Keeping Rivers Flowing:
Innovative Strategies to Protect and Restore Rivers

The Nature Conservancy
Protecting nature. Preserving life.™

Brian Richter
Director, Global Freshwater Strategies

Key Factors Affecting Freshwater Ecosystems

Physical Habitat

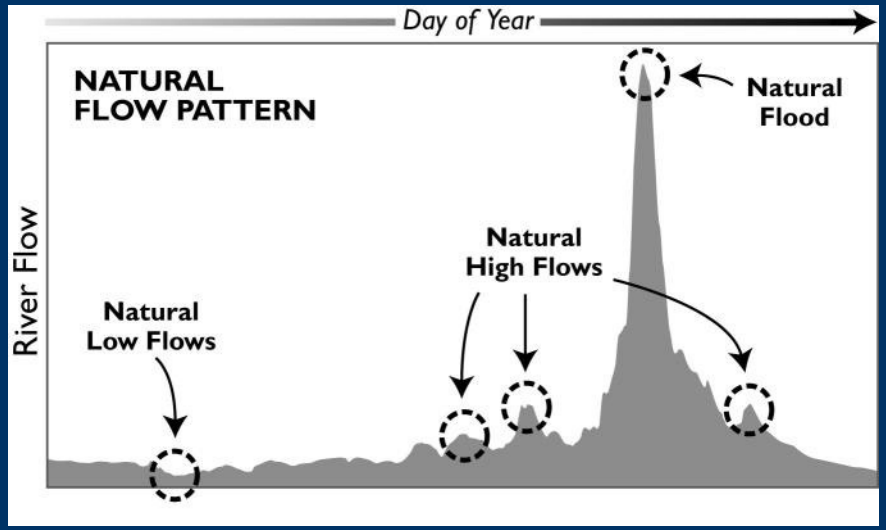
Biological Composition and Interactions

Connectivity

Water Chemistry/ Quality

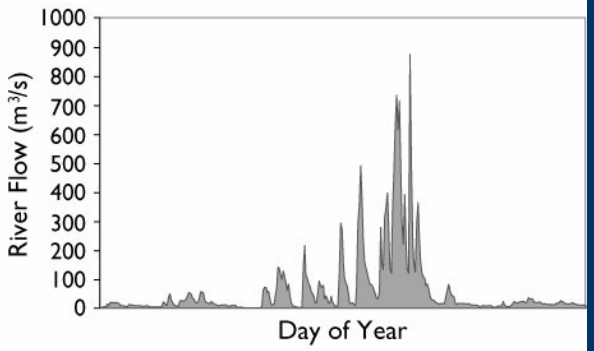
Water Flow Regime

Each river has its own natural water flow regime

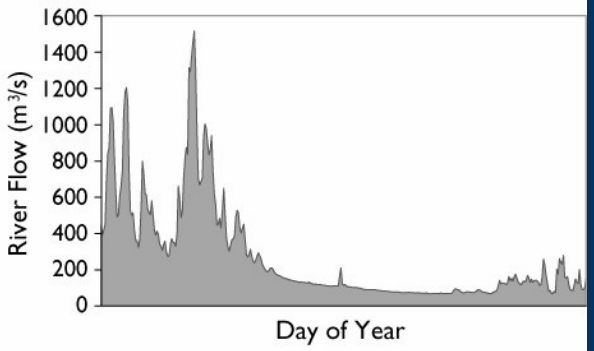


From "Rivers for Life" by Sandra Postel and Brian Richter (2003)

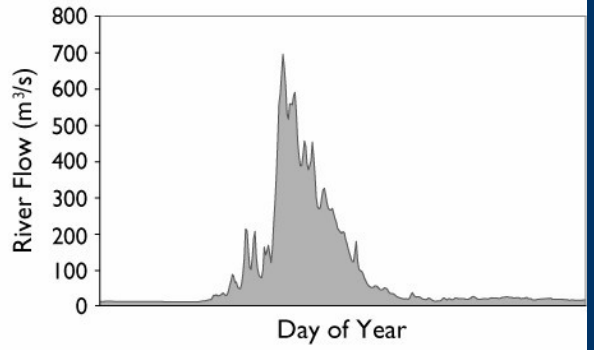
Nam-gang River, Korea



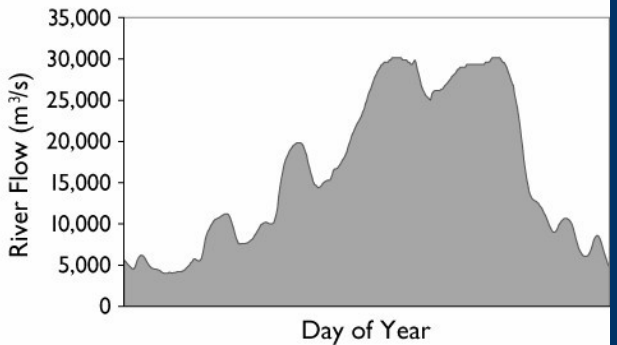
Cuiaba River, Brazil



Yampa River, Colorado, United States



Mississippi River, United States



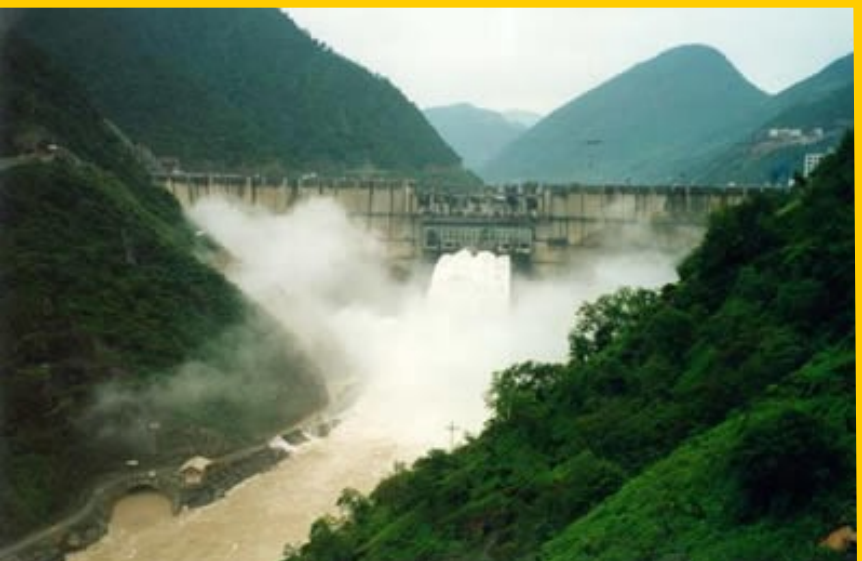
The Natural Flow Paradigm

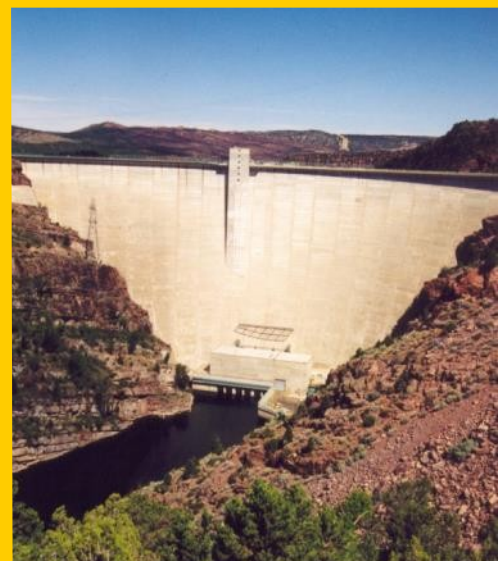
"The full range of natural intra- and inter-annual variation in hydrologic regimes, and associated characteristics of timing, duration, frequency, and rate of change, are critical in sustaining the full native biodiversity and integrity of aquatic ecosystems."

