

Aaron Wolf

Oregon State University

**International Waters: Global Issues
and Institutions**



Presented at

The Aspen Global Change Institute

June 5 - 10, 2003 Summer Science Session I

“Learning from Regions: A Comparative Appraisal of
Climate, Water, and Human Interactions in the Colorado and
Columbia River Systems”

INTERNATIONAL WATERS: GLOBAL ISSUES AND INSTITUTIONS

**Aaron T. Wolf, Ph.D.
Department of Geosciences
Oregon State University, USA**

**104 Wilkinson Hall
Corvallis, OR 97331, USA**

Tel: +1-541-737-2722

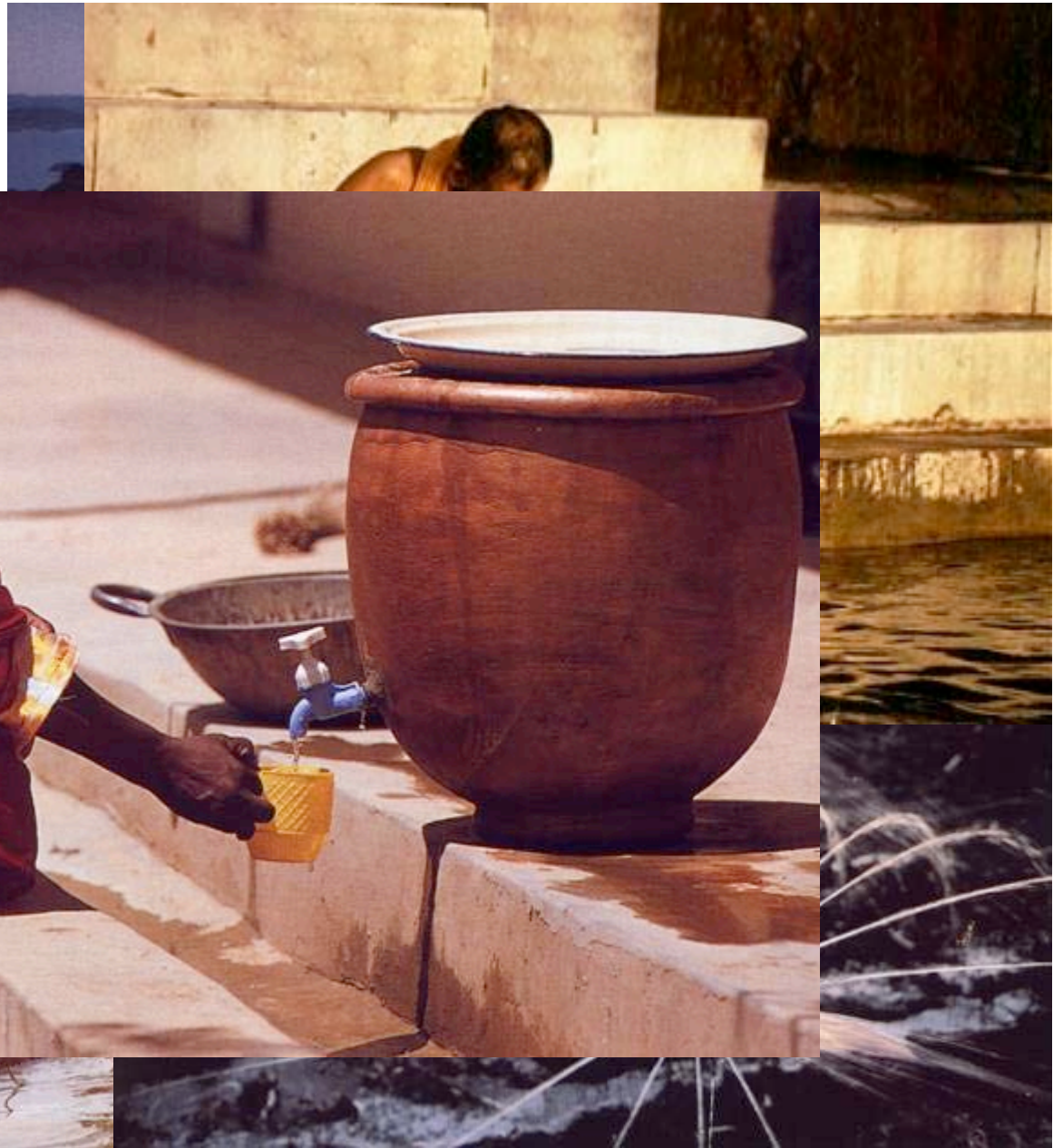
Fax: +1-541-737-1201

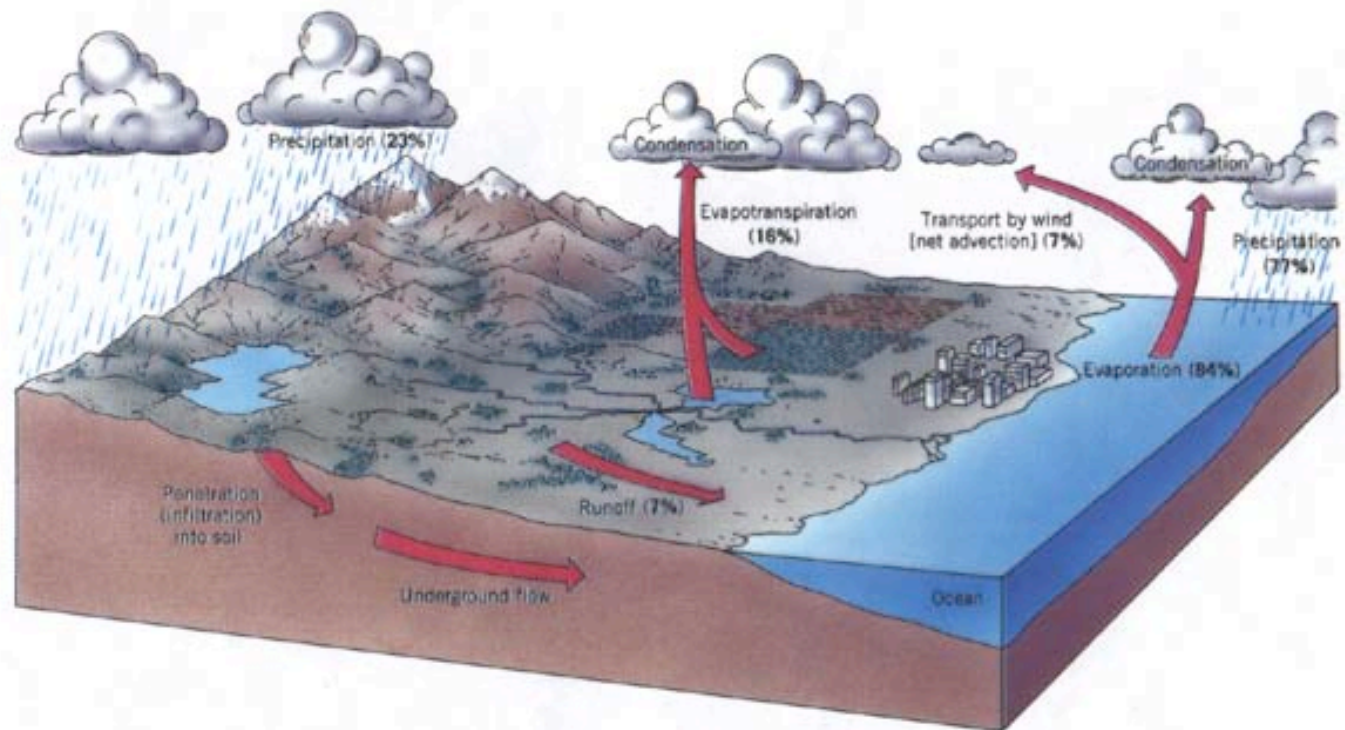
Email: wolfa@geo.orst.edu

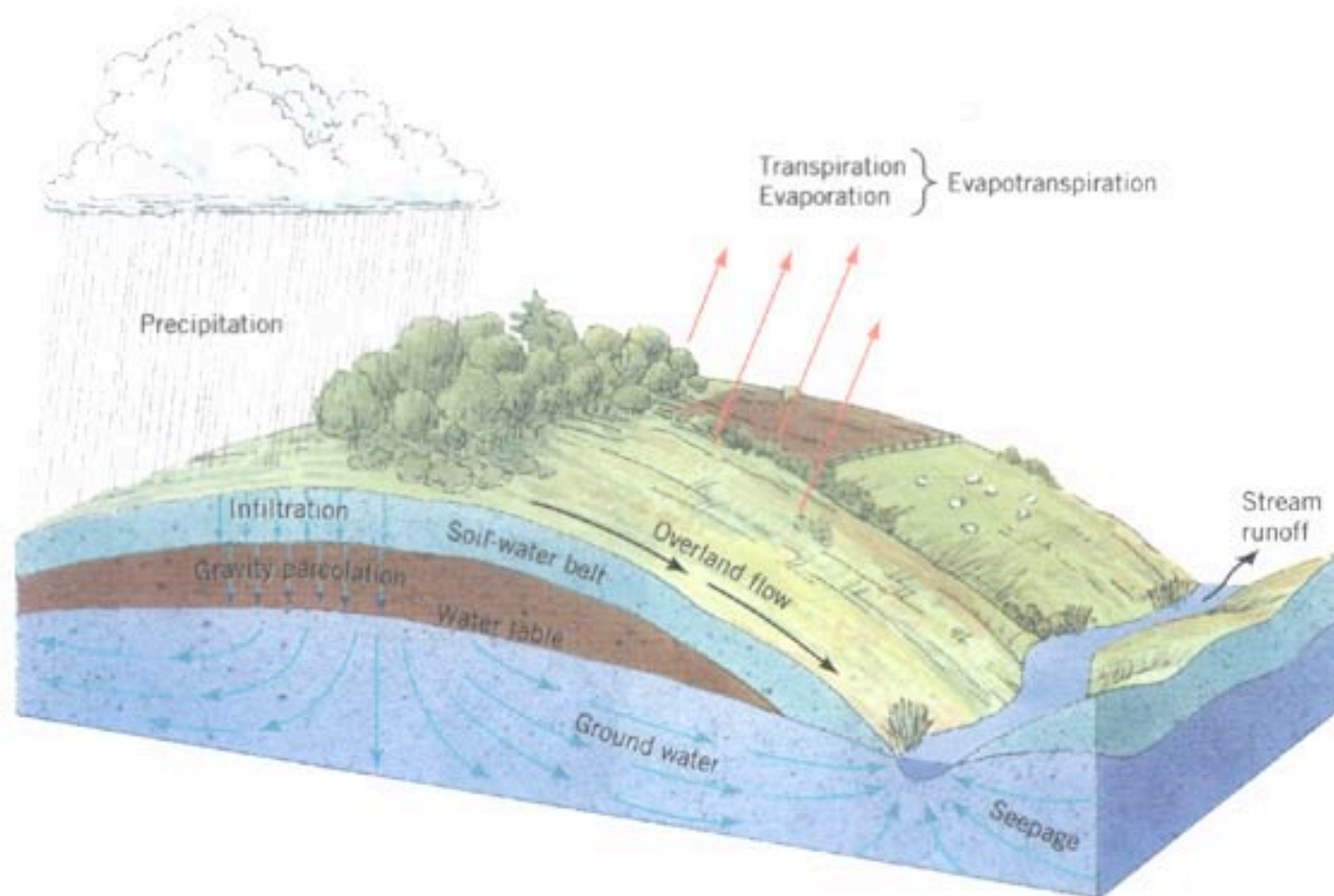
Website: www.transboundarywaters.orst.edu

