.5 (Arab States)	2,507 (Middle East and N. Africa)
Southern Asia	15	63.8 (South Asia)	768
South-eastern Asia	18	59.7-79.4	490-28,730
Eastern Asia	22	65.9-77.9 (Mongolia, China, Rep. Korea), 71.1 (East Asia & the Pacific)	1,000-17,690
Latin America	9	72.2	4785
Developed regions	1	79.4 (High Income OECD)	36,608
US	0	77.9	44,710

Source: ¹HDR 2007/2008, UNDP

²<http://siteresources.worldbank.org>

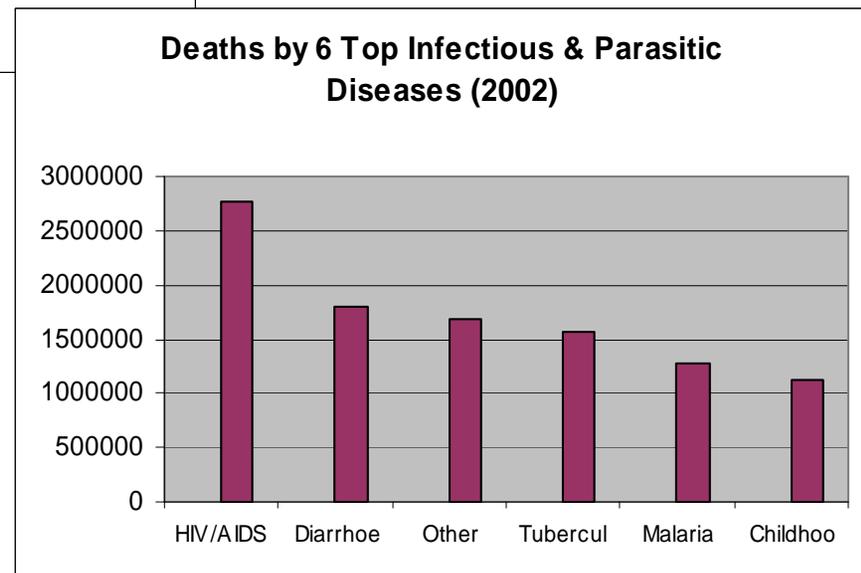
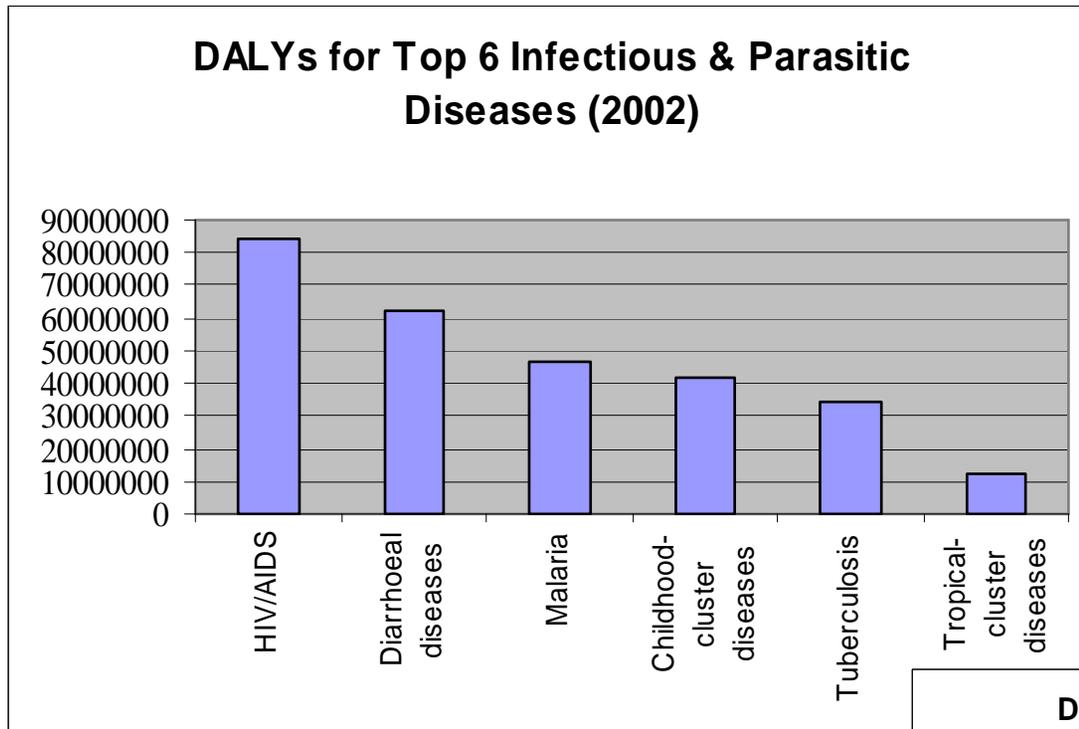
Public Health Implications of Inadequate Access to DWS

