



WATER AND SECURITY

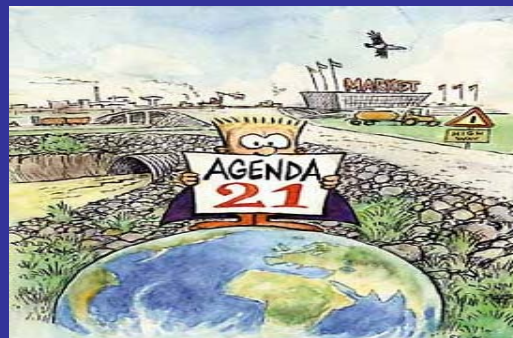
Santa Barbara, April 18, 2009

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MILLENNIUM DEV GOALS

	Goal 1 Eradicate Extreme Hunger and Poverty
	Goal 2 Achieve Universal Primary Education
	Goal 3 Promote Gender Equality and Empower Women
	Goal 4 Reduce Child Mortality
	Goal 5 Improve Maternal Health
	Goal 6 Combat HIV/AIDS, Malaria and other diseases
	Goal 7 Ensure Environmental Sustainability
	Goal 8 Develop a Global Partnership for Development



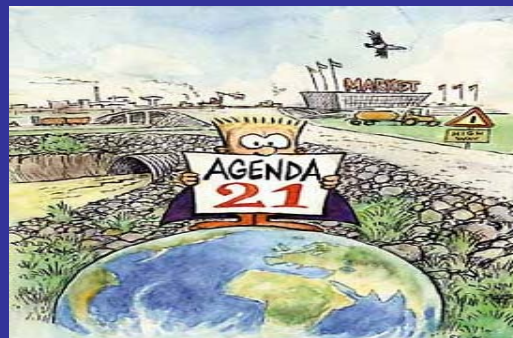
Water, Security and Global Water Policies

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Water, Security and Global Water Policies

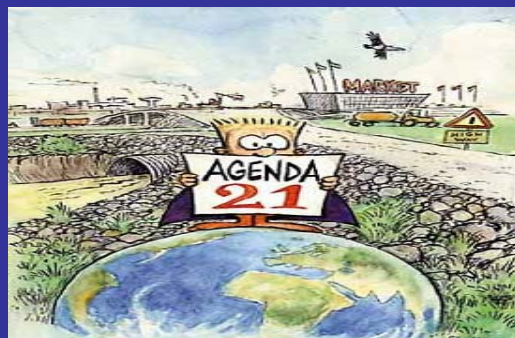
Water Climate Lecture Series March 3, 2010
Princeton

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Water, Security and Global Water Issues

Osher Lifelong Learning Institute

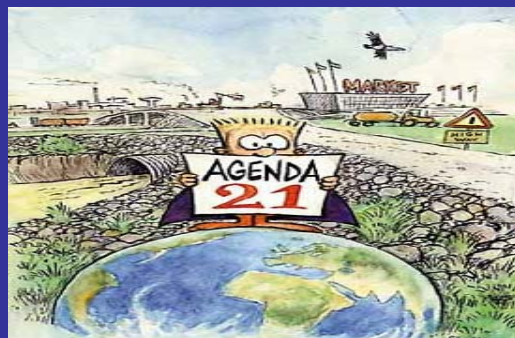
April 15, 2010

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1. Water: Conflict or Cooperation?



“The only matter that could take Egypt to war again is water.”

Anwar Saddat, 1979

“The next war in the Middle East will be fought over water, not politics.”

Boutros Boutros Ghali, 1985



“The wars of the next century will be about water.”

Ismail Seageldin, Vice President, World Bank, 1995



“Fierce competition for fresh water may well become a source of conflict and wars in the future.” Kofi Annan, March 2001.

- ***BUT! In 1995the Senior Israeli Defense Forces Official, "Why go to war over water? For the price of one week's fighting, you could build five desalination plants. No loss of life, no international pressure, and a reliable supply you don't have to defend in hostile territory".***
- ***“But the water problems of our world need not be only a cause of tension; they can also be a catalyst for cooperation...If we work together, a secure and sustainable water future can be ours.” Kofi Annan, January 2002.***



DEFINING WATER AND SECURITY

WATER SECURITY: BIG “S” AND SMALL “s”

Interdependence ➔ Vulnerability or Flexibility?

The Big “S”: Conflict, War, Large Scale Violence

- Water as Independent variable, cause of war – conflict
- Water as Tool of War – social Violence
- Eco – Shocks and Social Unrest

The Small “s”: Water: Means to Other Social Ends

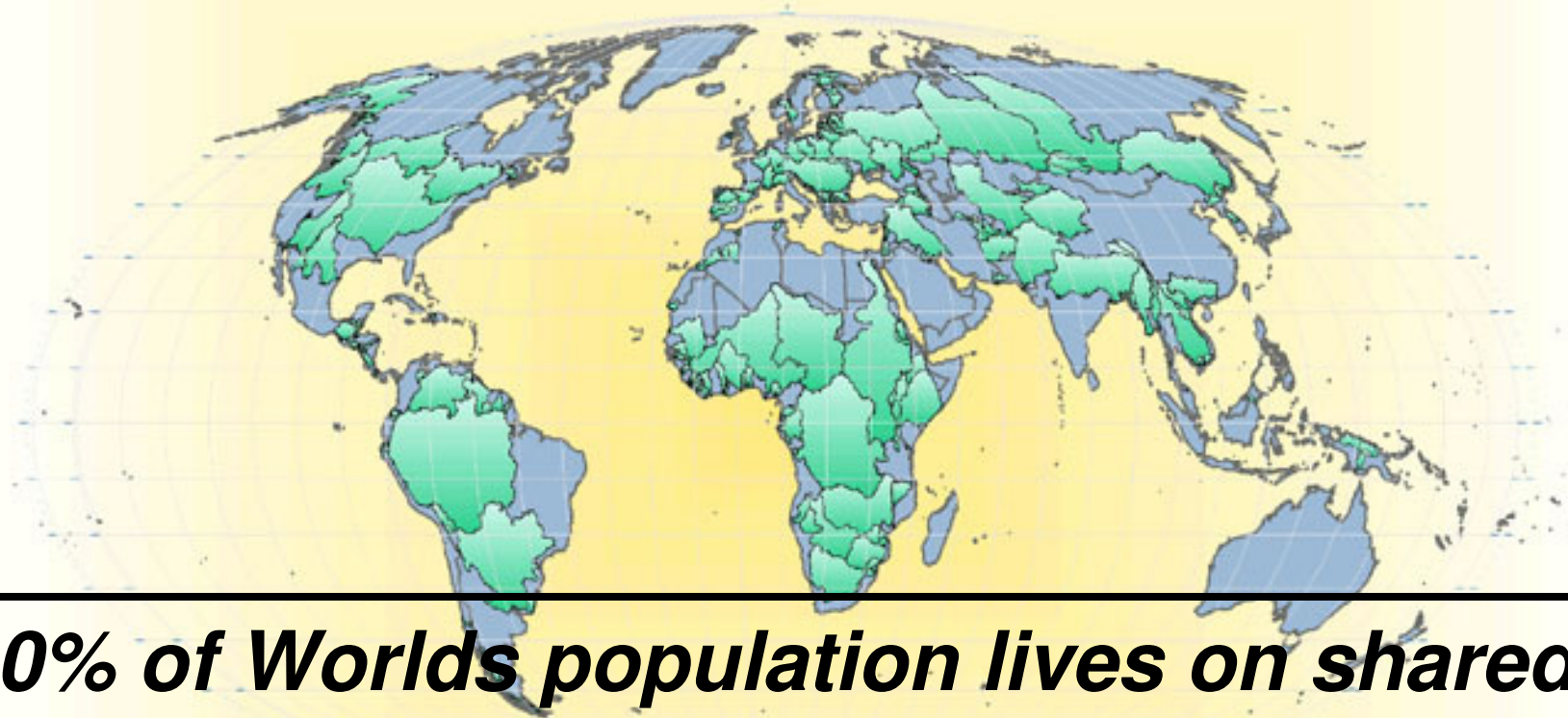
Our English Dictionaries define security as:

“ freedom from danger, from fear or anxiety, from want or deprivation.”

This is the history of humanity’s management of water:

- trying to be sure we have good water, in the right quantity at the proper time and place.
- Predicting floods, reserving sources for droughts, using water to help us generate wealth and avoid deprivation.

International Basins of the World



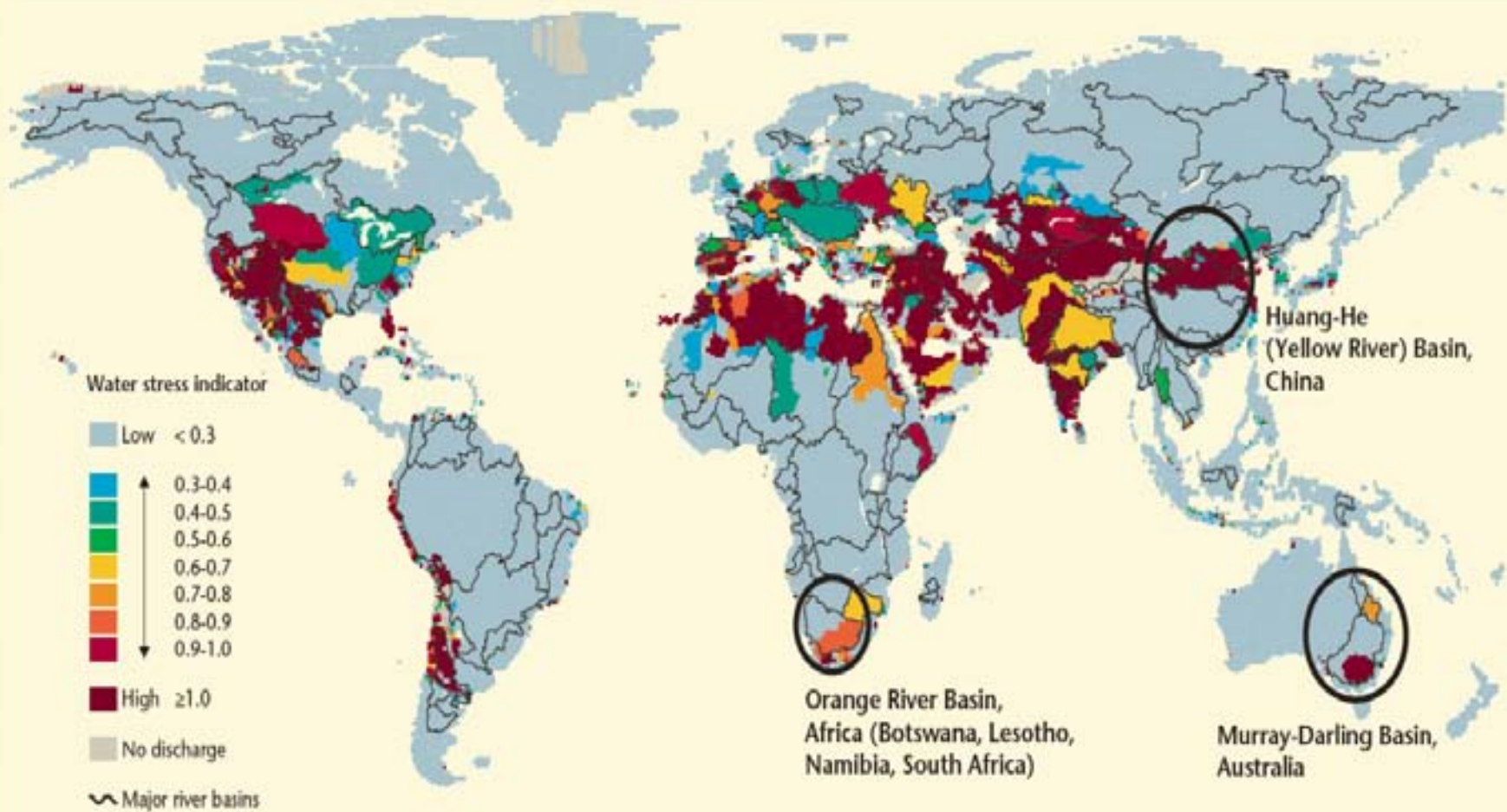
***40% of Worlds population lives on shared
basins: or more than 50% of earth landmass***

160°00'W

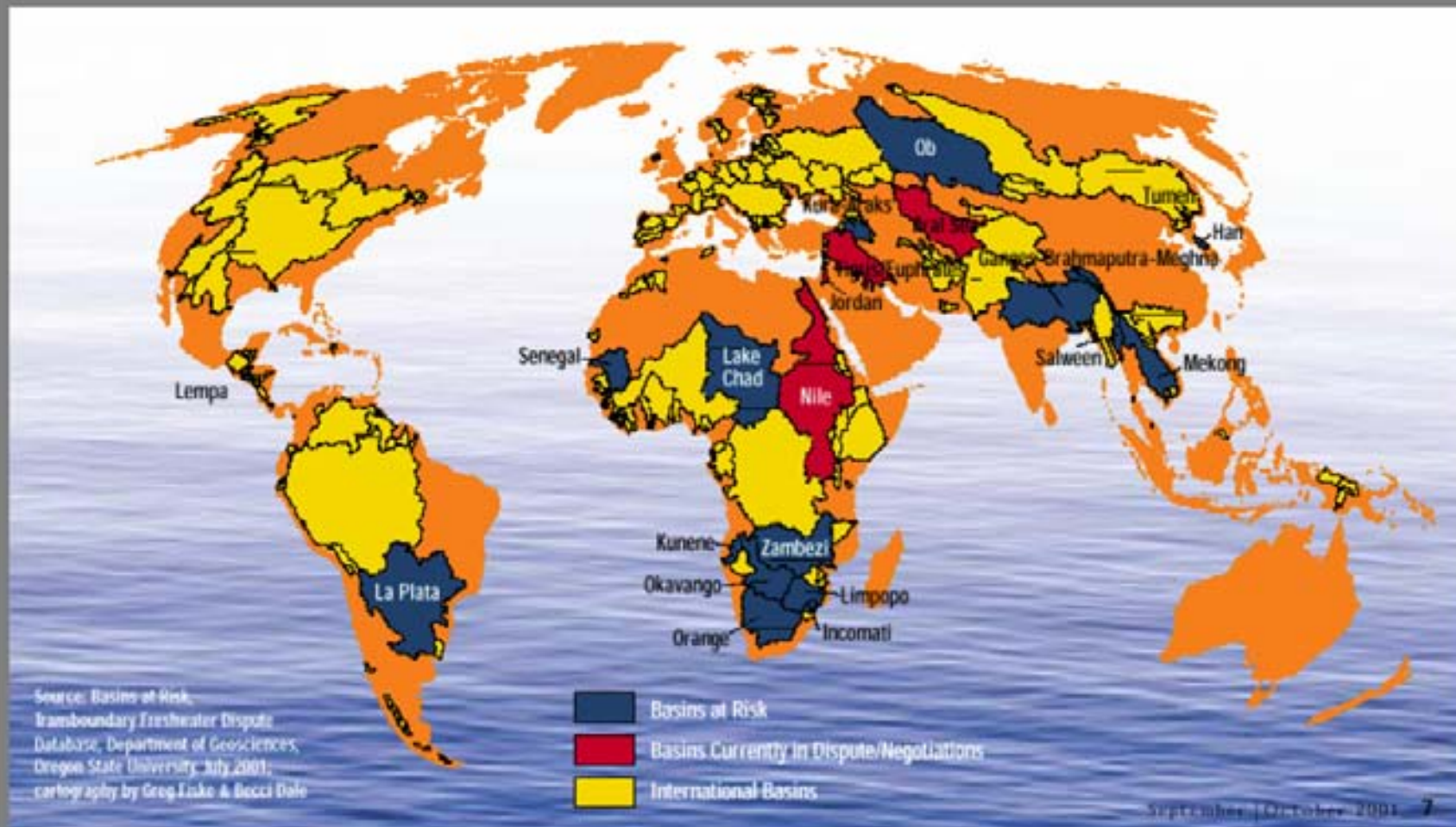
Database: Basins at Risk
Mollweide Projection
Oregon State University
October 2000

Map 6.3

Water stress level of major river basins, around 2002

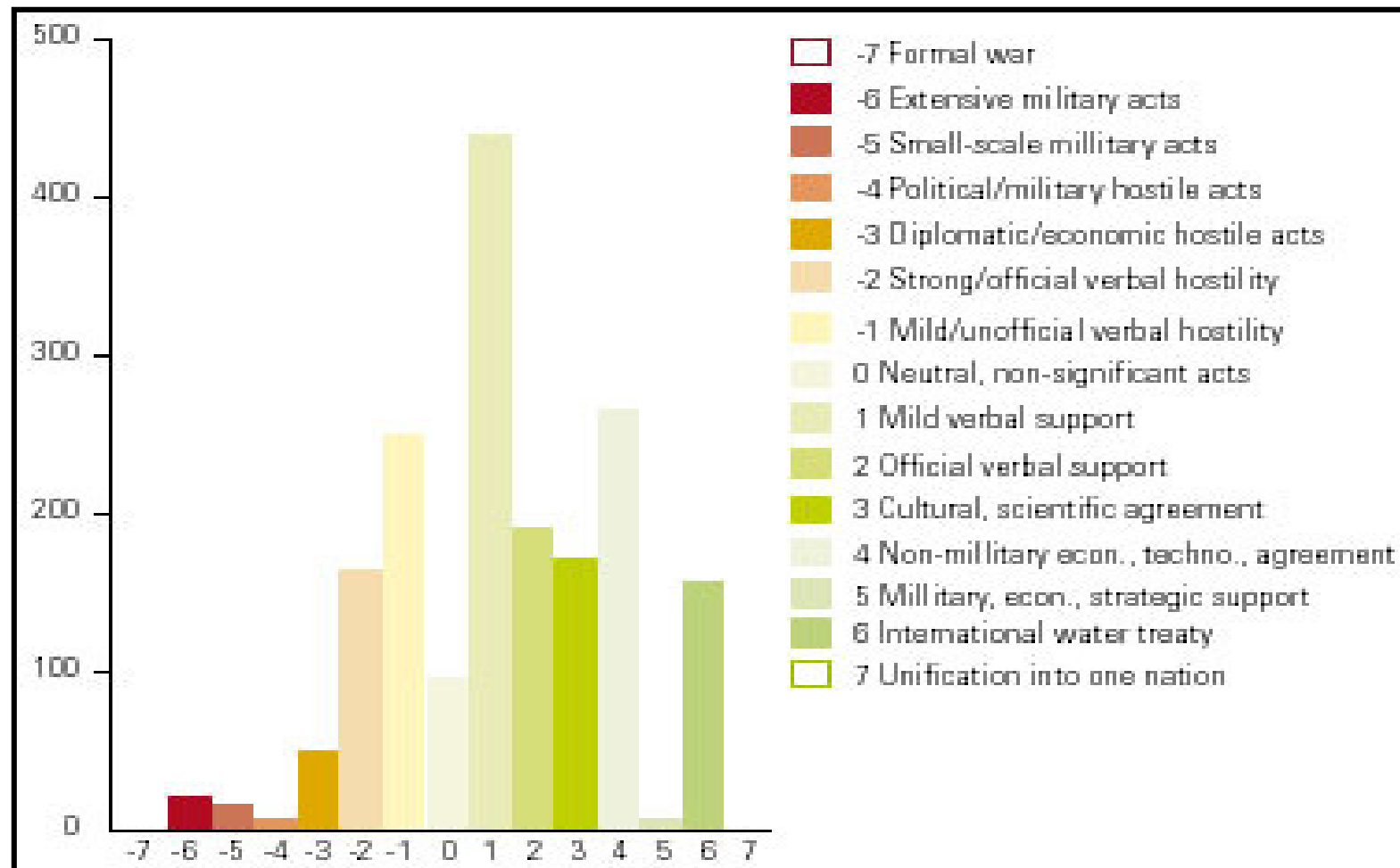


Source: Based on Smakhtin, Revenga, and Döll 2004.