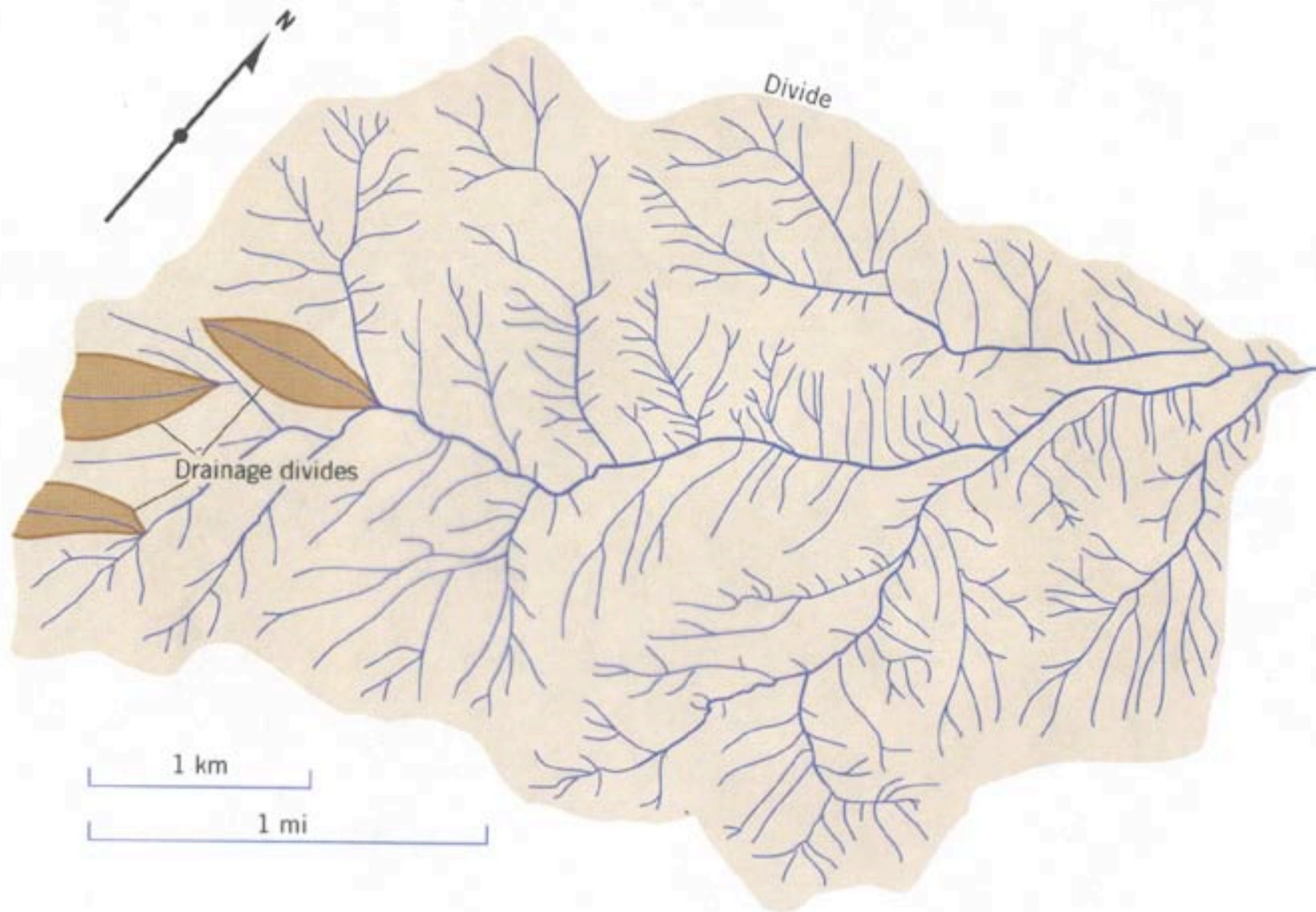
Global Water Crisis

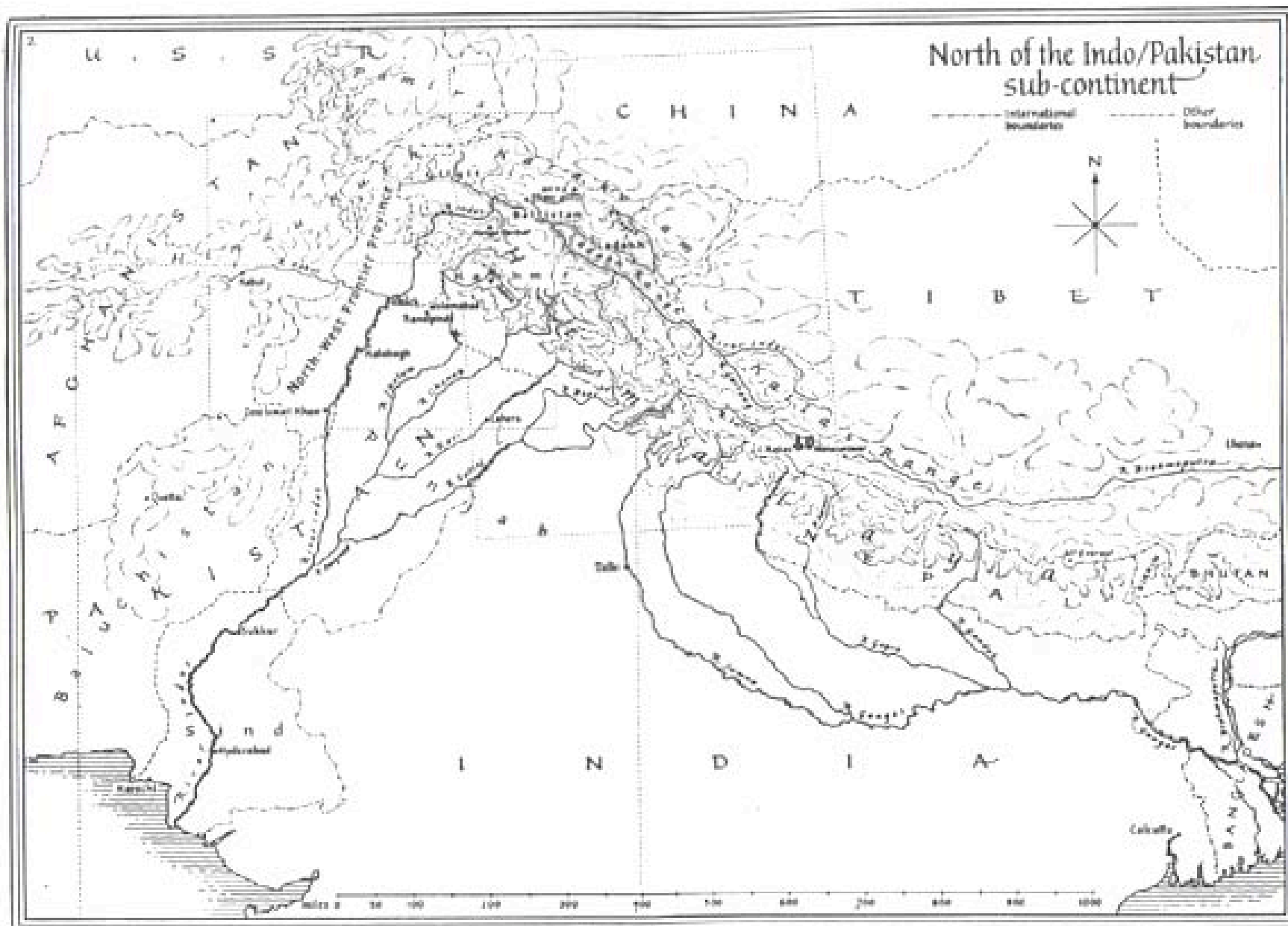
- Almost 3 billion people lack access to adequate sanitation
- >1 billion people lack access to safe drinking water
- At least 250 million illnesses result
- 5-10 million deaths
- 20% of irrigated lands are salt-laden
- Water-related disease costs US\$125 billion/yr.
- Would “only” cost US\$7-50 billion/yr. to resolve



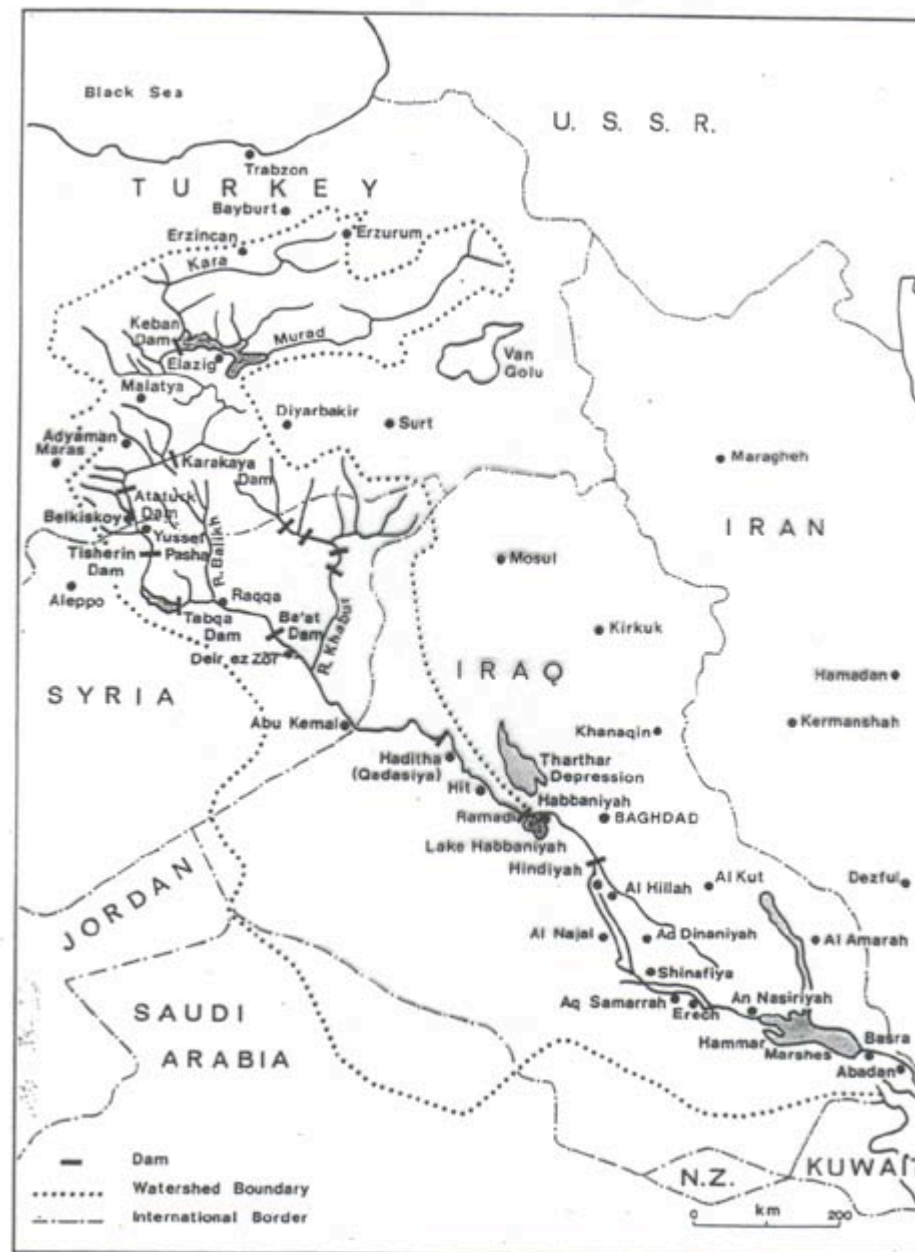




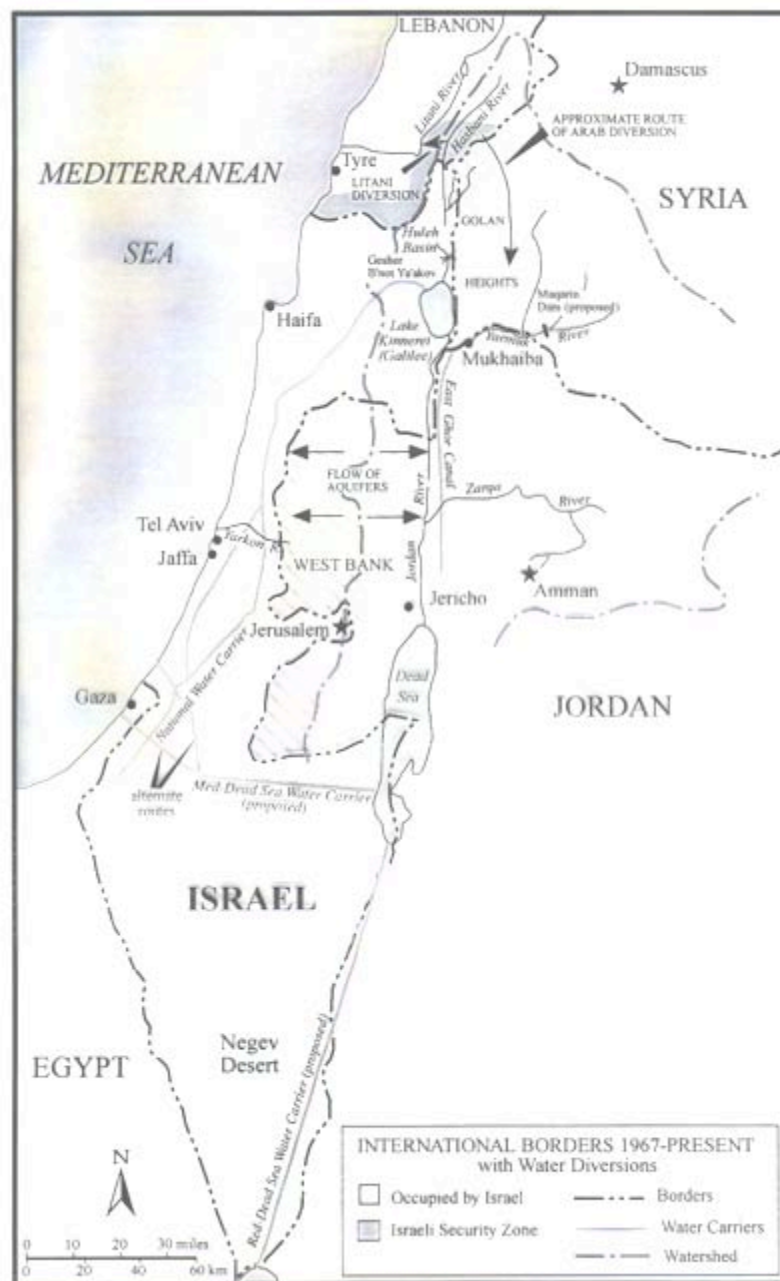




Source: Jean Fairley, *The Lion River: The Indus*, S.I. Gillani, Lahore, 1975.