	Direct Effects		Indirect Effects	
	Waterborne disease incidence (species)	Water-related disease incidence (species)	DALY from waterborne & water related diseases	HAZ-2
Africa – North				
Africa - South				
Asia				
Europe				
Latin America				
Oceania				
US				

Public Health Effects of Inadequate Access to DWS

- Diarrheal disease
 - Est. 4.1% of total disability adjusted life years (DALY) global burden of disease
 - 1.8 million deaths per year
 - 88% of that burden:
 - attributable to unsafe water supply, sanitation and hygiene, and is mostly concentrated in children in developing countries

Prioritizing Safe Drinking Water



WHO Global Burden of Disease, 2002

Evidence of lasting disability effects from early childhood diarrhea (ECD)

1. **Growth** shortfalls (esp. **HAZ-2; 8.2cm** by 7yo)
2. **Fitness** impairment (=17% decr. work prod.)
3. **Cognitive** impairment (c. **10 IQ** points)
4. **School** performance (c. **1 yr**)

(increased age at starting school and age-for-grade)

These effects >DOUBLE the global diarrhea DALYs.

Moore et al. Int J Epi 30: 1457, 2001.

Guerrant DI et al. Am J Trop Med Hyg 61: 707, 1999.

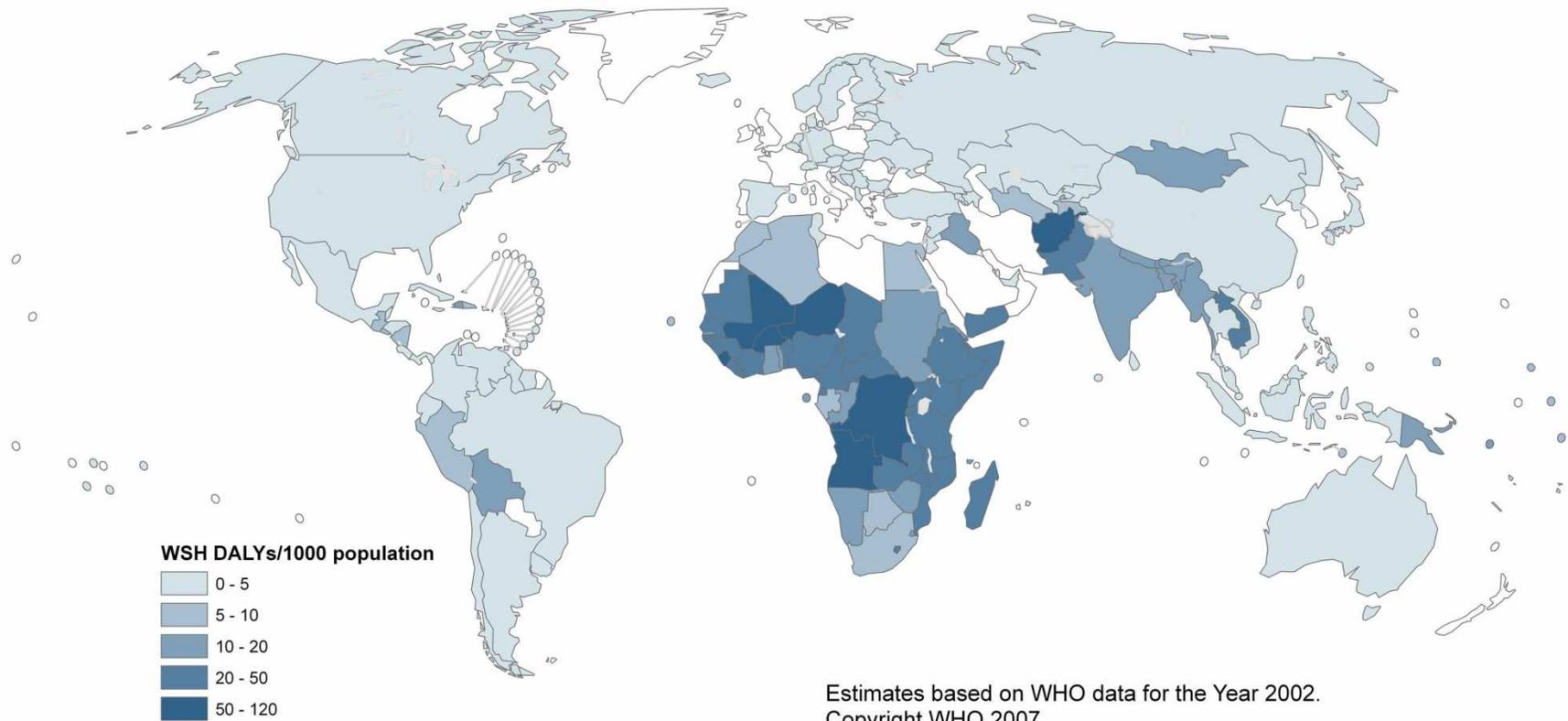
Niehaus et al Am J Trop Med Hyg 66: 590, 2002.