conflict

Water Vector of Cooperation vs. Source of Conflict

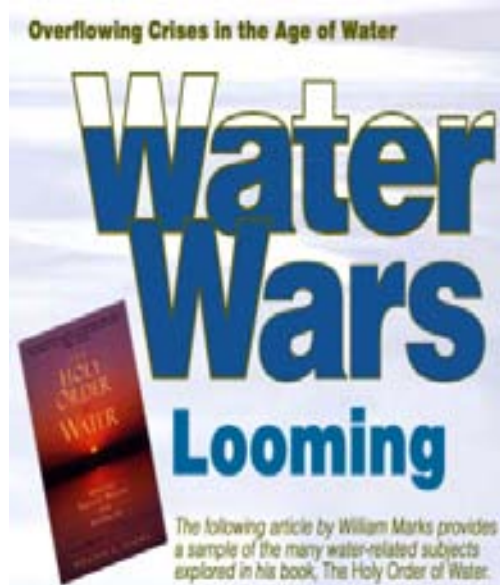


Fifty years of 1,831 conflicting and cooperative interactions over the last fifty years.

- 7 disputes involved violence; 507 conflictive events have occurred
- 200 treaties signed; 1,228 cooperative events.

So - Why *Aren't* Water Wars more Common?

1. Strategic Argument
2. Shared Interests Argument
3. Institutional Resiliency Argument
4. Economic Argument?
5. There are Trends to Cooperation



Some Trends to Cooperation

- Technical information beginning to bond vs.. separate
- Price for control over river = cooperation
- Opportunity costs for not cooperating growing
- New actors/new claims that cross jurisdictions
- Austerity requires multipliers
- Events of 1990's in world water community
- Science showing cooperation as root to evolution and security
- Functional and second track diplomacy
- Accept facilitator vs.. expert dictator role
- Technologies now cheap and facilitative
- Others



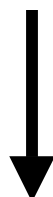
2. MAIN THESIS

Water Actions as Key Societal Adaptation Tools

Investment in Water Infrastructure, IWRM, Flood Management



**Water Security (small s)
Minimum Platform for Growth**



**Internal Stability
and Security (large S)**

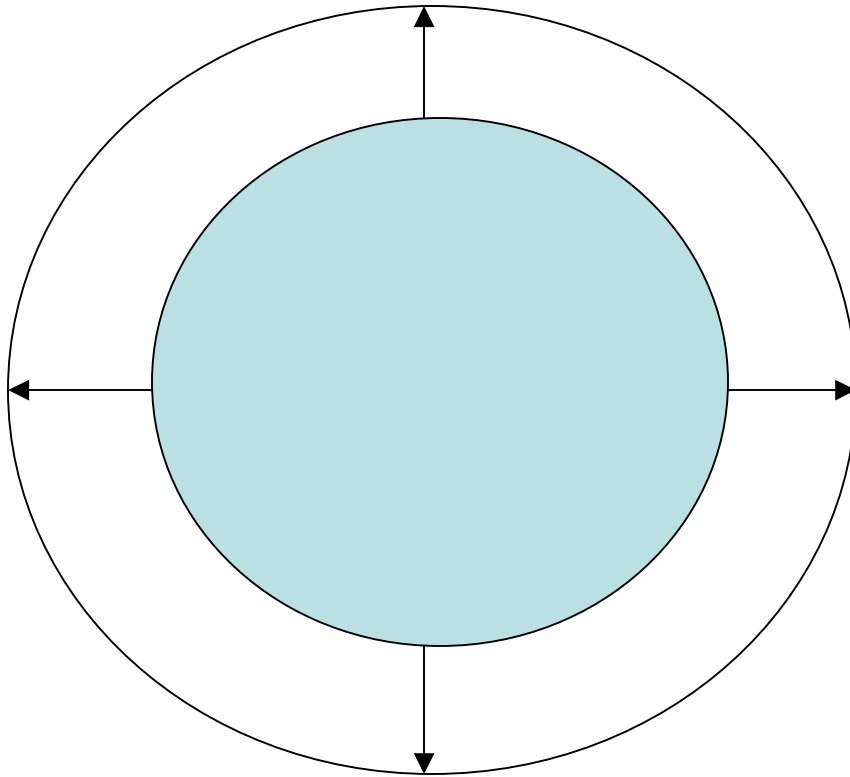


**Strategic
Security**

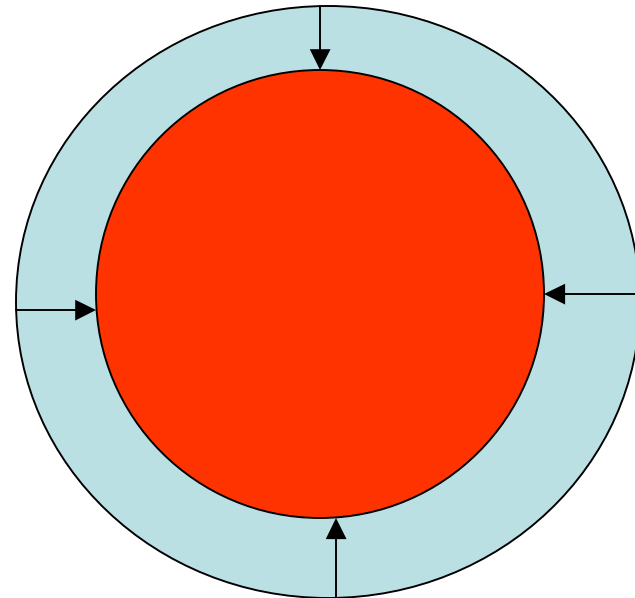
WATER IS MORE THEN ACCESS

- Many uses: irrigation, floods damage reductions, drought, ecological flows, hydropower, energy coolants, navigation, recreation
- **Multiple Purpose uses Allows for Jointly Creating Benefits (both off and on) the water vs. Fighting Over Allocation of Flows – Key to Water Venue of Dialog**
- Water's Tradition of Expanding the Negotiating Pie vs. Reallocating Limited Pie:
 - Absolute vs. Relative Scarcity; Redistribution vs. Relative Deprivation
 - Interest/Needs Based Negotiations - Approaches
 - Virtual Water Movement
- **Water More Humanity's Learning Ground for Building Community then Generator of War**

Negotiating Arenas: Benefits - Interests



**Increasing the Pie
Benefits Created**

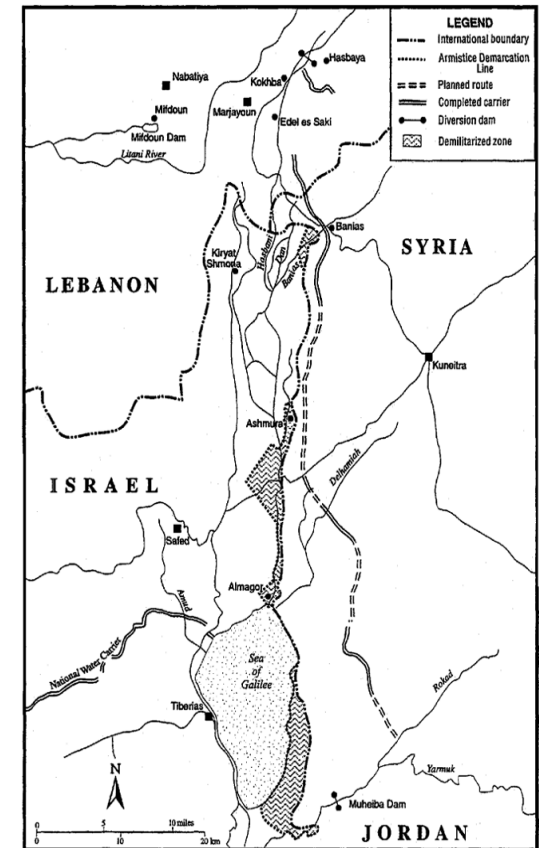


**Mitigating against
Decreasing Pie**

Role of IWRM?

Some Current Examples....

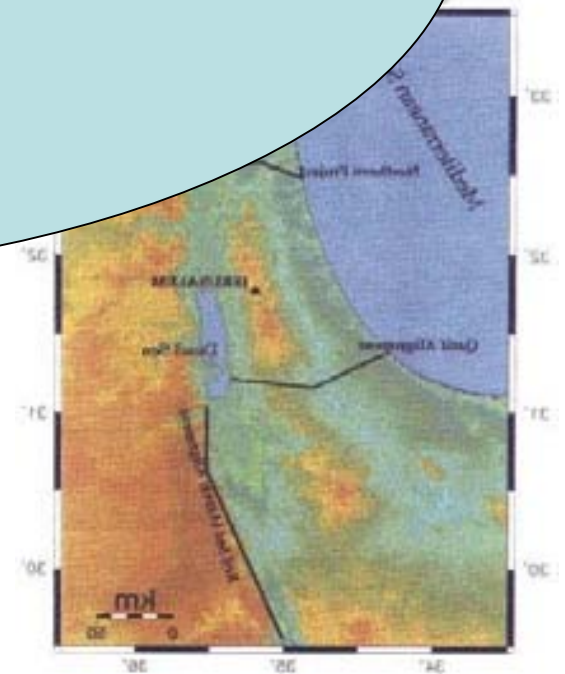
- Middle East Table Talks
- Multilateral Water Talks in Middle East: current use of Desal. center
- Indus river in 1950s: current arbitration
- Recent Istanbul Conference and T-E river
- Afghanistan: water investment strategic objectives
- Others.....



Red Dead Canal

Environmental People Security?

- "This is the end in the region with a war with the dead end of the region"
- Israeli environmentalists and [the World Bank](#) of the Red Sea-Dead Sea Canal project discussions in their favor, at a public hearing Sunday in Neveh Ilan, west of Jerusalem that frequently erupted in chaotic screaming matches.



57-year-old Israeli billionaire Yitzhak Tshuva, owner of the El-Ad Group, Jerusalem Post, May 16, 2009



Water Infrastructure and Social Change 20th Century

“As I look upon Bonneville Dam today, I cannot help the thought that instead of spending, as some nations do, half their national income in piling up armaments and more armaments for purposes of war, we in America are wiser in using our wealth on projects like this which will give us more wealth, better living and greater happiness for our children...,” (FDR Dedicating Bonneville Dam Set 28, 1937)



Central Valley CA

- Do we reduce water and decrease agriculture and increase dependency on foreign important of agriculture – and then reduce our security?
- If security means reduce dependency on external sources, do we have alternatives? What?
- The li throughout the co potatoes - up to more (...)
- Security is found in how we balance these- are there alternatives between imports vs.U.S. agriculture

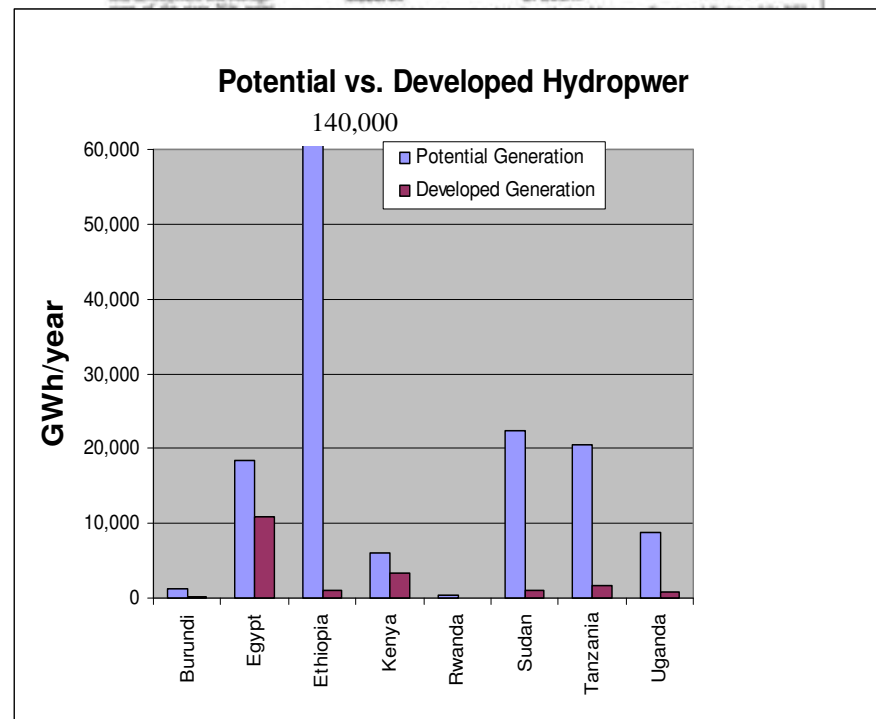
REALLOCATION REAPPORTIONMENT



Nile Basin opportunities:

Major potential win-win benefits from cooperative development

- Power production/trade: ~90% HP potential undeveloped; ~85% pop. unserved
- Food production/trade: ~60% of irrigable land unirrigated
- Multipurpose storage: very low despite very high rainfall variability
- Environmental sustainability: watersheds, soils, wetlands, lakes
- Conflict prevention; reduced tensions promote integration



Southern African Hydropolitical Complex



- **Role of international rivers as an element of a regional security complex is as yet largely unexplored.**
- **Threats to economic security derive from the role of water as a foundation for the economic growth and prosperity of a given state.**
- **International river basins form an important element of the Southern African Regional Security Complex.**

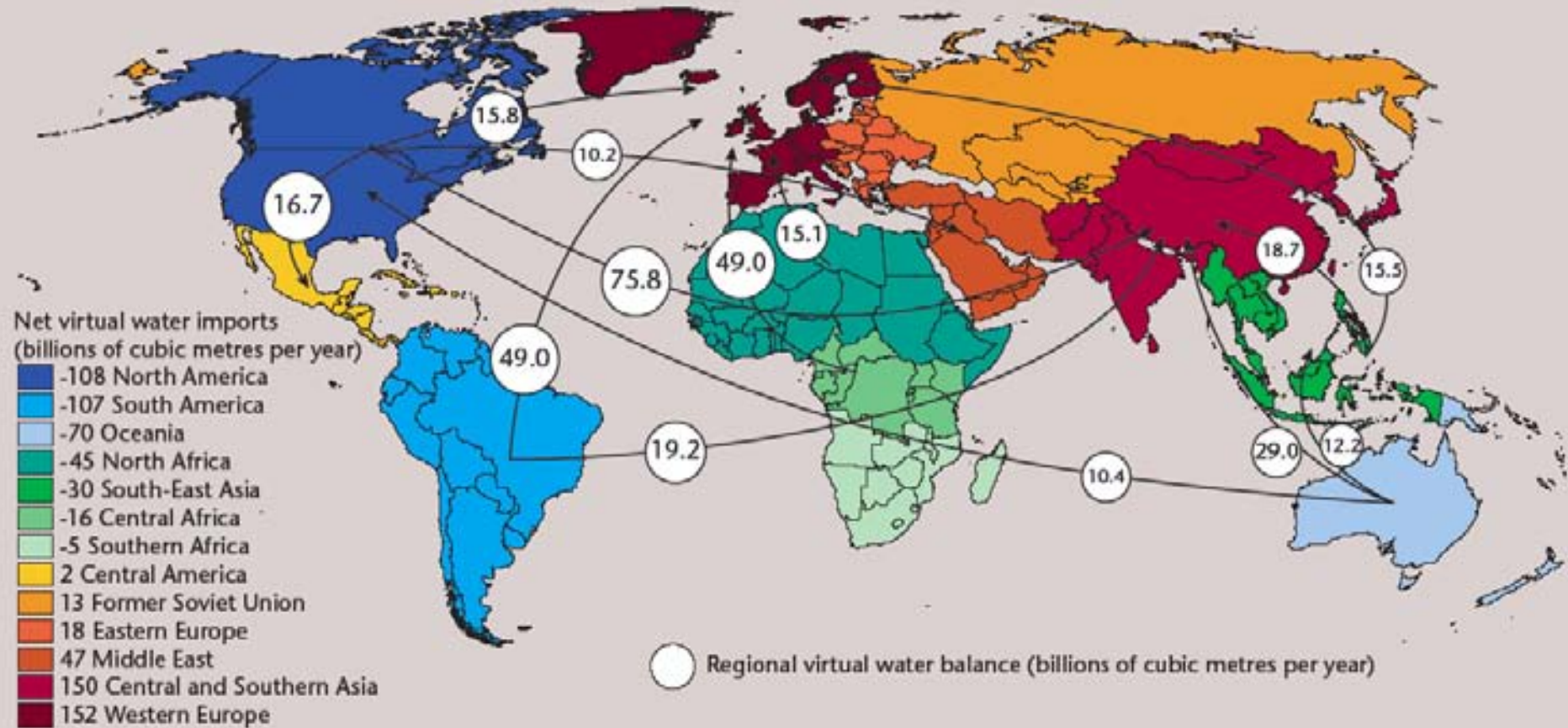
REGIONWIDE CHANGES 1985-2000

	1985	2000	Turkey 2000
	(%)	(%)	(%)
✓ RURAL WATER SUPPLY	57	60	75
✓ URBAN WATER SUPPLY	15	65	73
✓ RURAL ELECTRICITY	66	99	99
✓ VILLAGE ACCESS	71	98	99
✓ LITERACY	55	69	85.1
✓ INFANT MORTALITY (%0)	111	60	35.3
✓ LANDLESS POPULATION*	40	** 25	25

* Irrigable areas

** 1995 figures

Regional virtual water balances and net interregional virtual water flows related to trade in agricultural products, 1997-2001



Source: Based on Hoekstra and Chapagain 2008.