Richter, B.D., J.V. Baumgartner, R. Wigington, and D.P. Braun. 1997. How much water does a river need? *Freshwater Biology* 37:231-249.

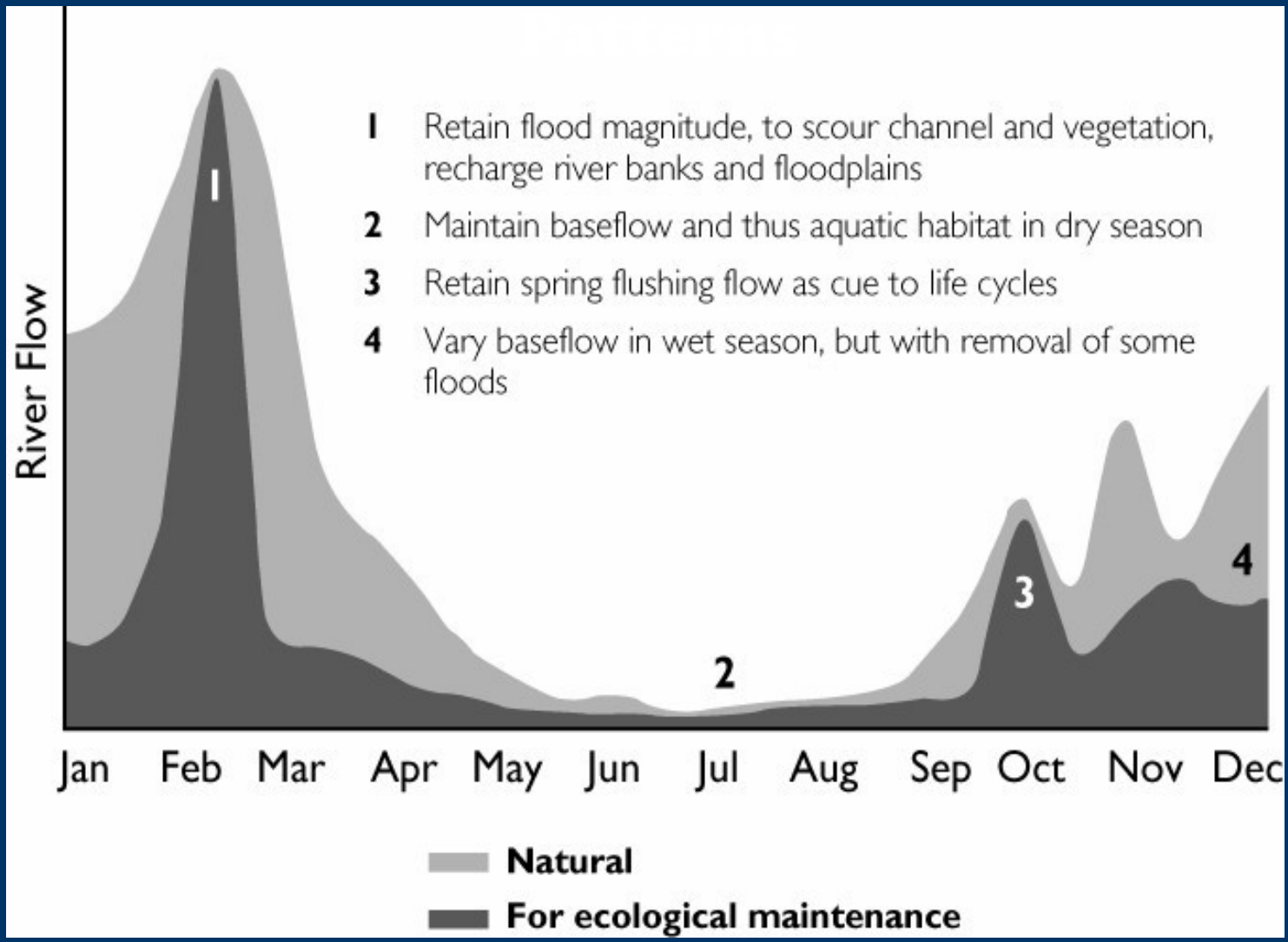
What alters water flows?