Guerrant et al Tr Parasitol 18: 191, 2002.

Lorntz et al PIDJ 2006.

Public Health Implications of Inadequate Access to DWS

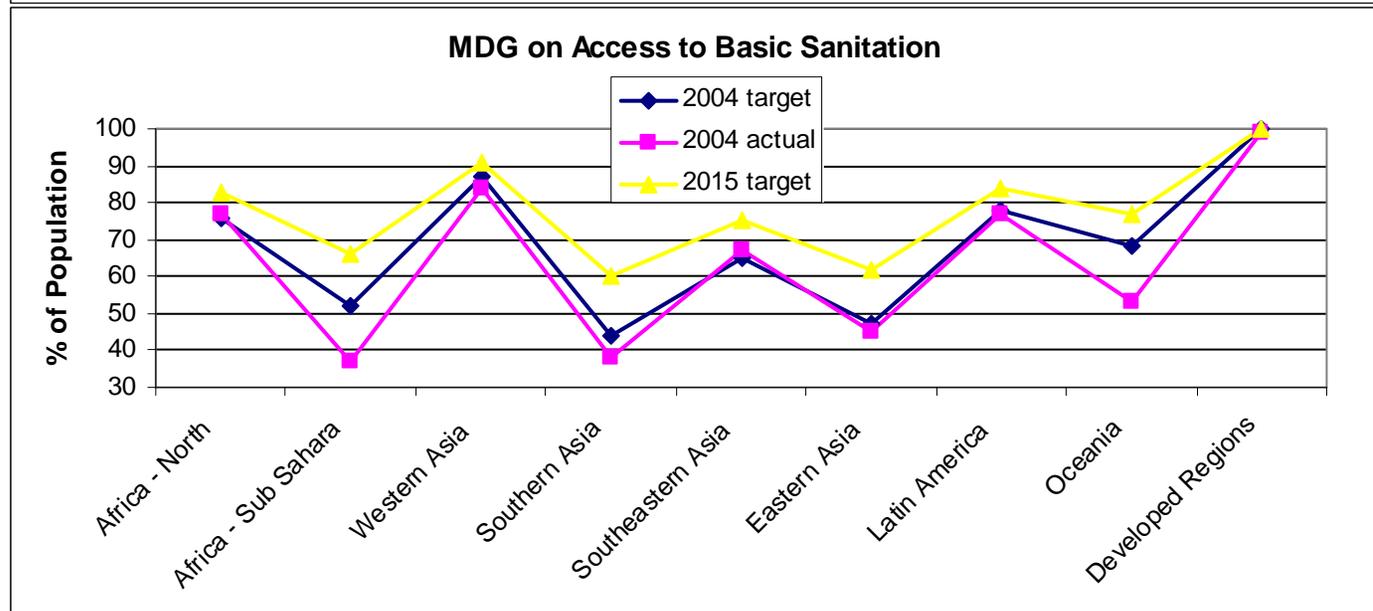
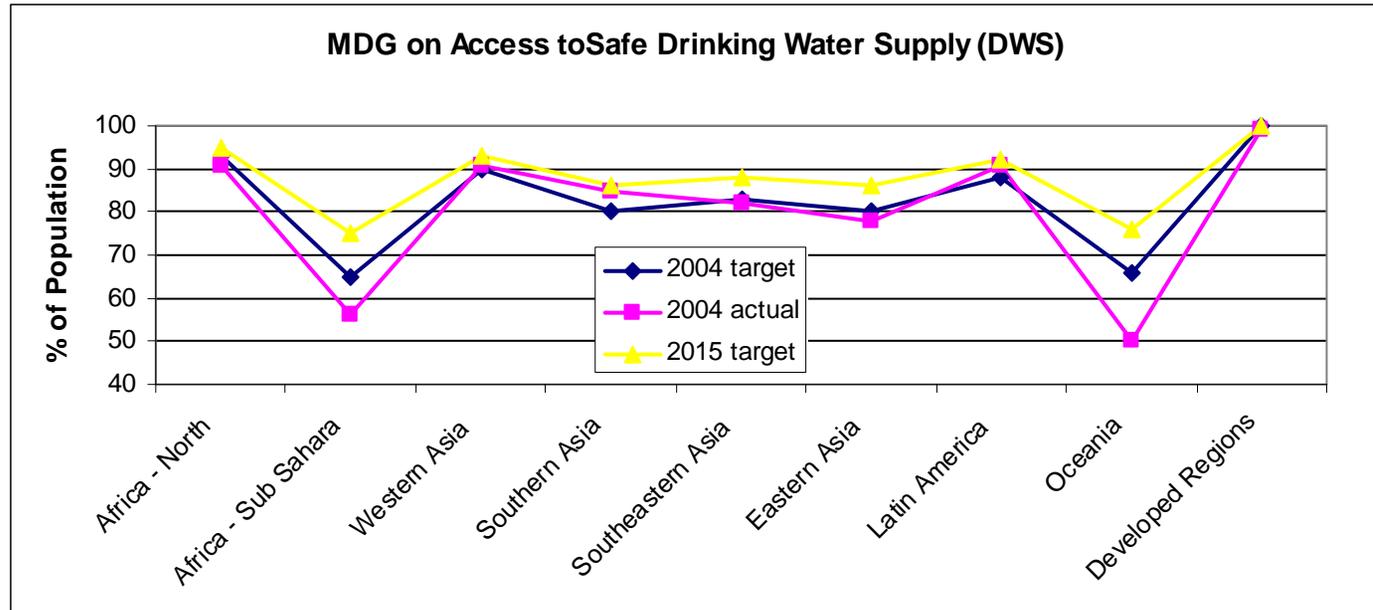
Diarrhoeal DALY (per 1000 capita – year) attributable to water, sanitation & hygiene



Source: http://www.who.int/quantifying_ehimpacts/national/countryprofile/mapwsh/en/index.html

MDG 14-Yr Assessment (1990-2004)

Increasing
Access:
MDG



Source:
WHO and
UNICEF,
2006

Reasons for Shortfall: Institutional

- Lead institution for WASAN
- International commitment
- Comprehensive programs in countries
- Is a decade enough?