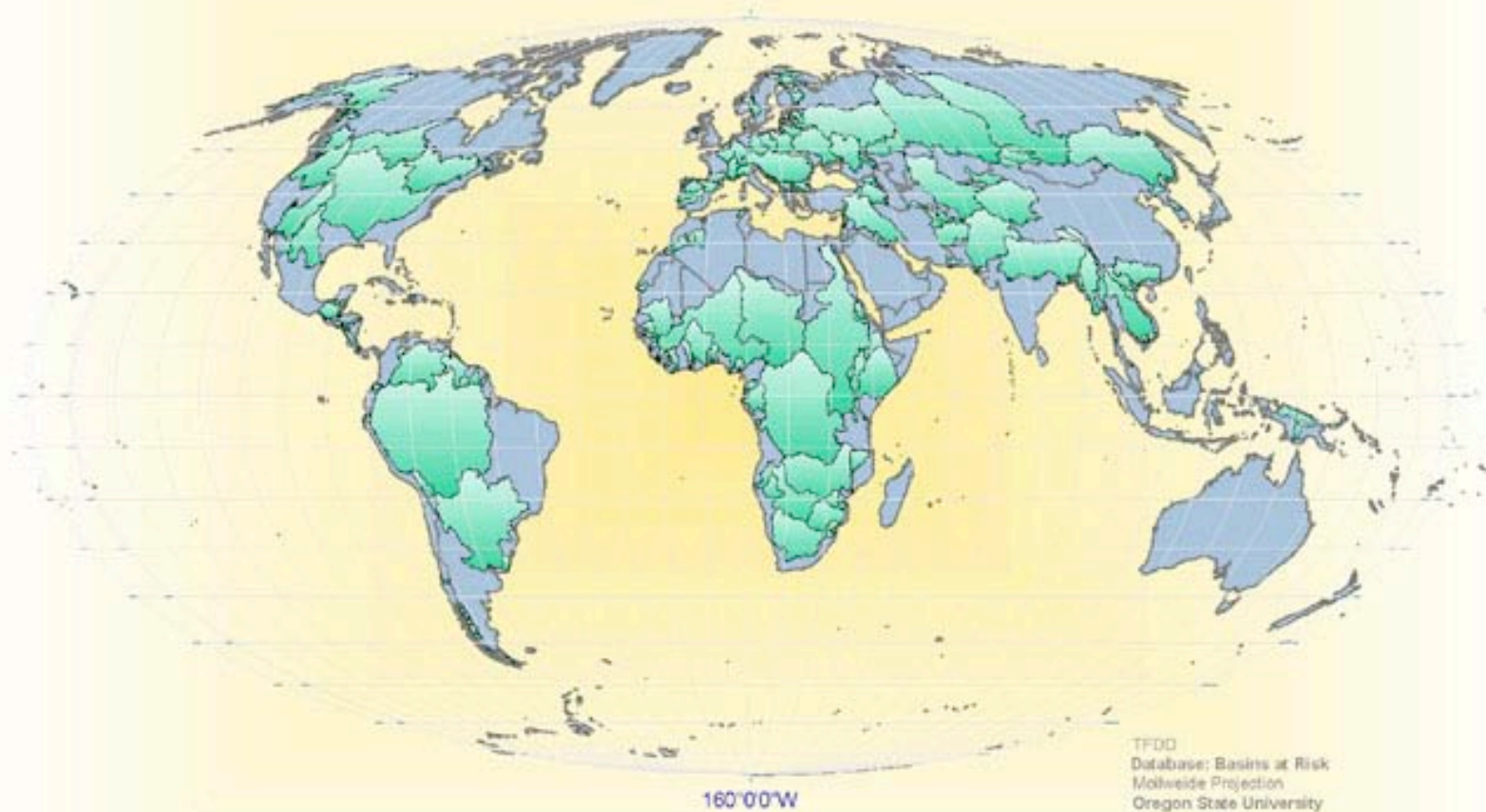


Water and Conflict

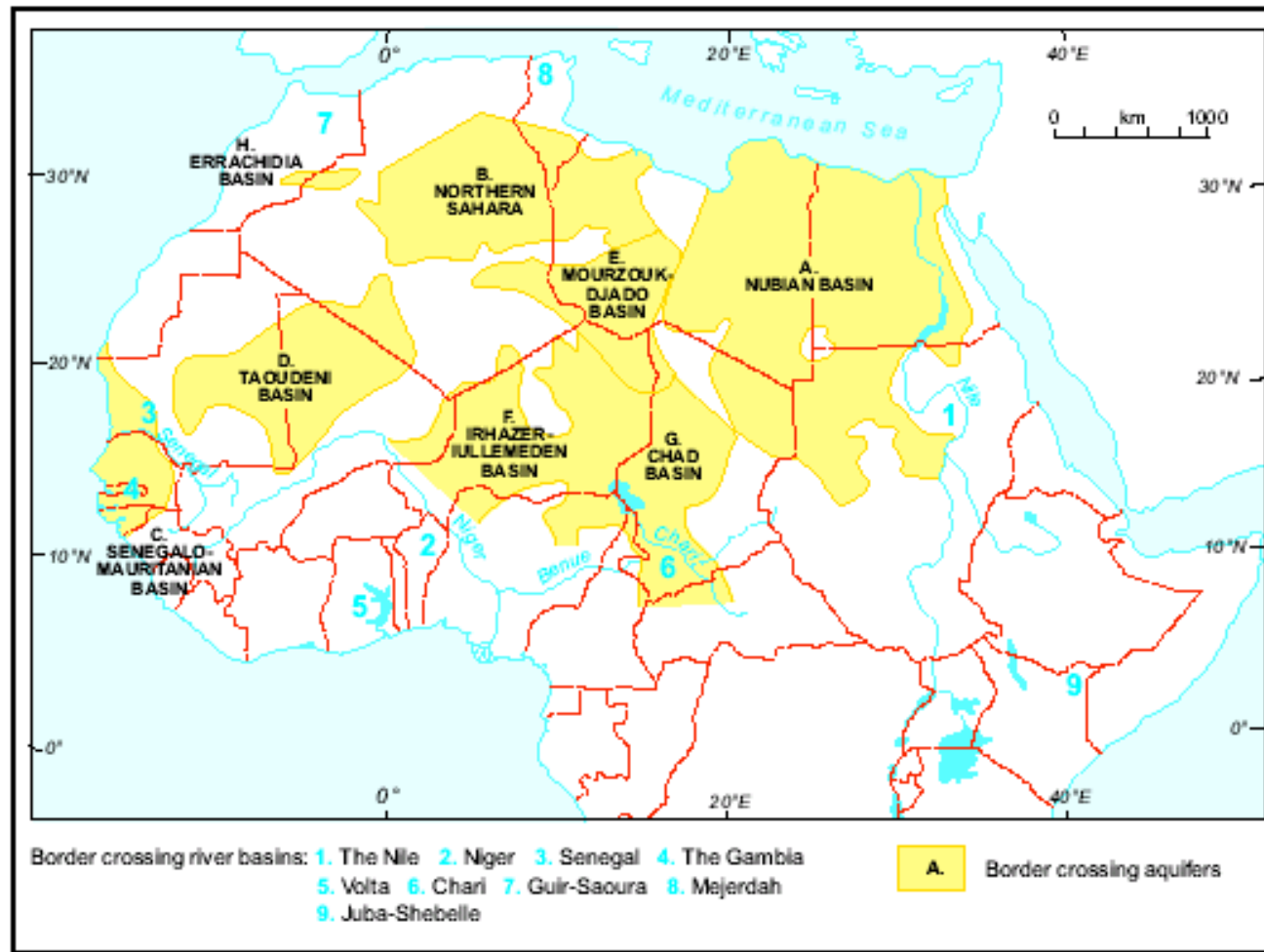
“Fierce competition for fresh water may well become a source of conflict and wars in the future.”

- Kofi Annan, March 2001

International Basins of the World

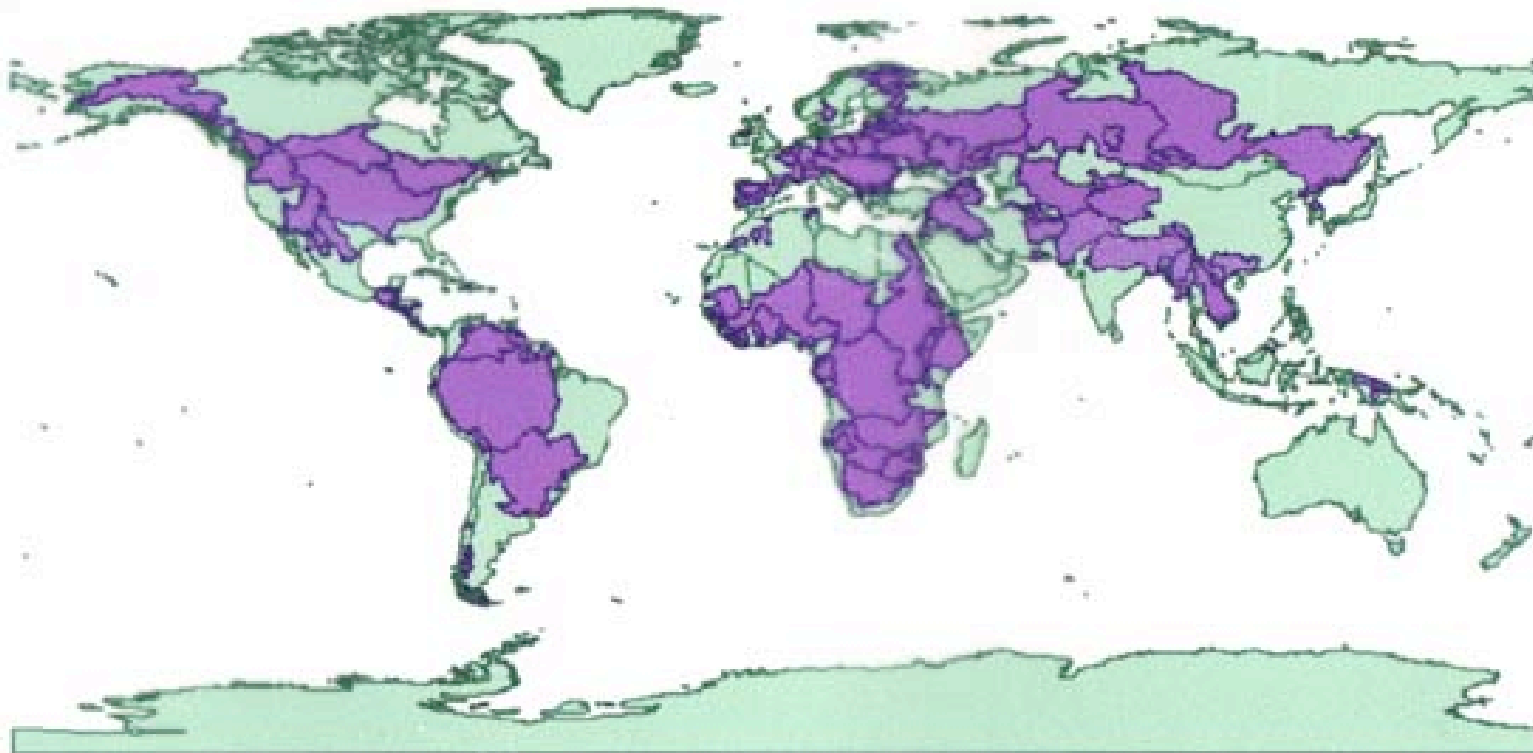


Challenges of Transboundary Aquifers

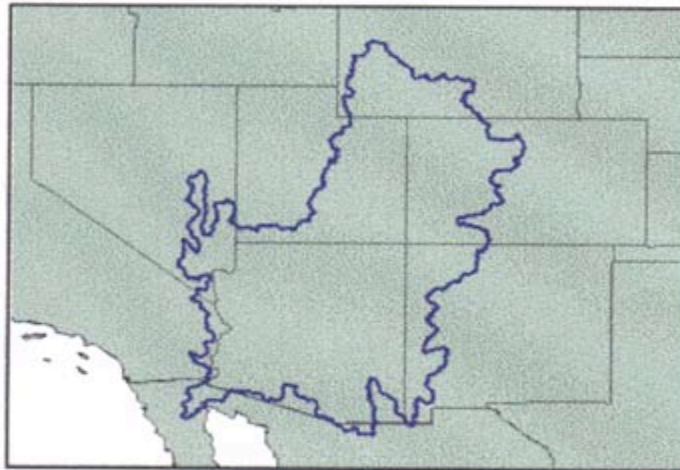


From Puri and others (2001).

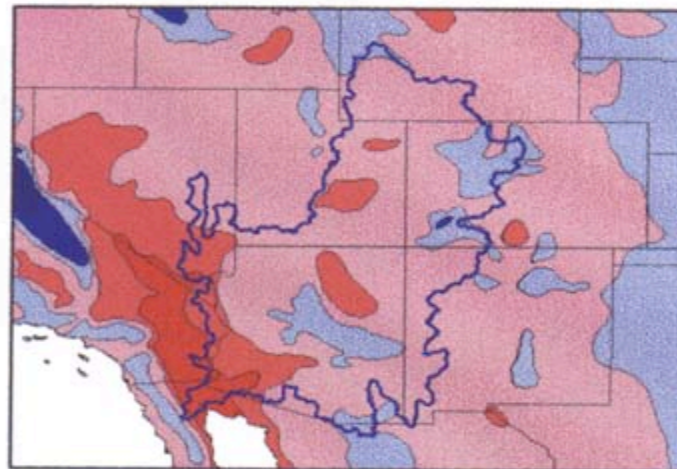
Scale of Conflict



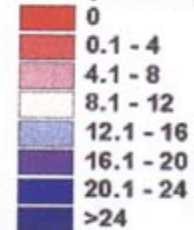
BASINS AT RISK: Spatial Variation



Colorado River Basin



Precipitation (inches/year)



The Transboundary Freshwater Dispute Database

A Project of
Oregon State University
Department of Geosciences
and the Northwest Alliance for
Computational Science

- Reference to 3,600 water-related treaties (805-1997)
- Full-text of 400 treaties and 40 US compacts, entered in computer database
- Detailed negotiating notes (primary or secondary) from fourteen case-studies of water conflict resolution
- Annotated bibliography of “State of the Art” of water dispute resolution literature
- News files on cases of acute water-related disputes
- Indigenous methods of water dispute resolution

Interactive Search Interface



Bibliography

[illegible]

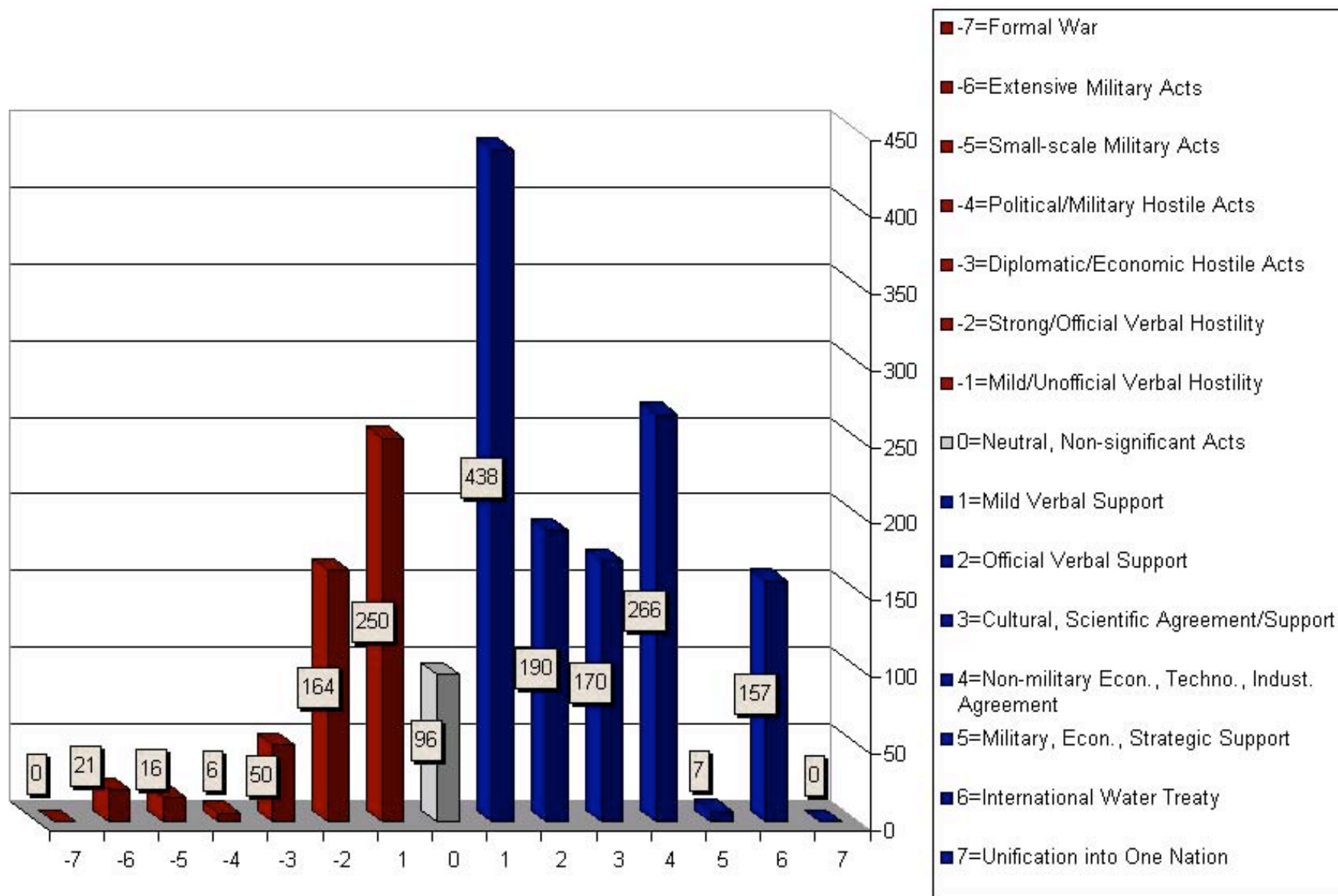
Treaties

Issue	Location	Estimated Fishes	Trapped Fishes	Male Fishes	Size	Sexual Maturity	Sex Ratio Males/Females	GHG for all members
Incidence of fish - regarding the management of the Chaco Wildlife Sanctuary	San Mateo, Bolivia	2,000-3,000	2%	1%	less 5 cm	Blond	2:1	0.0000
Agreement between the Government of the Province of Jujuy and the administration of Bolivia	San Mateo, Bolivia	Water 1,000	1%	1%	Minimum 5-10 cm	Blond	Equal	0.0000

DATE	BASIN	COUNTRIES	BAR SCALE	EVENT SUMMARY	ISSUE TYPE
12/5/73	La Plata	Argentina-- Paraguay	4	PRY AND ARG AGREE TO BUILD 1B DAM, HYDROELECTRIC PROJECT	Infrastructure
1/1/76	Ganges	Bangladesh-- India--United Nations	-2	Bangladesh lodges a formal protest against India with the United Nations, which adopts a consensus statement encouraging the parties to meet urgently, at the level of minister, to arrive at a settlement.	Quantity
7/3/78	Amazon	Bolivia--Brazil-- Colombia-- Ecuador-- Guyana--Peru-- Suriname-- Venezuela	6	Treaty for Amazonian Cooperation	Economic Development
4/7/95	Jordan	Israel--Jordan	4	Pipeline from Israel storage at Beit Zera to Abdullah Canal (East Ghor Canal) begins delivering water stipulated in Treaty (20 MCM summer, 10 MCM winter). The 10 mcm replaces the 10 mcm of desalinated water stipulated Annex II, Article 2d until desalinization plant completed	Quantity
6/1/99	Senegal	Mali--Mauritania	-3	13 people died in communal clashes in 6/99 along border between Maur. & Mali; conflict started when herdsmen in Missira-Samoura village in w. Mali, refused to allow Maur. horseman to use watering hole; horseman returned w/ some of his clansmen, attacking village on 6/20/99, causing 2 deaths; in retaliation that followed, 11 more died.	Quantity

