International River Basins: Mapping Institutional Resilience to Climate Change

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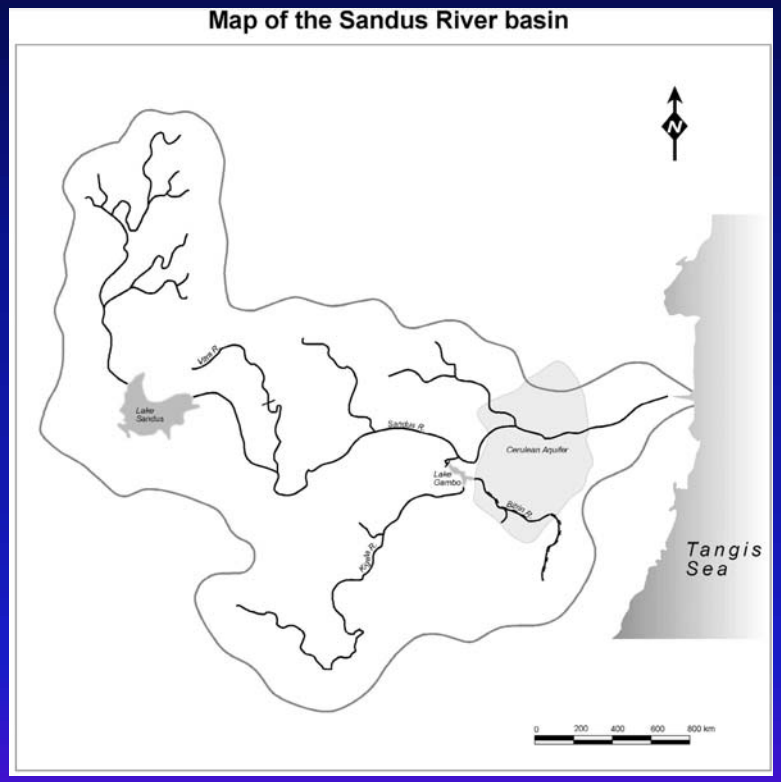
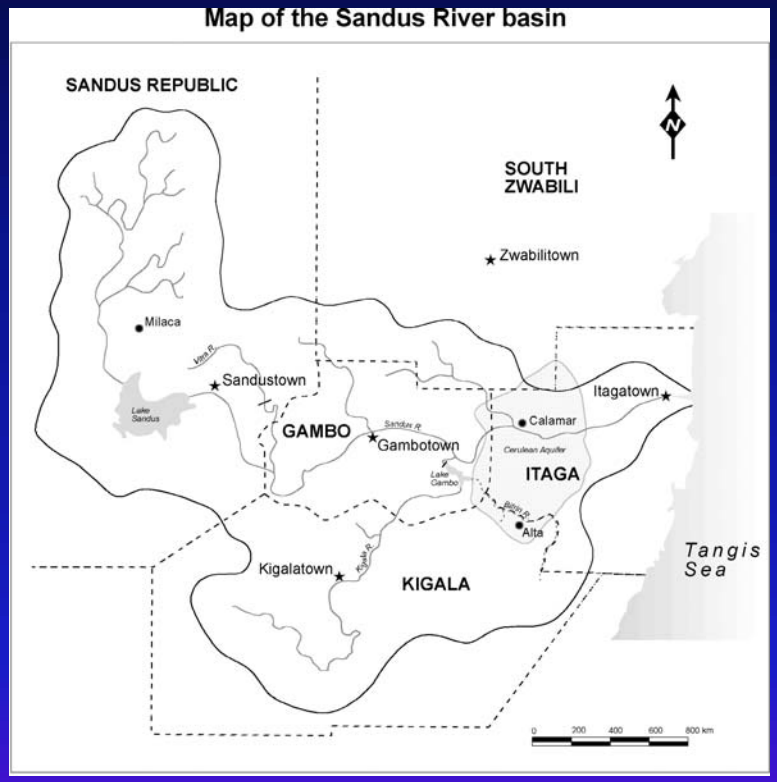
What *is* International Water Management??

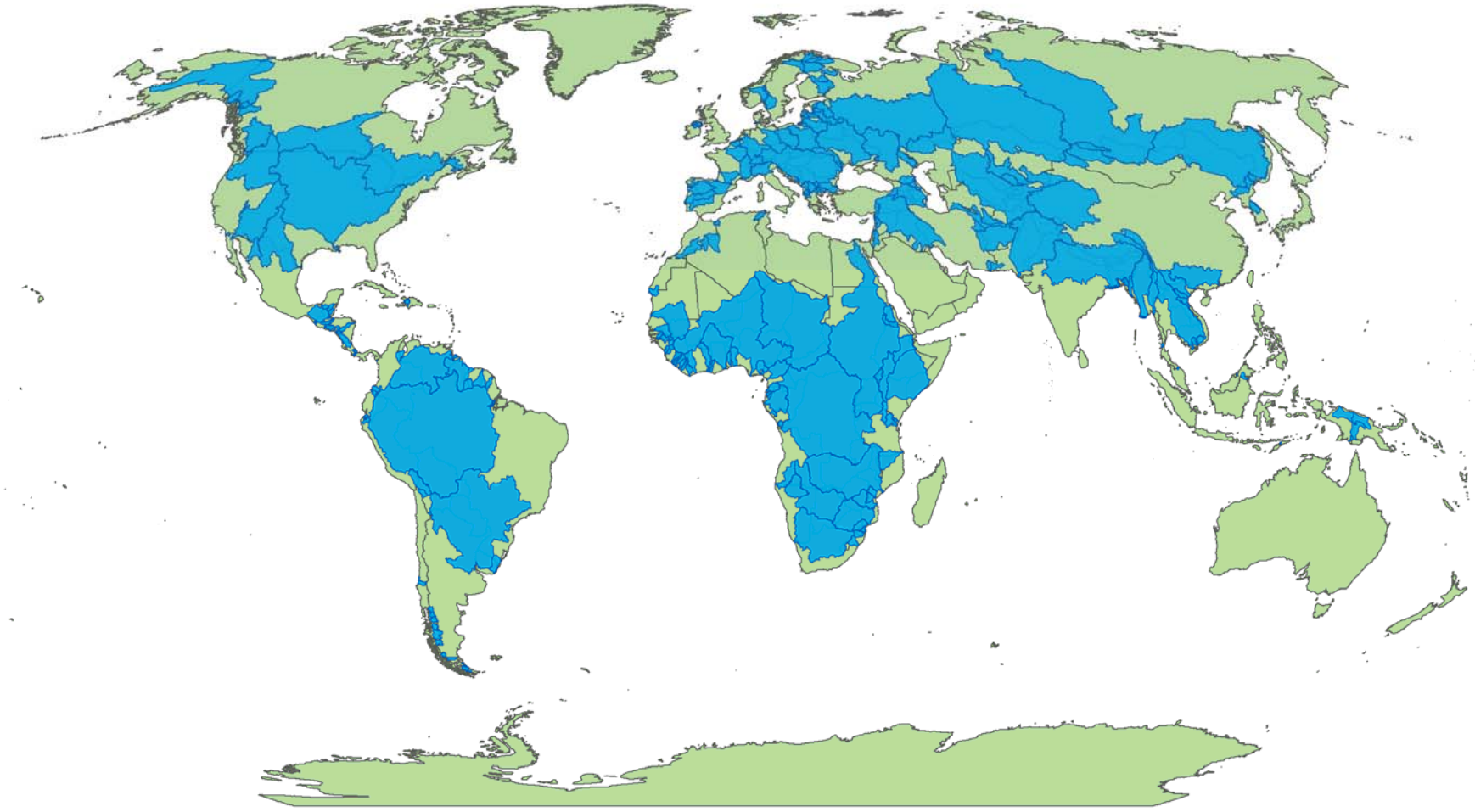




What changes when a border is present?

What capacity do we need to address the change?