VIRTUAL WATER INTERDEPENDENCE WATER SECURITY

Many countries, including Japan, Mexico and most countries in Europe, the Middle East and North Africa, have net virtual water imports (see map). Water security in many countries thus strongly depends on external water resources (see chapter 7).

Strategy

- **Identify Priority Areas of Security concerns**
- **Ask:**
“How can Water Actions be Used as Means to Achieve Security Ends in Each Priority Area?”

- **Move Beyond Humanitarian Assistance**
- **Ask:**
“How can we work to prevent and reduce vulnerability to Disasters?”



- **Move Beyond Environment alone**
- **Ask:**
“How to use water to create platform for growth while designing mitigation cost to environment?”

3. NOT NEW: SOME HISTORICAL CONTEXT

Collaboration: Machiavelli and Leonardo Da Vinci for Multipurpose Diversion of the Arno River

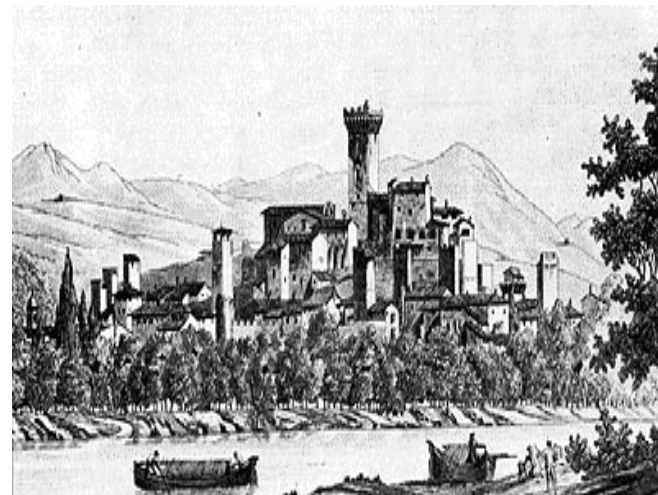
“The Rediscovery of engineering and the development of trade provided an important foundation for art and philosophy. After a long period of instability...scholars have described the period from around 1400 -1470 as the equilibrium of the Renaissance. Particularly in Italy, agriculture flourished and harvests improved, population stabilized and political conflict moderated. These transformations were slower to come in Northern Europe, particularly in regions where the technology of water control was not as well developed as in Italy. “(Masters 1998)



Rome and European Rivers



**..Boatsman associations
and organizing the
whole river
..special offices for
arbitration on river uses..**



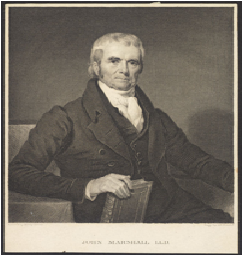
Water Ways & Establishing National Federal Interventions Over Interstate Issues



1808: Gallatin Report

Waterways to be used for:

- Building Political Unity and Nation
- National Defense
- Economic Development



Marshall



Gibbons



Ogden

1824: GIBBONS VS. OGDEN

(Estbl. Federal Powers vs. States)

Claims are said to be repugnant—

- 1st. To that clause in the constitution which authorizes Congress to regulate commerce.
- 2d. To that which authorizes Congress to promote the progress of science and useful arts.

1920's - "308" Reports: Congress Authorizes USACE do Comp. assessments of all major rivers of the US



George C. Marshall

June 5, 1947

Harvard University,
Cambridge, Mass.



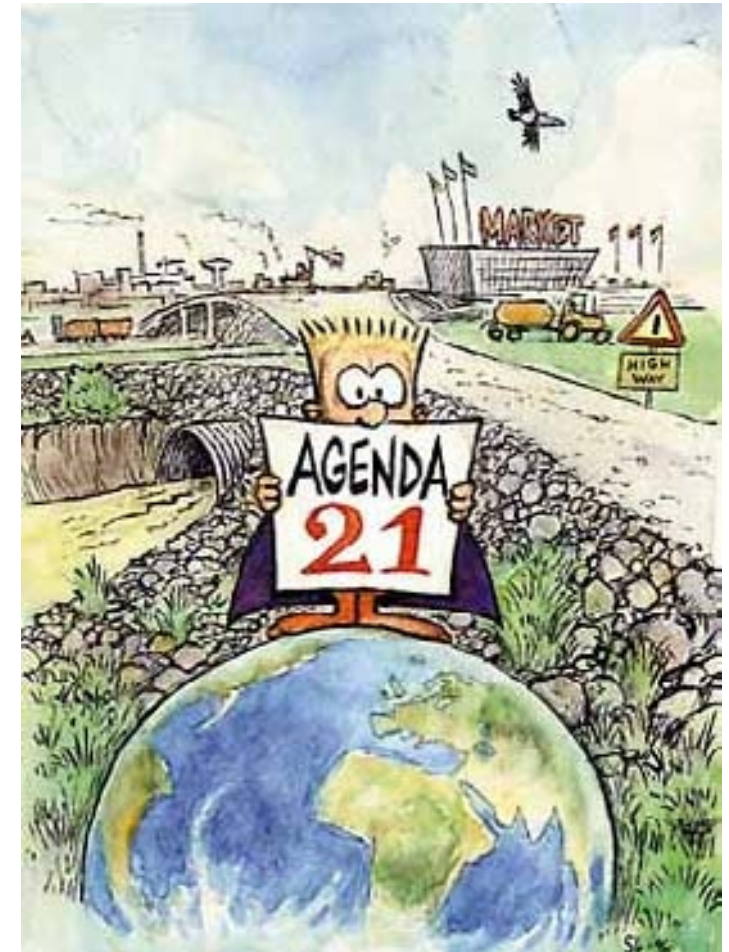
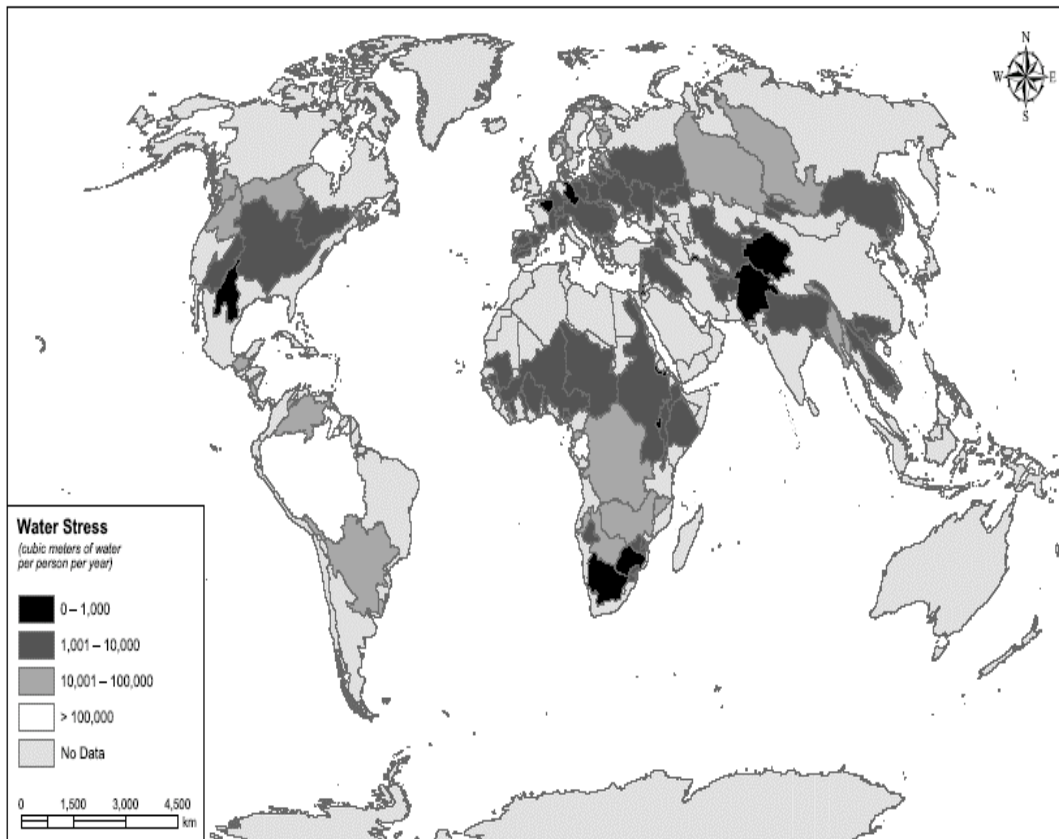
“...Aside from the demoralizing effect on the world at large and the *possibilities of disturbances arising as a result of the desperation* of the people concerned, the consequences to the economy of the United States should be apparent to all.

“It is logical that the U.S should do whatever it is able to do to assist the return of normal *economic health in the world, without which there can be no political stability and no assured peace.*”

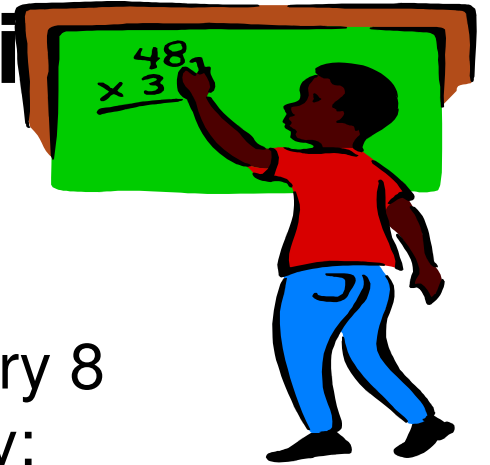
“Our policy is directed not against any country or doctrine but against hunger, poverty desperation and chaos. Its purpose should be the revival of a working economy in the world so as to permit the emergence of political and social conditions in which free institutions can exist....”



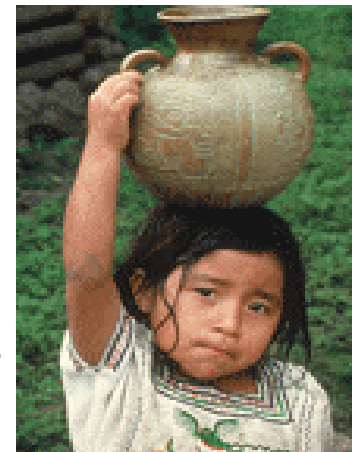
4. World Water Situation



Some of the Gloomy Arithmetic of Water



- **1.4 billion people lack safe water**
- 80% of diseases carried by water: 1 child every 8 seconds killed and 5-7 million people annually: \$125 billion in workday losses/yr.
- **50% of people lack adequate sanitation**
- 20% of freshwater species near extinction
- 76% live in water stressed areas (less than 1000cm): most in politically unstable regions
- **Losing irrigated land by 30% in 2025 and 50% by 2050**
- 50% of people will depend on world markets for food
- Asia: ***Over two thirds of population live in areas where 80% of rainfall occurs in 20% of the year***



WATER AND CONFLICT SITUATIONS

***In countries at war where IRC
is present, 300 million people
Do not have access to water
and 450 million to improved
sanitation***



Poor and Privatization


- Of the 100 recent cases - 80% in middle income countries
- A few International companies 4-5
- The Poor pay far higher % of income:
 - \$1/cm - \$2.50/cm on average
 - In US we pay \$.30 - \$.80 on average
 - Connected poor pay \$1/cm & unconnected \$5.50-\$16.50/cm!



Cochambamba Bolivia

Increased Urbanization





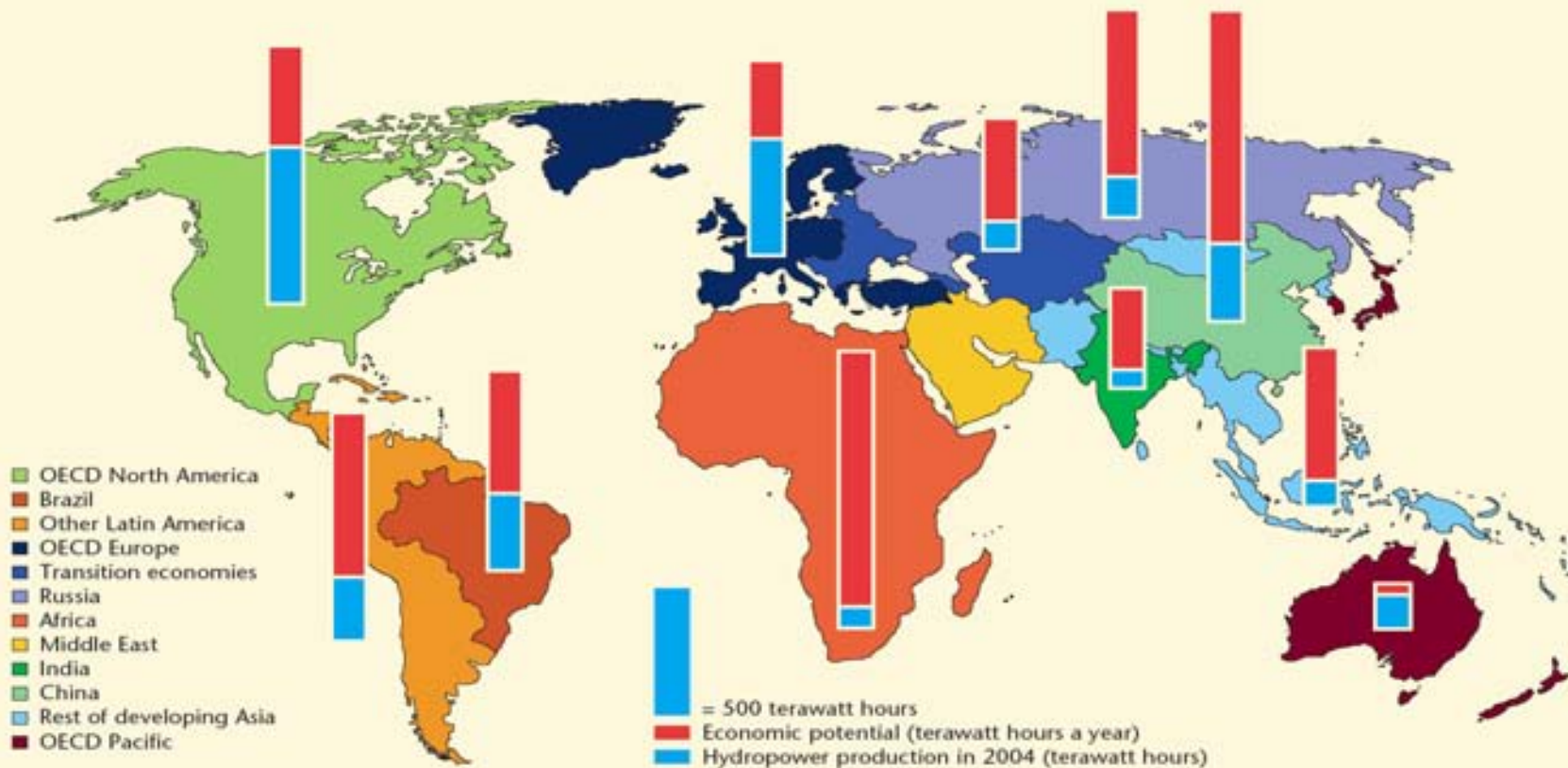
This "right to water, is founded on the dignity of the Human person;...it is necessary ..to...examine attentively the approach ...of those who treat water merely as an economic commodity.... Its use must be rational and supportivethe result of balance...between...public and private....(Pope Benedict Zaragoza, Spain July 15 2008)

**Water Consumer
or
Water Citizen?**

Water Rights

Map 7.6

World potential and current hydropower production, 2004



Source: IEA 2006.

• 2 Billion People lack Electricity and electricity Demand is growing-
Cheap Electricity a traditional key to economic development

• Hydro Potential Used: OECD countries 70%, LA 35%, Asia 20%, Africa 6%

From \$75 Billion to \$180 Billion



Changing Distrib. of Costs of Water Services (Dev.)



Municipal Treat + 19%

Sanitation + 8%

Agriculture -21%

Drinking Water -19%

Sources of Funds for Water Investment (Dev.)