Events Database, Example

Number of Events by BAR Scale

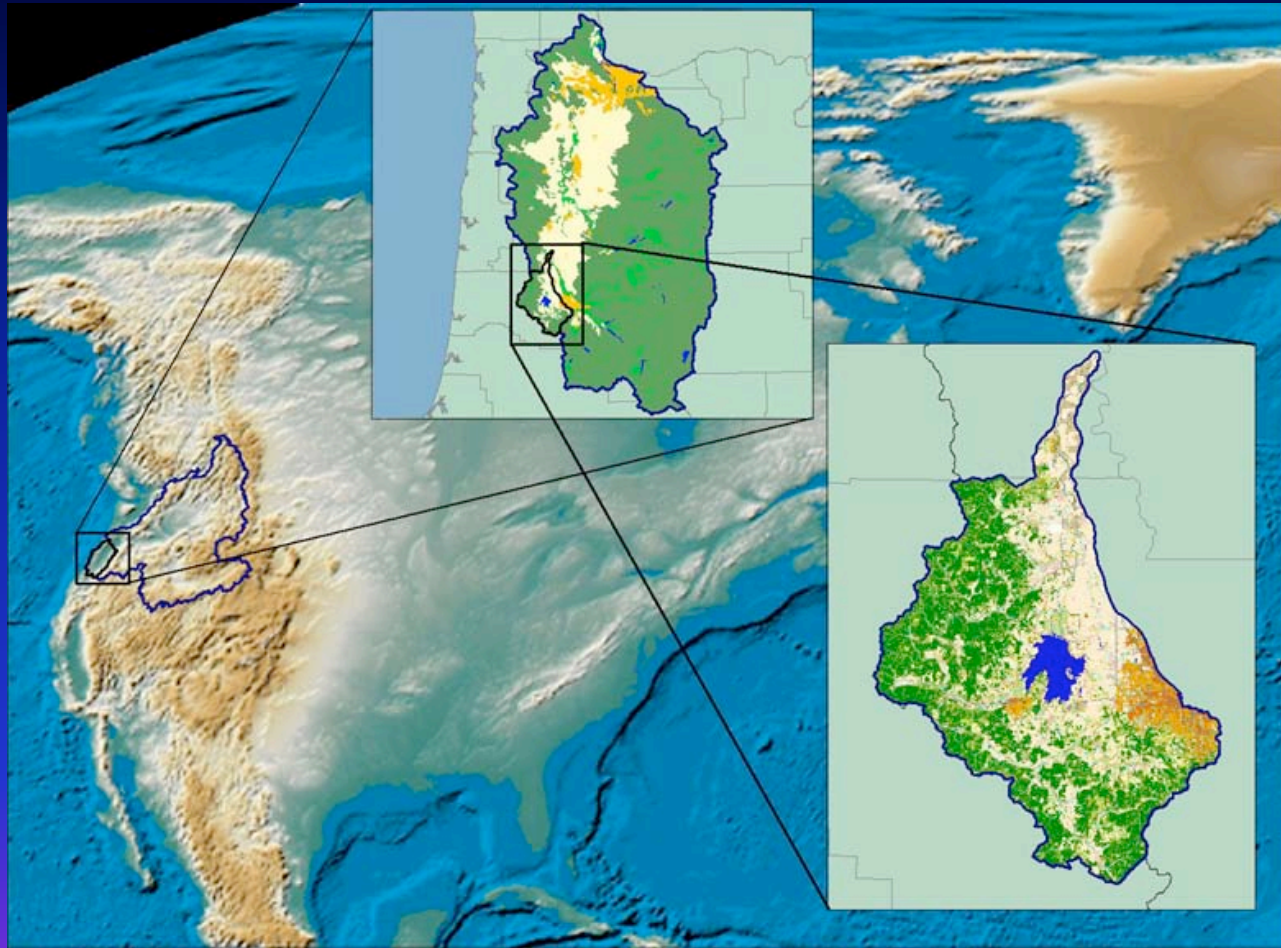


Institutional Resiliency Argument

Transboundary water institutions are resilient over time, even between hostile riparians, even as conflict is waged over other issues:

- **Picnic Table Talks**
- **Mekong Committee**
- **Indus River Commission**
- **Caucasus**
- **SADC Region**

Conflict Within and Between Multiple Scales

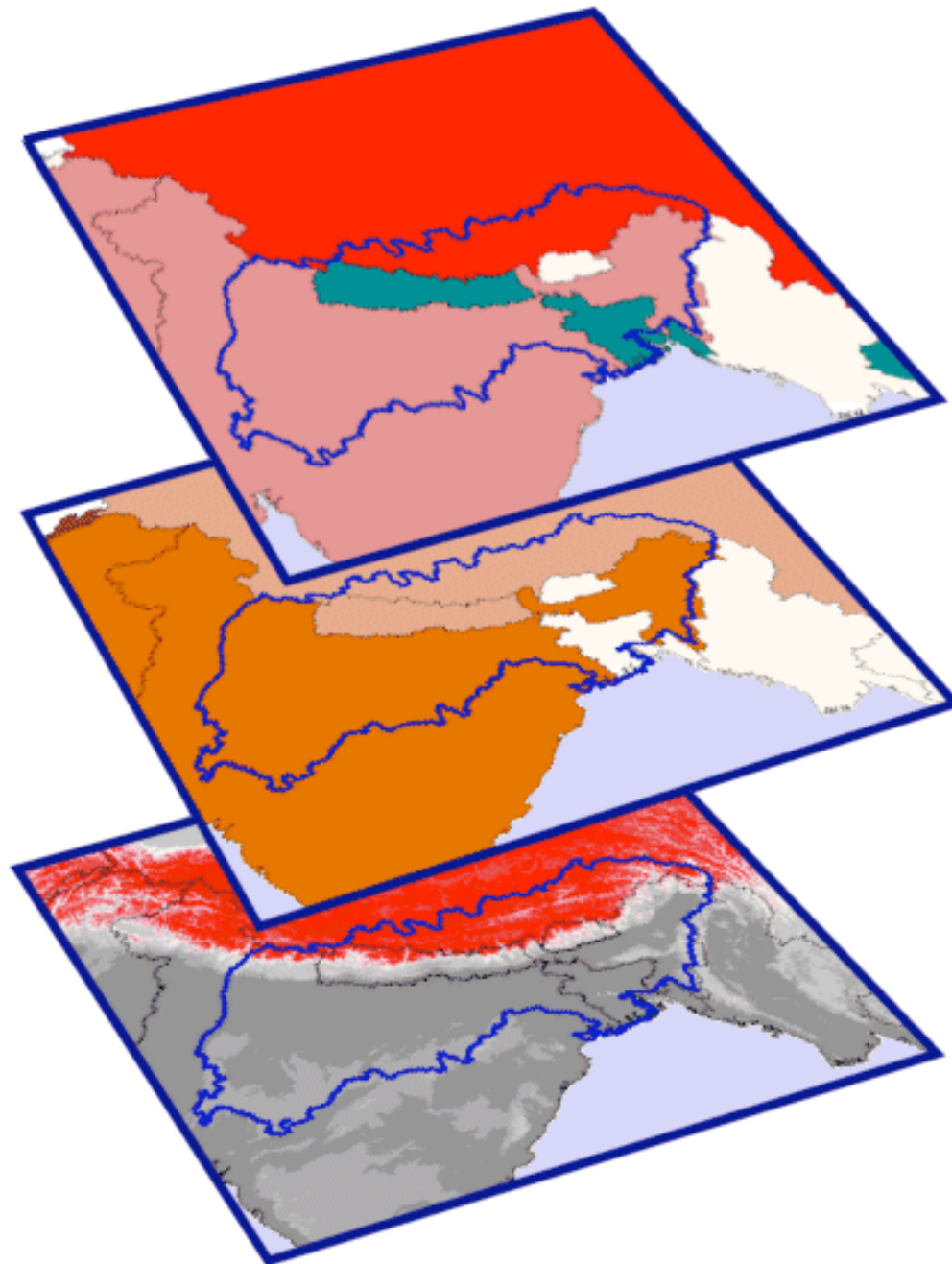
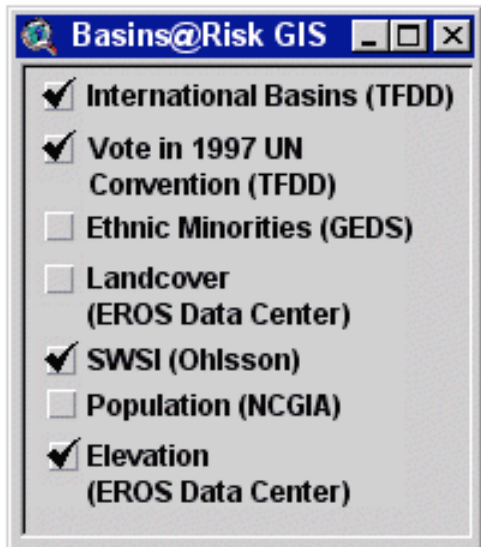


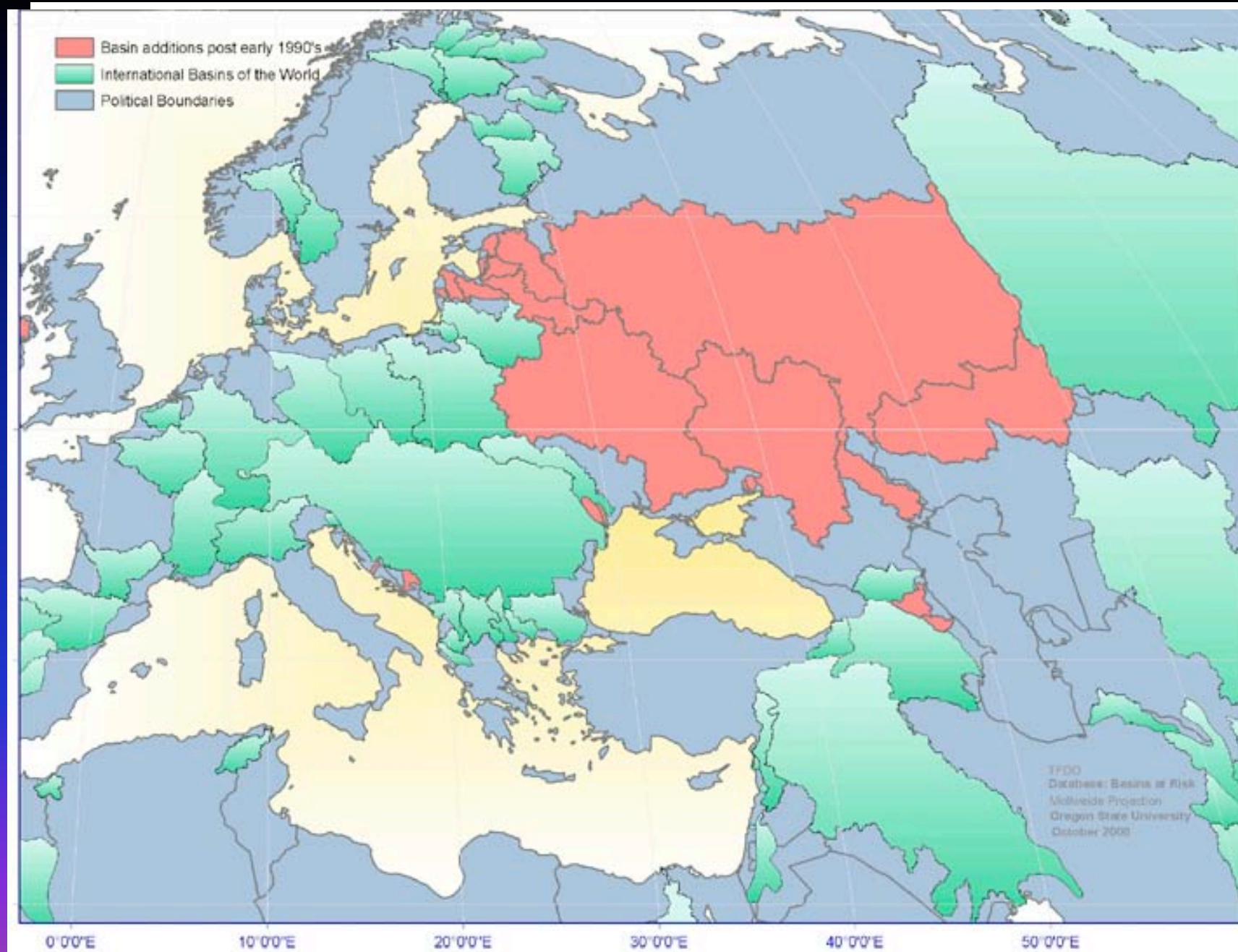
The smaller the scale, the greater the likelihood of violence.

“Prevailing Wisdom”

Causes of conflict include:

- Climate
- Water stress
- Population
- Level of development
- Dependence on hydropower
- Dams or development *per se*
- “Creeping” changes:
 - general degradation of quality
 - climate change induced hydrologic variability

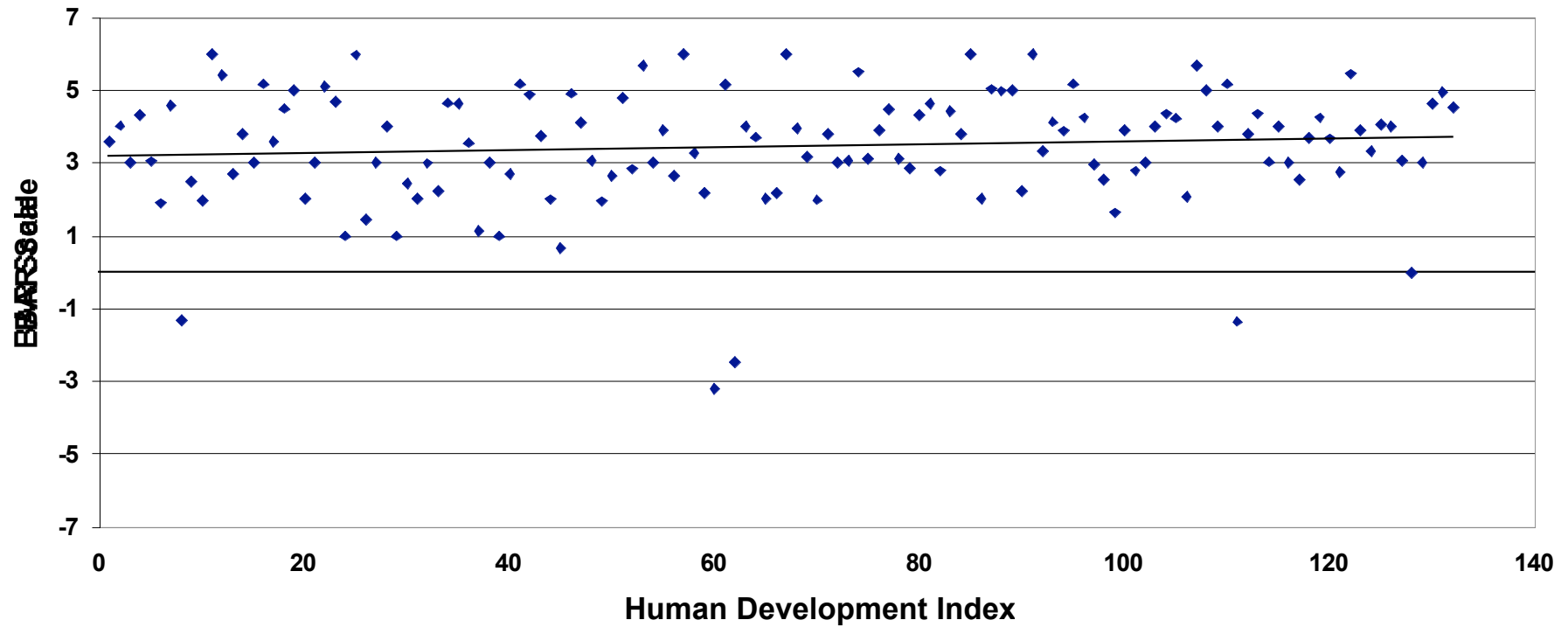




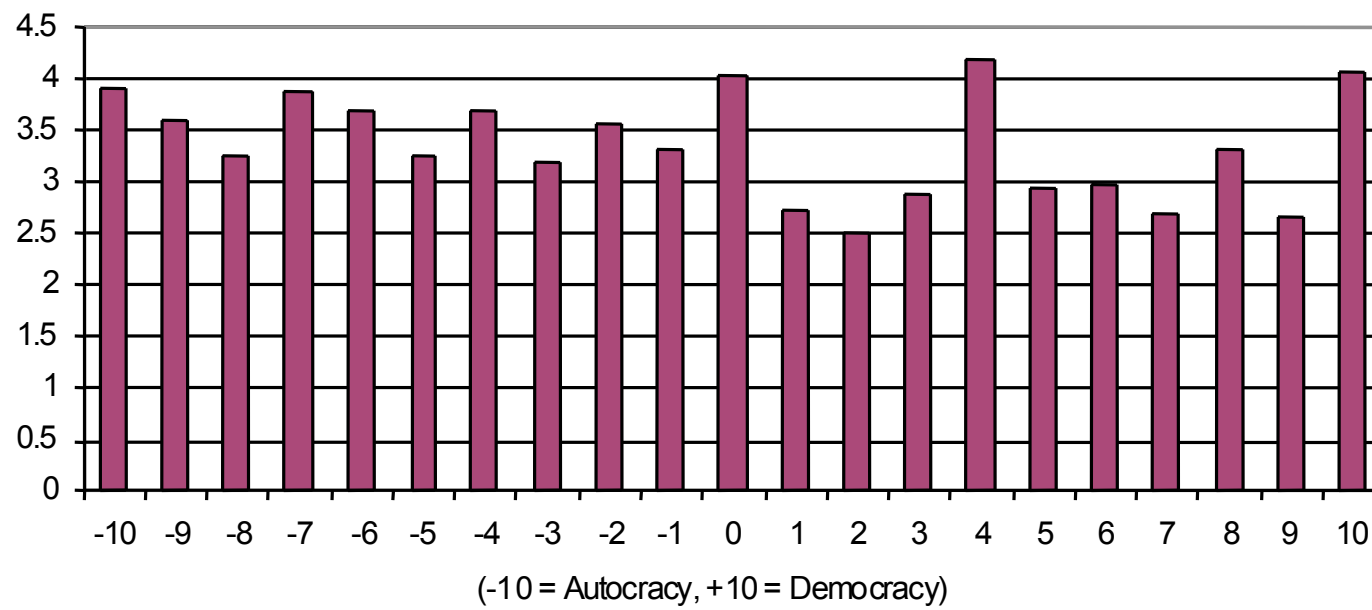
Excerpt of River Names File Amazon River Basin