Scale of Conflict



Security/Economic Alliance

Tensions

Hostilities (e.g. sanctions)

War

Cooperation

Neutral Relations

Disputes

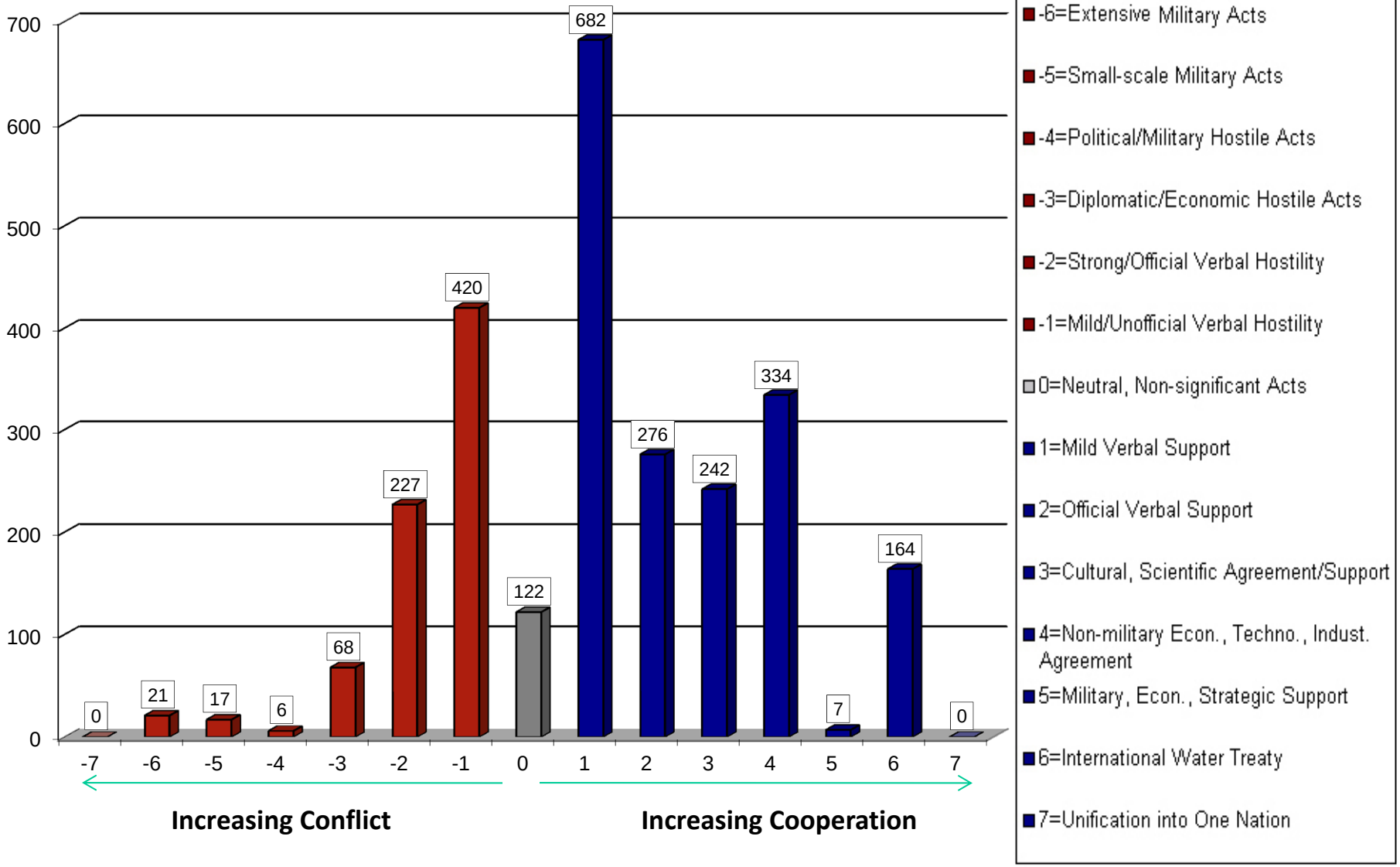
Acute (Violent) Conflict

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 688 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

Number of Events by BAR Scale 1948-2008



Source: De Stefano, L., P. Edwards, L. de Silva and A. T. Wolf 2010. "Tracking Cooperation and Conflict in International Basins: Historic and Recent Trends." Water Policy. Vol 12 No 6 pp 871–884. Adapted with permission of the authors.

Water Myths and Water Facts

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

Basins at Risk

Conflict and Cooperation Over International Waters

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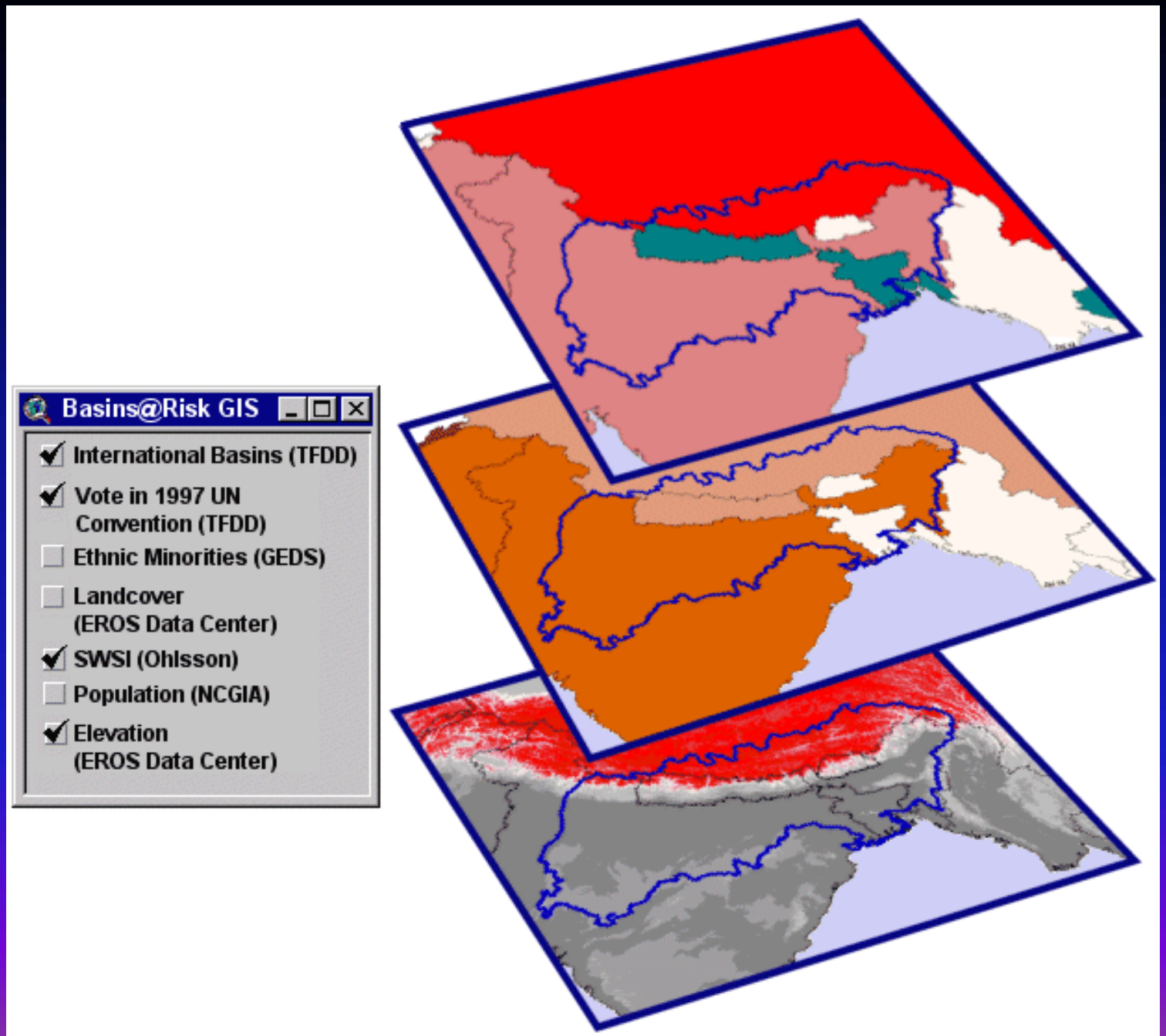
Daniel Wise