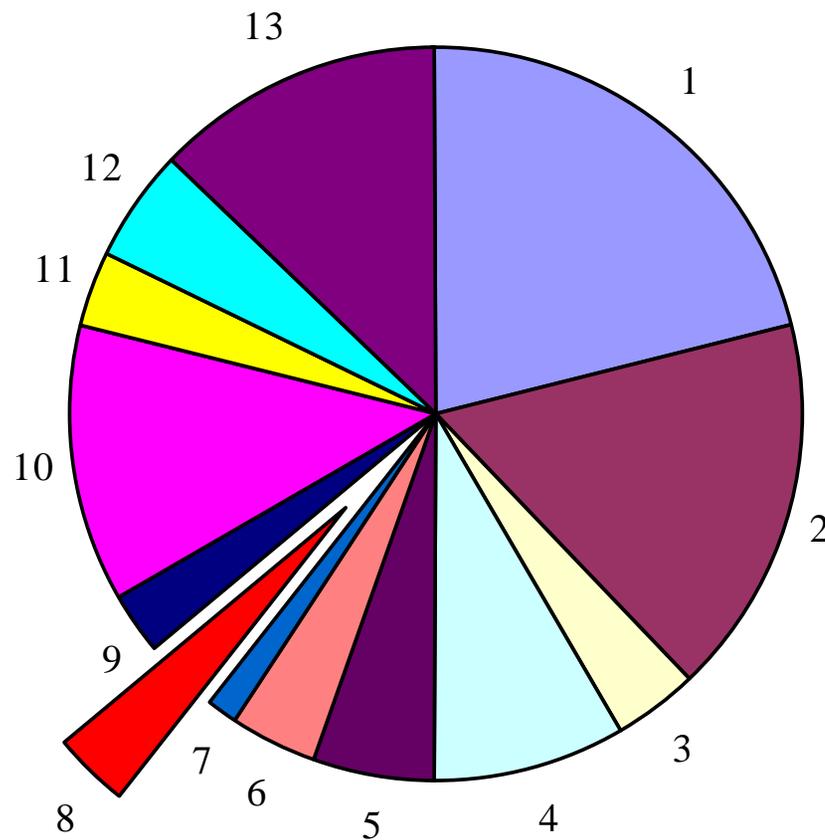
Reasons for Shortfall: Institutional

	Typhoid	Green Revolution	WASAN
Lead Organization			
International Commitment			
Programs in DC			
Preset time limit?			

No dedicated organization with exclusive WASAN mission; eg. UNFAO

Reasons for Shortfall: Institutional

WHO proposed 2008-2009 budget by strategic objective



WHO strategic objective 8: to promote a healthier environment, intensify primary prevention and influence public policies in all sectors so as to address the root causes of environmental threats to health.

This objective receives a smaller than average portion of the budget. Improvements to drinking water and sanitation systems are one of several targets within this objective.

Source: http://www.who.int/gb/ebwha/pdf_files/AMTSP-PPB/a-mtsp_7en.pdf

Shortfall: Human Resources & Technical Factors

	# WASAN Engineers per 100,000 population	% DWS facilities inactive
Africa – North		
Africa - South		
Asia		
Europe		
Latin America		
Oceania		
US		

Shortfall: Economic & Financial Factors

	% GDP Spent on DWS	Opportunity Loss of Inadequate DWS
Africa - N		
Africa - S		
Asia		
Europe		
Latin America		
Oceania		
US		

Shortfall: Supply & Energy Factors

Regions	% Without Access to DWS	% Without Access to Electricity ¹
Africa - North	9	4.5
Africa - Sub Sahara	44	74.1
Western Asia	9	21.9 (Middle East)
Southern Asia	15	48.2 (South Asia)
Southeastern Asia	18	34.4
Eastern Asia	22	2 (China, Taipei, Mongolia, Rep. Korea)
Latin America	9	10
Developed Regions	1	0
US	0	0 ²

Source: ¹<http://www.worldenergyoutlook.org/docs/weo2006/electricity.pdf>

²HDR 2007/2008, UNDP

Shortfall: Socio-cultural Factors

	% Without Access to DWS	Annual # of Deaths by Diarrheal Diseases Among Children < 5yo (per 1000 population) ¹	Adult Literacy Rate ²
Africa - North	9	6.32 (all Africa)	52.3-84.2 (Algeria, Libya, Egypt, Morocco, Tunisia)
Africa - Sub Sahara	44		60.3
Western Asia	9	3.61 (eastern Mediterranean)	70.3 (Arab States)
Southern Asia	15		59.3 (South Asia)
South-eastern Asia	18	3.08 (south east Asia)	68.7-92.7
Eastern Asia	22		90.7 (East Asia & the Pacific)
Latin America	9	0.93 (all Americas, excluding USA and Canada)	89.9
Oceania		1.45 (western Pacific without Australia, Japan, and NZ)	
Developed regions	1	0 (USA, Canada, and European countries with low mortality)	99.1 (high-income OECD)
US	0	0	99

Source: ¹The World Health Report 2005, WHO

²HDR 2007/2008, UNDP