Basin/Country Polygons	AMZN_BOL	AMZN_BRA	AMZN_COL	AMZN_ECU	AMZN_GUY	AMZN_PER	AMZN_SUR	AMZN_VEN
	Abuna	Abacaxis	Ajaju	Acre	Cafuni	Acre	Trombetas	Bina
	Apere	Abuna	Apapona	Chandless	Ieng	Alto Purus		Casiquiare
	Baures	Acalau	Caqueta	Comentes	Tacutu	Agumac		Concerochite
	Beni	Acarai	Cuduyan	Curaray		Blanco		Grande
	Blanco	Acre	Icana(Isasha)Iaco			Chandless		Negro
	Grande	Agua Preta	Papun	Janua		Chi		
	Guapore	Ajuana	Quaima	Moranon		Comentes		
	Guapore Iten	Alalau	Raudal Yupuri	Morona		Heath		
	Heath	Anama	Tiquie	Napo		Huallaga		
	Lago de San	Anaia	Tiana	Postaza		Iaco		
	Lago Rogaus	Andma	Uaupes	Tigre		Inamban		
	Madidi	Apiaca	Yan	Yavan		Inuya		
	Mamore	Apiau				Janua		
River Names		Manu Madre	Apidia			Manu Madre de Dios		
		Manunpi	Araca			Manunpi		
		Negro	Araua			Moranon		
		Orton	Annos			Moranon		
		Paragua	Anpuana			Napo		
		Rapulo	Arracias			Orton		
		San Martin	Arraras			Pachtea		
		San Miguel	Bacaja			Pampas?		
		Secure	Bau			Postaza		
		Yata	Bia			Putumayo		
			Brea			San Juan?		
			Buri			Santa Ana?		
			Cach Do Tararambu			Santa Eulalia		
			Cachoeira da Batena			Santuano?		
			Cachoeira Caracatai			Sheshea		

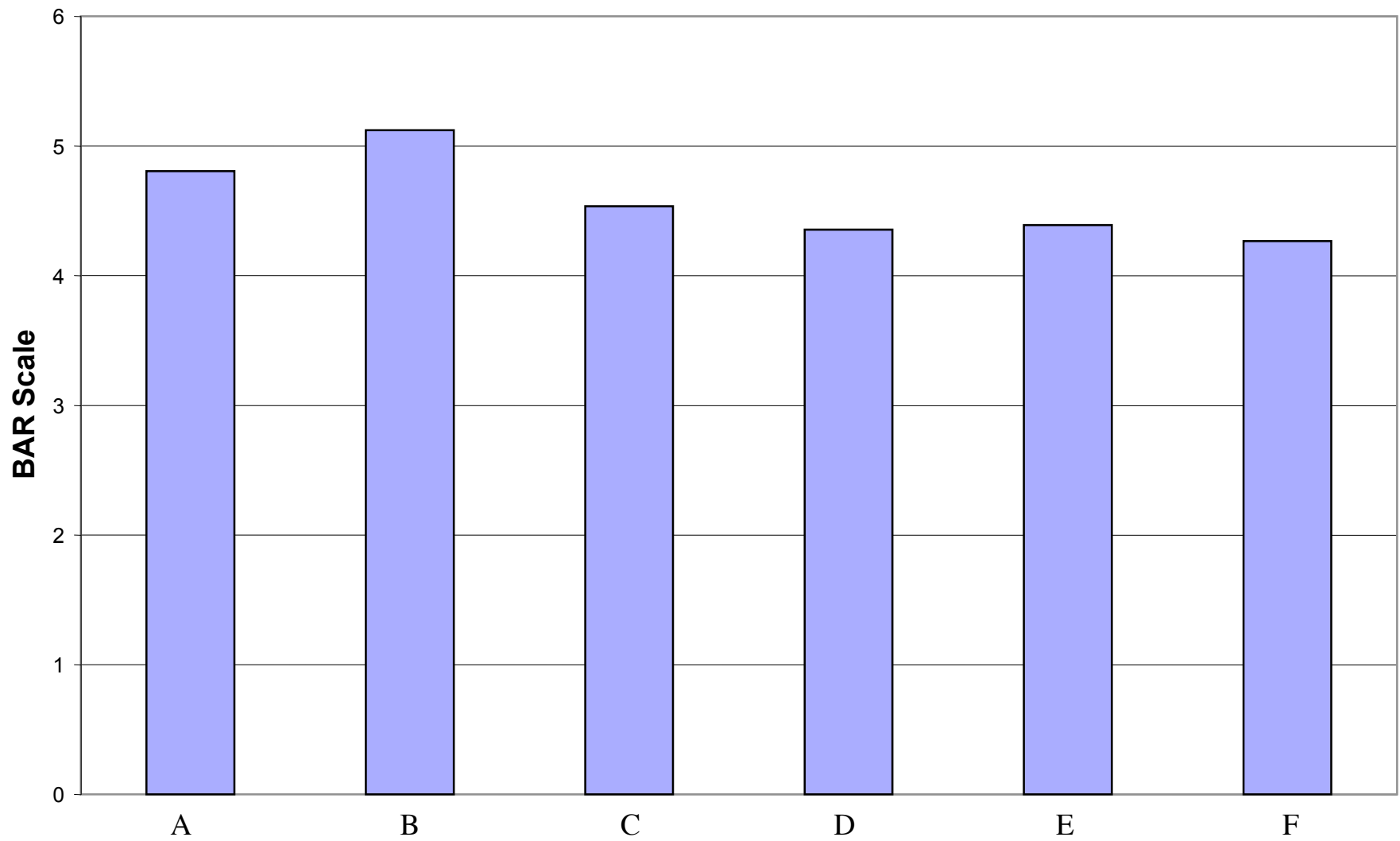
Human Development Index Vs. BAR Scale (By Country)



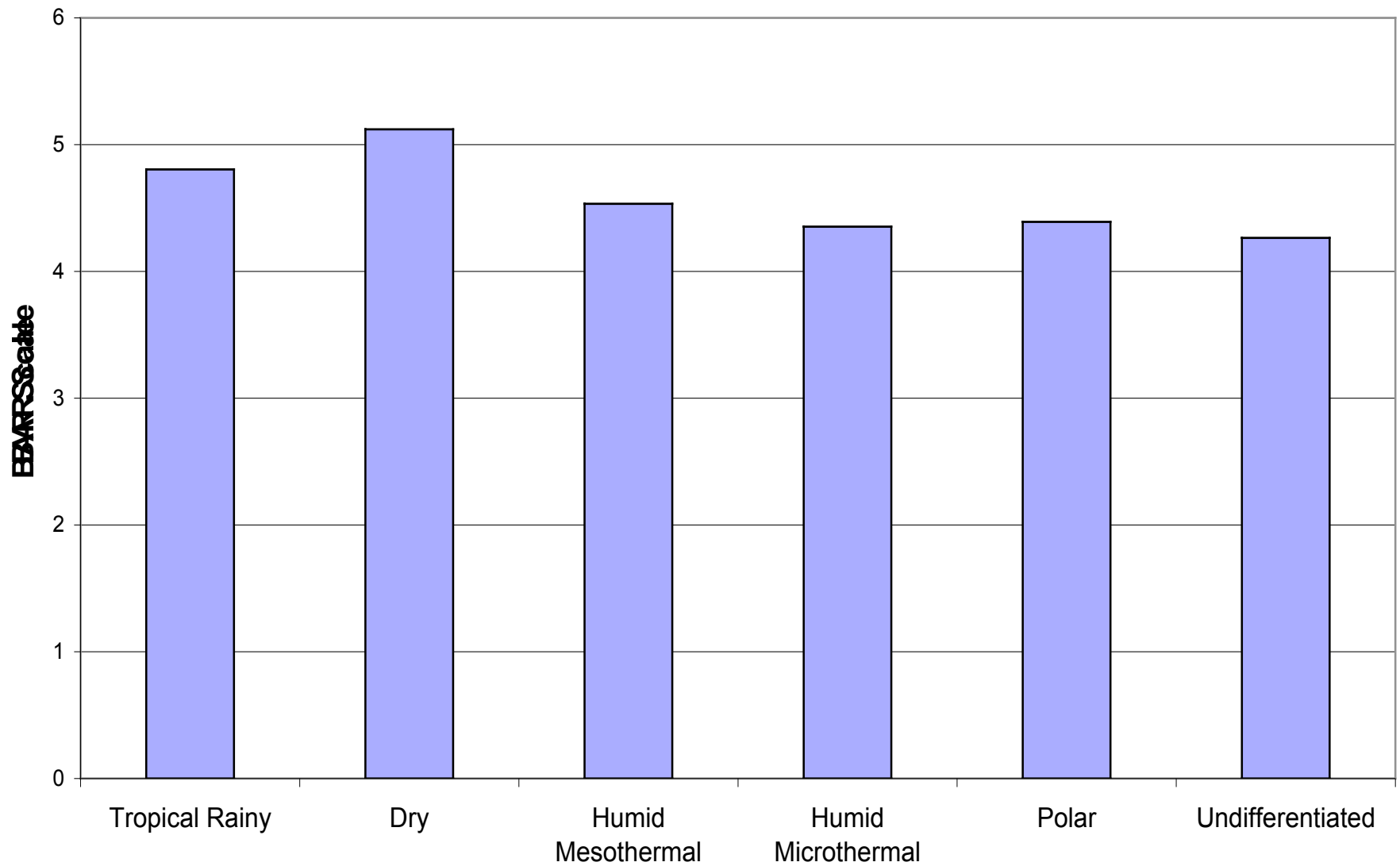
Government Type Vs. Bar Scale



**Primary Climate Type Vs. BAR Scale
(By Basin)**



**Primary Climate Type Vs. BAR Scale
(By Basin)**



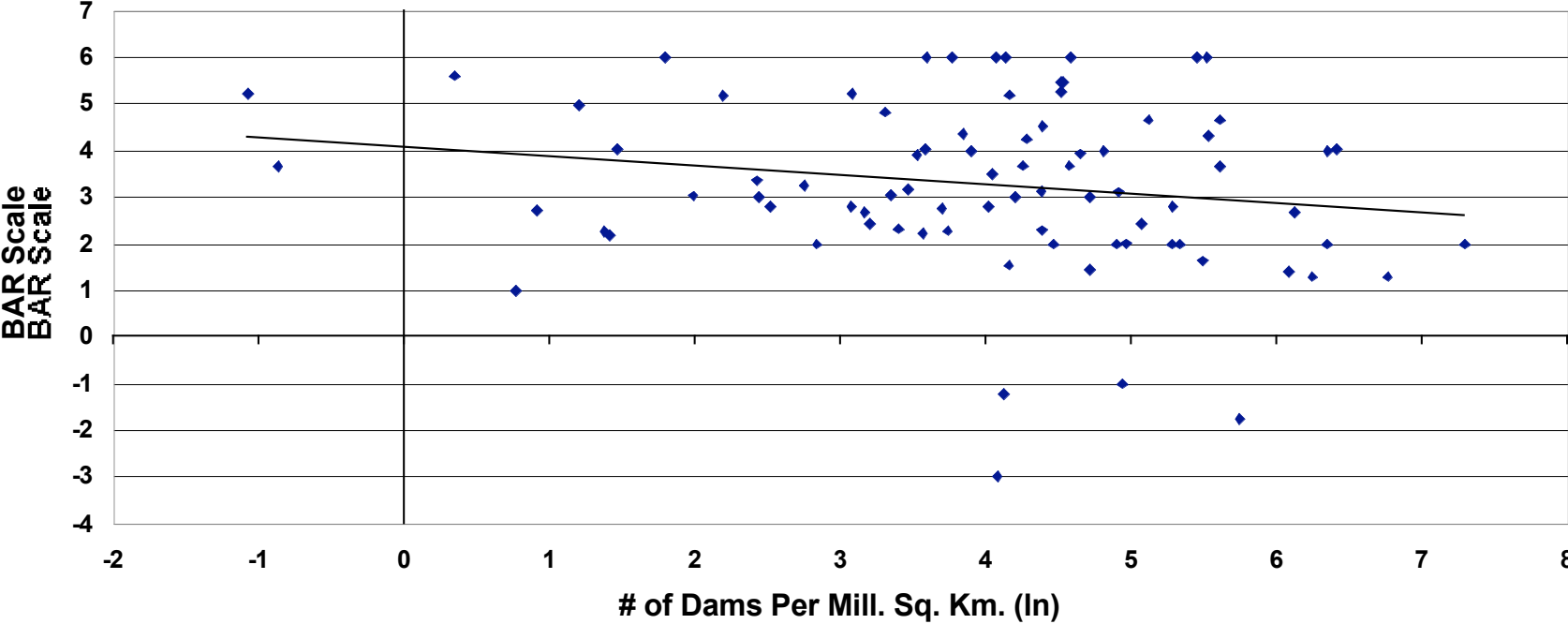
BASINS AT RISK: Working Hypothesis

“The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change.”