In Country Private +20%

Int'l Private +22%

Multi/Bilat -5%

In Country Public -36%



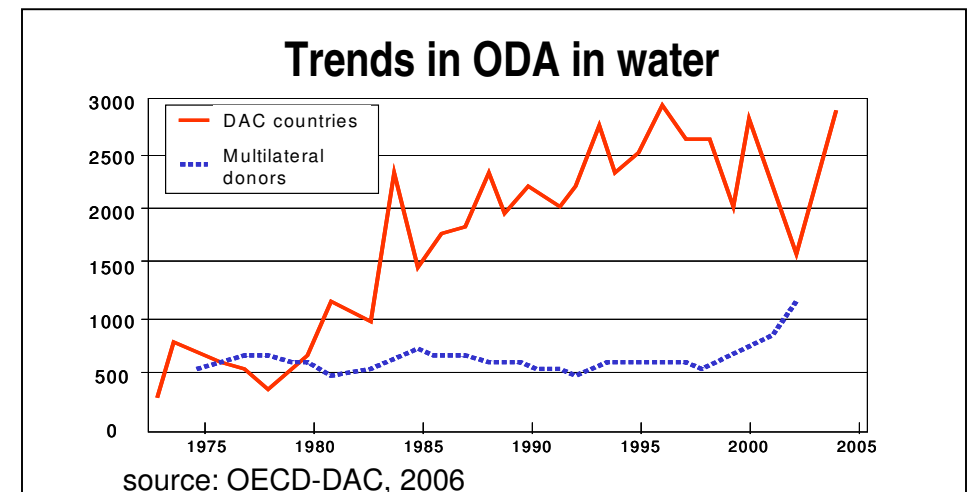
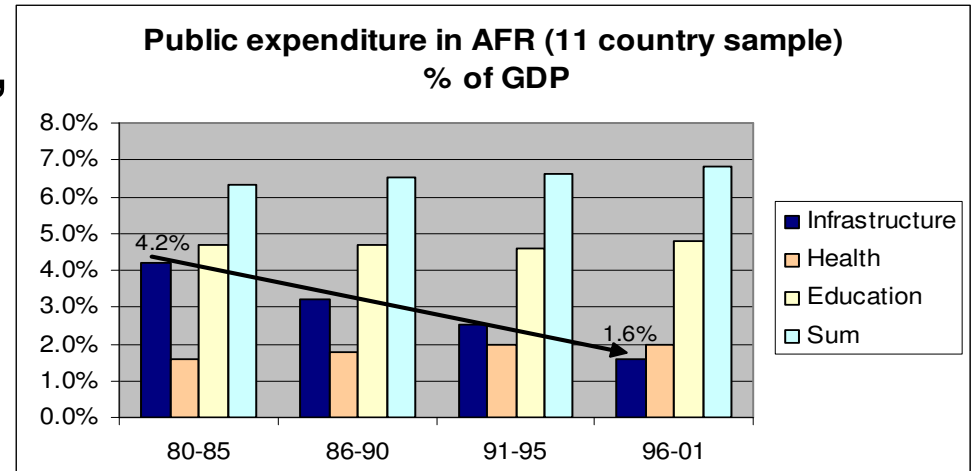
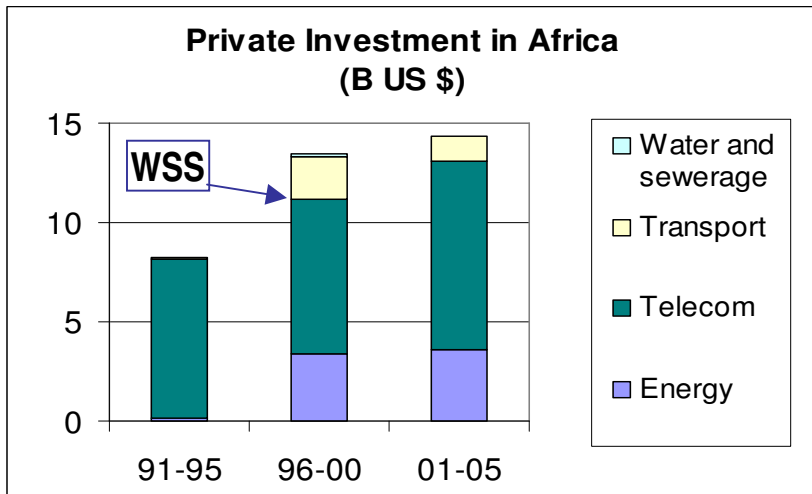
Unsafe sanitation is a major health risk in informal urban areas.

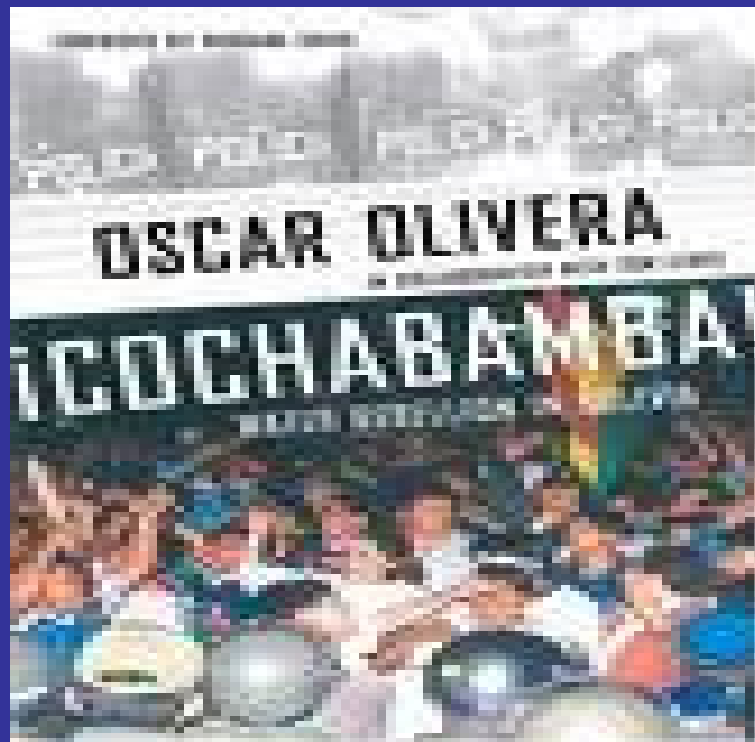
The finance challenge: all sources of finance decreasing

Private investment is increasing,
but not in water

Public investment in
infrastructure is decreasing

Donor financing: stable (?)



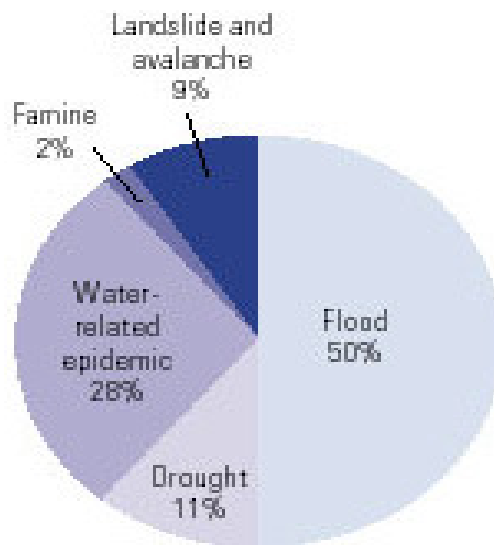


A Recipe for Social Upheaval Protest

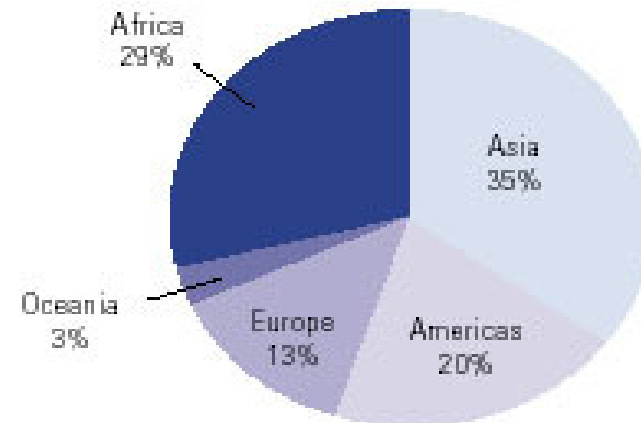


TYPE AND DISTRIBUTION OF DISASTERS

Type of water-related natural disasters, 1990-2001



Distribution of water-related disasters, 1990-2001



More than 2,200 major and minor water-related disasters occurred in the world between 1990 and 2001. Asia and Africa were the most affected continents, with floods accounting for half of these disasters.

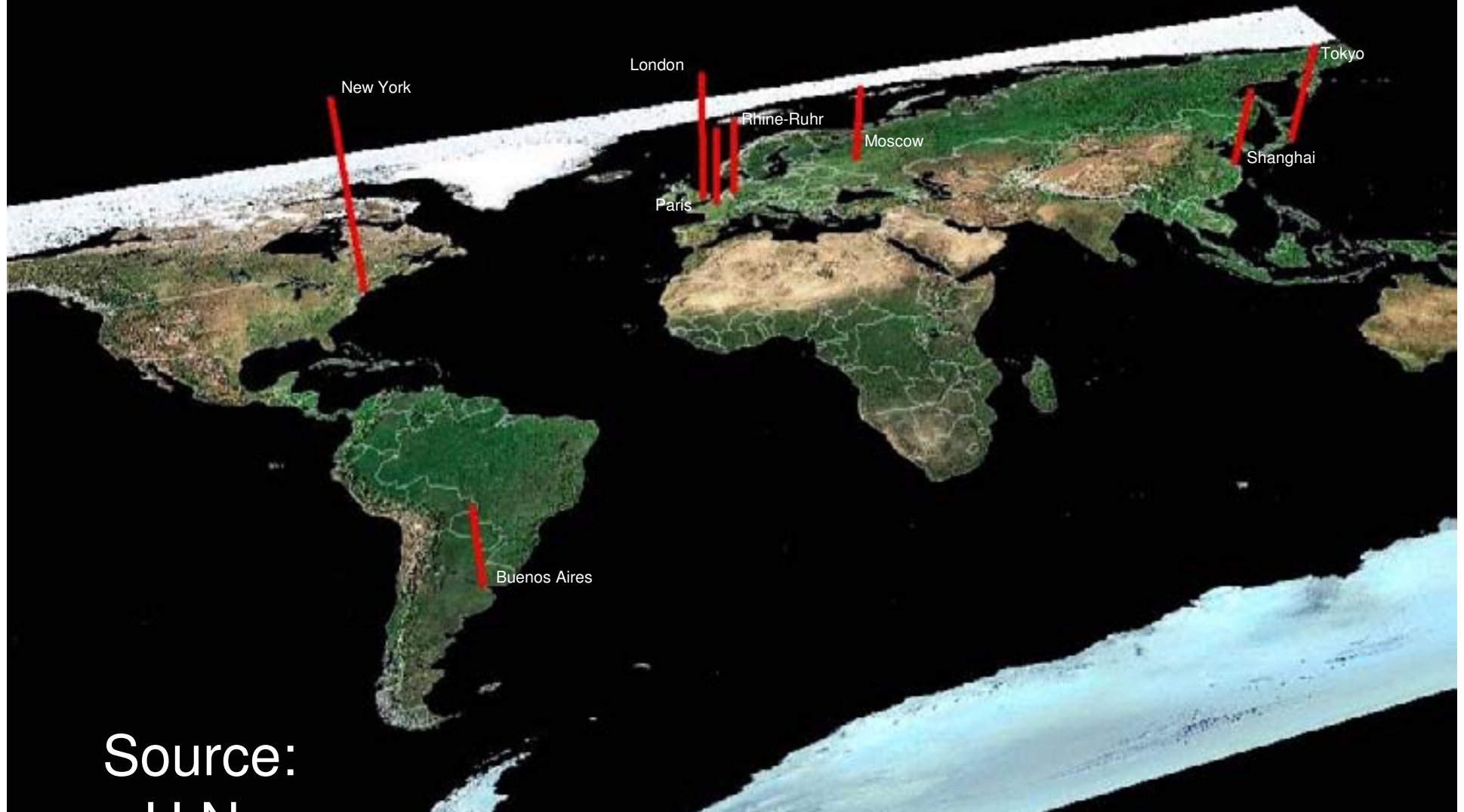
Extracted from the Executive Summary of the World Water Development report. CRED (Centre for Research on the Epidemiology of Disasters). 2002. The OFDA/CRED International Disaster Database. Brussels, Université Catholique de Louvain.

1. Water Related Disasters Situation

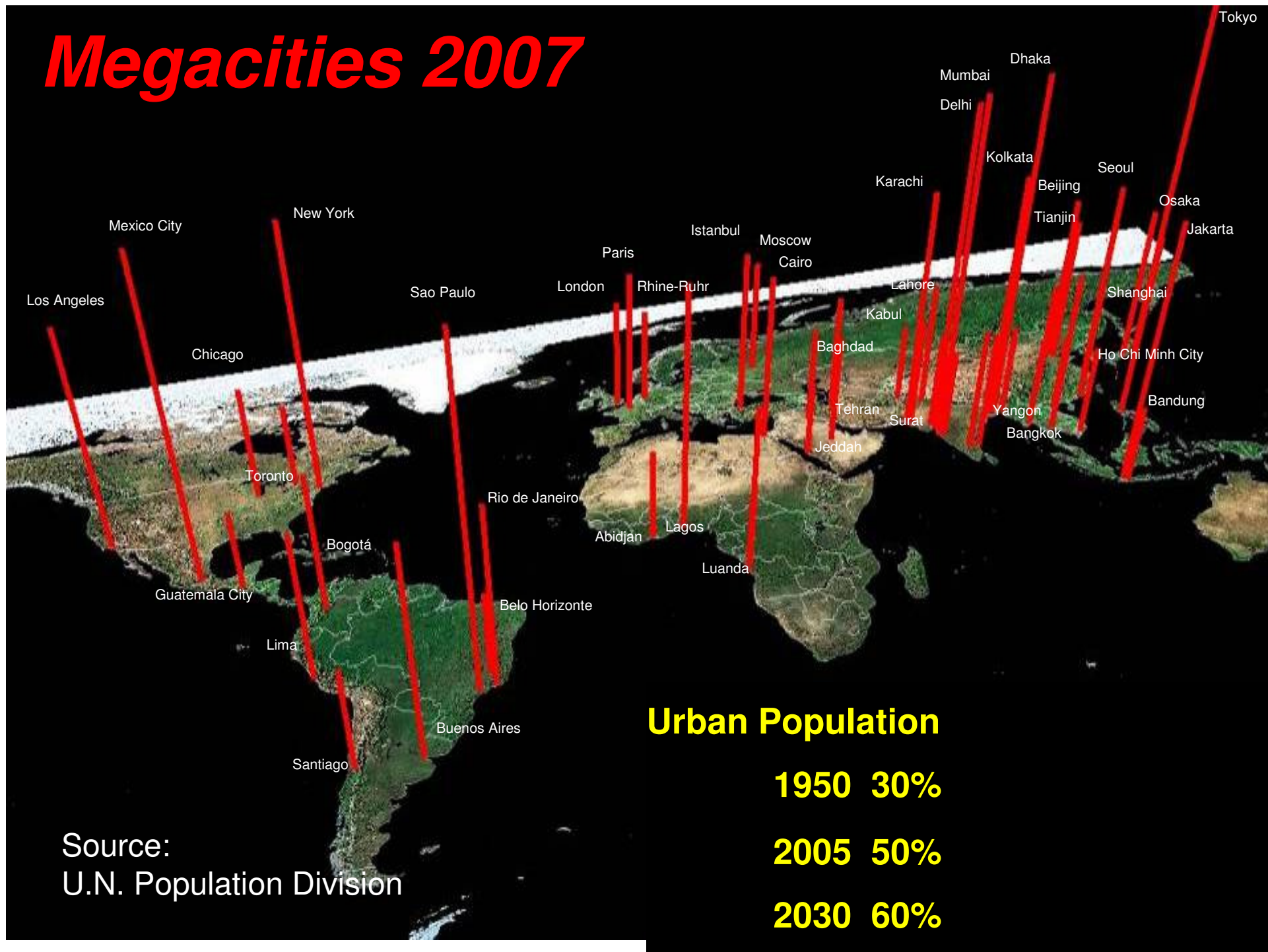


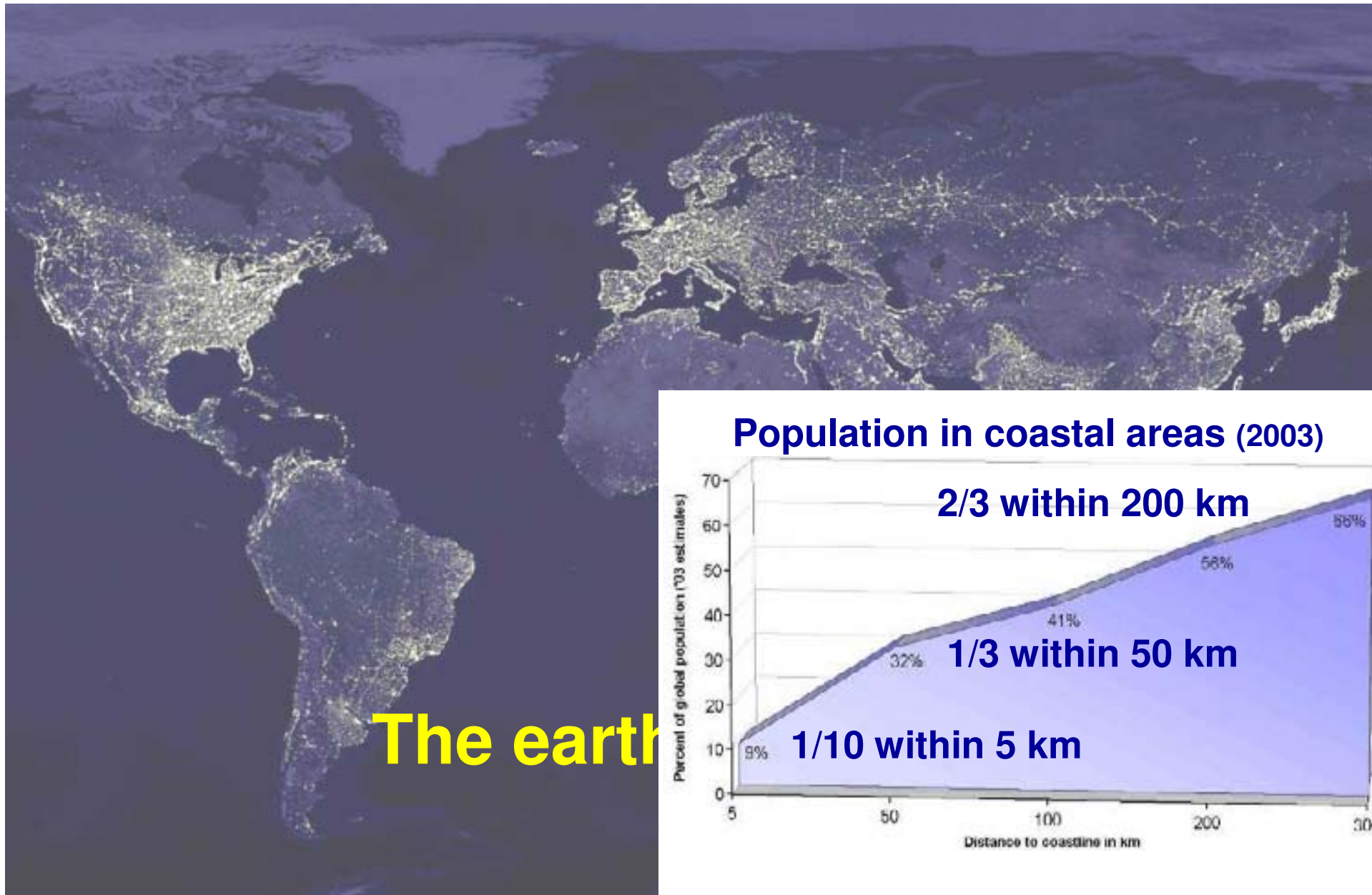
Value concentration in urban agglomerations and megacities