- ✓ Dams
- ✓ Water diversions/pumping
- ✓ Land-use changes
- ✓ Climate change





Maintaining Natural Flow

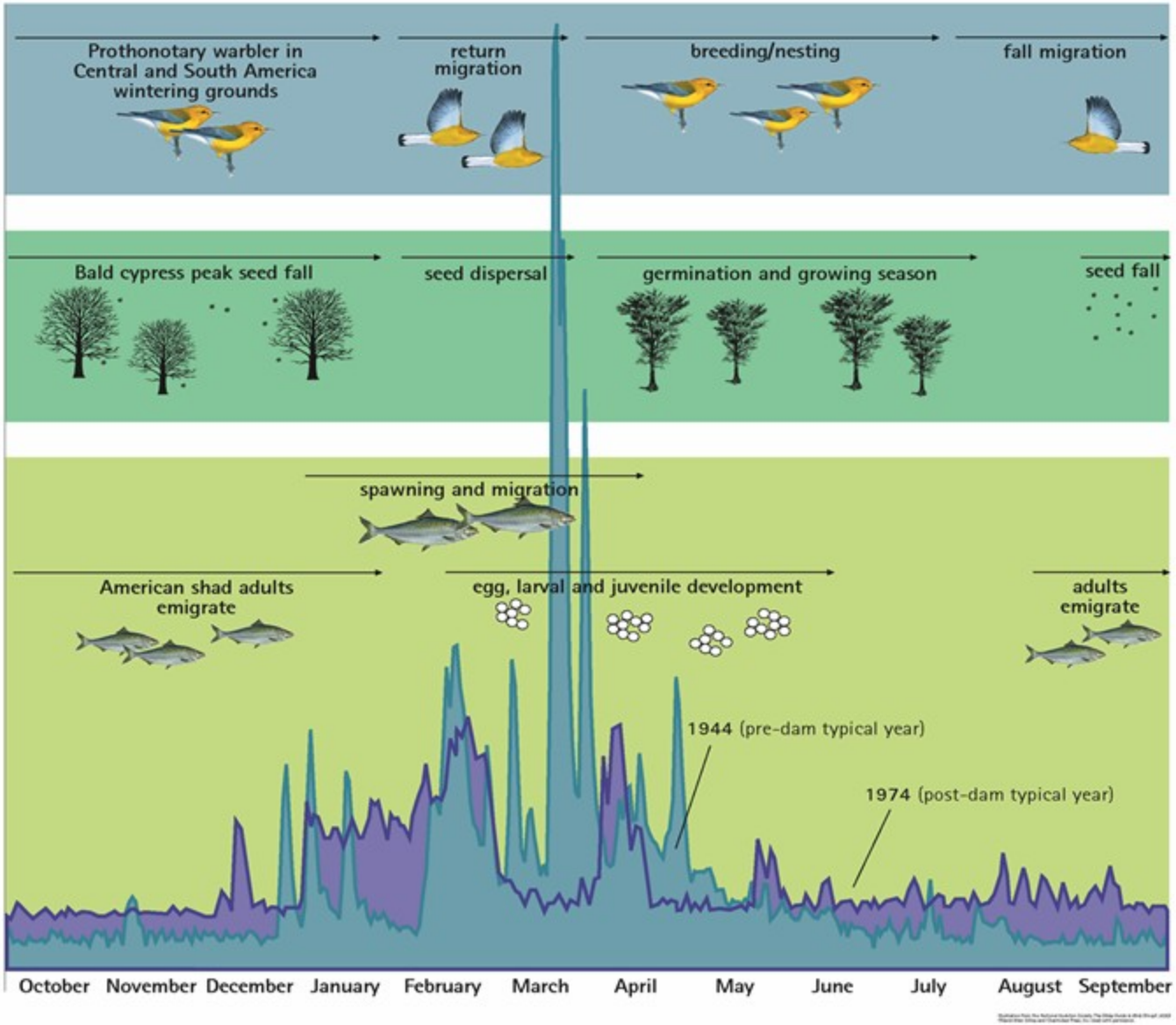


From "Rivers for Life" by Sandra Postel and Brian Richter (2003)

Environmental Flows

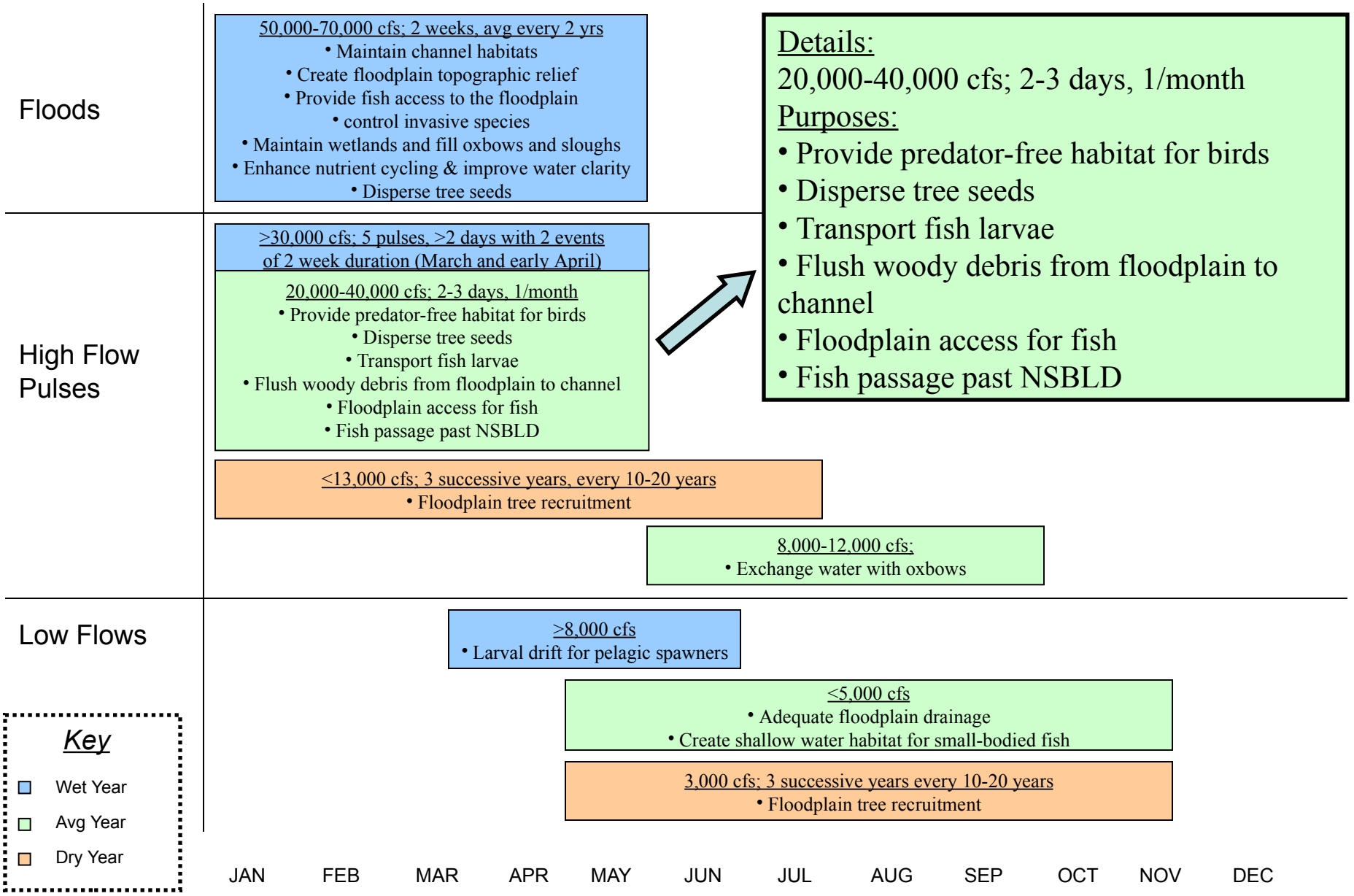
The flow or fluctuations of water in a river, lake or aquifer that sustains healthy ecosystems and the goods and services that people derive from them.

Ecological Model of the Savannah River



Environmental Flow Recommendations

Savannah River, USA (below Thurmond Dam)