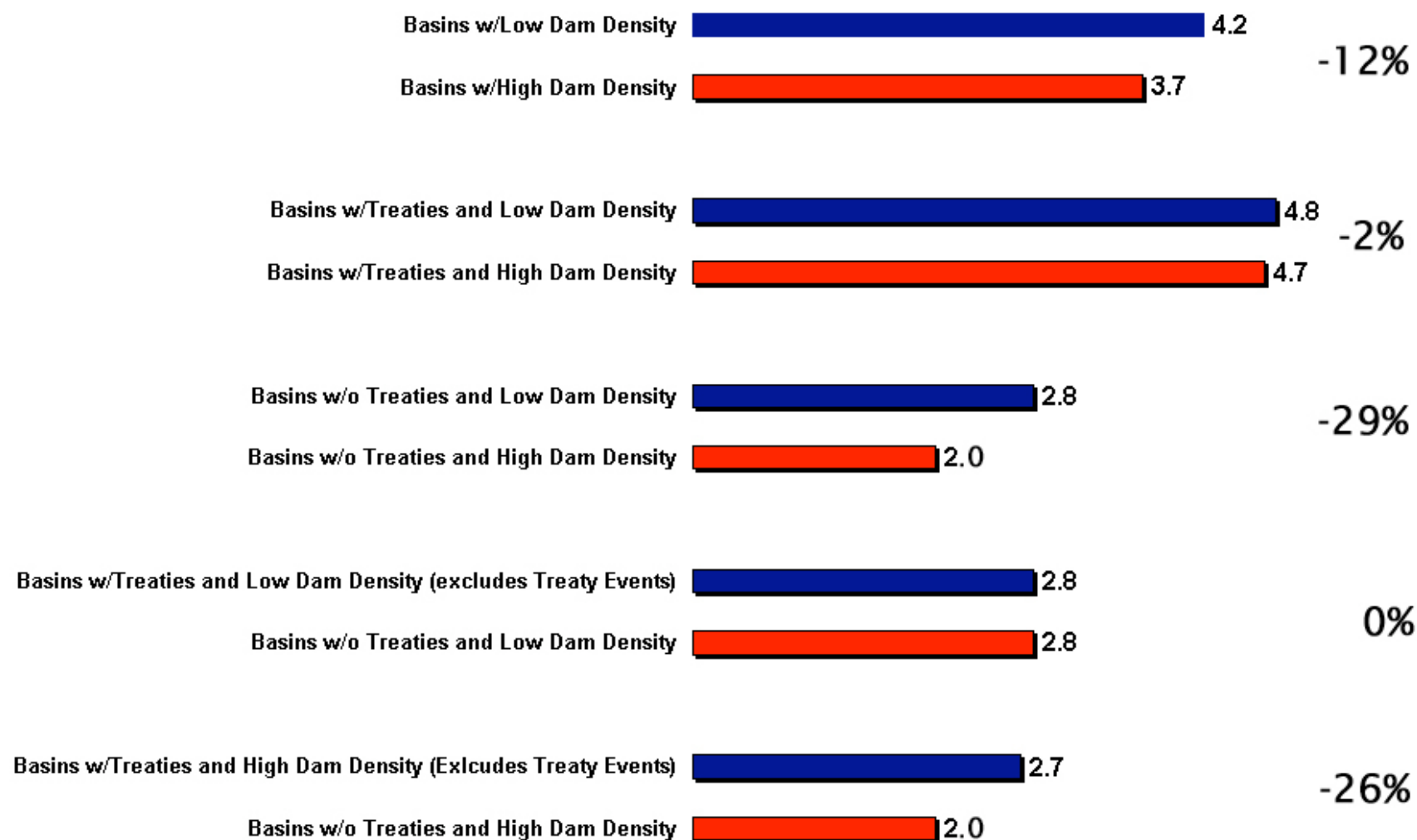
Parameters which seem *not* to be indicators:

- Climate
- Water stress
- Population
- Level of development
- Dependence on hydropower
- Dams or development *per se*
- “Creeping” changes:
 - general degradation of quality
 - climate change induced hydrologic variability

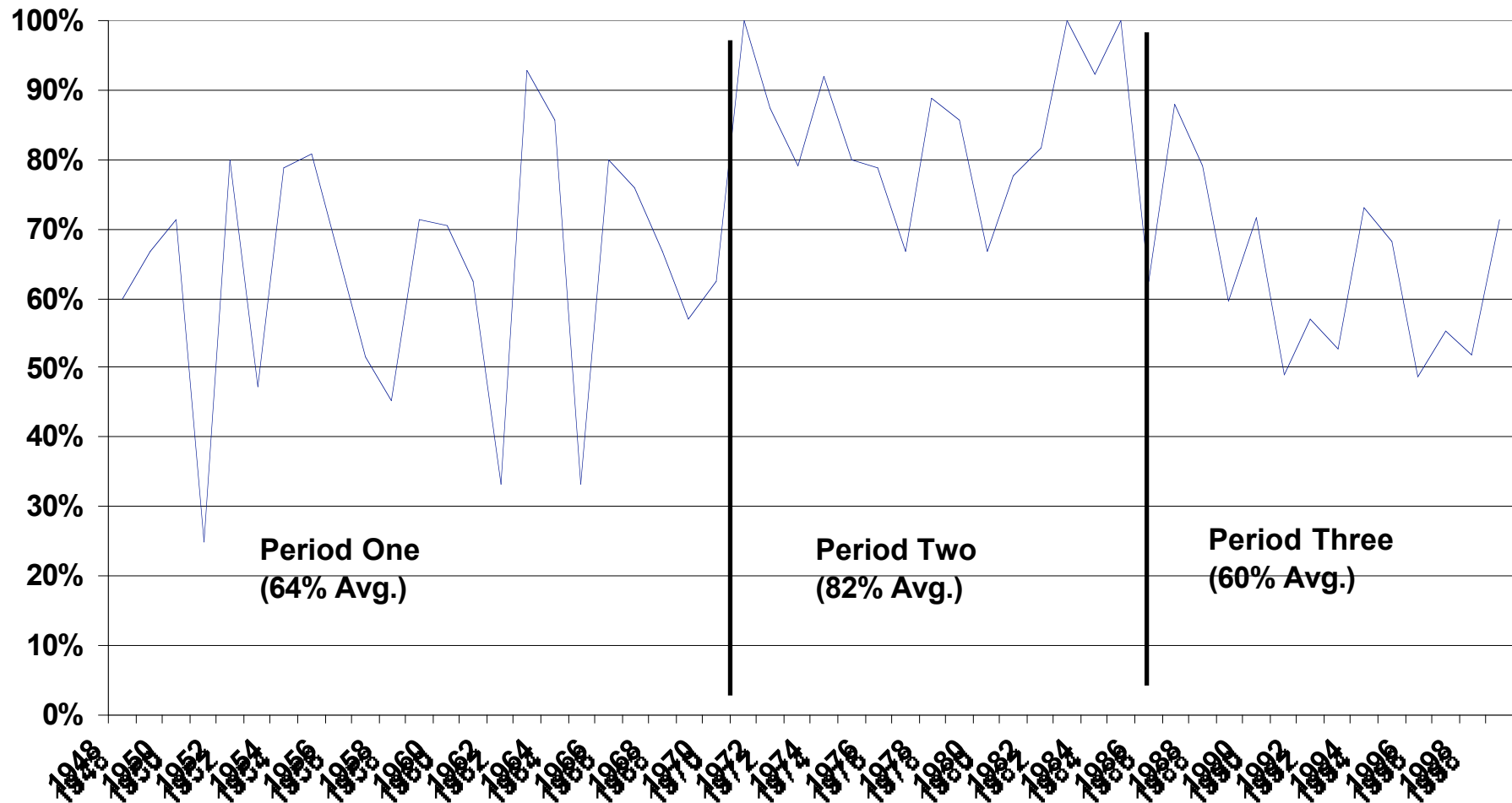
Dams Per Million Sq. Km. (ln) Vs. BAR Scale
(By Basin)



Development and Institutional Capacity: Basin Setting and Corresponding BAR Scale



Cooperative Events as a Percentage of Total Events



BASINS AT RISK: Working Hypothesis

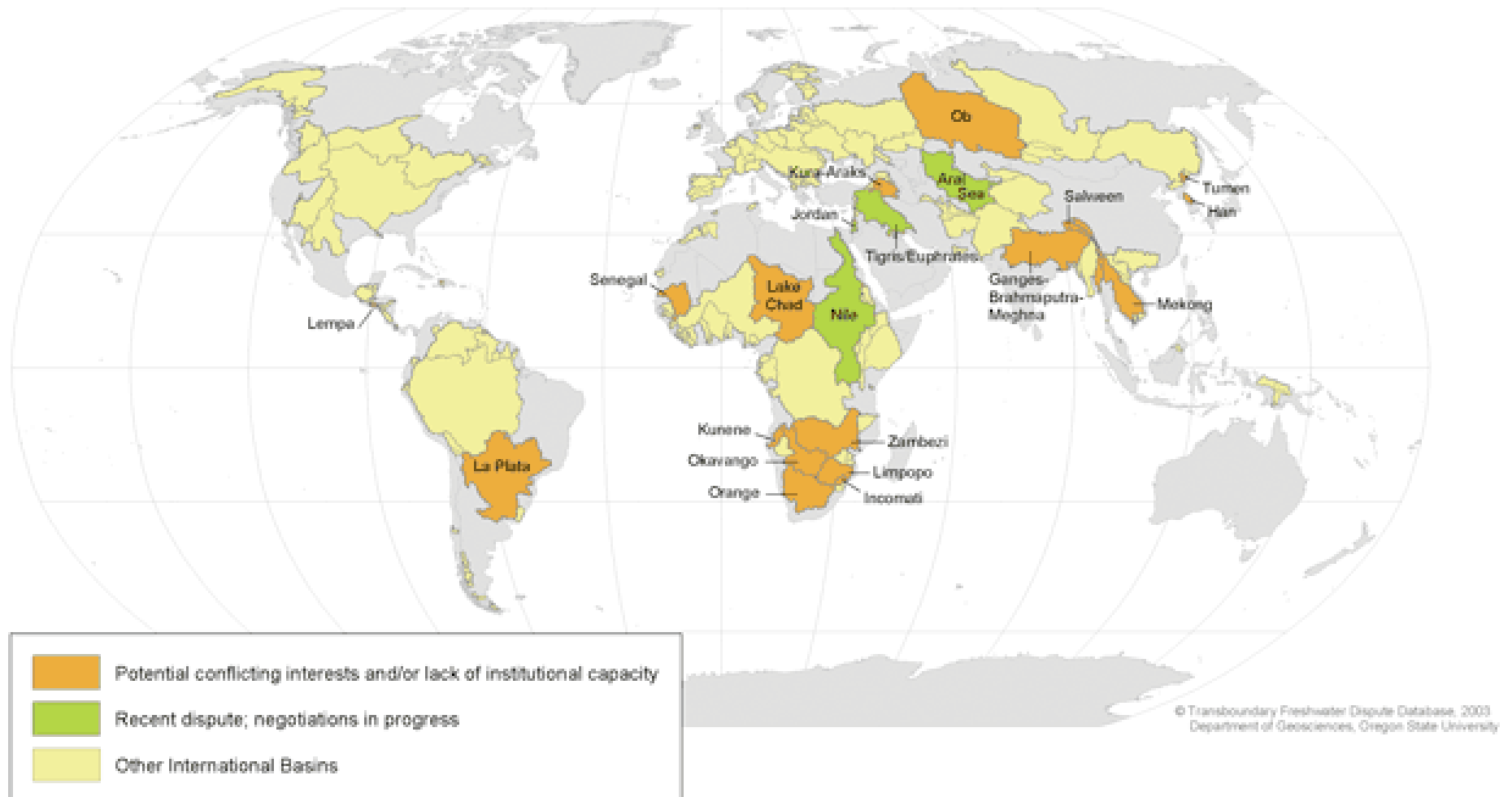
“The likelihood of conflict rises as the rate of change within the basin exceeds the institutional capacity to absorb that change.”

What *are* indicators?

Sudden physical changes or lower institutional capacity are more conducive to disputes:

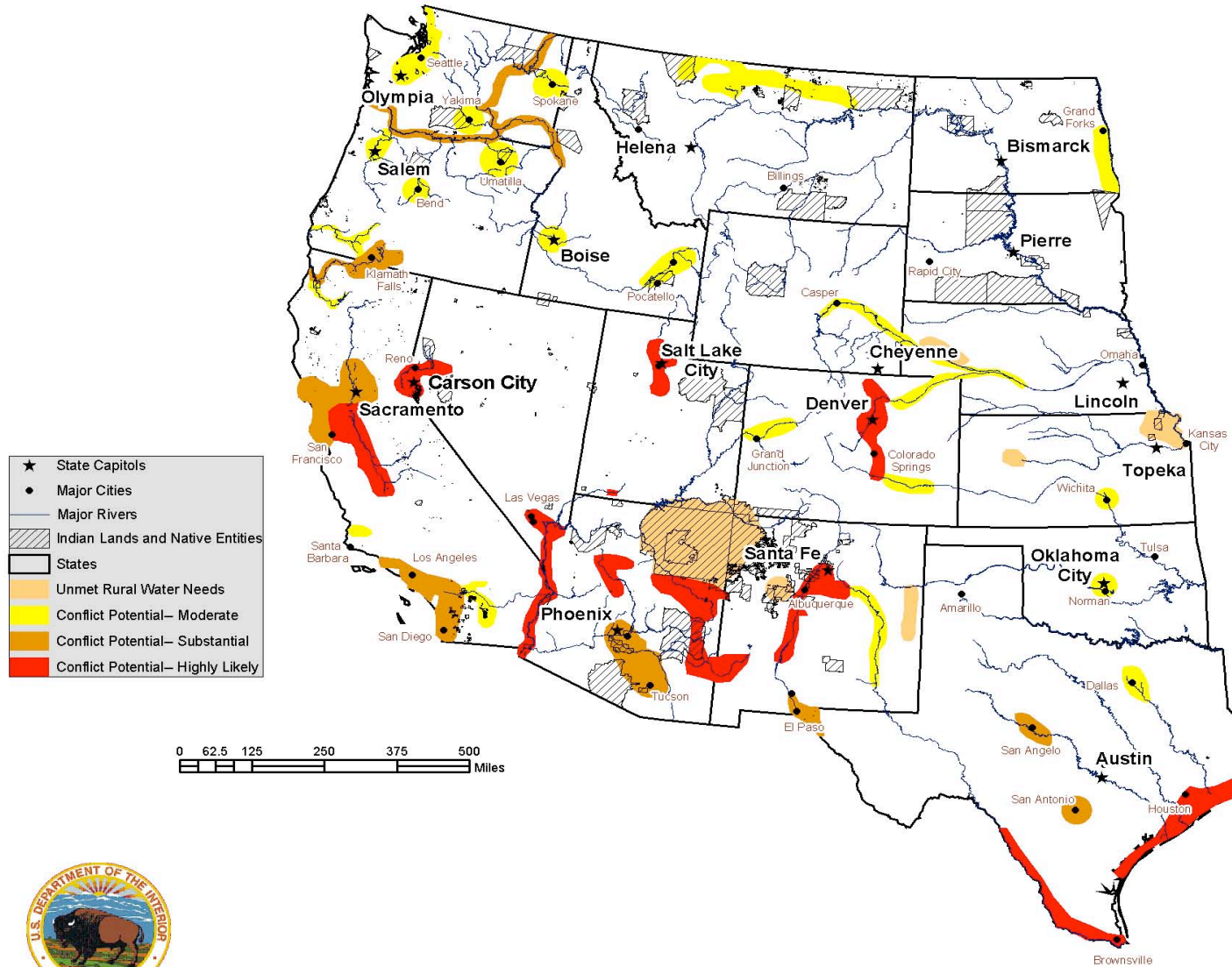
- 1) Uncoordinated development: a major project *in the absence* of a treaty or commission
- 2) “Internationalized basins”
- 3) General animosity