TFDD: Basins at Risk
Department of Geosciences
Oregon State University


Basins@Risk GIS
International Basins (TFDD)
Vote in 1997 UN Convention (TFDD)
Ethnic Minorities (GEDS)
Landcover (EROS Data Center)
SWSI (Ohlsson)
Population (NCGIA)
Elevation (EROS Data Center)

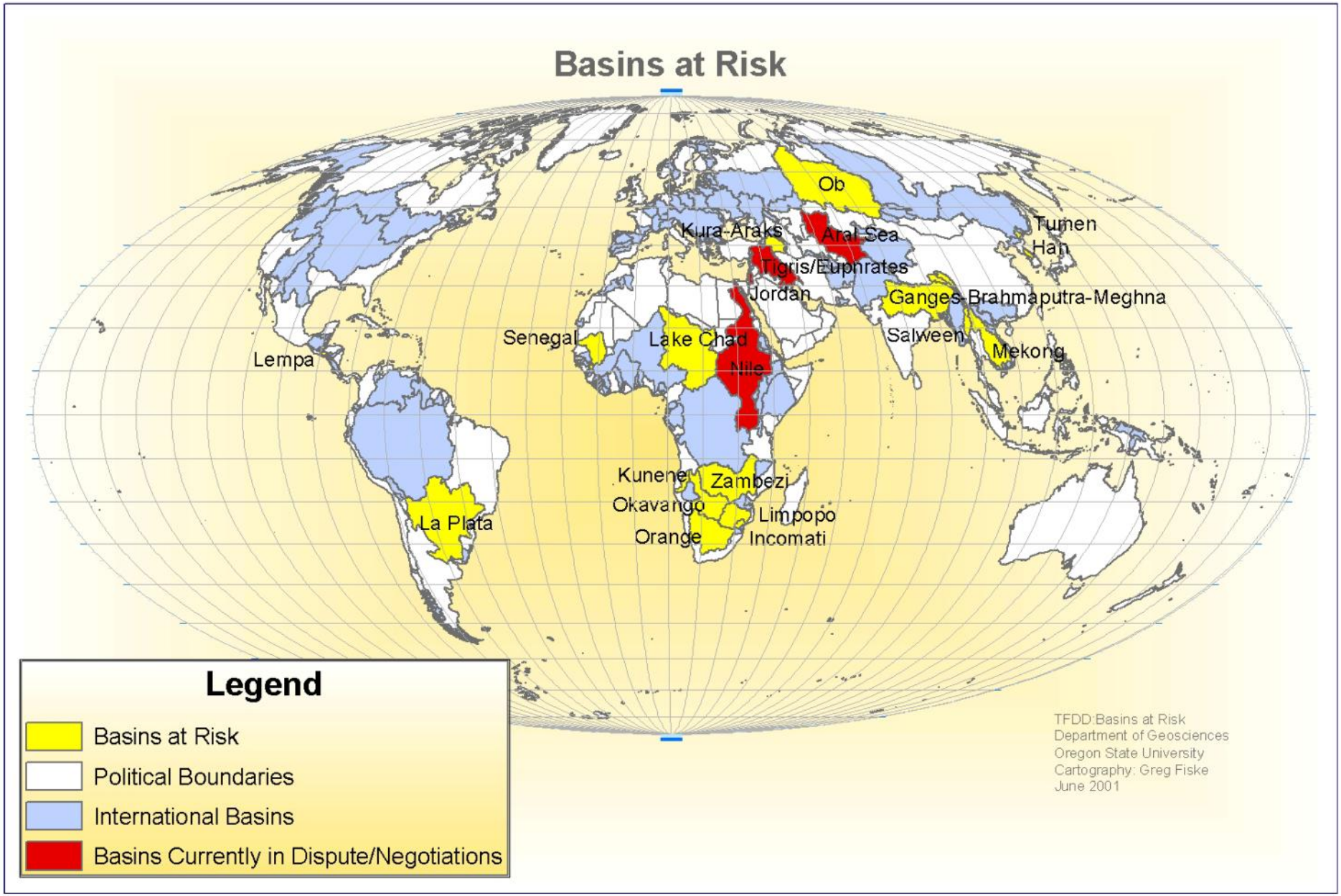
BASINS AT RISK: Working Hypothesis

"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 at Risk
Ob
Tumen
Han
Kura-Araks
Aral Sea
Tigris/Euphrates
Jordan
Ganges-Brahmaputra-Meghna
Salween
Mekong
Senegal
Lake Chad
Nile
Lempa
Kunene
Zambezi
Okavango
Limpopo
Orange
Incomati
La Plata
Legend
Basins at Risk
Political Boundaries
International Basins
Basins Currently in Dispute/Negotiations
TFDD:Basins at Risk
Department of Geosciences
Oregon State University
Cartography: Greg Fiske
June 2001

WATER SECTOR BOARD DISCUSSION PAPER SERIES

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Mapping the Resilience of International River Basins to Future Climate Change-Induced Water Variability

Lucia De Stefano, James Duncan, Shlomi Dinar, Kerstin Stahl, Kenneth Strzepek and Aaron T. Wolf

THE WORLD BANK

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NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