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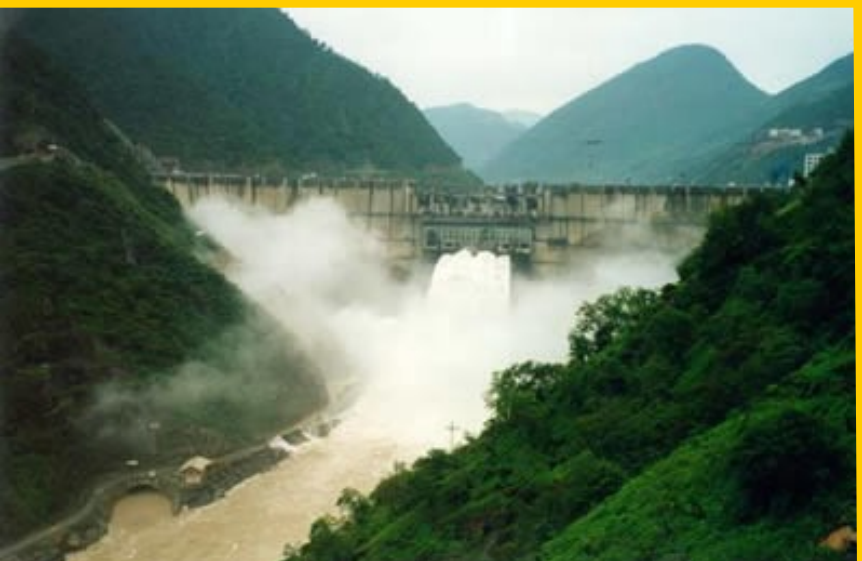
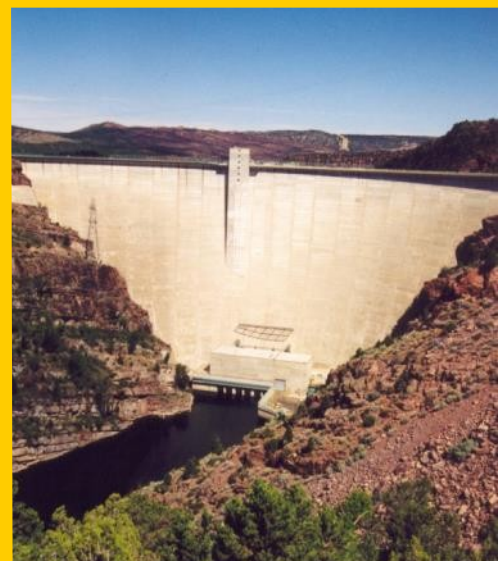
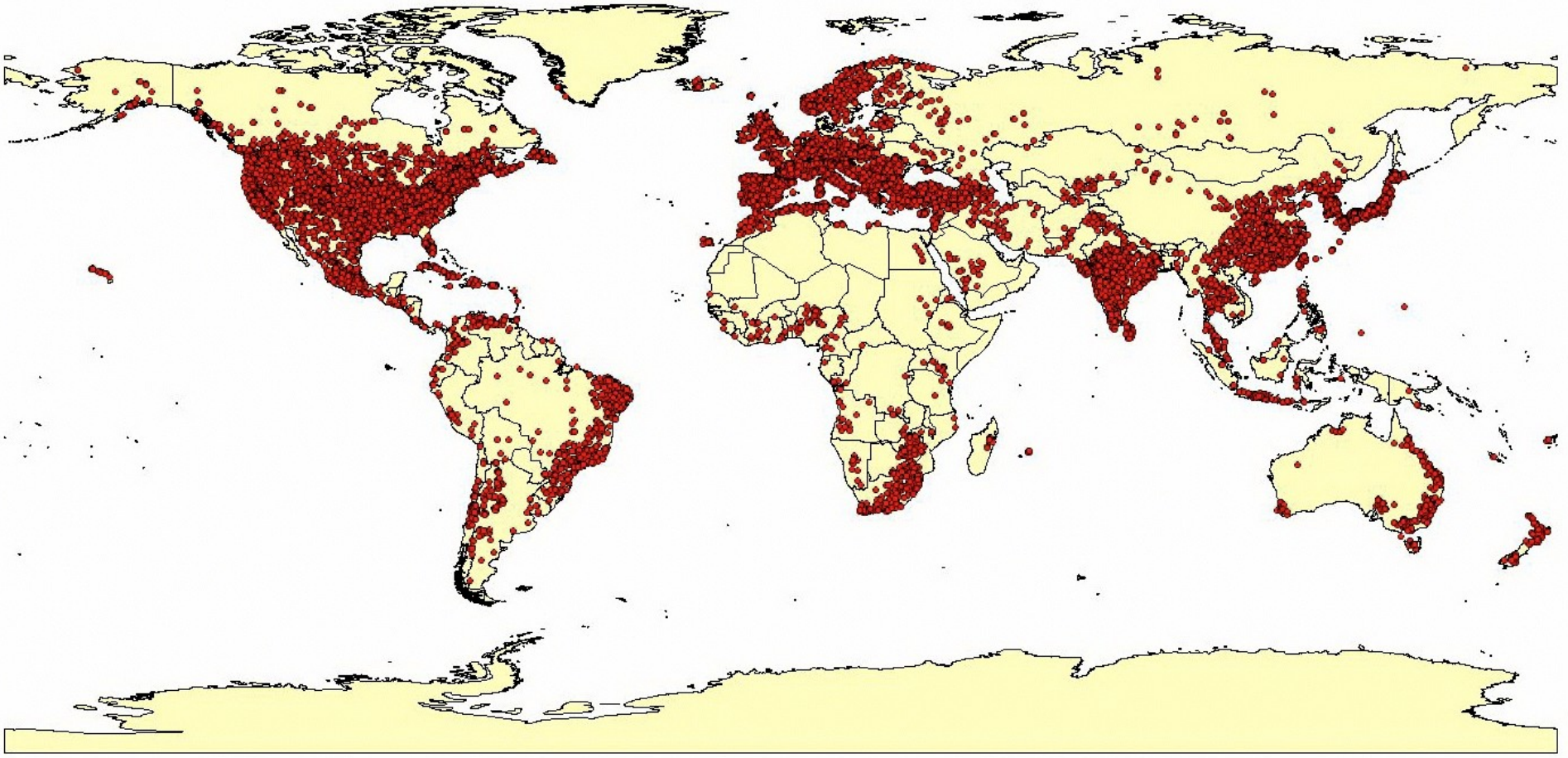




The History of Global Dam Development

1990 - 2000



Map shows 23,427 large dams worldwide. Dam data are from Greifswald University, the ICOLD World Register of Dams, the FAO African Dams Database, the U.S. National Inventory of Dams, and The Nature Conservancy.