Basins Under Observation

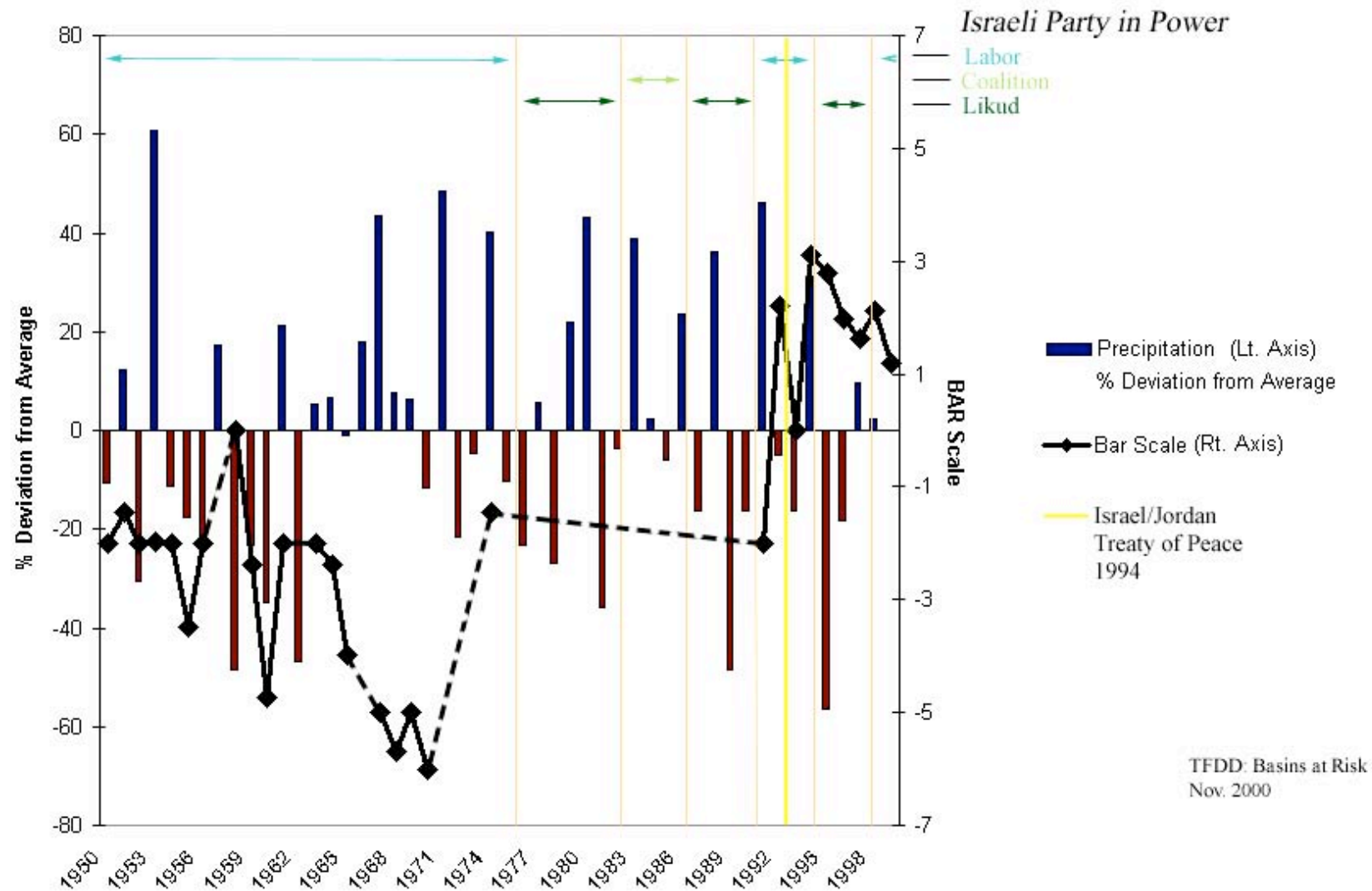


Potential Water Supply Crises by 2025

(Areas where existing supplies are not adequate to meet water demands for people, for farms, and for the environment)



Jordan River Timeline





Universities Partnership for Transboundary Waters

Promoting peace, environmental protection, and human security
through transboundary waters education, outreach and research

A stylized world map in shades of blue and grey, showing the outlines of continents and a grid of latitude and longitude lines. The map is centered on the Atlantic Ocean. Overlaid on the map are the names of nine universities in white text.

**Oregon State
University**

**University of
New Mexico**

**Universidad
Nacional
Costa Rica**

**Universidad
Nacional del Litoral**

Linköping University

**University of
Dundee**

Universities Partnership for Transboundary Waters

Yunnan University

**Asian Institute of
Technology**

**University of
Zimbabwe**

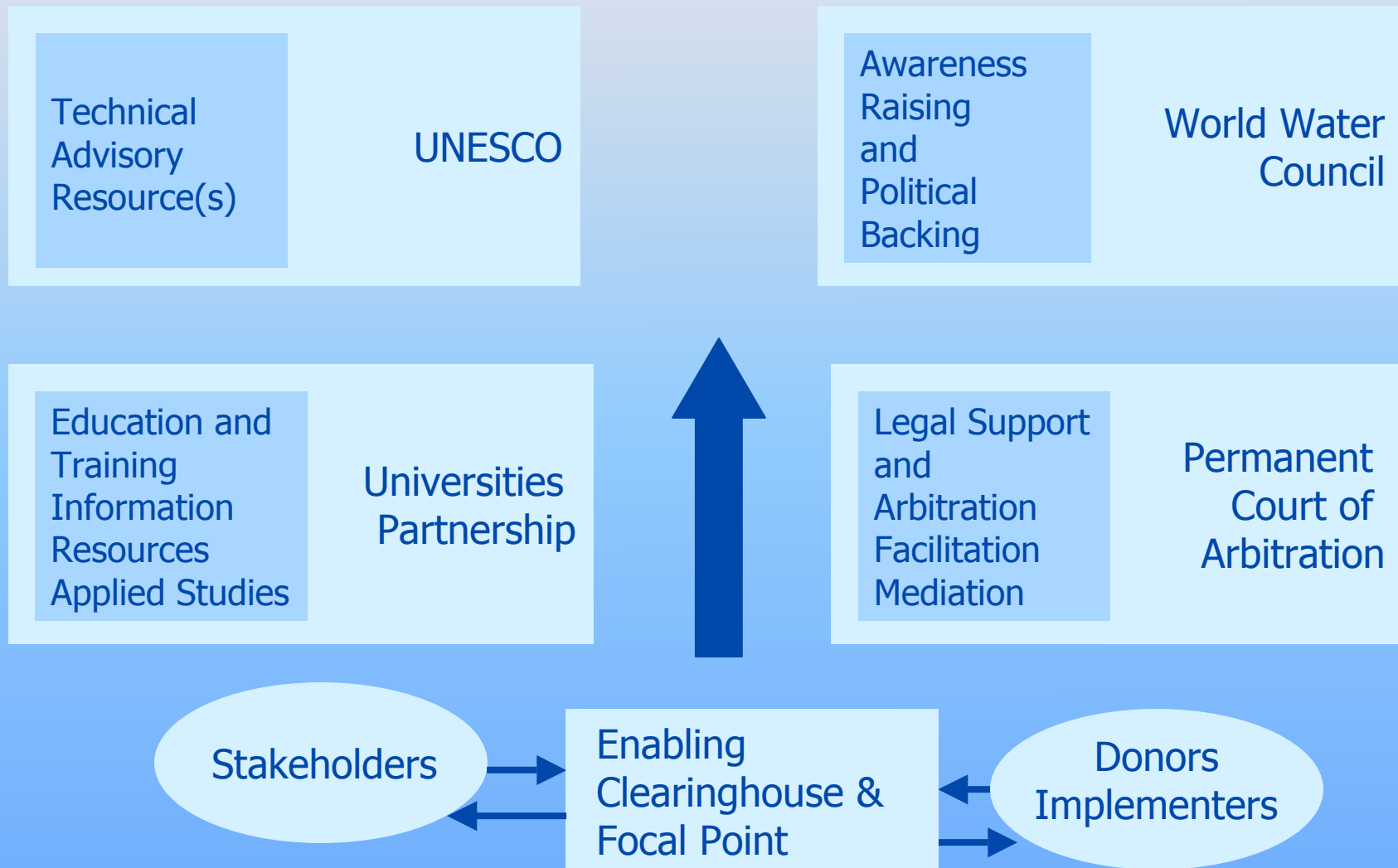
**University of
Pretoria**

Partnership Objectives

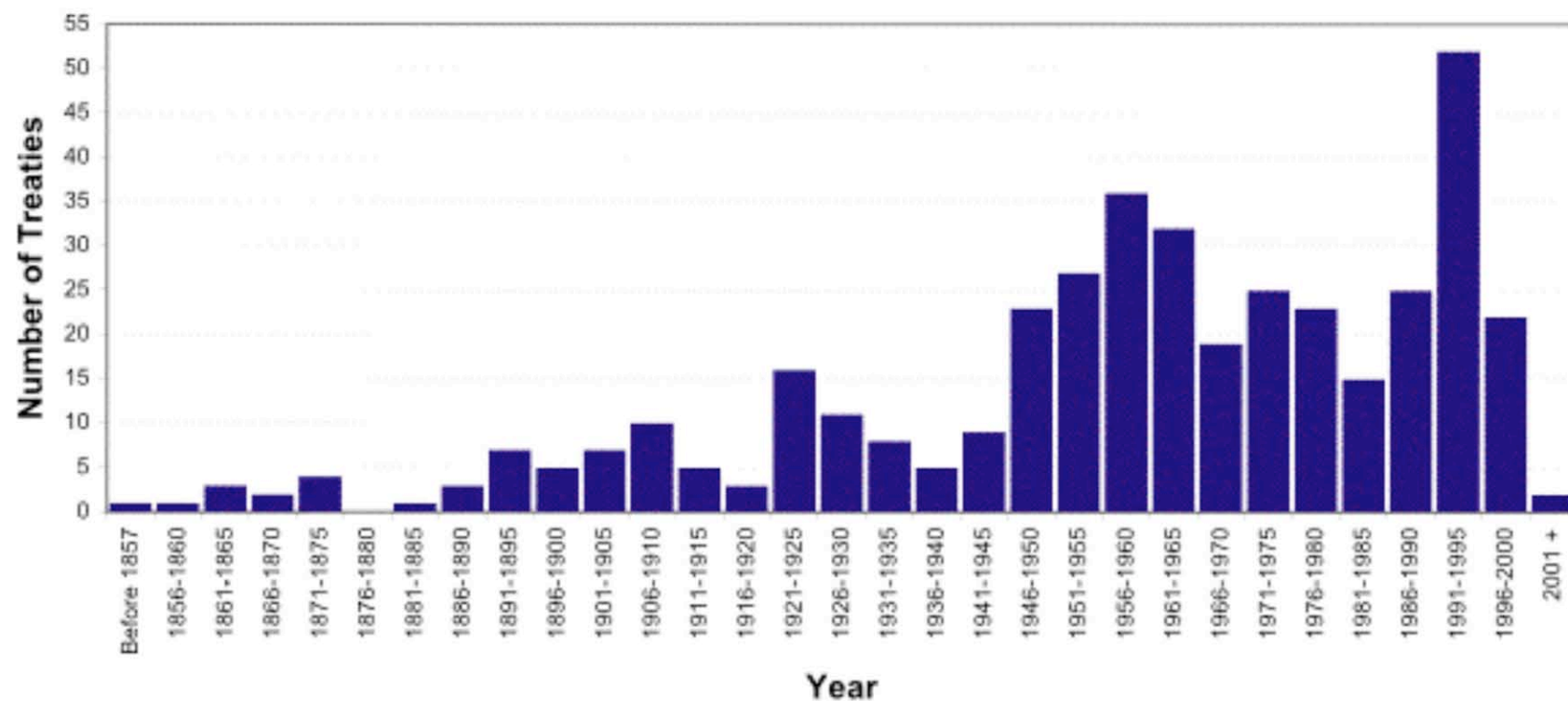
- Enhance capacity to address and prevent transboundary waters conflict and degradation
- Four focus area initiatives
 - Training workshops
 - Graduate and professional certification
 - Linked information technology
 - Collaborative analytical studies

Water Co-operation Facility

The international support centre for managing water conflicts and building consensus



Number of Treaties by Year



TRANSBOUNDARY FRESHWATER DISPUTE DATABASE
www.transboundarydisputes.oregon.edu

Copyright 2002, Oregon State University

Water and Cooperation

“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, February 2002



ARI:

Three Stages of Negotiations

- **Adversarial** -- each side defines its positions, or rights (win-lose, zero-sum, distributive).
- **Reflexive** -- the needs of each side bringing them to their positions is addressed.
- **Integrative** -- negotiators brainstorm together to address each side's underlying interests (win-win, positive sum).

- Source: Rothman, J. 1991. Negotiation as Consolidation. *Journal of International Relations*. 13 (1).

Criteria for Water Allocations

Initial Positions:

- Rights-based: Geography vs. Chronology

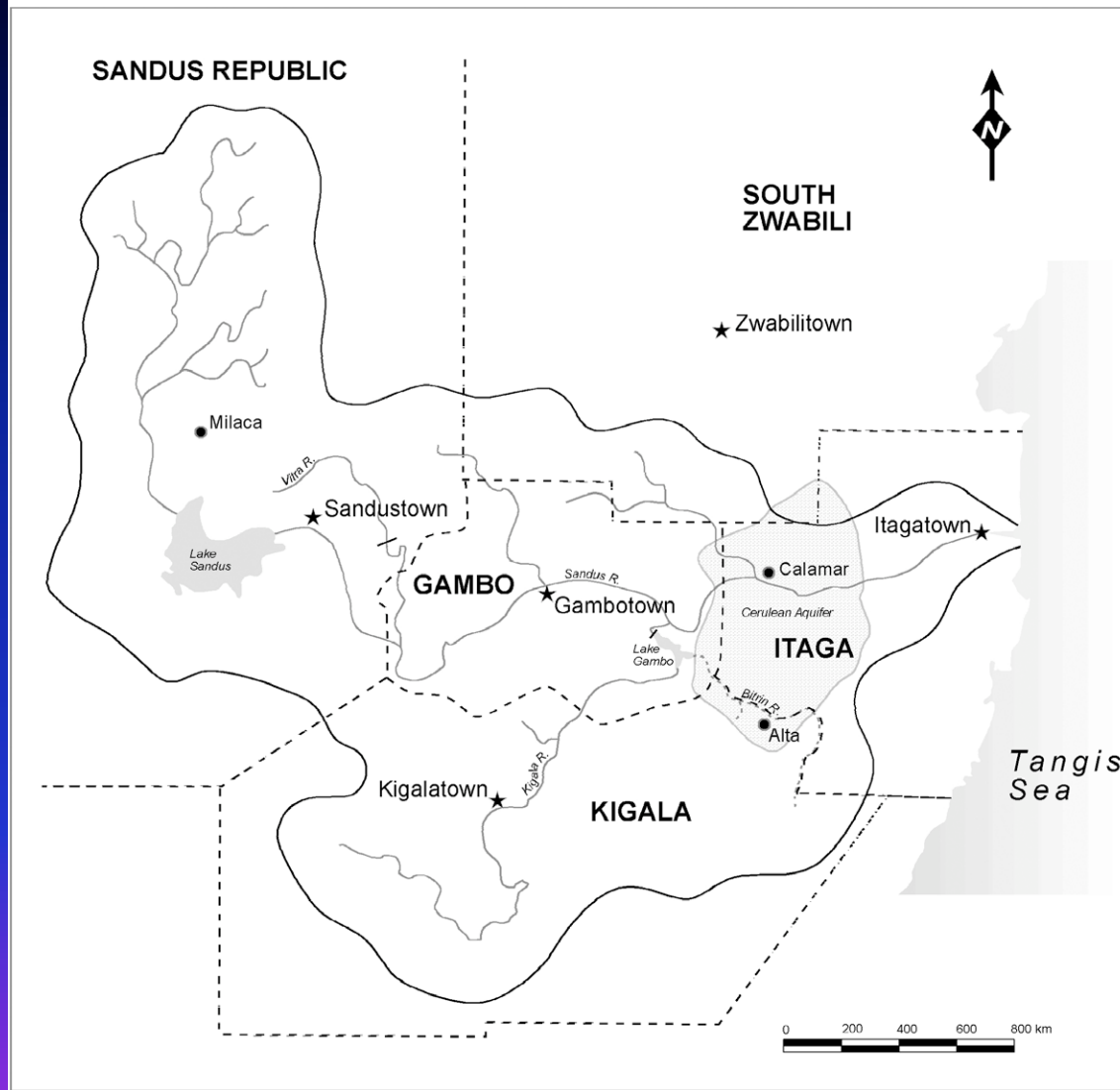
Interim Positions:

- Needs-based plus recognition of historic use

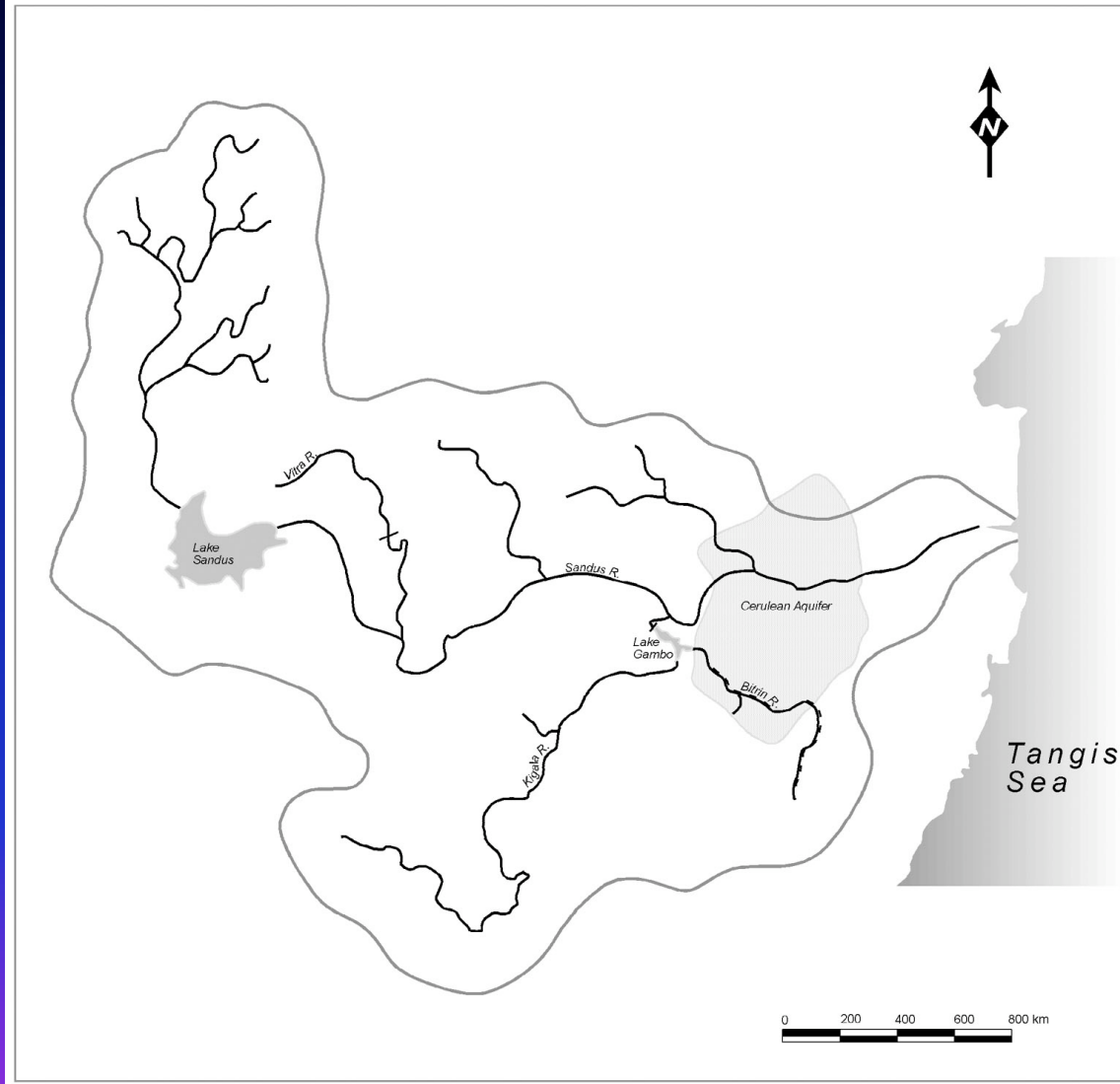
Final Agreement:

- Interest-based: Equal distribution of “baskets” of benefits

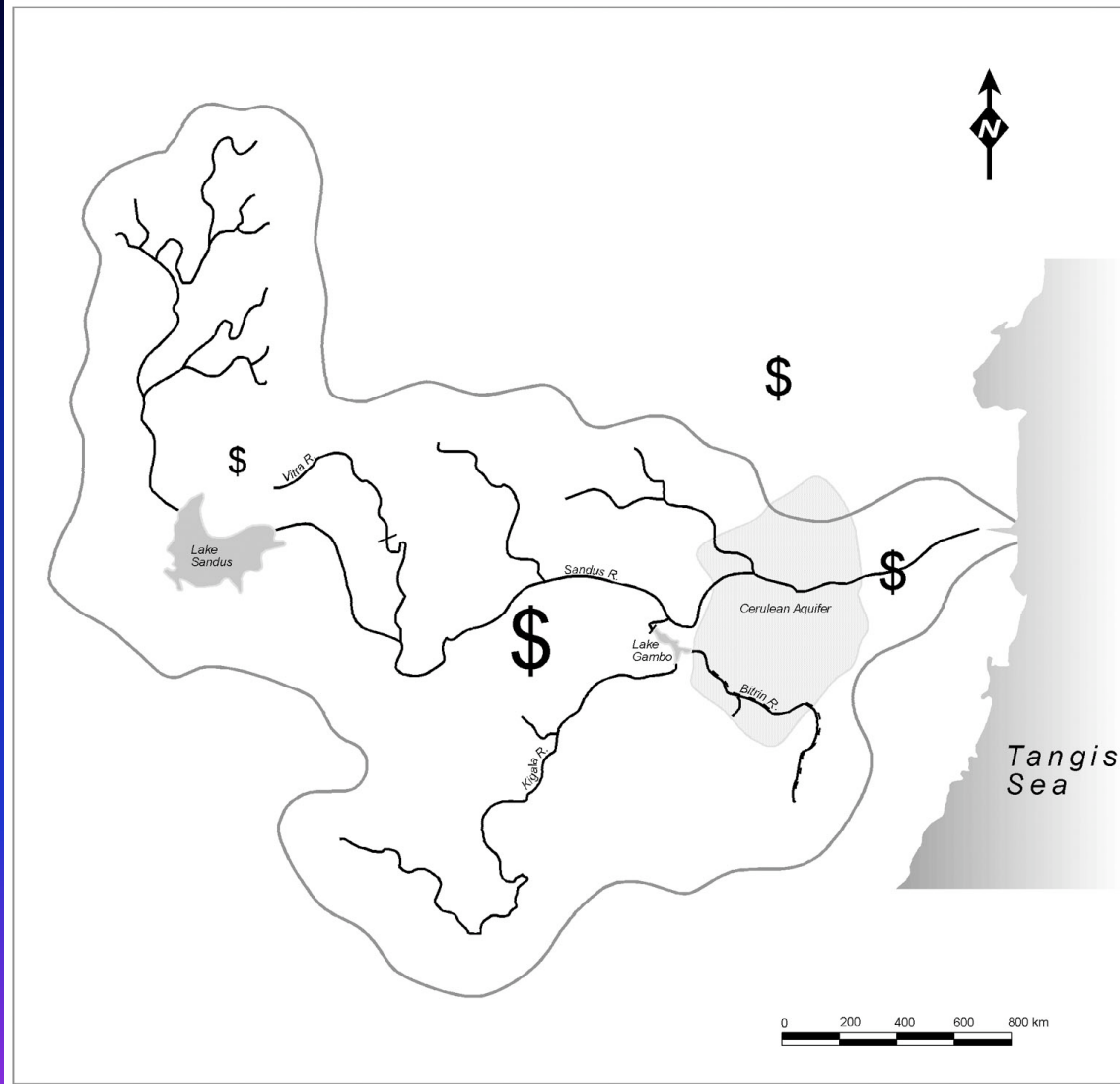
Map of the Sandus River basin



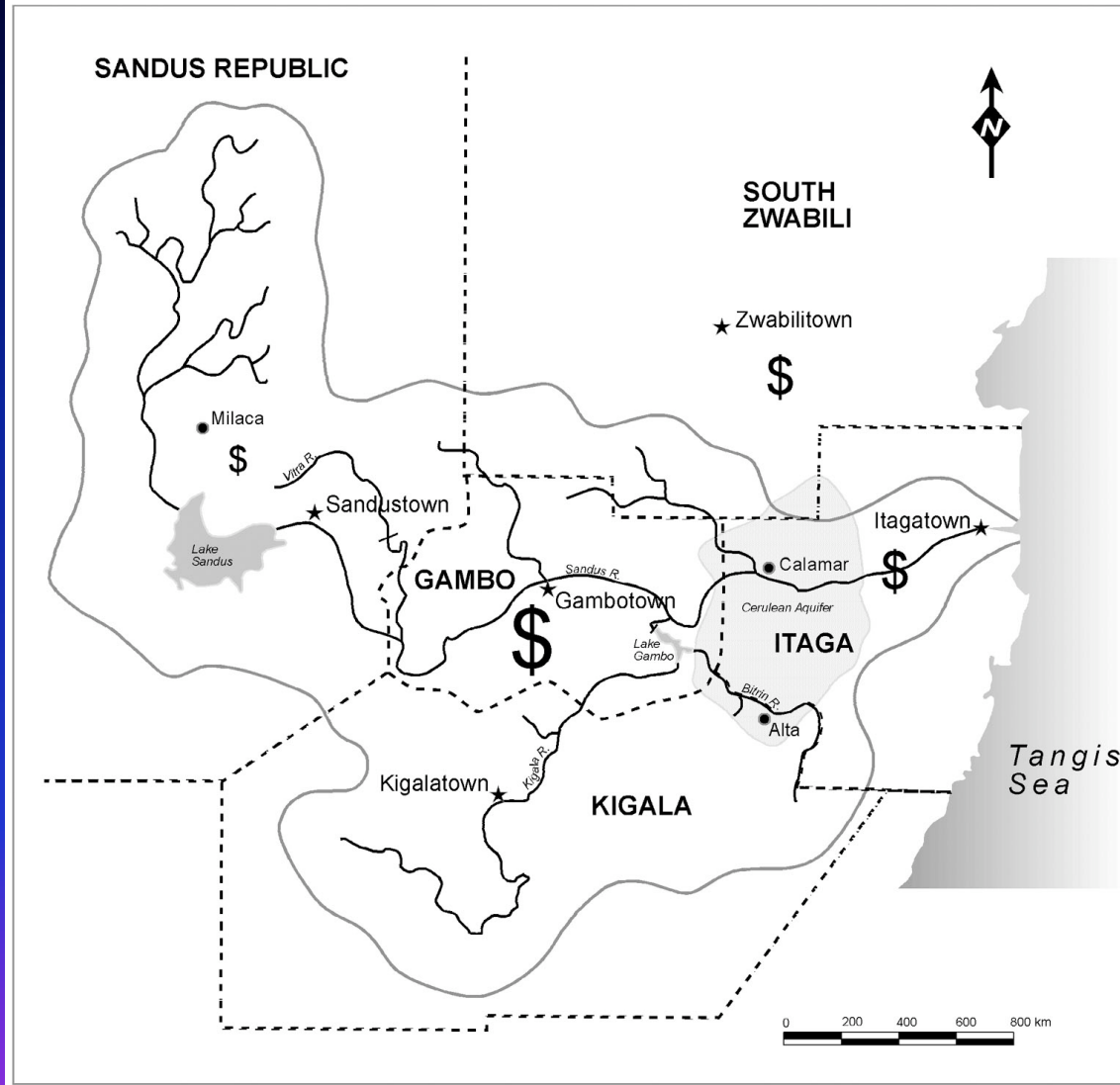
Map of the Sandus River basin



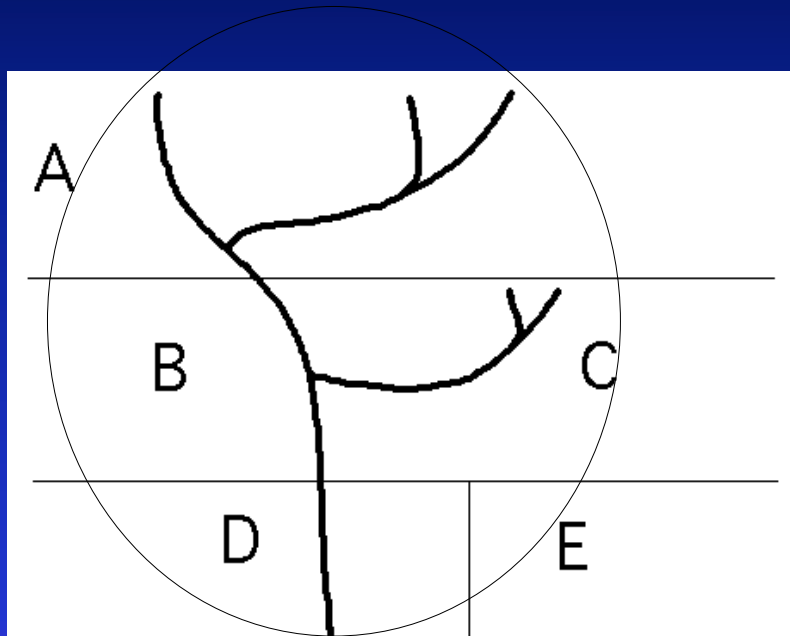
Map of the Sandus River basin



Map of the Sandus River basin



INSTITUTIONAL MODELS



- Unilateral Development
- Coordinated Management (eg. Jordan)
- Integrated Watershed Management (eg. Schelde, Mekong)

Integration versus Transaction Costs: Transboundary Management Structures

(after Feitelson, forthcoming)

Structure	# of Tasks	Potential for Disagreement	Sovereignty Infringement	Transaction Costs
Watershed Monitoring	Single	Low	None	Low
Technical Research Coordination	Single	Low	None	Low
Resource Conservation	Single	Low	None	Low
Training Center	Single	Low	None	Low
Apportionment Body	Single	High	Limited*	Medium*
Arbitration Body	Single	High	Limited*	Medium*
Apportionment Monitoring	Single	Moderate	None	Low-Medium
Investigative Advisory Body	Few	High	Limited	Medium
Risk Management	Few	High**	Limited	Medium
Pollution Control	Many	Moderate*	Significant*	High*
Joint Regulatory Bodies	Several	High	Major	Very High
Wastewater Utility	Several	Moderate	None	Medium
Water Utility	Several	Moderate	None	Medium
Economic Development	Several	Moderate-High*	Limited	Medium-High
Project Management	Several	High	Limited	Medium-High
Water Transfers or Markets	Several	Moderate	Limited	High***
Comprehensive Utility	Many	High	Limited	High***
Integrated Watershed Management	Many	Very High	Major	Very High
Centralized Joint Management	Many	Very High	Major	Very High

RESILIENT TRANSBOUNDARY WATER INSTITUTIONS

- Adaptable Management Structure
 - public input
 - changing basin priorities
 - new information/monitoring abilities
- Clear and Flexible Allocation
 - rights to needs to interests
 - hydrologic extremes
 - new knowledge
 - changing societal values
- Equitable Distribution of (Baskets of) Benefits, Not Water
- Detailed Conflict Resolution Mechanism
- Sustainable Institution and Financing