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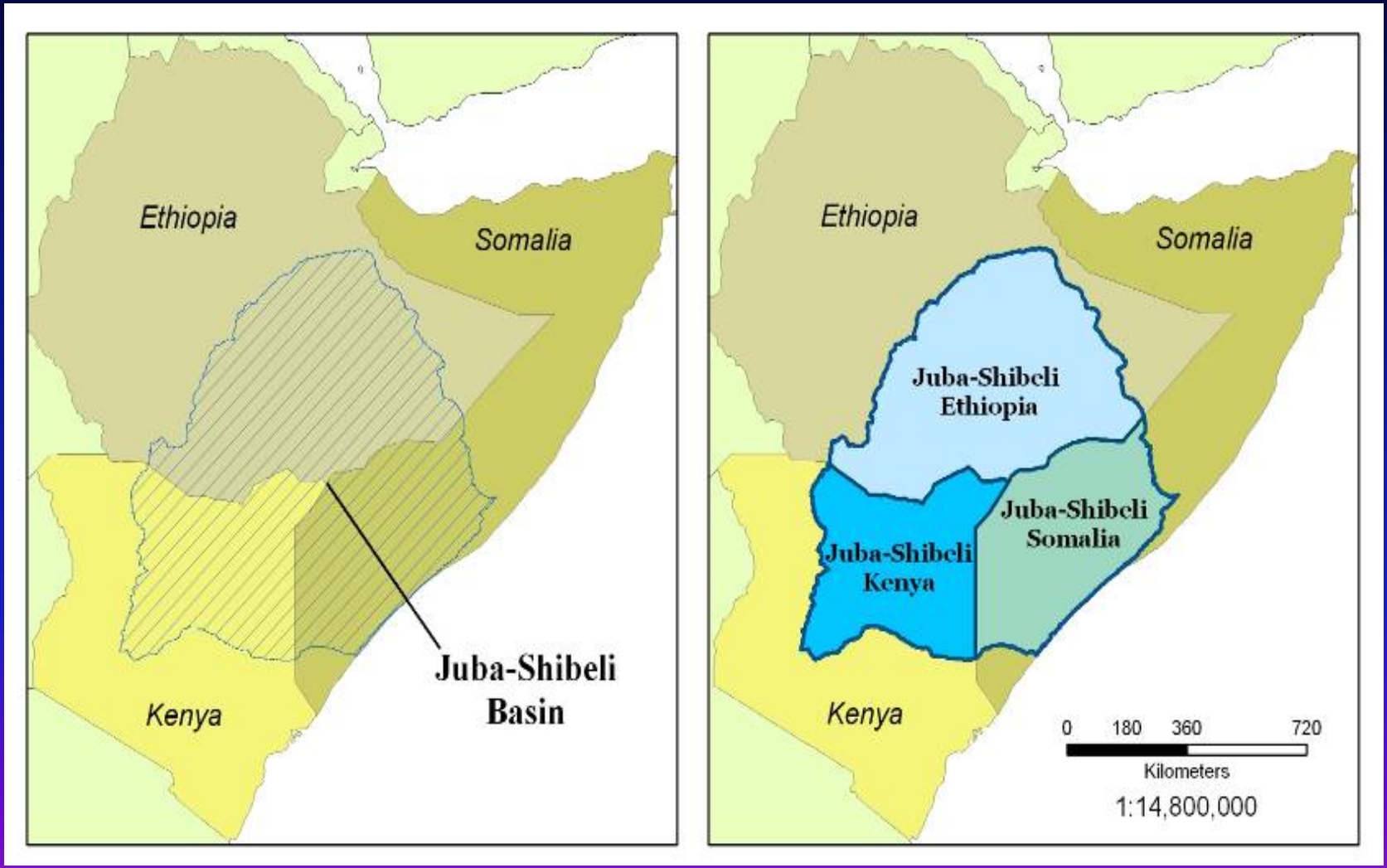
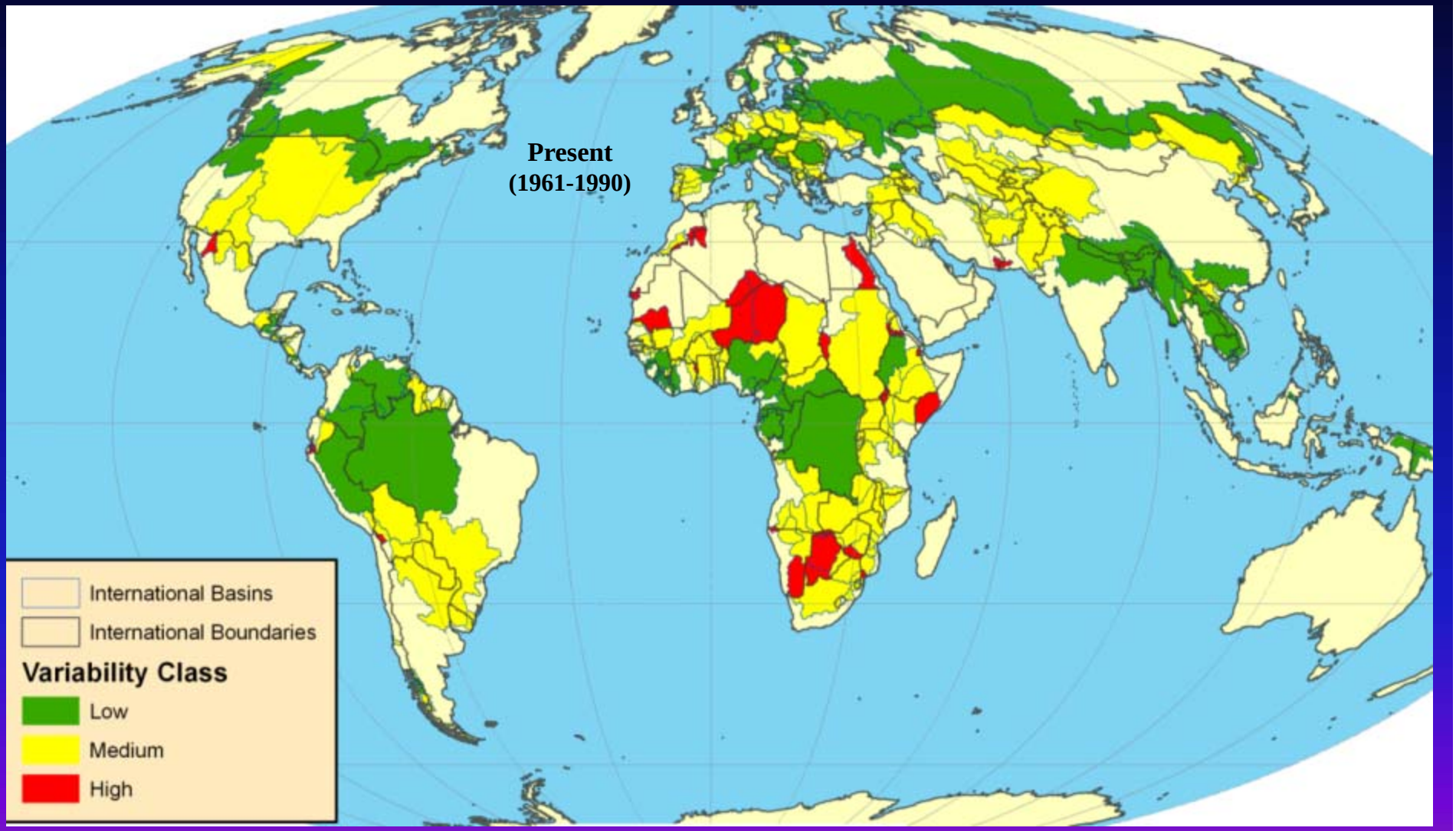
Approving Manager: Julia Bucknall, Sector Manager, ETWWA

Basin-Country Units (BCUs)