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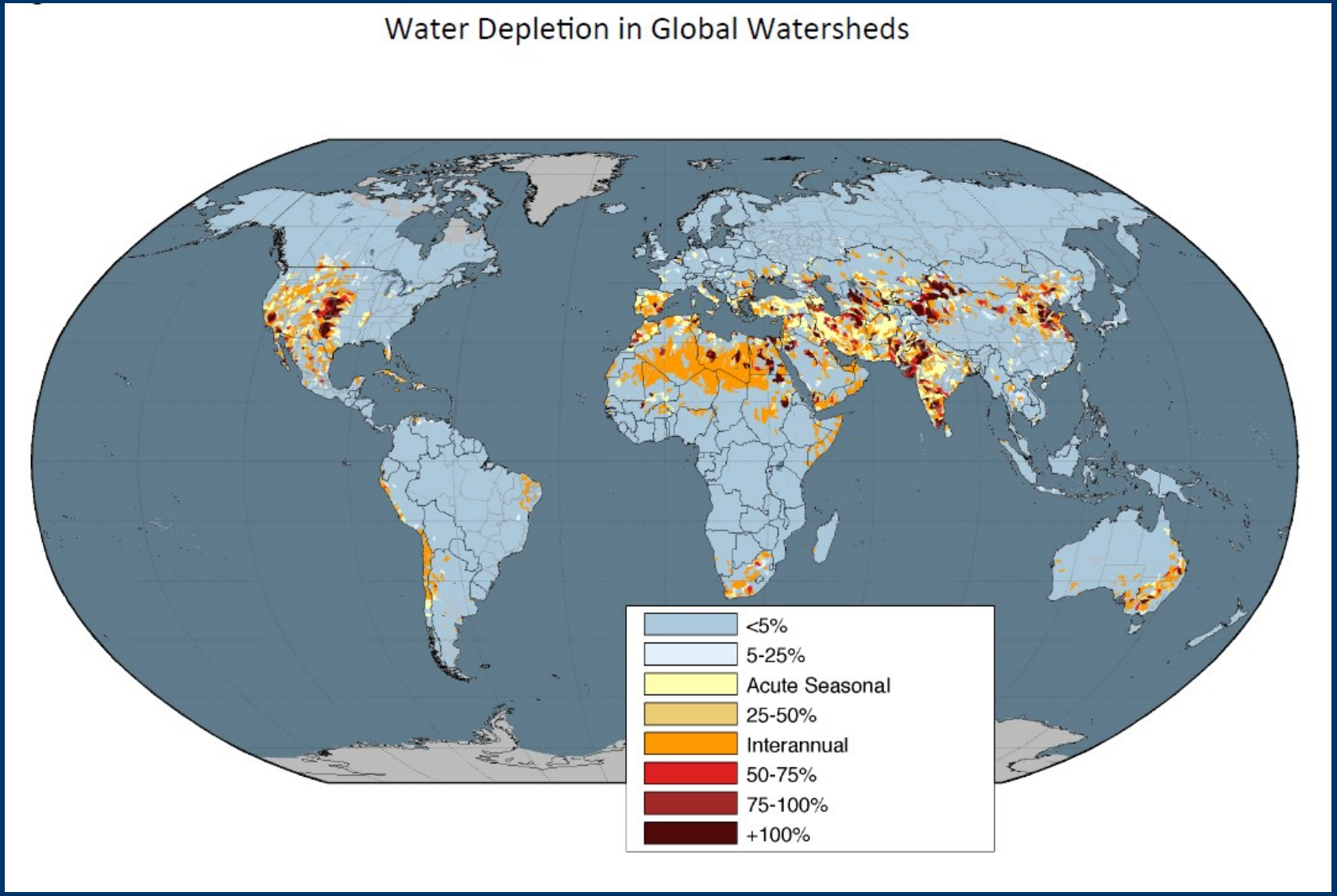
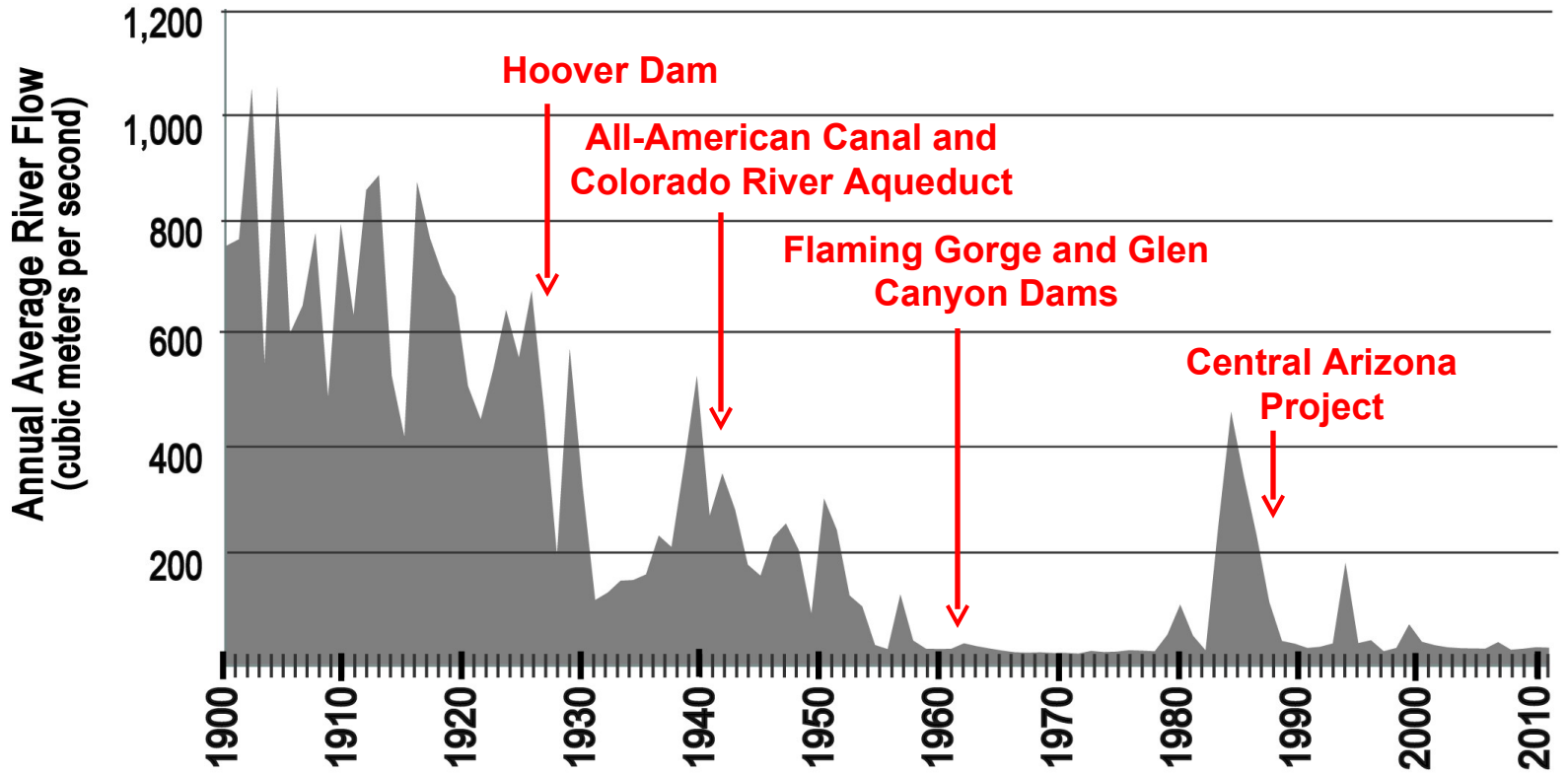
Global Water Scarcity