Megacities 1950 (Population > 5 million)



Megacities 2007

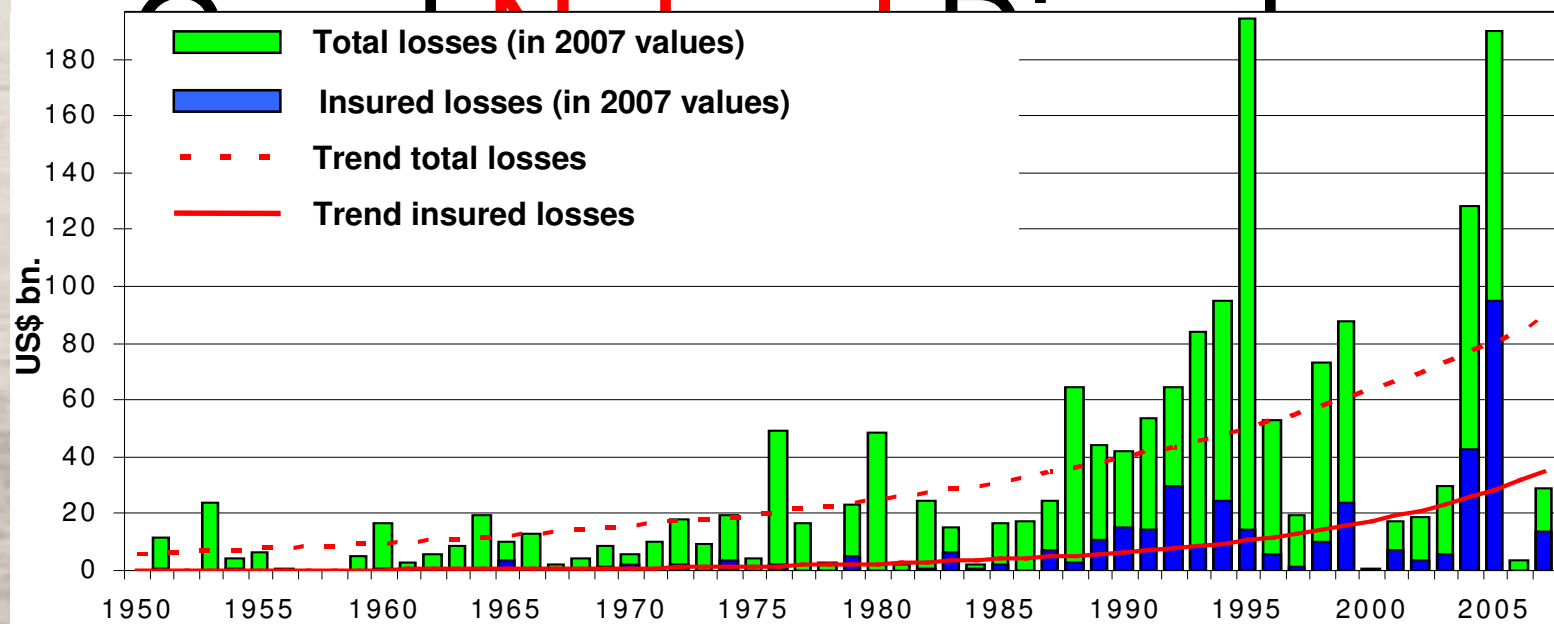




The earth

Value concentration along coasts

How Much is Reimbursed?



The costliest floods in the 21st century

(original values in US\$ million, not adjusted for inflation)

* including wind-storm losses)

☐ = High % Reimb

		losses in m US\$	total	insured	[% ins]
2000	Japan: Typhoon Saomai		1,400	1,050	75
2002	China (Yangtze)		8,200		<1
2003	China (Yangtze, Huai)		7,890		<1
2004	China (Yangtze, Yellow, Huai)		7,800		<1
2004	India, Bangladesh, Nepal		5,000		<1
2005	Protected because we are rich OR rich because we invest in adaptation means				<1
2005					15
2006					8
2007	Indonesia (Sulawesi)		1,100	110	24
2007	Tajikistan		1,000		<1
2007	India		2,600		<1
2007	Oman: Tropical Cyclone Gonu		3,900	650	17
2007	China (Huai)		6,800		<1
2007	Pakistan: Tropical Cyclone Yemyin		990		<1
2007	Bangladesh: Tropical Cyclone Sidr	*	3,775		<1
2000	Italy (north), Switzerland (south)		8,500	470	6
2000	United Kingdom		1,500	1,100	73
2002	Central Europe (Elbe, Danube)		21,500	3,400	16
2003	France (Rhône)		1,600	900	56
2005	Romania, Bulgaria		2,440	15	<1
2005	Switzerland, Austria, Germany (Bavaria)		3,300	1,760	53
2007	United Kingdom		8,000	6,000	75
2001	USA: Tropical Storm Allison (Houston, TX)		6,000	3,500	58
2001	Argentina		750		<1
2005	Canada (Alberta)		860	190	22
2005	USA: Hurricane Katrina (Gulf Coast)	*	125,000	61,600	49
2007	Mexico (Tabasco)		2,500	350	14
2007	Australia (East Coast)	*	1,300	680	52
2008	Australia (Queensland)	?	2,000	1,600	>80
2000	Mozambique, Zimbabwe, South Africa		715	50	7
2007	Madagascar	*	240		<1
2007	Sudan		300		<1

Governance of Disaster Risk in Latin America and the Caribbean



Adaptation: Reducing the Risks of Climate Change

What is the best strategy for dealing with uncertainty of this type?

Structures or behavioral change?

Is soft more democratic? (Gleick)

Is small better than large? (McCully)

"water demand management and institutional adaptation are the primary components for increasing system flexibility to meet uncertainties of climate change." (IPCC) ????

*"while water management systems are often flexible, water agencies should re-examine water system designs and operating rules under a wider range of climatic conditions than traditionally used."
(AWWA 1997)*



***Ethics of Adaptation vs. Mitigation:
Raising anxiety with change while denying means to cope
e.g. India***

“You cannot say that because there is climate change that the developing World shouldn't grow...you are essentially saying, ..no more electricity to your house, close your factories, go back to the fields.” (C. Bhyhan, Center for Science and Environment New Delhi, 2009, in Wash Post B8, Nov. 22, 2009)



“In India...almost half a million children die each year from water borne Diarrhea, providing access to basic services such as clean drinking water Is more pressing ten cutting emissions,... and to do so requires energy..” (Wash Post B8, Nov. 22, 2009)

“If as a result of technology, self denial and determination, you were to cut Your emissions by 50% -the moment you achieve it yourself, we will accept that cap.” (Ahluwalia, Policy Advisor, Government India, in Wash Post, B8, Nov. 22 2009)

Ethics of Adaptation vs. Mitigation:

Raising anxiety with change while denying means to cope?

- **Main Triggers to human concern are water related (Droughts; Floods; Storm Surges..)**
- **Traditional concerns of Water Managers: Managing Variability to Decrease Vulnerability: Why Humans became Engineers**
- **Investment in managing variability is key to Creating Platform for Socio-Economic Transformation + Breaking Cycles of Poverty**
- **Water actions have been key Social actions for society's to adapt to variability in nature and climate**
- **Impairment to Human activity and Creativity is key; not just # Trigger Events: (e.g. Damage % of GDP...)**
- **Defining Baseline/Normal condition – is a prime Intellectual challenge**

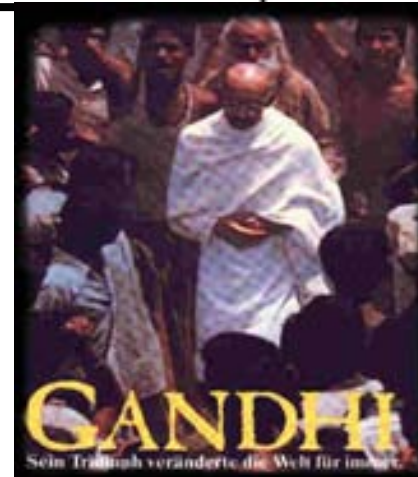
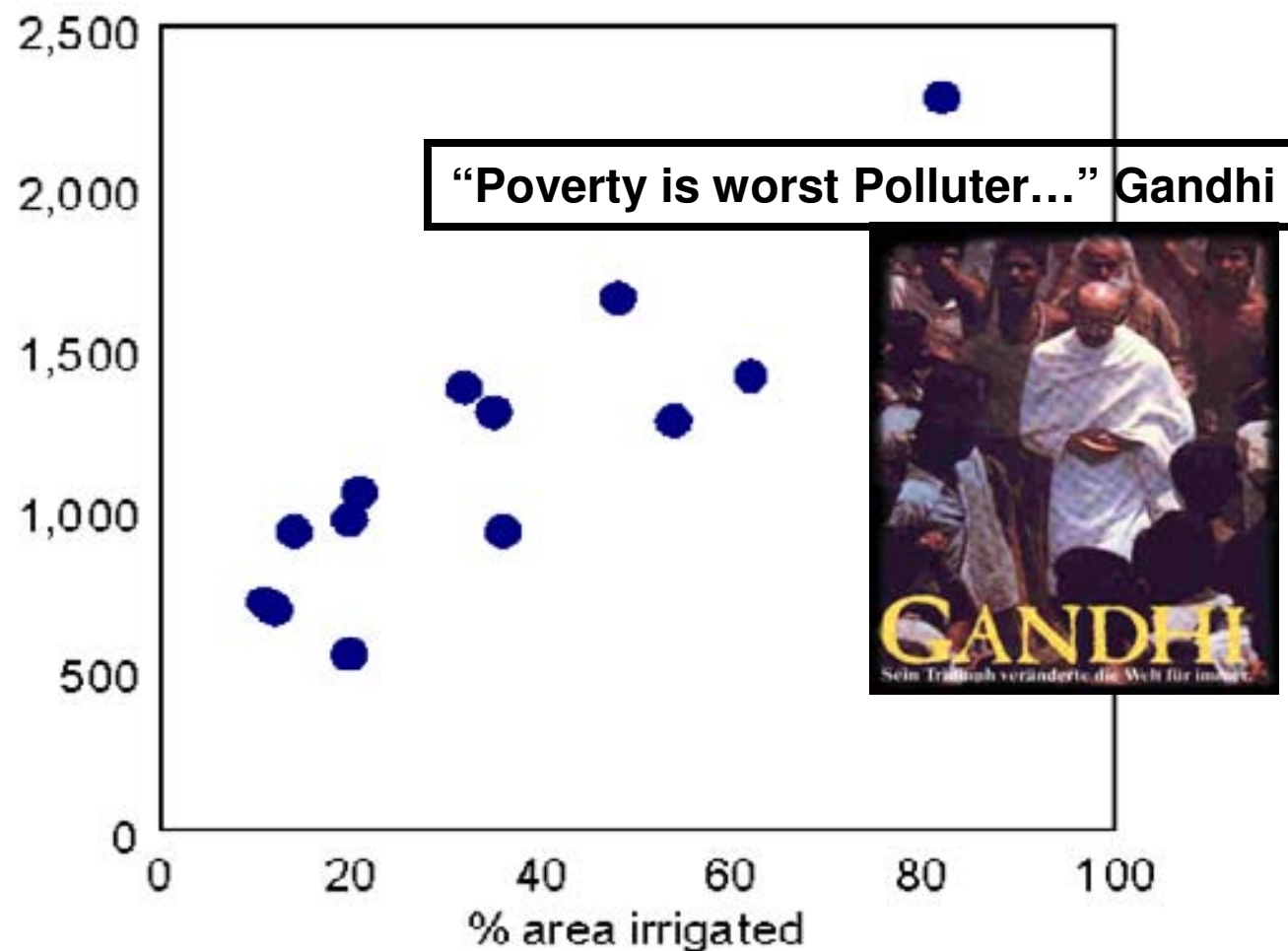
5. Water Infrastructure Investment Matters



- **Strong correlations between public capital investment and movements in private sector productivity**
- **Ratio of non-structural/behavioral measures to structural measures matters:**
 - *If too high* - extreme events can crack social system as leaders have no tools to respond
 - *If too low* - ecological costs are too high

Myth of Soft Path = More Democratic

Average Income levels and irrigation intensity in India

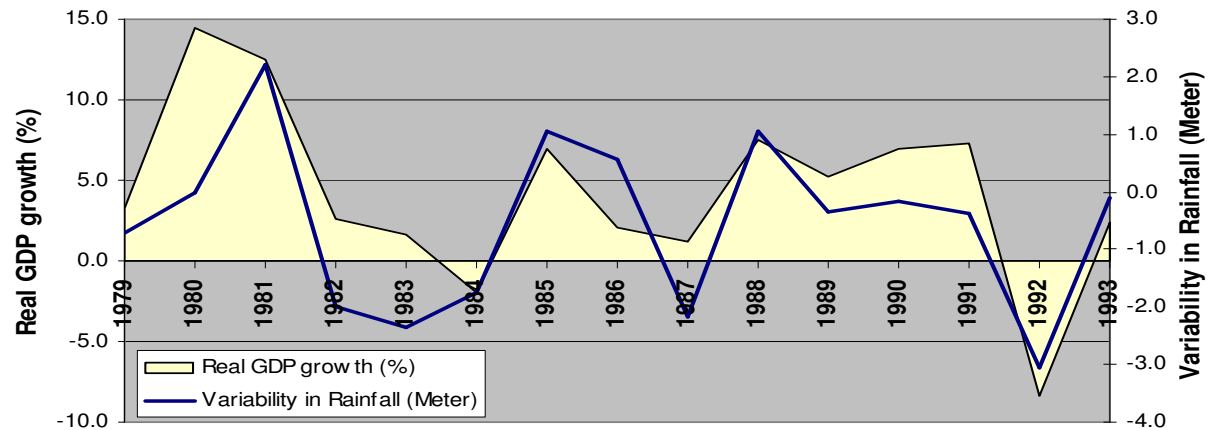


Net effect: districts with:

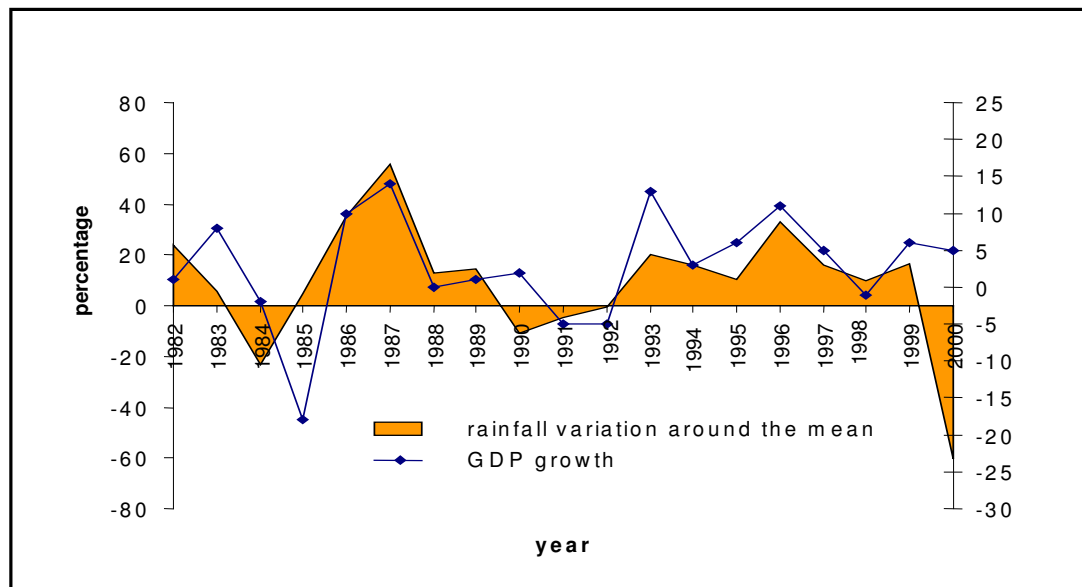
- < 10% of cropped area irrigated --- 69% below poverty line
- > 50% of cropped area irrigated --- 26% below poverty line