Present Runoff Variability Regime

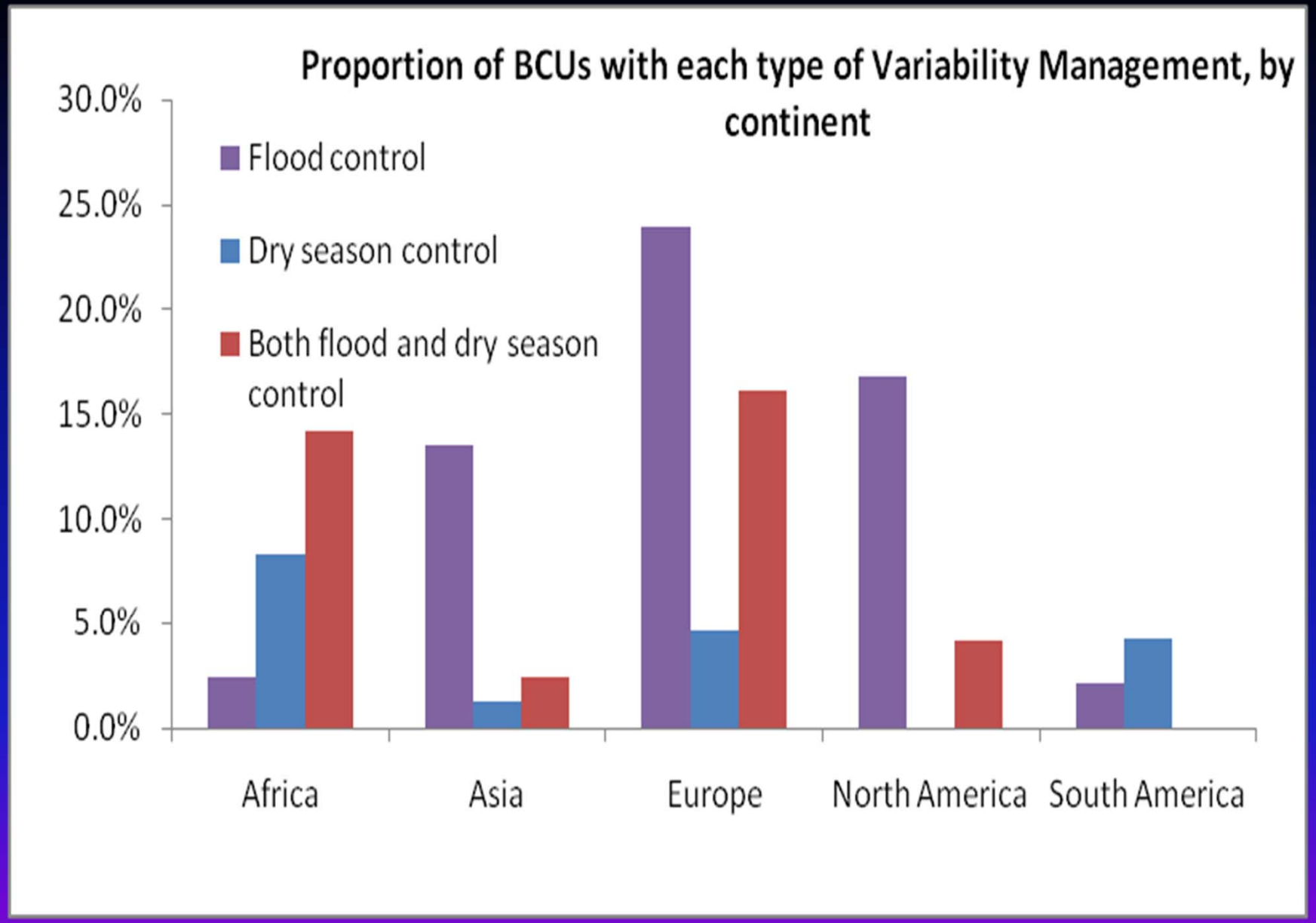


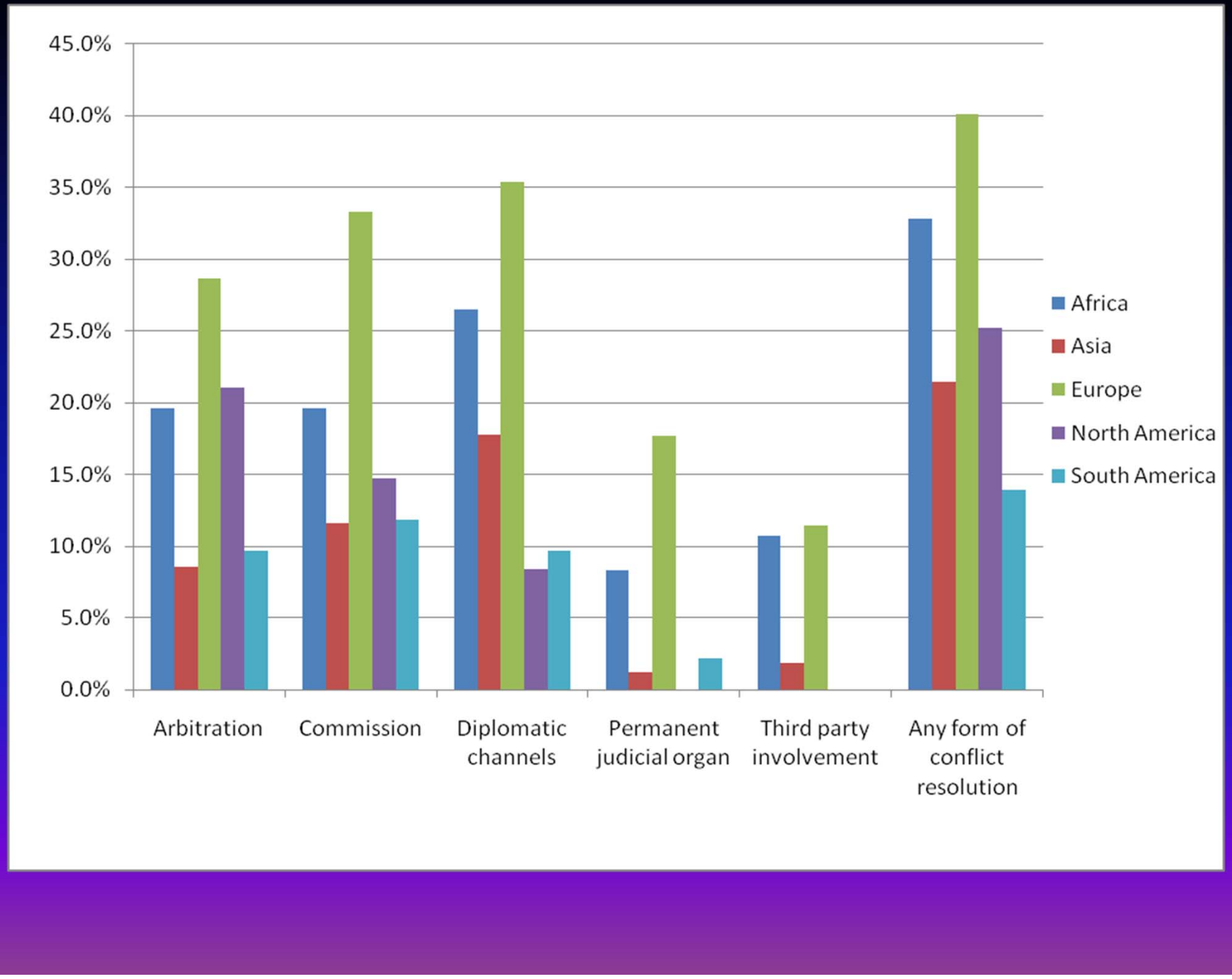
TFDD-IWMI Treaty Update

	Africa	Asia	Europe	N. America	S. America	TOTAL
# TB BASINS	63	60	69	46	38	276
# Multi-lateral Basins	30	22	23	3	8	86
% w/at least 1 treaty	30.2	30.0	55.1	63.0	23.7	40.9
% Bilateral Basins w/at least 1 treaty	9.1	15.8	39.1	60.5	16.7	30.5
% BCU's w/at least 1 treaty	37.3	30.1	58.9	61.1	29.0	43.2
% TB Area w/at least 1 treaty	74.4	43.4	47.5	98.5	86.1	68.5
% TB Population covered by at least 1 treaty	78.8	78.0	71.2	94.5	85.2	78.6

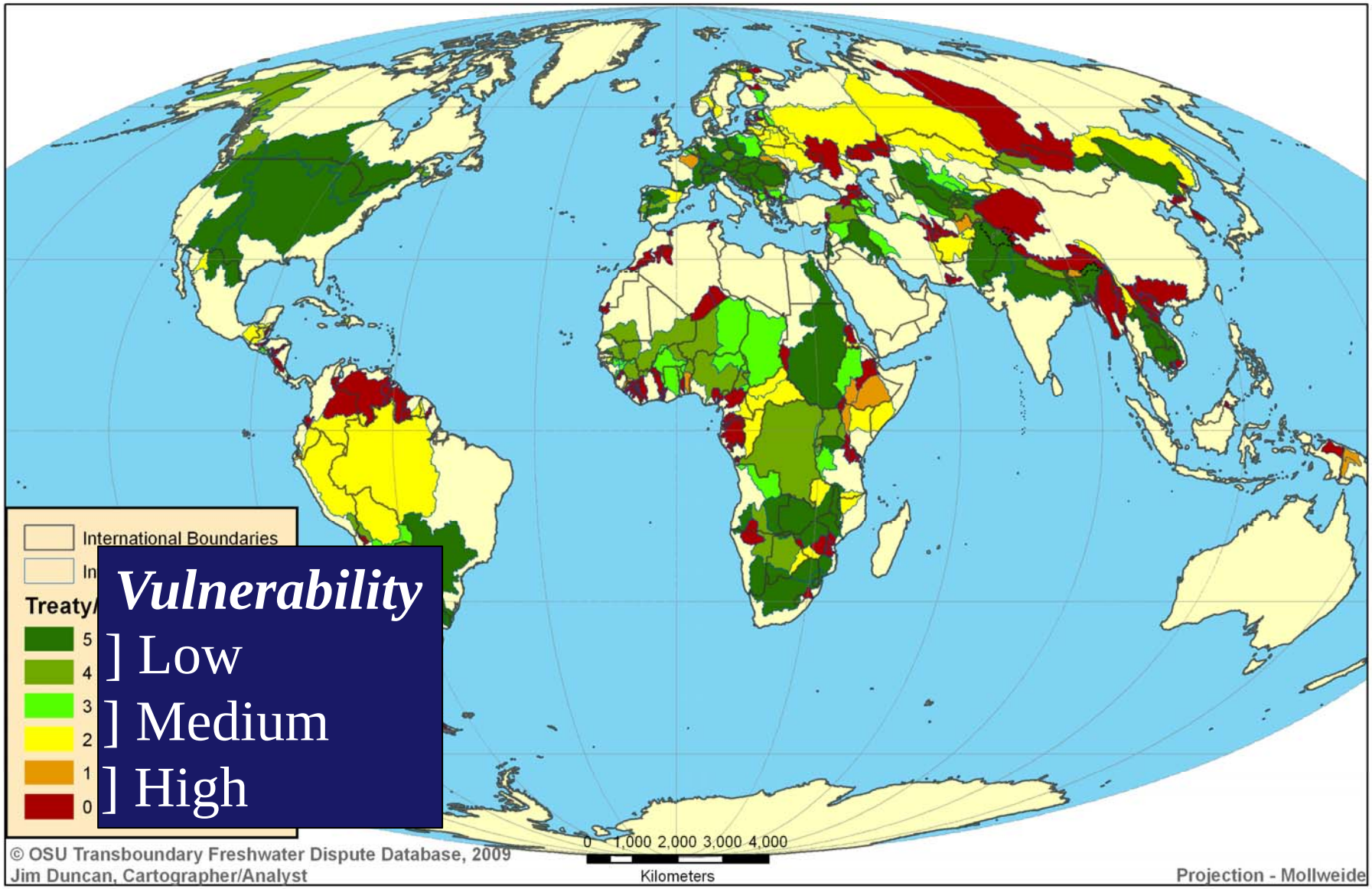
Management components	Allocation mechanisms	175	25.4%
	Joint management institutions	219	31.8%
	RBO	31	4.5%
	Hydropower	140	20.3%
	Irrigation	88	12.8%
	Groundwater	38	5.5%
	Environmental Issues	140	20.3%
	Conflict resolution mechanisms	202	29.4%
	Consultation	66	9.6%
	Stakeholder Participation	18	2.6%
	Technical/financial Cooperation*	162	23.5%
	Information Exchange*	208	30.2%
	Monitoring*	145	21.1%
	Agreement Financing*	198	28.8%
	Needs of Locals*	60	8.7%
	Compensation *	60	8.7%
	Link to national programs*	42	6.1%