Source: WaterGAP model, University of Kassel, Germany

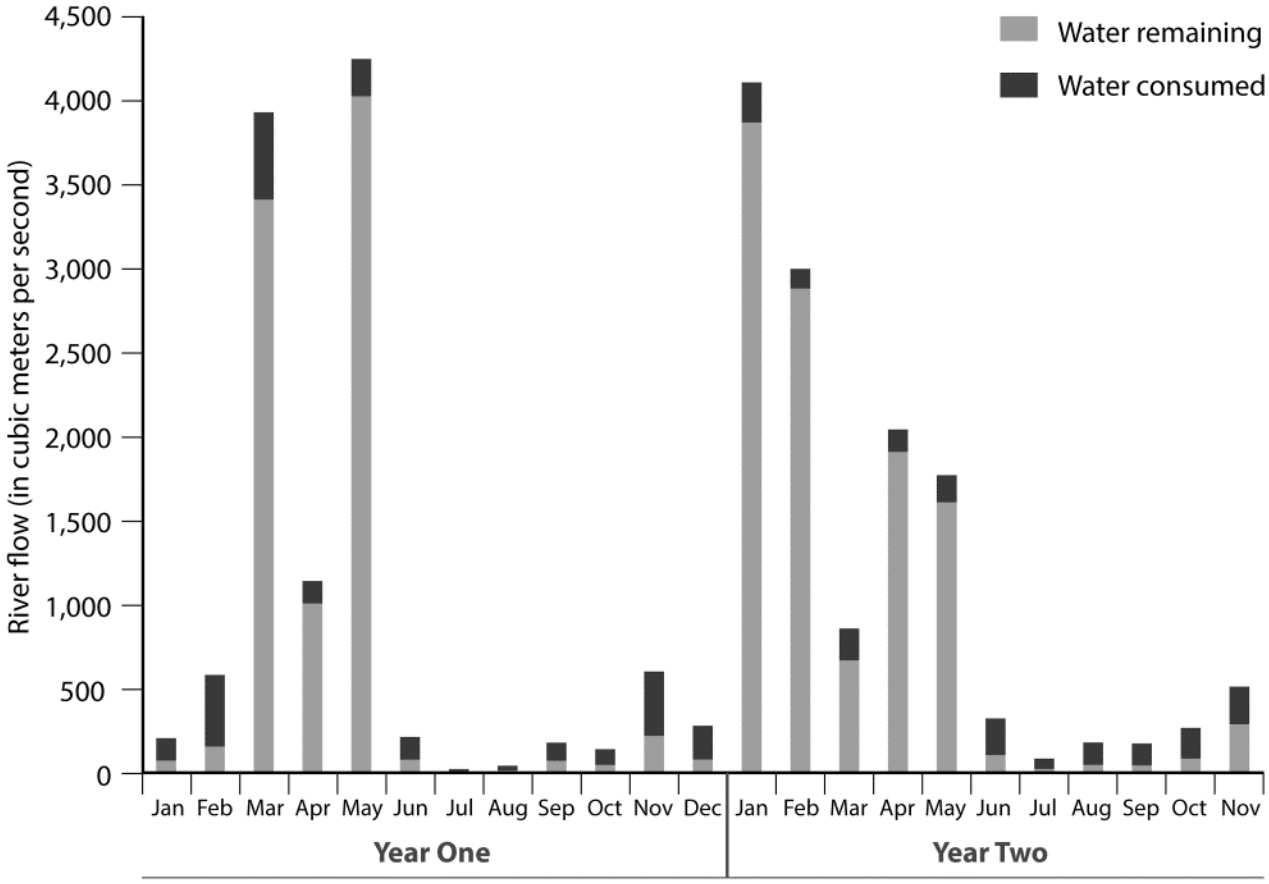
Colorado River of the West



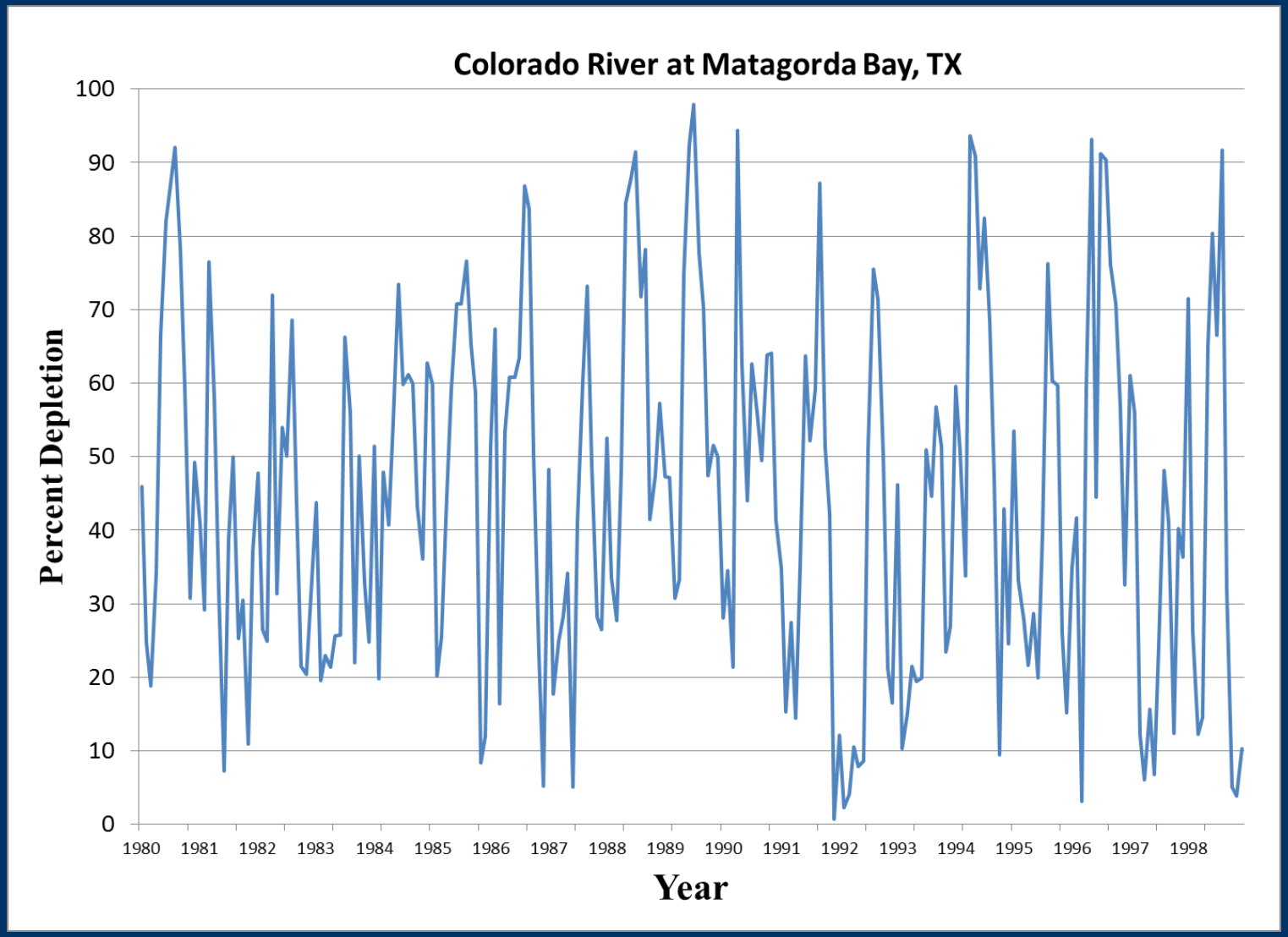
Colorado River Delta, Mexico

Photo: Jonathan Waterman

Brazos River, Texas

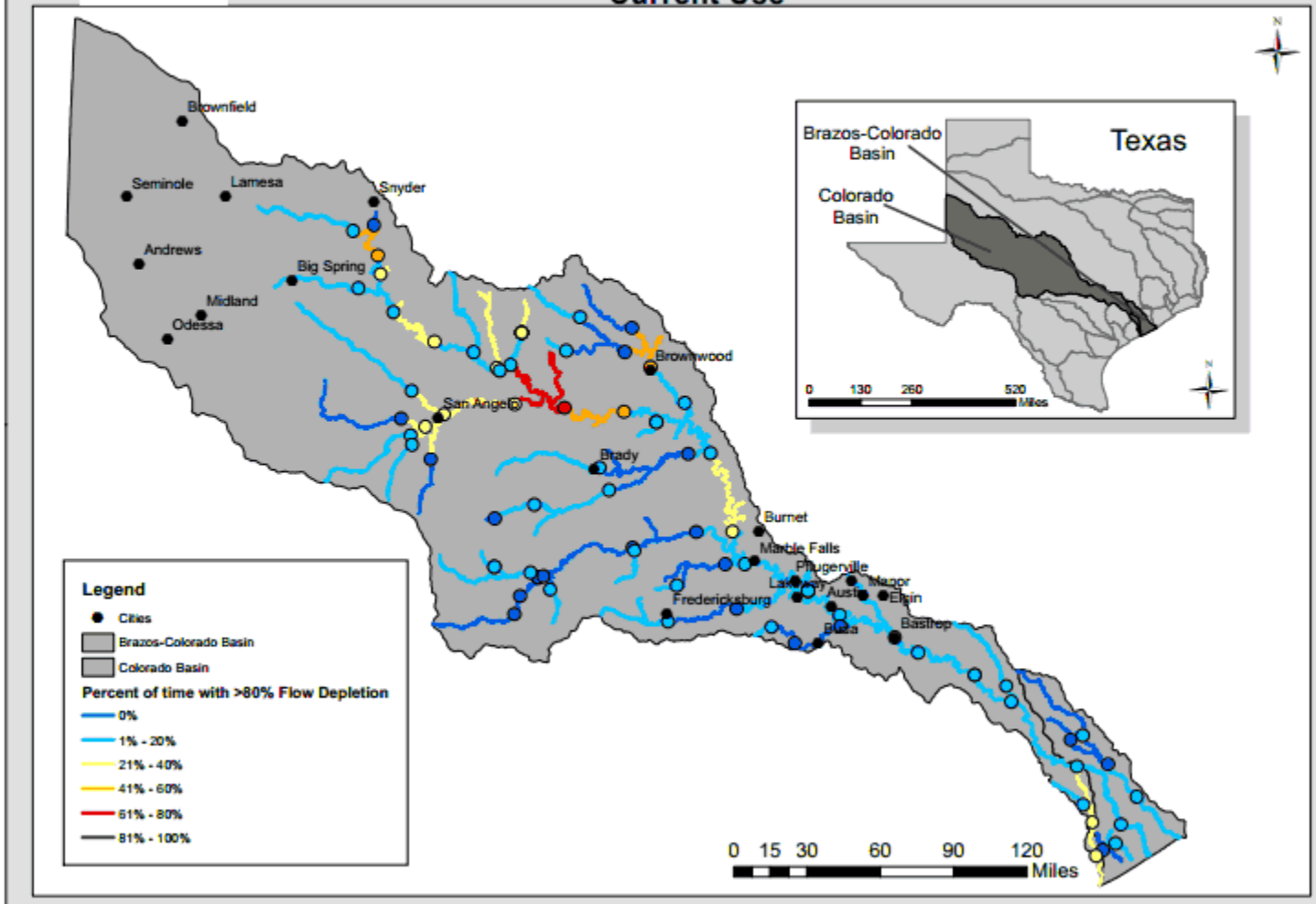


From "Chasing Water: A Guide for Moving from Scarcity to Sustainability" by Brian Richter (Island Press, 2014)