Economy-wide impacts



Rainfall & GDP growth: Zimbabwe 1978-1993

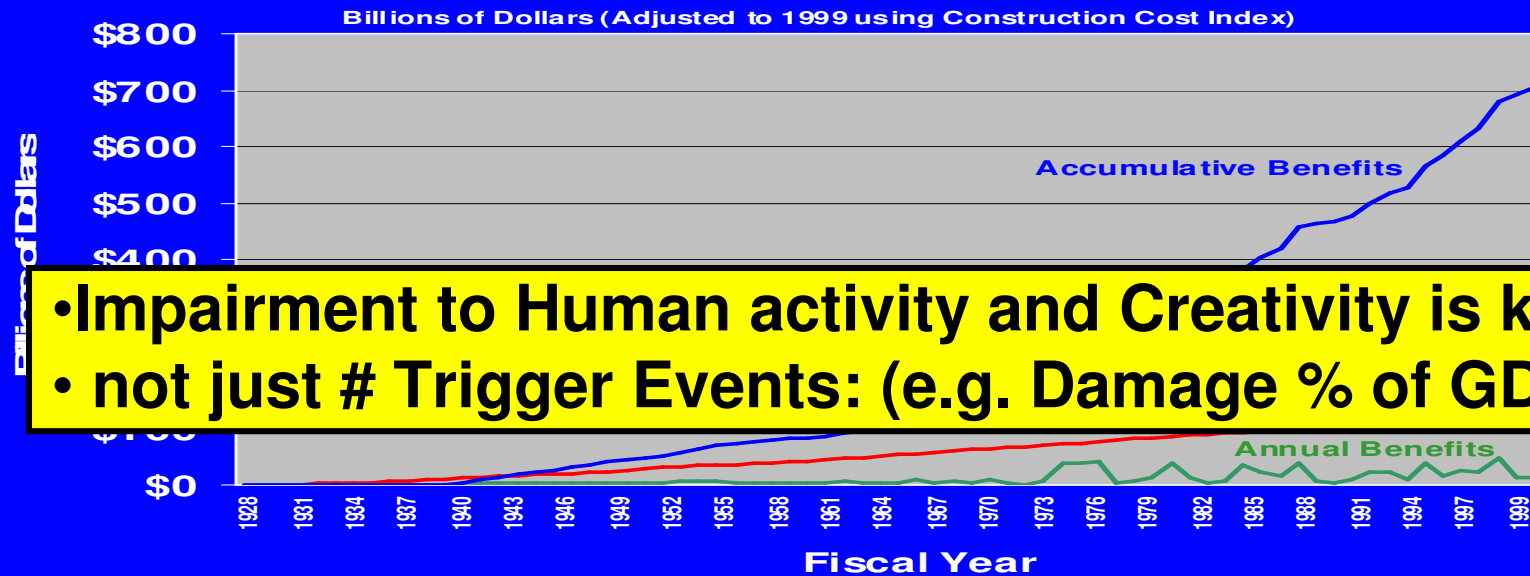


Rainfall & GDP growth: Ethiopia 1982-2000



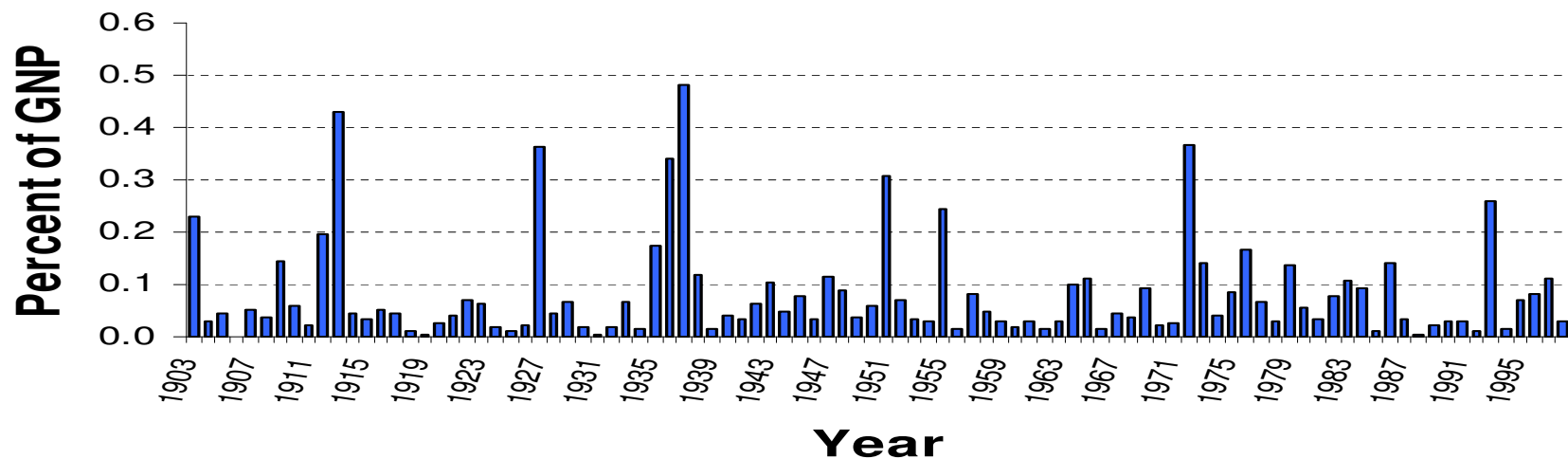
Figure 5

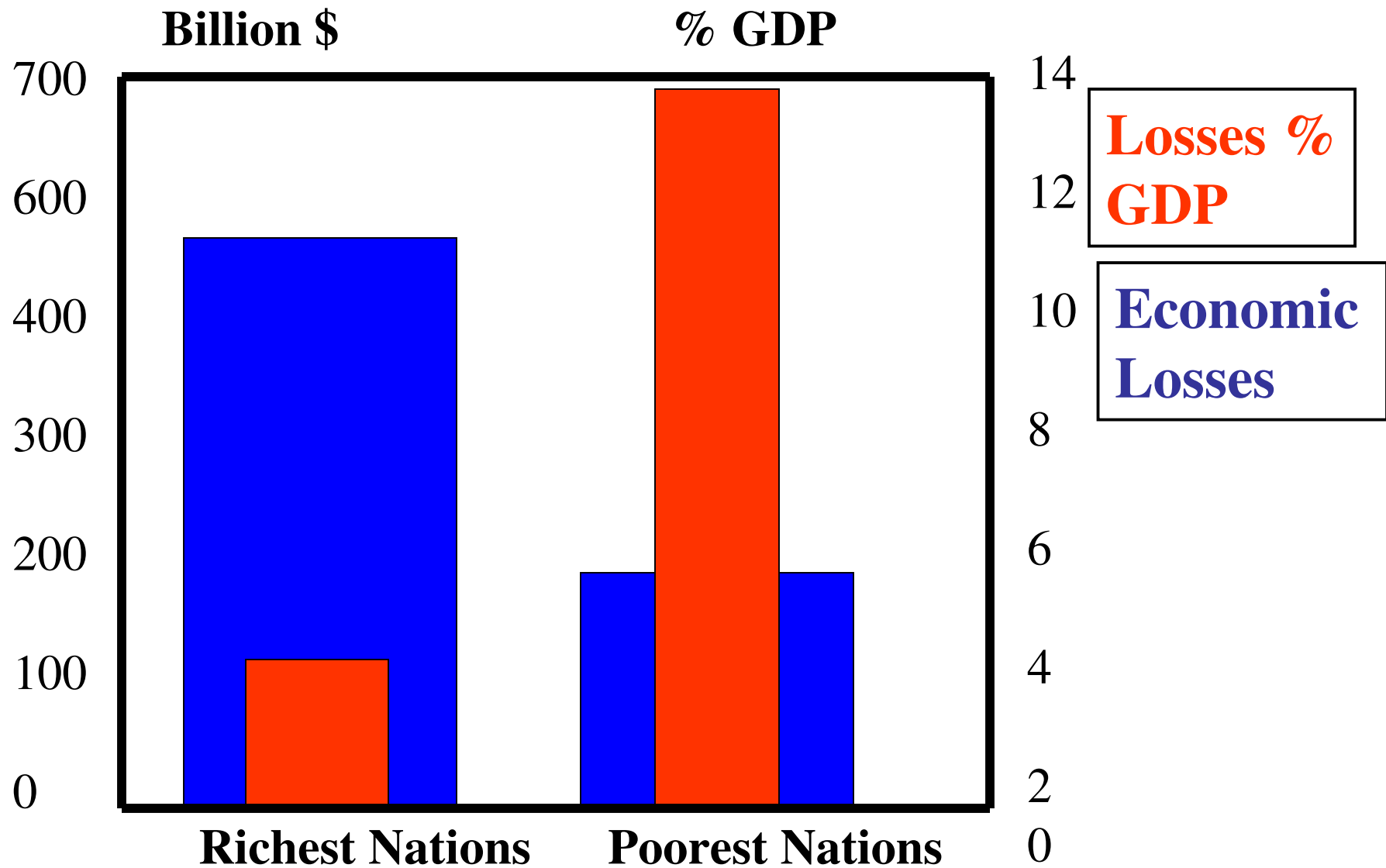
**Benefits of Federal Projects (Damages Prevented)
Accumulative Corps Expenditures (Principle plus O&M)**



- Impairment to Human activity and Creativity is key;
- not just # Trigger Events: (e.g. Damage % of GDP...)

National Flood Damages Suffered





Disasters Losses, Total and as Share of GDP, In the Richest and Poorest Nations, 1985 – 99 (world watch 2001)

A hypothesis....

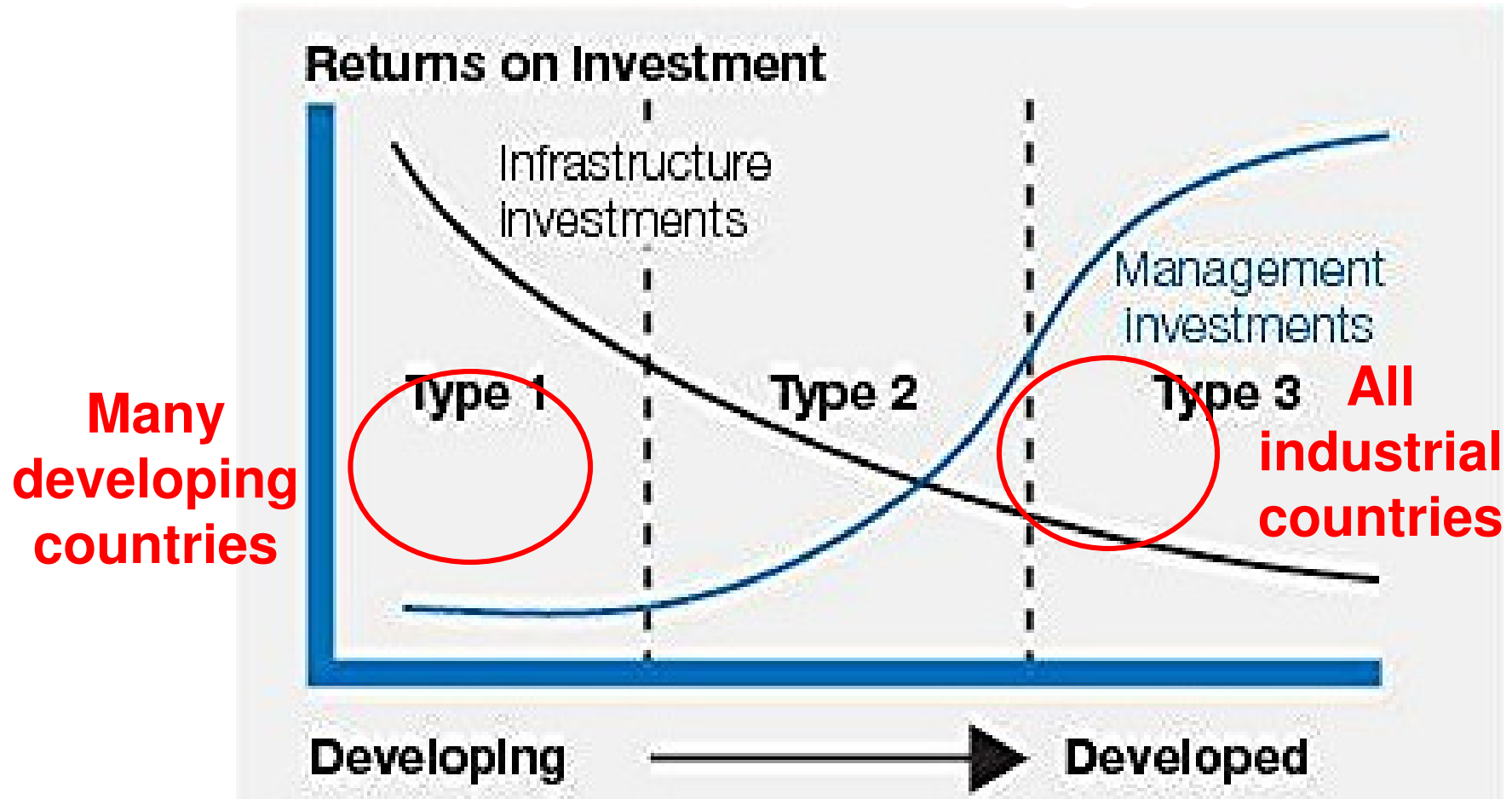


- ***There is a minimum platform of water resources infrastructure & institutions to achieve “water security”***
- ***Water security is essential for sustained economic growth and poverty eradication***
 - public good = public finance (primarily)
 - all industrial countries have invested heavily to achieve it

6. The Changing Terms of Discourse on World Water



Relations b/w Developed and Developing Worlds



Developed countries are more likely to think of environment and security in terms of global environmental changes and developing countries more with the human security implications of local and regional problems.

Political Dialogue: Ministers DC's-LDC's-TC'S

(August 2008 IWA and WWW)

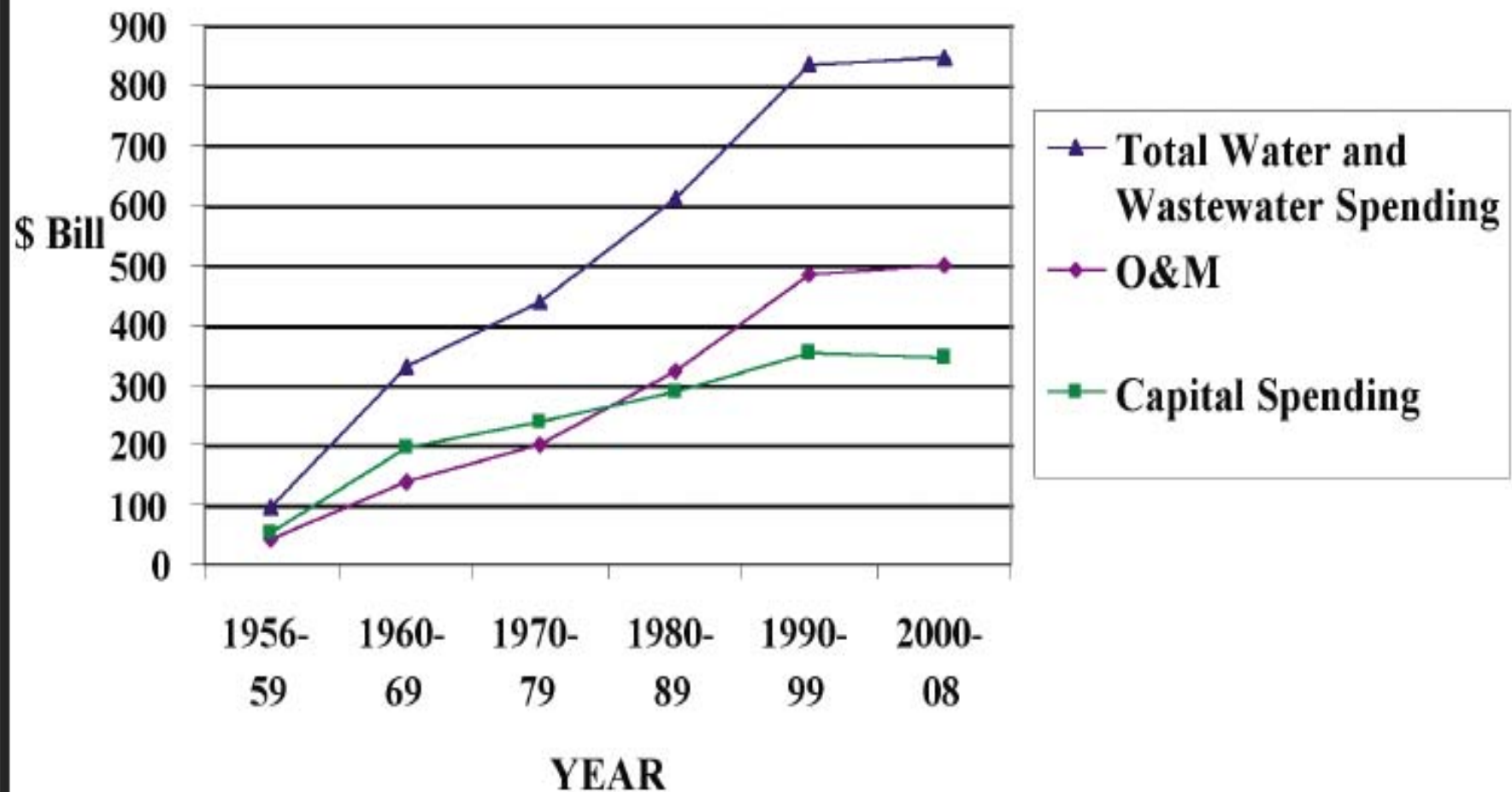
	Best Practises	No regret	Climate proofing
Developed countries	+	+	+
Countries in Transition	+	+/-	-
ODA	+	-/+	-

Unconscious Transfer of Value Assumptions

(e.g. History -US Investment in Water Supply)

- New Deal: PWA 2600 water projects = \$312 million (in 1930's \$'s!)
- FERA, CWA WPA \$112 million for municipal water (in 1930's \$'s!)
- 1972-1990 more than \$650 billion in Federal grants for sewage treatment and \$20 billion + from States
- WEF estimates we need \$23 billion/yr. for 20 years to meet EPA standards
- *Over 100 countries without adequate sanitation have an annual budget less than \$23 billion!*

Figure 2: Local Government Spending on Public Water and Wastewater, 1956 –2008, Constant Dollars (2008=100%)



Political Culture and Water: Passive Acceptance to Active Choosing of Level of Risk

How we make decision about Risk and Water are Central to Health of Democratic Political Culture and Individual Freedom

From Paternalism to Informed Consent
basis for professions ethics:

- ASCE guidelines on Informed Consent parallel those for PI
- Overcoming Dueling Experts and adversarial Science and Confusion of Science and Normative Ethics



Funeral oration



Active-Self
Helping Citizen
J.S. Mill

**Adaptation as a pastoral
response to impacts of
change:**

**Engineering means as the
Pastoral role in dealing
with anticipation and
Impact of Variability**

...engineering is always an experiment involving the public as human subjects. This new view suggest that engineering always oversteps the limits of science. Decisions are always made with insufficient information. In this view, risks taken by people who depend on engineers are not really the risks over some error of scientific principle. More important and inevitable is the risk that the engineer, confronted with a totally novel technological problem, will incorrectly intuit which precedent that worked in the past can be successfully applied this time. ...Interestingly these new moral dimensions are not being created primarily by philosophers. They are the works of engineers themselves. ("The Slippery Ethics of Engineering," Taft Broome)

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CONCLUSIONS

- **Identify Priority Areas of U.S. Security concerns**

Ask: “How can Water Actions be Used as Means to Achieve Security Ends in Each Priority Area?”