Criterion	*Score*
At least one water treaty	0/1
At least one treaty with an allocation mechanism	0/1
At least one treaty with a variability management mechanism	0/1
At least one treaty with a conflict resolution mechanism	0/1
At least one river basin organization present	0/1
Total possible treaty/RBO score for each basin-country unit	***0 to 5***


Proportion of BCUs with each type of Variability Management, by continent
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Flood control
Dry season control
Both flood and dry season control
Africa
Asia
Europe
North America
South America


45.0%
40.0%
35.0%
30.0%
25.0%
20.0%
15.0%
10.0%
5.0%
0.0%
Arbitration
Commission
Diplomatic channels
Permanent judicial organ
Third party involvement
Any form of conflict resolution
Africa
Asia
Europe
North America
South America

GLOBAL DISTRIBUTION OF TREATY AND RBO COVERAGE
COMBINED TREATY/RBO SCORE



TRANSBOUNDARY BASINS OF THE HIMALAYA RANGE

International Basins
International Boundaries
Disputed Boundary
Disputed Boundary

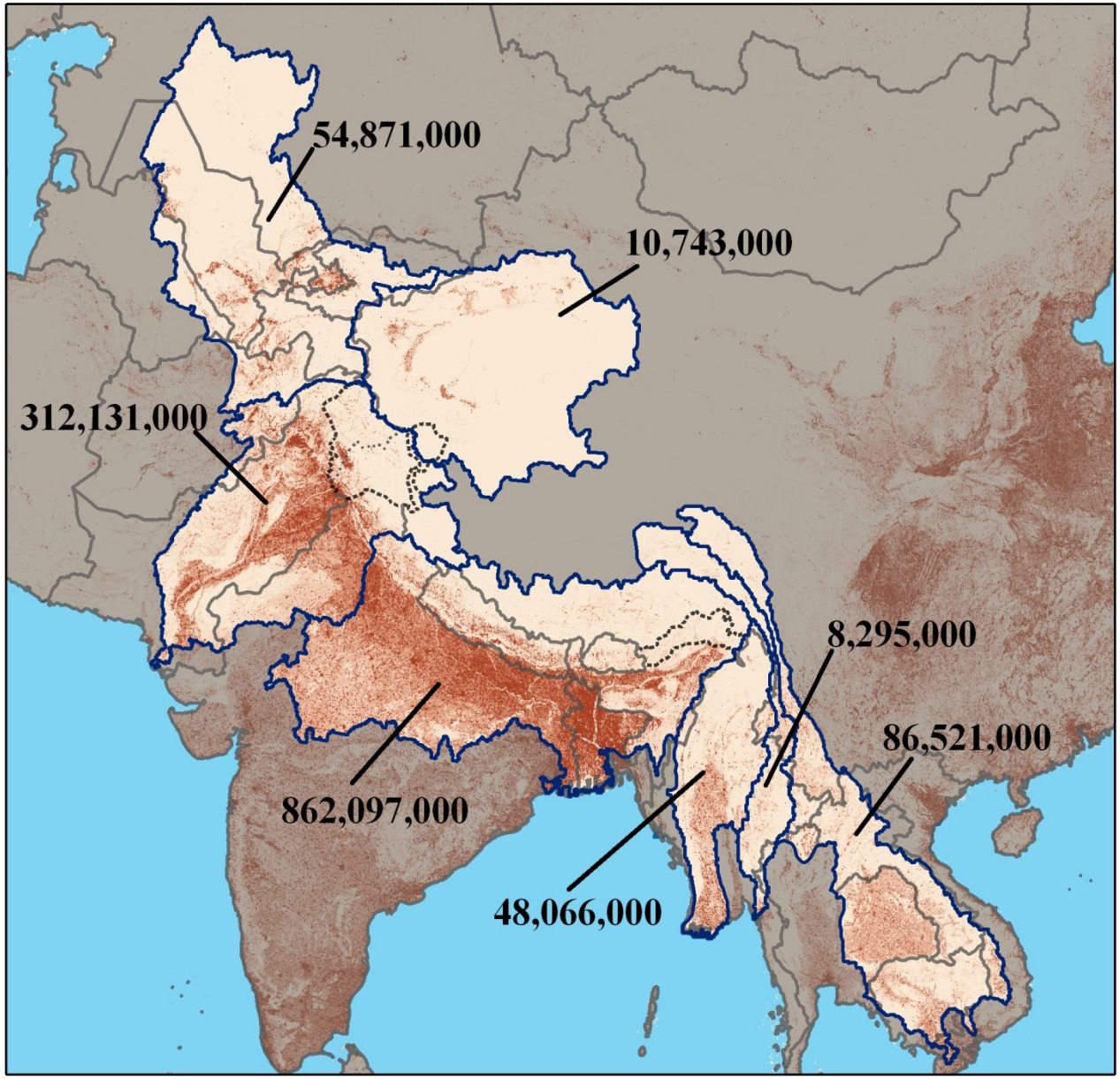
Elevation

High
Low

0 1,250 2,500 3,750 5,000
Kilometers

Projection - Albers Equal Area Conic

Jim Duncan, Cartographer/Analyst



TRANSBOUNDARY BASINS OF THE HIMALAYA RANGE

Population Distribution

High

Low

International Basins

International Boundaries

Disputed Boundary

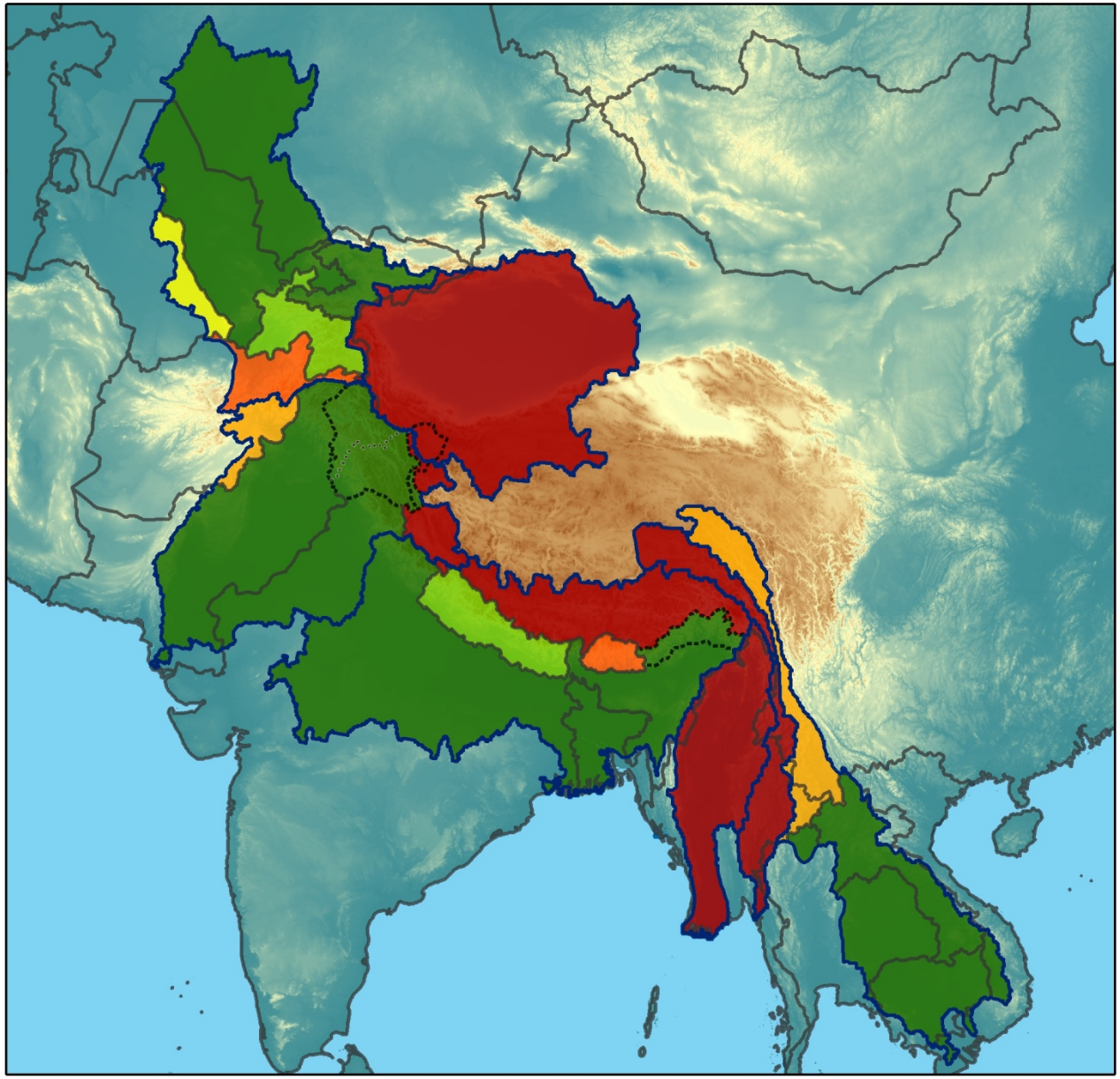
Disputed Boundary

0 1,250 2,500 3,750 5,000

Kilometers

Projection - Albers Equal Area Conic
Population data - Oak Ridge National Laboratory, 2009

Jim Duncan, Cartographer/Analyst



TRANSBOUNDARY BASINS OF THE HIMALAYA RANGE

Treaty and RBO Score

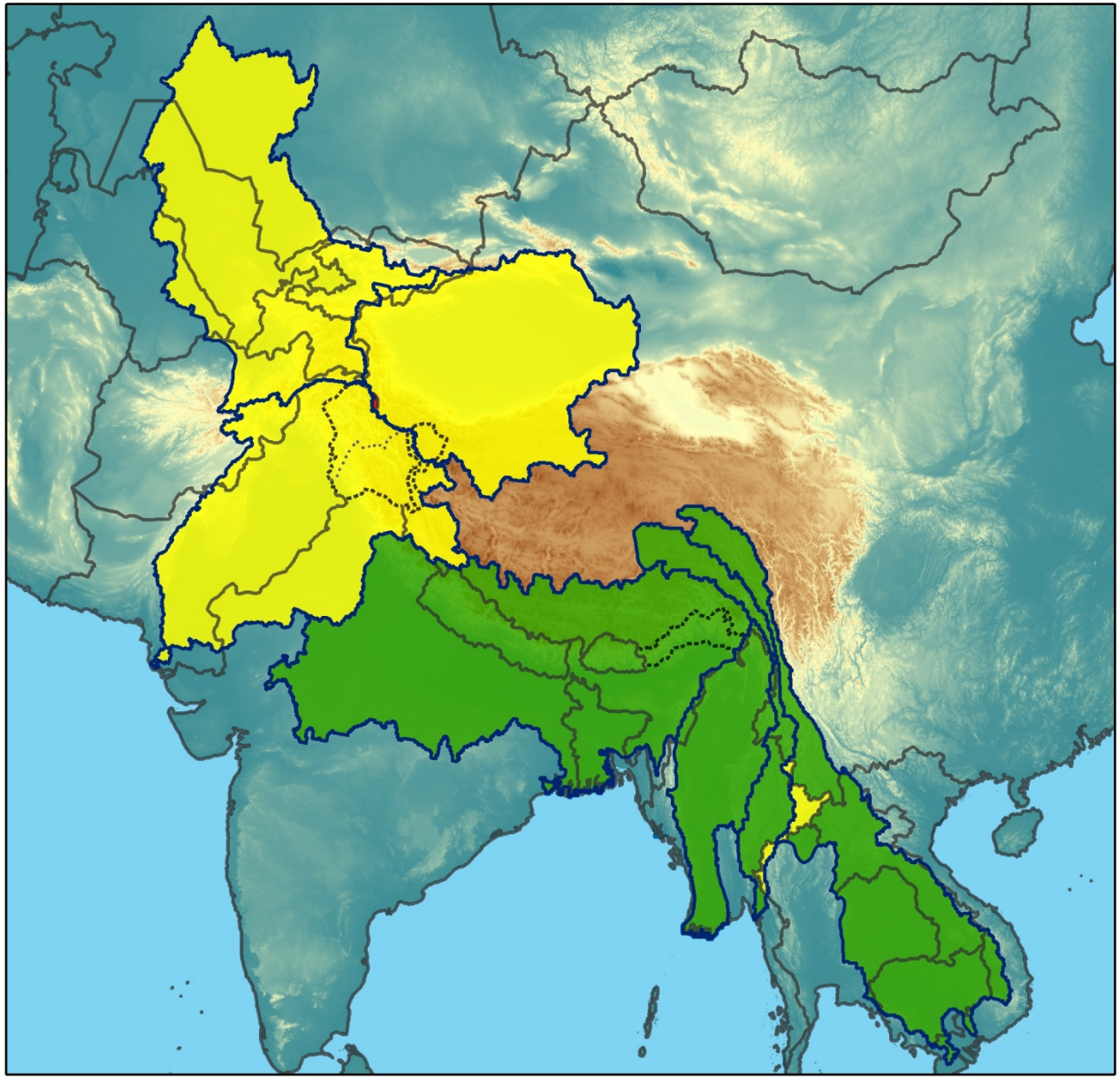
- 5
- 4
- 3
- 2
- 1
- 0
- International Basins
- International Boundaries
- Disputed Boundary
- Disputed Boundary