Source: Water Availability Model for Texas

Flow Depletion
Colorado and Brazos-Colorado River Basins:
Current Use



Increasing Water Depletion

Low	Moderate	Significant	Severe
Minimal impacts	Ecological impacts appear	Impacts to ecosystem services appear	Serious economic impacts

Full natural availability

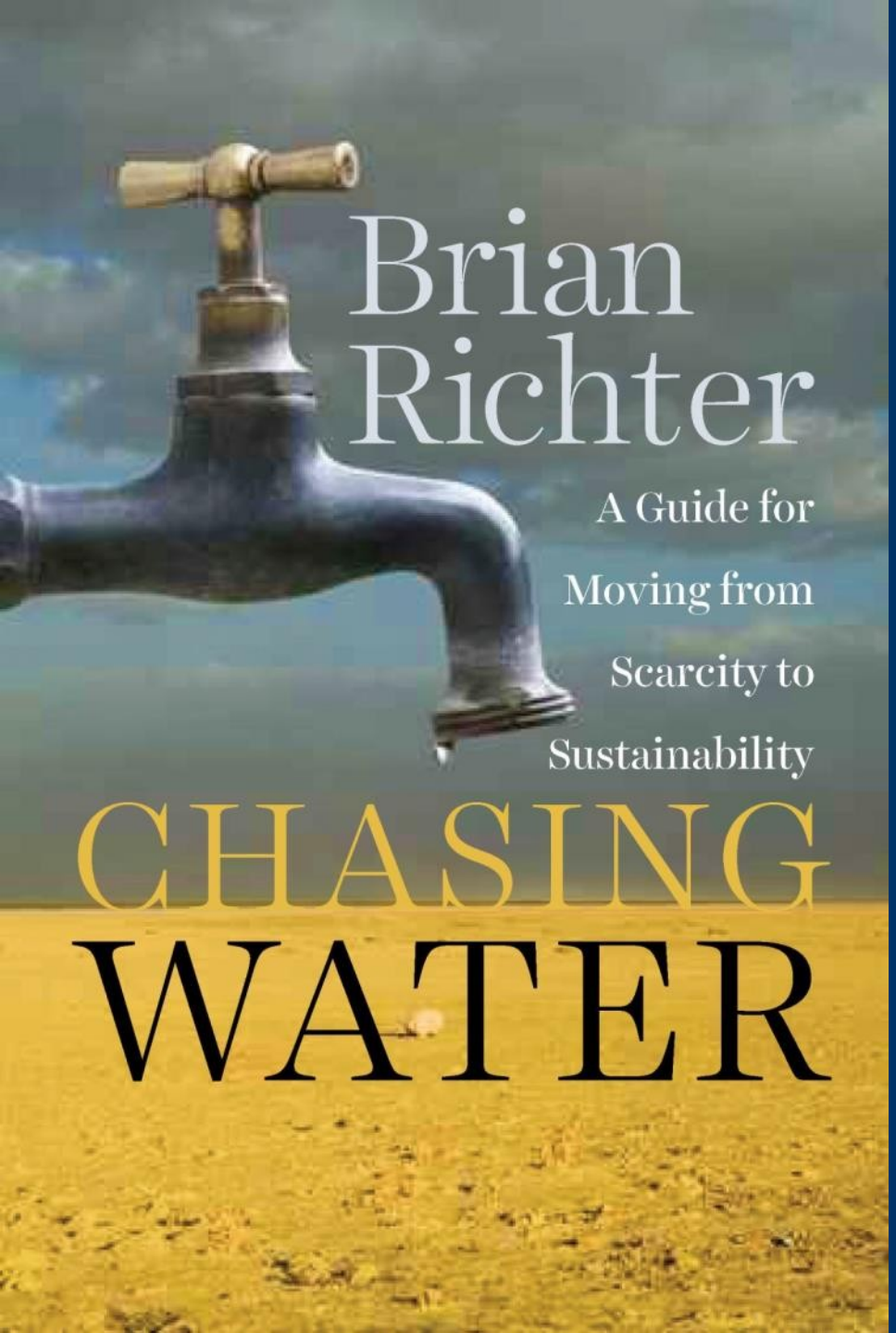
20% depletion of renewable annual supply