- **Move Beyond Humanitarian Assistance**

Ask: “How can we work to prevent and reduce vulnerability to Disasters?”

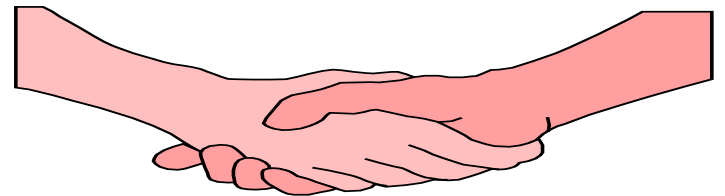


- **Change the Terms of Discourse on World Water; Be Careful Our Rhetoric Does Not Create the Conflict**
We seek to avoid: “Water Wars;” “Do Not Use – Preserve,”..

- **Move Beyond Environment Alone and Ask:**
“How to use water to create platform for growth while designing mitigation cost to environment?”

Water Decisions = Ethical Decisions

- **Water debates mirror debates of social ethics**
 - water as a common good
 - water and human dignity
 - water as facilitator of well being
 - rights and responsibilities to access
 - water and social justice
 - wealth generation roles of water
- **Water as symbol of reconciliation, healing, regeneration**



Water management (and water reform) is ALWAYS political.....

Ancient Chinese Characters describing water
management



+



=



river

+

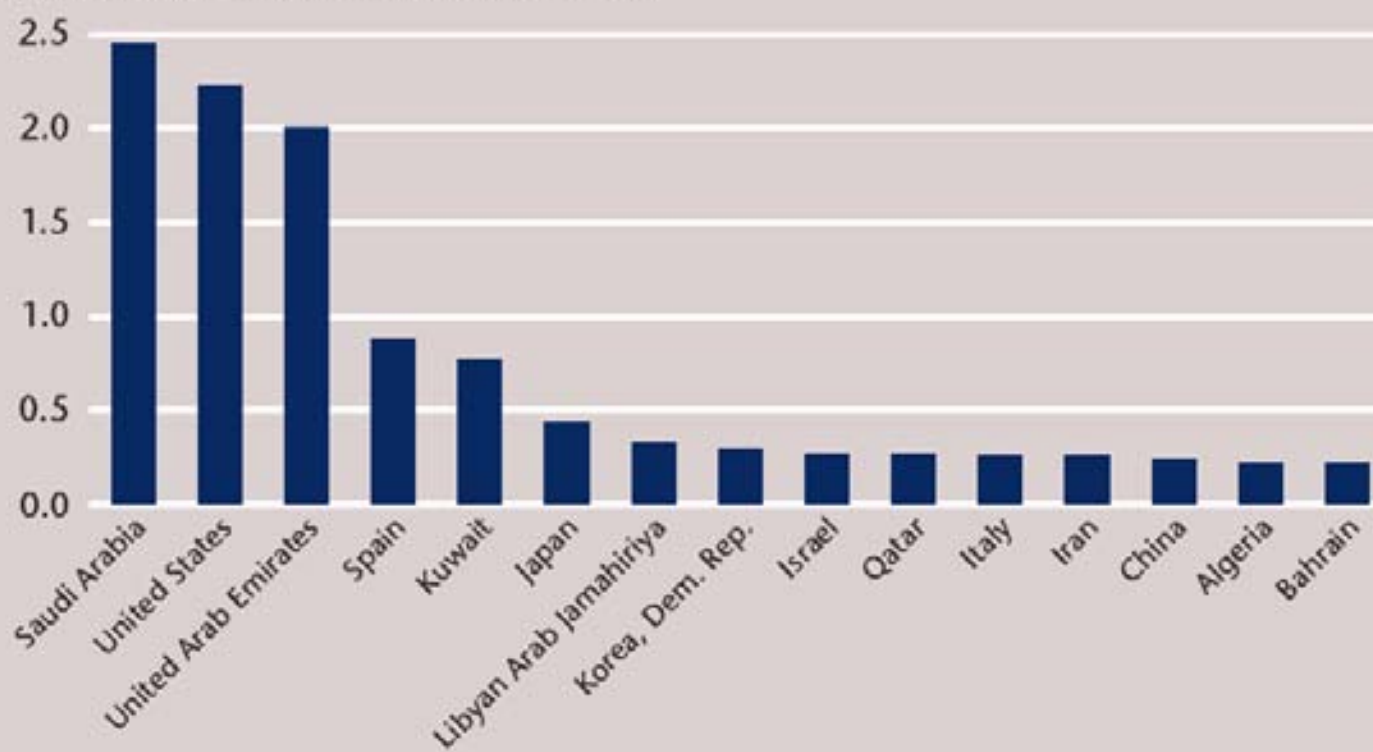
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Political
order

Figure 1 Desalination capacity in selected countries, 2002

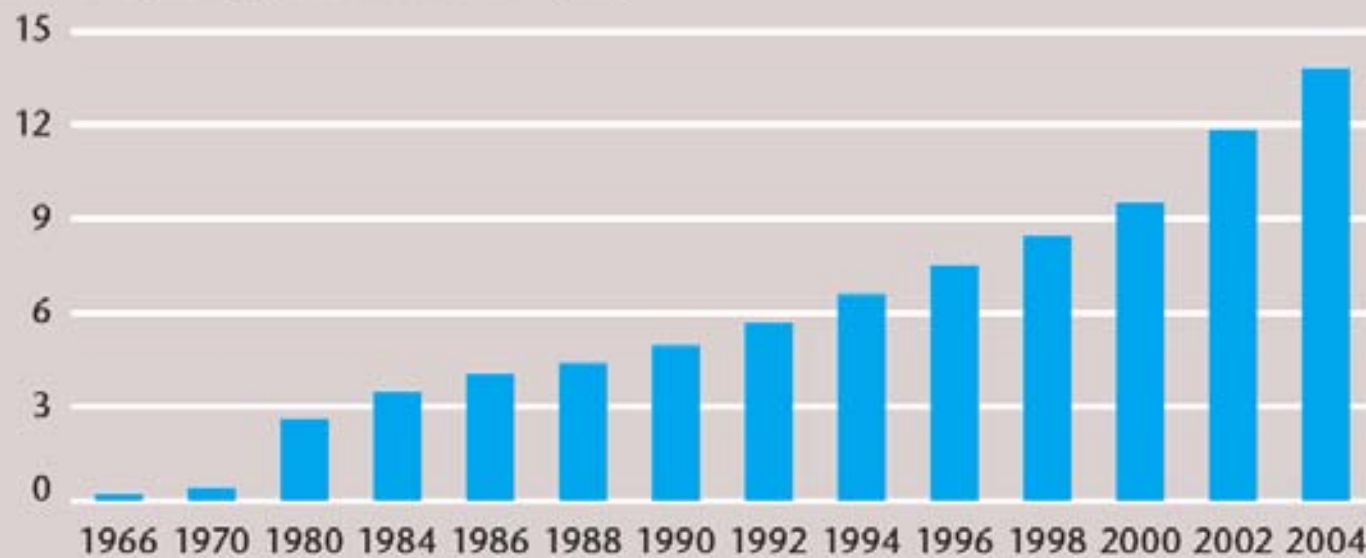
Installed capacity (cubic kilometres a year)



Source: Based on Maurel 2006.

Figure 2 Rapid growth of global installed capacity for desalination, 1966-2004

Installed capacity (cubic kilometres a year)



Source: Based on Maurel 2006.

Conflict and cooperation

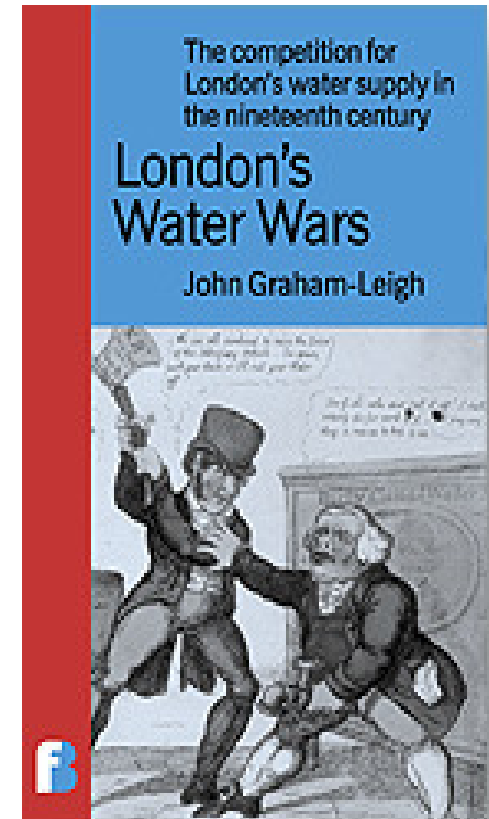
There have been 1,831 interactions (both conflictual and cooperative) over the last fifty years.

- 7 disputes have involved violence, and 507 conflictive events have occurred
- Approximately 200 treaties have been signed, with a total of 1,228 cooperative events.

The concept of 'virtual water' has been developed which allows nations and states to share the products and benefits.

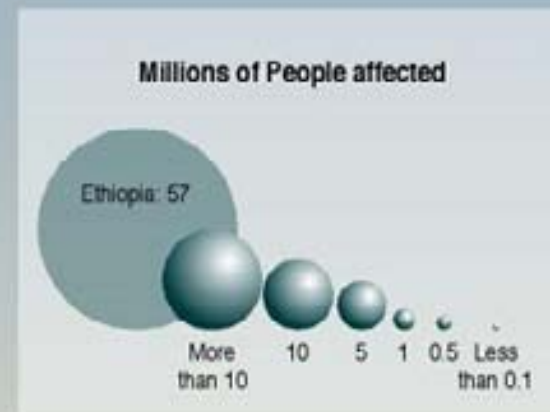
Water and Security

- Security defined as freedom from fear anxiety, want deprivation.
- History of water management: good water, right time and place
- Predict floods, reserve for drought, generate wealth, avoid deprivation, maintain ecology
- Past seers and priests and origin of religion
- Today synthetic hydrology, engineering , science
- Same end - security and water
- GWP- Water Security=common goal



•Interdependence
Vulnerability
or
Flexibility?

People Affected by Natural Disasters between 1971-2000



Source: The Office of U.S. Foreign Disaster Assistance (OFDA), The Centre for Research on the Epidemiology of Disasters (CRED), International Disaster Database, www.cred.be/emdat, Université Catholique de Louvain, Brussel, Belgium



GRID
Arendal

DELFTRE OECDE
BASED ON AFRICAN STAFF REPORTS
JUNE 2002

state of water – increasing disasters

Hydropower

- **2 Billion People lack Electricity and electricity Demand is growing**
- **Cheap Electricity a traditional key to economic development**
- **Hydro Potential Used:**
 - OECD countries 70%,
 - Africa 6%,
 - Asia 20%,
 - LA 35%

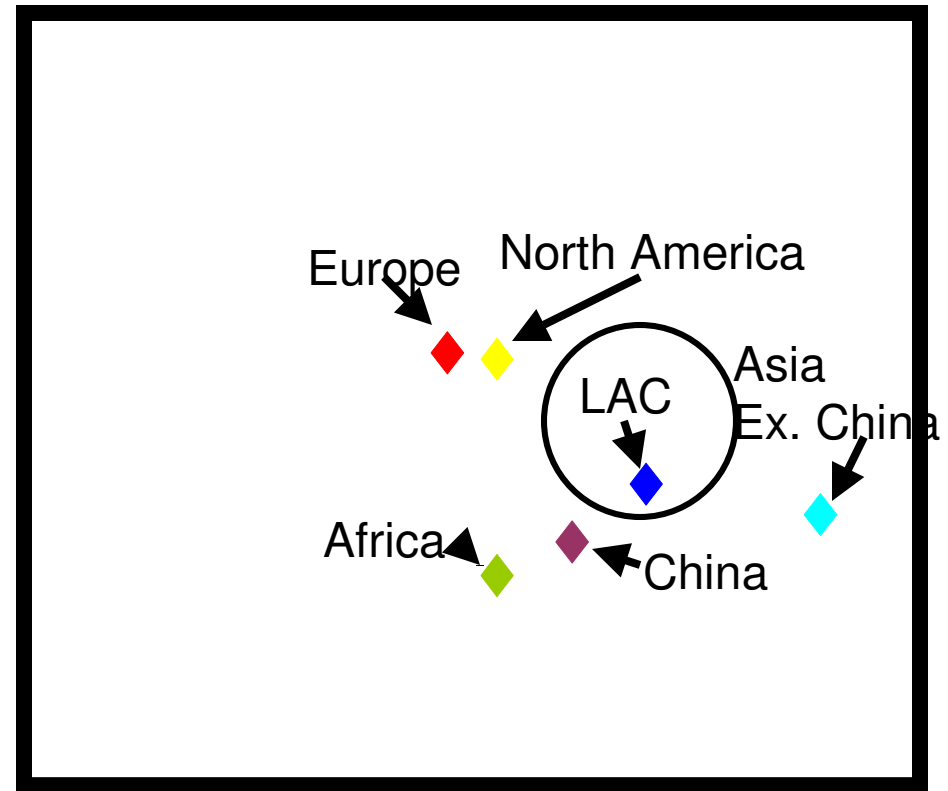
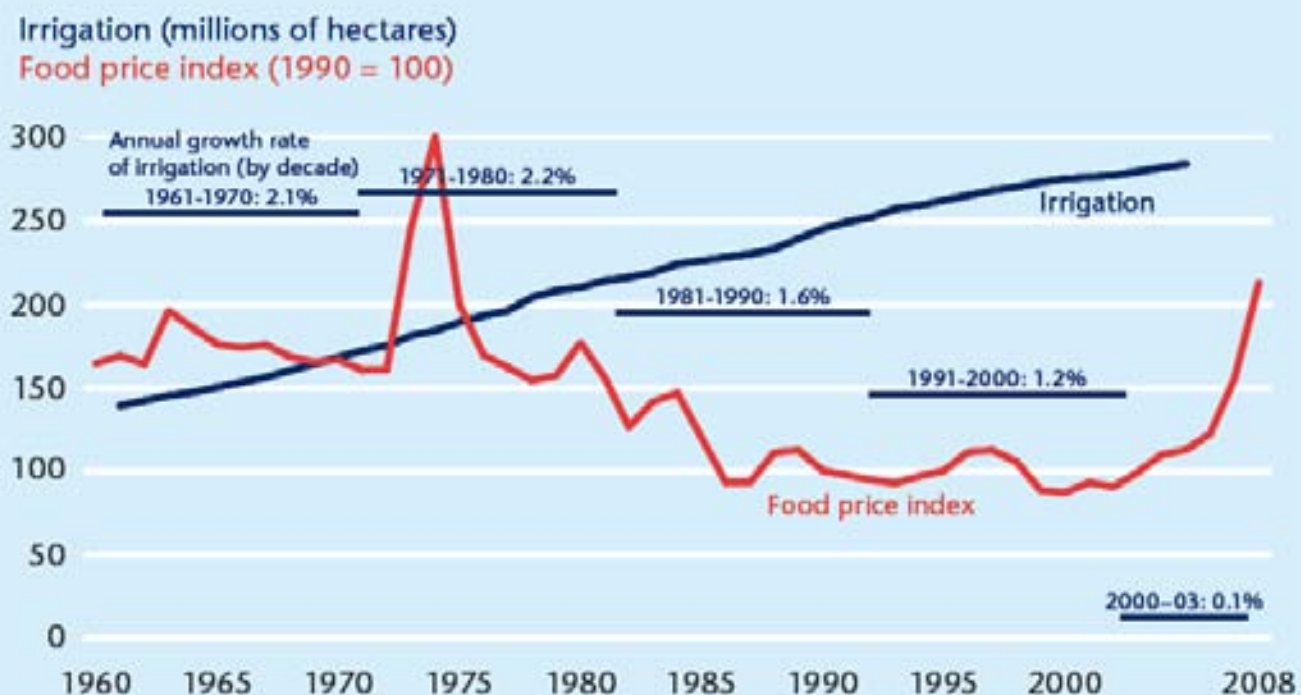


Figure 7.6 As irrigation area expanded, food price fell for 30 years before starting to rise again



Source: Based on Comprehensive Assessment of Water Management in Agriculture 2007; FAO FAOSTAT.

Table 5.1 Economic impacts of flood and drought in Kenya, 1997-2000

Impact area	Costs (\$ millions)	Share of total (percent)
<i>1997-98 El Niño flood impact</i>		
Transport infrastructure	777	89
Health sector	56	6
Water supply infrastructure	45	5
Total flood impact	878	
Share of GDP 1997-98 (percent)		11
<i>1998-2000 La Niña drought impacts</i>		
Industrial production	1,400	58
Hydropower	640	26
Agricultural production	240	10
Livestock	137	6
Total drought impact	2,417	
Share of GDP 1998-2000 (percent)		16

Source: World Bank 2004.