0 1,250 2,500 3,750 5,000

Kilometers

Projection - Albers Equal Area Conic

Jim Duncan, Cartographer/Analyst



TRANSBOUNDARY BASINS OF THE HIMALAYA RANGE

Historic Runoff Variability

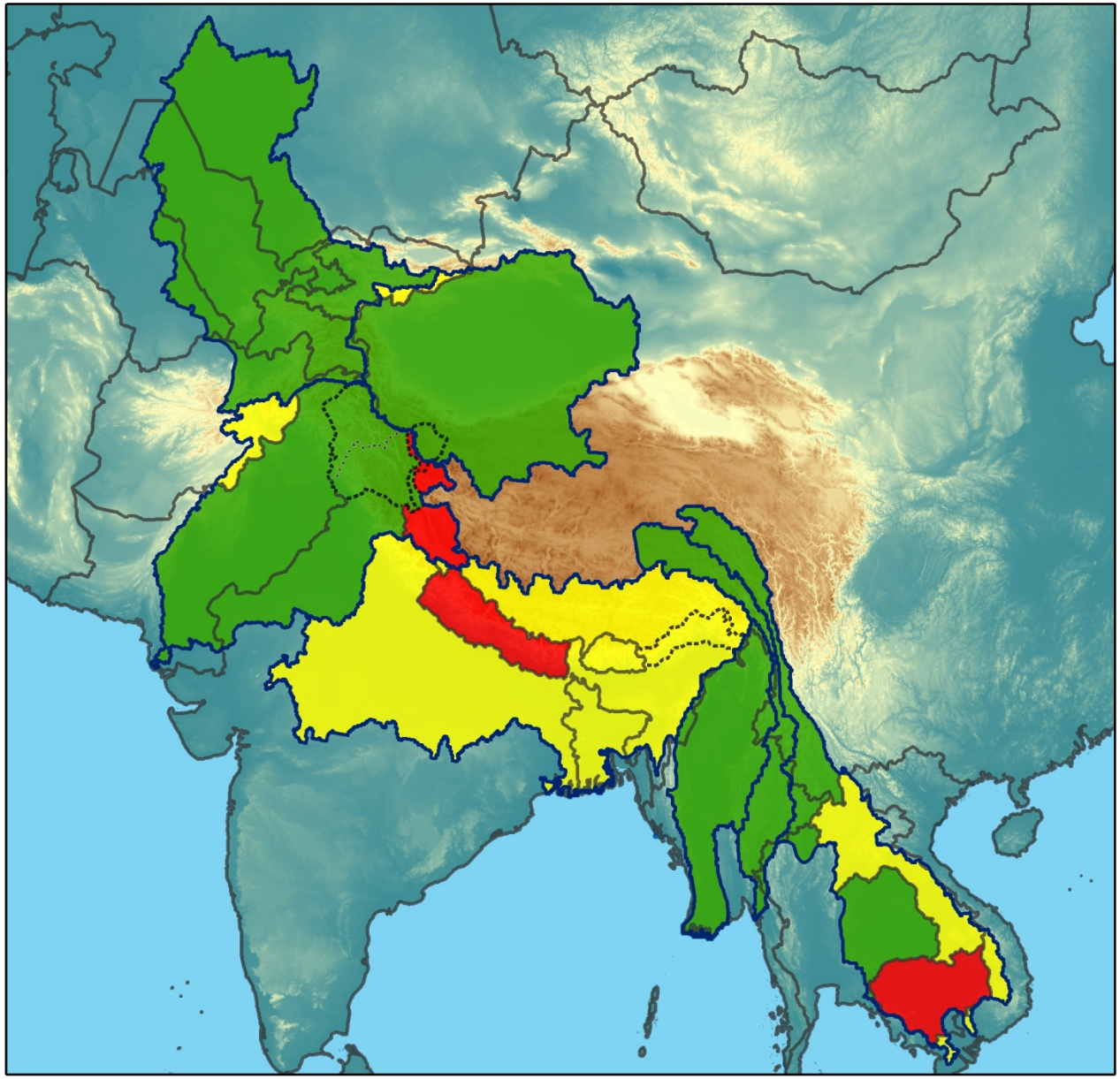
- High (CV > 0.75)
- Medium (0.25 < CV < 0.75)
- Low (CV < 0.25)
- International Basins
- International Boundaries
- Disputed Boundary
- Disputed Boundary

0 1,250 2,500 3,750 5,000

Kilometers

Projection - Albers Equal Area Conic
Climate data - Strzepek and McCluskey, 2009

Jim Duncan, Cartographer/Analyst



TRANSBOUNDARY BASINS OF THE HIMALAYA RANGE

Change in the runoff variability regime projected for 2030 under moderate climate change scenarios (relative to historic)

Runoff Variability Change

- High (ΔCV > 15%)
- Moderate (5% < ΔCV < 15%)
- Low (ΔCV < 5%)
- International Basins
- International Boundaries
- Disputed Boundary
- Disputed Boundary

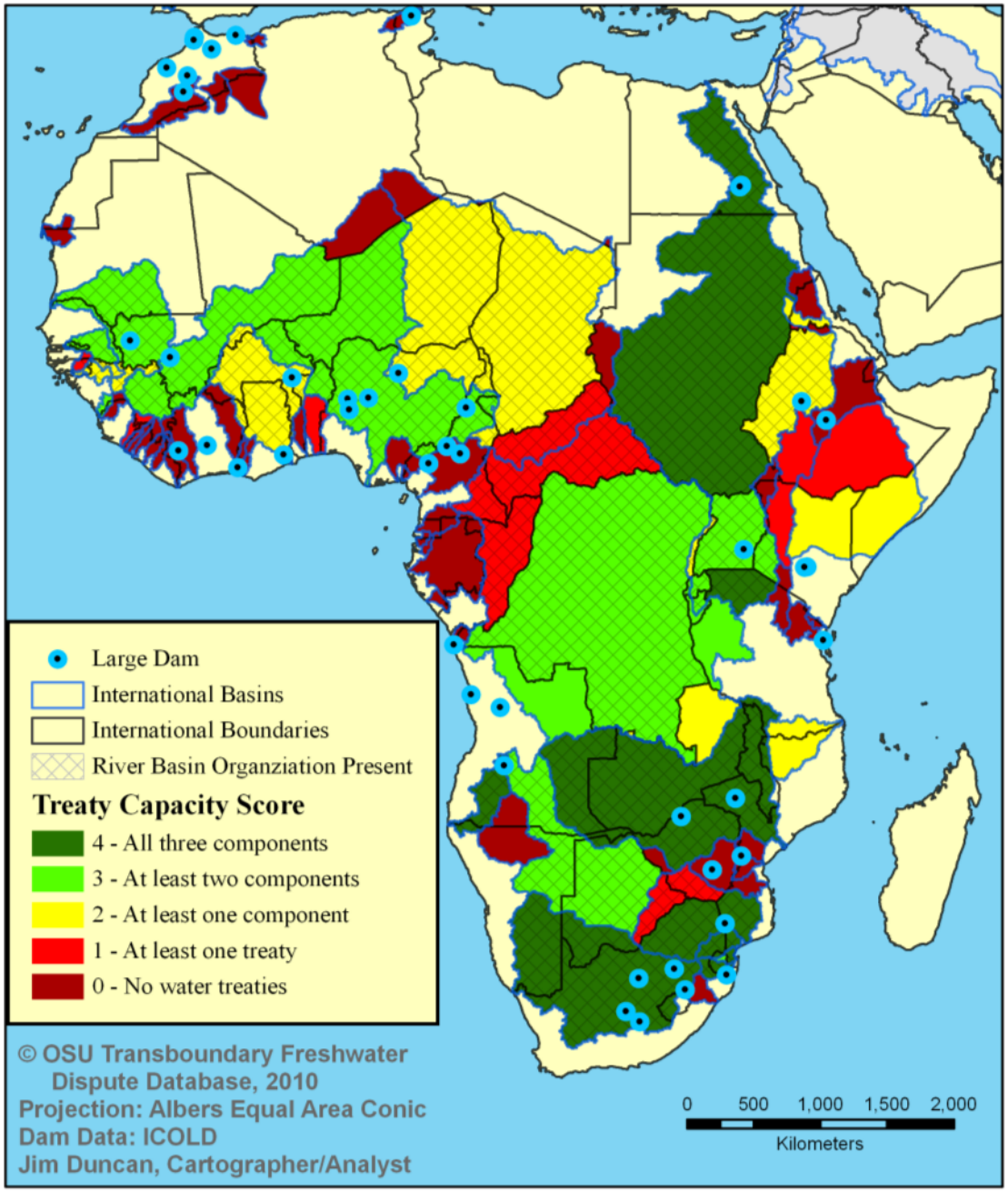
0 1,250 2,500 3,750 5,000

Kilometers

Projection - Albers Equal Area Conic
Climate data - Strzepek and McCluskey, 2009

Jim Duncan, Cartographer/Analyst

River Basin Organizations and Treaty Capacity



Where are they in Mekong Basin? (1)

Reservoirs:

- *China dams in Lancang;*
- *Laos dams in tributaries;*
- *Vietnam dams in the Central Highlands;*
- *Cambodia dams in tributaries;*
- *LMB mainstream giant dams???*

Flood protection and control structures and road system in Flood Plain