Figure 5.2 GDP growth tracks rainfall variability in Ethiopia (1983-2000) and Tanzania (1989-99)

Ethiopia



Tanzania

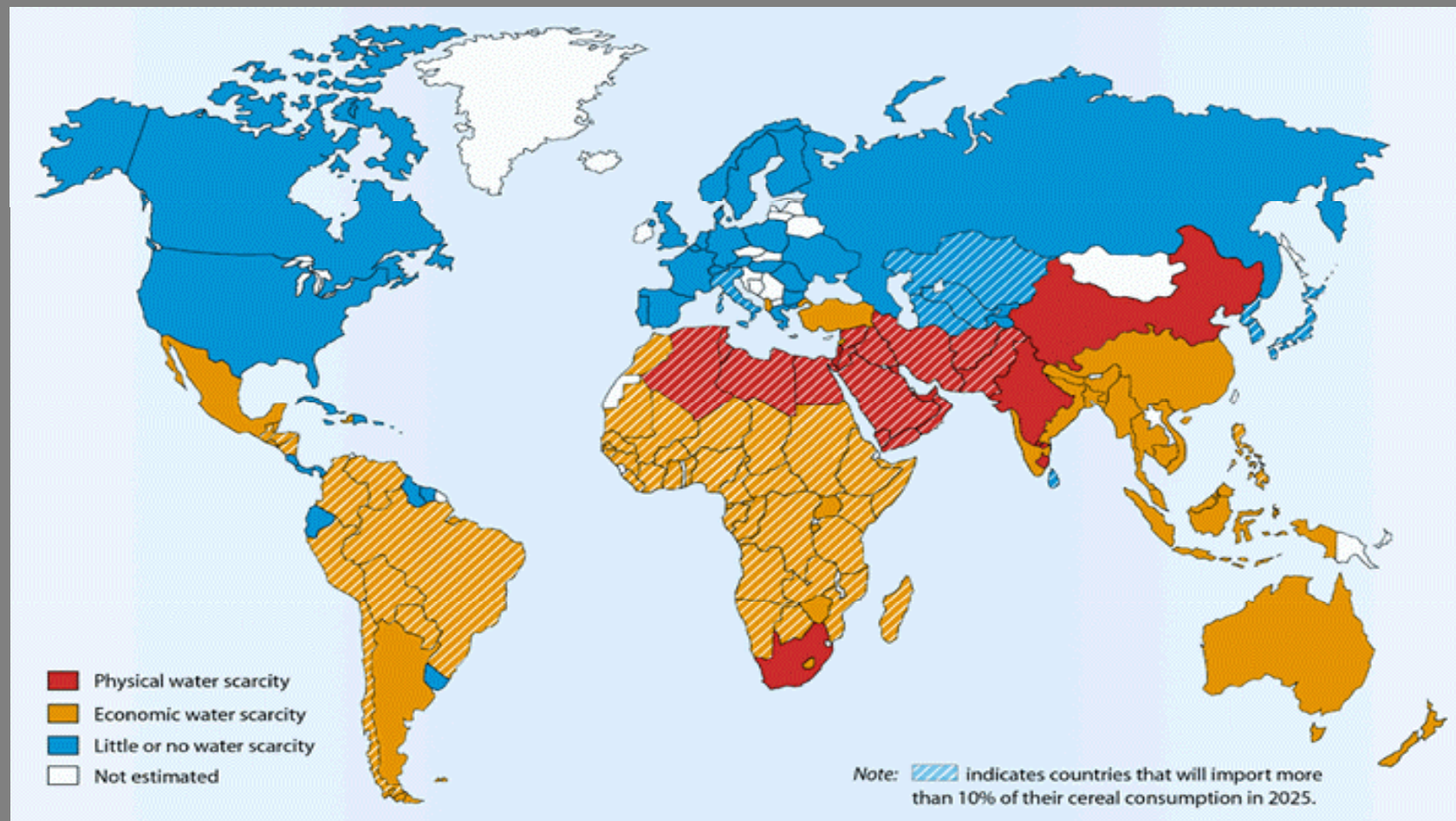


Source: Based on van Aalst, Hellmuth, and Ponzi 2007.

Floods and Disasters (1988-1997)

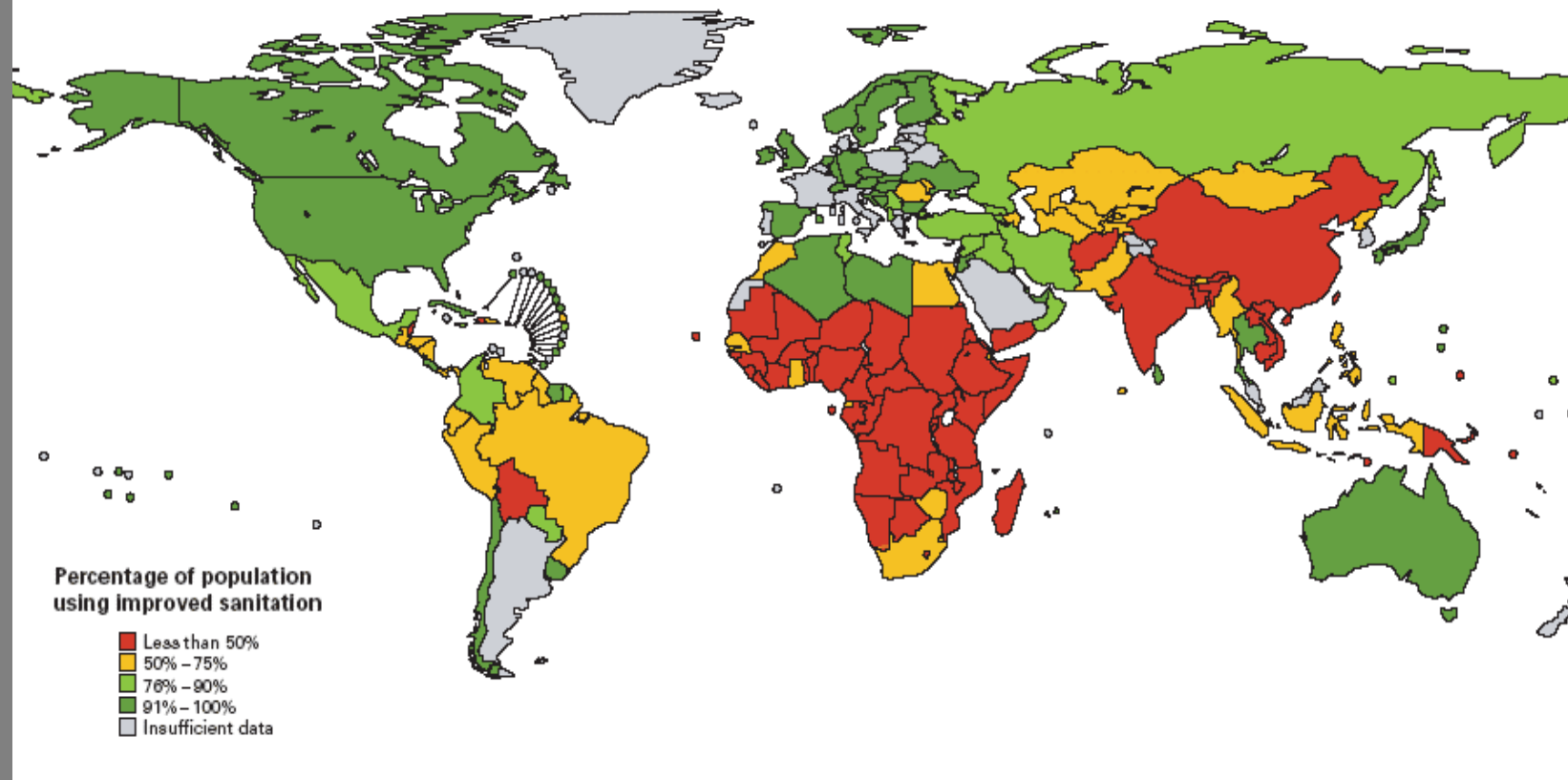
- 25% of world live in high risk of drought and floods: Average annual losses now over \$40 billion
- Average Annual victims from 19 to 131 million
- Economic losses 10 times more then 1960s





2025: over 1 billion people will face absolute water scarcity

FIGURE 7 Sanitation coverage in 2002



why water matters - health

WATER & CHILDREN



Diseases can be reduced by 77% with good water and sanitation programs

In Africa and Asia, women walk up to 6km/day for water; Weight of water carried on heads averages 20kg

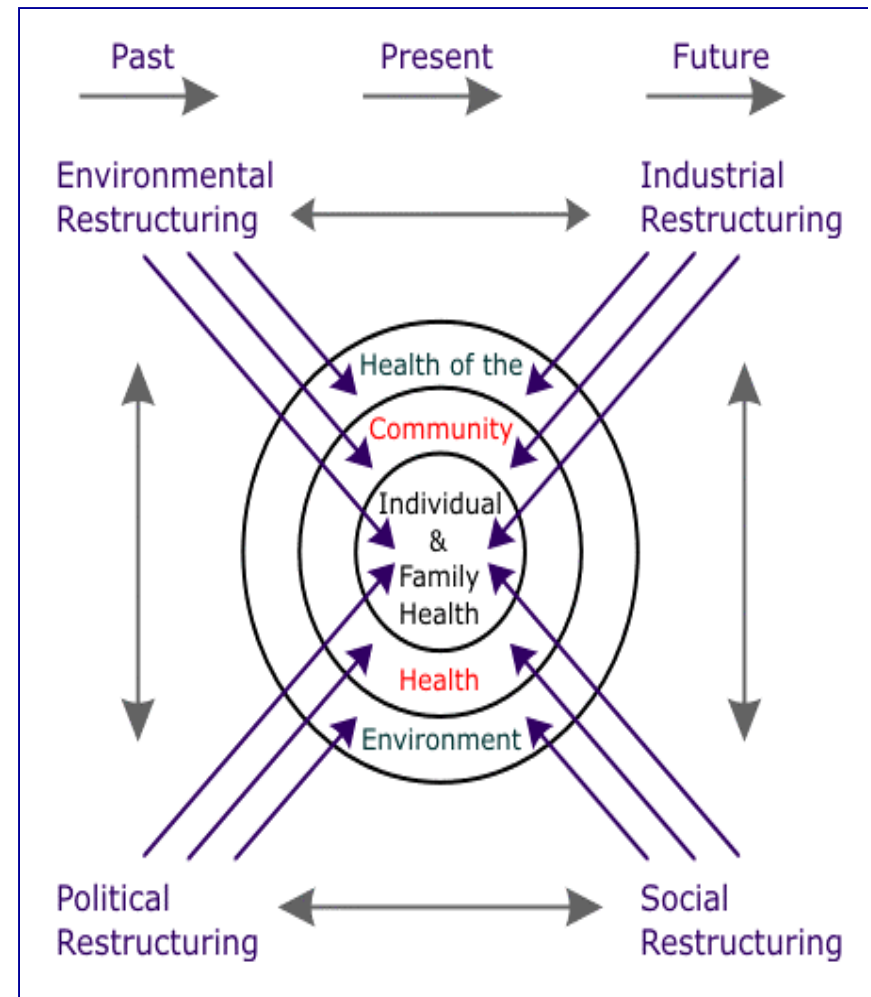
2.2 million in developing countries; 1.7 million are children, die From water borne diseases, bad Sanitation and poor hygiene

At any time; one half of world's hospital beds occupied by Patients suffering from water borne diseases; 80% in LDC's

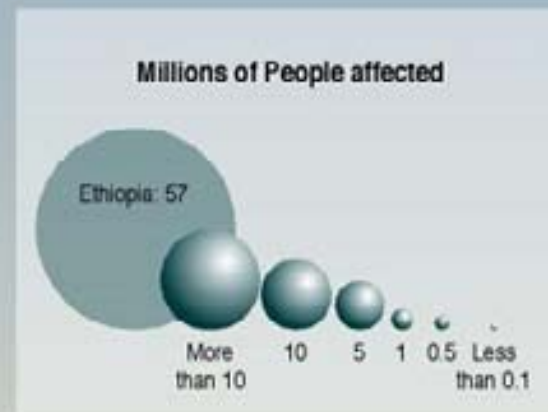


Political Cultural Drivers of Change

- Water Reforms most advanced where see Macro Economic reform open markets, less corruption, more participation
- water crises
- macro economic crises (*Mexico*, India...)
- political restructuring (SA-human rights...)
- liberalization policies (*Chile*, *Brazil*, China...)
- meeting EU standards (*Spain*, *Poland*, Hungary...)
- international lenders and donors



People Affected by Natural Disasters between 1971-2000



Source: The Office of U.S. Foreign Disaster Assistance (OFDA), The Centre for Research on the Epidemiology of Disasters (CRED), International Disaster Database, www.cred.be/emdat, Université Catholique de Louvain, Brussel, Belgium



DELPHINE DEDELE
BASED ON A REQUEST BY DELPHINE DEDELE
JUNE 2002

state of water – increasing disasters

A European Traveler noted:

“Even when I visited the better-off farms, I discovered that a very large percentage of them had kitchens with ovens burning wood –the poor cooking in pots and pans over a little fire on the hearth, as in the Middle Ages; that they were lighted by dim, smoking, smelly, oil lamps, that the washing of clothes was done by hand in antiquated tubs; that the water was brought into the house by the women and children, from wells invariably situated at inconvenient and tiring distances.....”



BASINS AT RISK

"The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change." (osu)

Basin characteristics which enhance resilience to change include:

- International (and intra-state, cross-jurisdictional) agreements and institutions, such as RBOs
- a history of collaborative projects
- generally positive political relations
- higher levels of economic development

Basin characteristics which indicate vulnerability include

- rapid environmental change
- rapid population growth or asymmetric economic growth
- major unilateral development projects
- the absence of institutional and/or organizational capacity
- generally hostile relations

There are river basins at risk especially if left unattended with poor water management. OSU 16 basins at risk which included 51 nations on five continents 8 in Africa, 6 were in Asia,

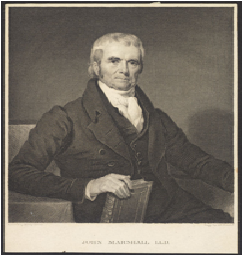
Water Ways & Establishing National Federal Interventions Over Interstate Issues



1808: Gallatin Report

Waterways to be used for:

- Building Political Unity and Nation
- National Defense
- Economic Development



Marshall



Gibbons



Ogden

1824: GIBBONS VS. OGDEN

(Estbl. Federal Powers vs. States)

Claims are said to be repugnant—

- 1st. To that clause in the constitution which authorizes Congress to regulate commerce.
- 2d. To that which authorizes Congress to promote the progress of science and useful arts.

1920's - "308" Reports: Congress Authorizes USACE do Comp. assessments of all major rivers of the US

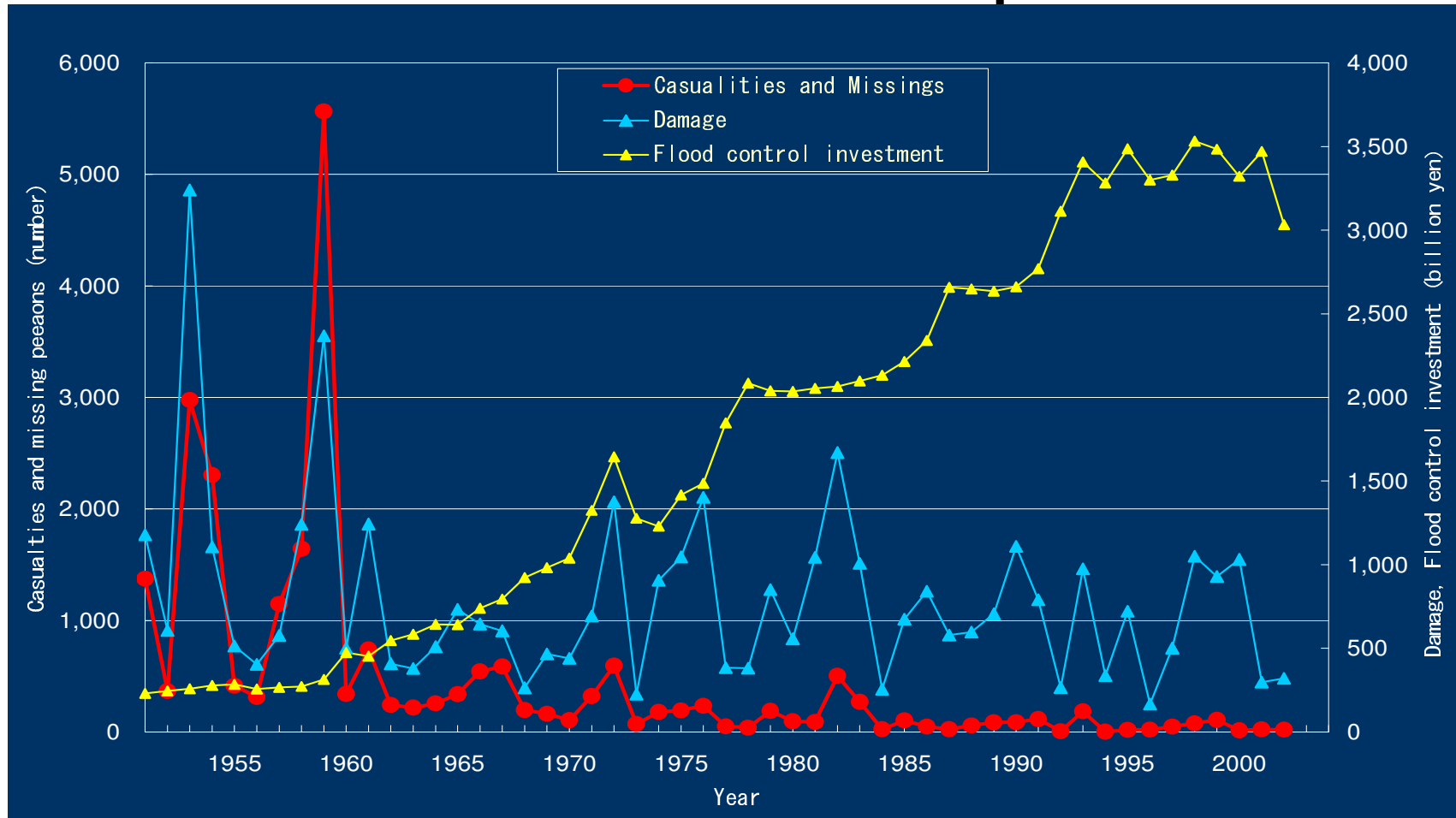


**FT, June 18, 2001:
Rain in India...**

**"Every one of my budgets was
largely a gamble on rain."
Finance Minister of
Government of India**



Flood damage and flood control investment in Japan



1987 – 2001 \$36 Billion in FD prevented – Spent \$32 Billion