50% depletion

80% depletion

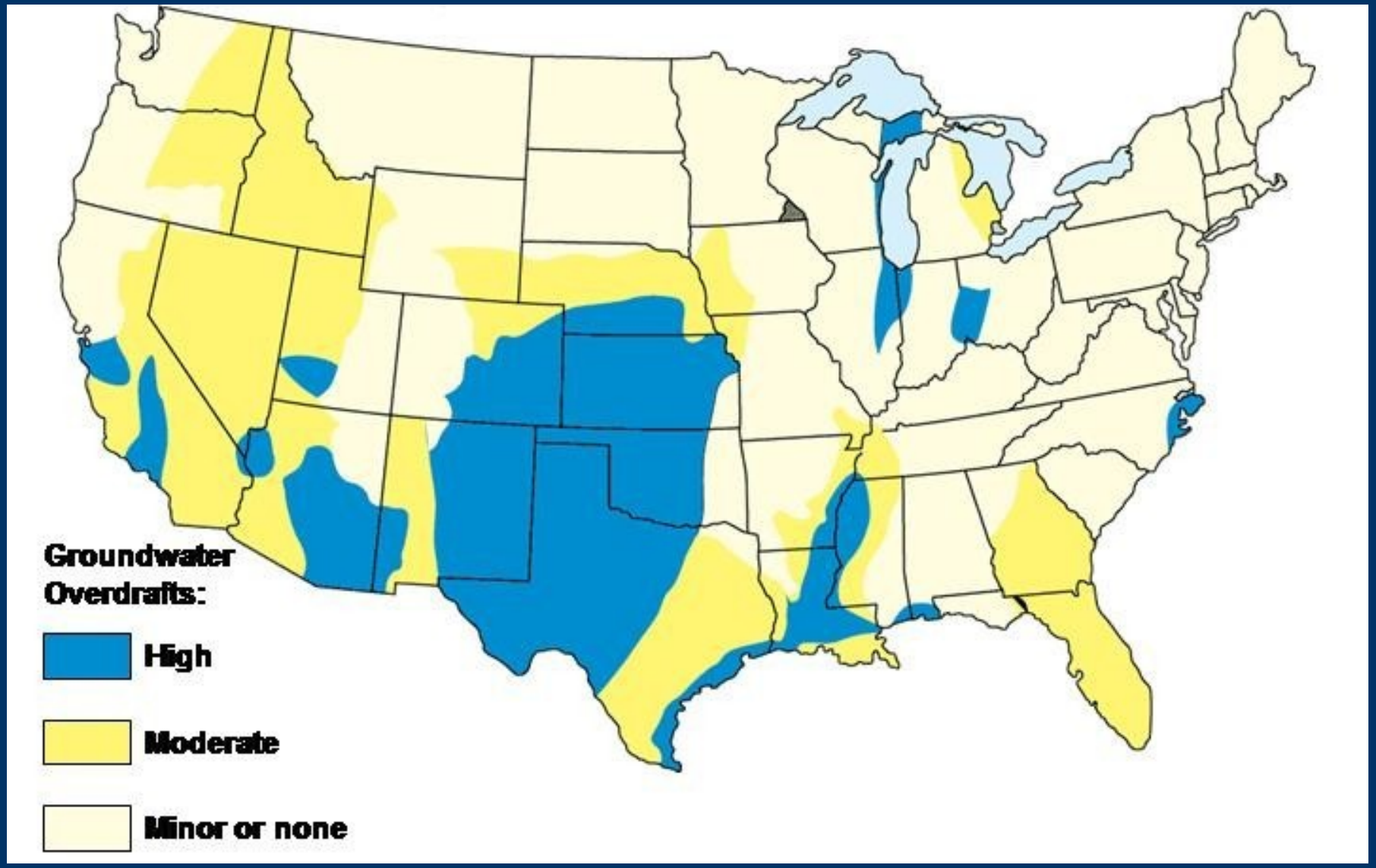
Water all gone

Texas (USA): $12b lost in 2011
US: $6-8b lost annually
China: $39b lost annually


Brian
Richter
A Guide for
Moving from
Scarcity to
Sustainability
CHASING
WATER

Two Big Solutions

1. Don’t over-allocate the available water. Place a “cap” on the maximum allowable volume of water consumption from each water source



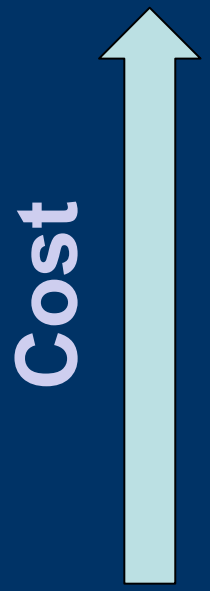
Source: City University of New York

Two Big Solutions

1. Don’t over-allocate the available water. Place a “cap” on the maximum allowable volume of water consumption from each water source

2. Invest in the most cost-effective and sustainable measures

Six Ways to Fix a Water Shortage

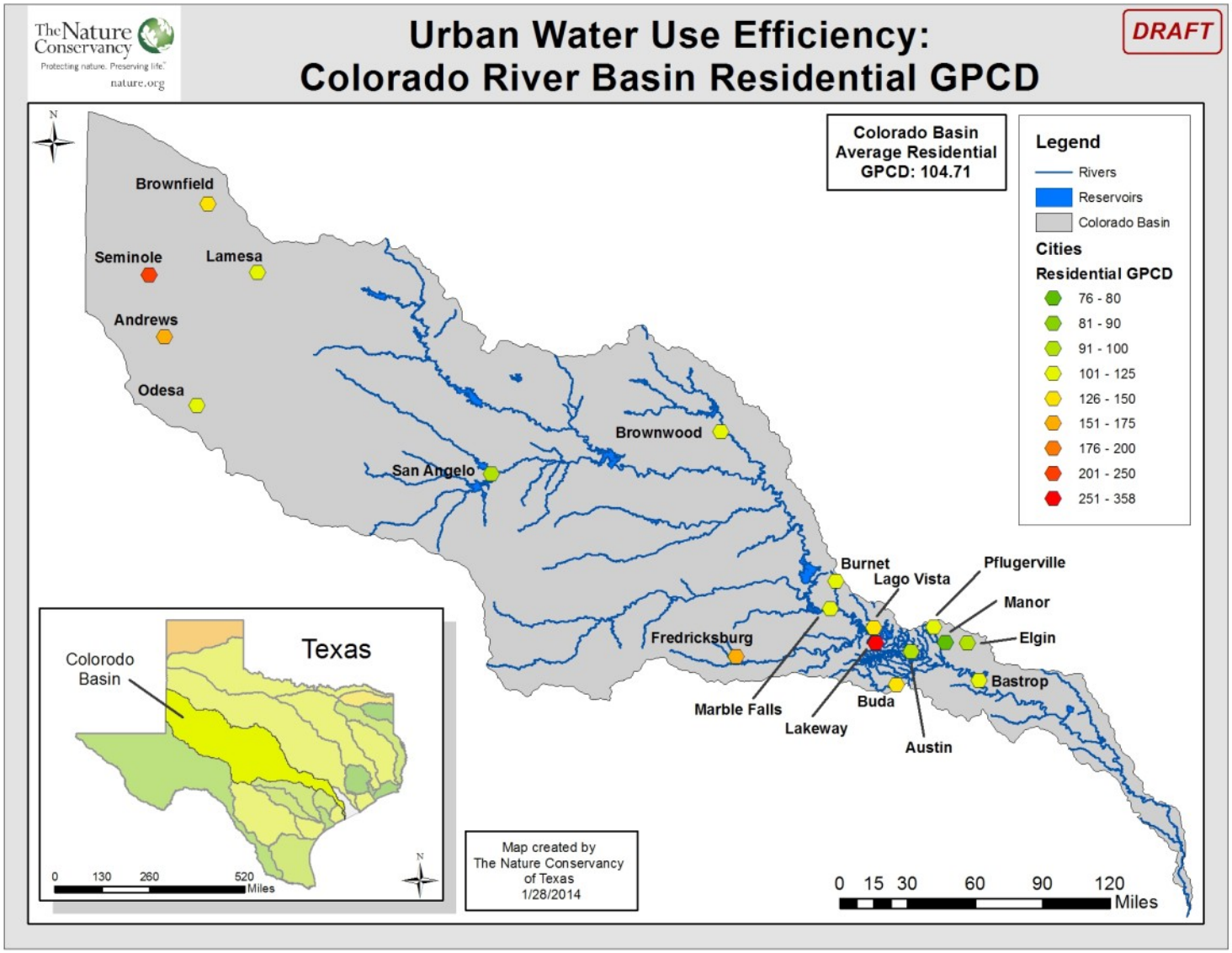


- Desalination
- Water reuse
- Water importation
- Water storage
- Watershed management
- Water conservation

Water Conservation

Australian cities use half as much water as cities in the western US

A savings of just 15-20% of the water consumed in agriculture would resolve water shortages in most of the world's water sources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Urban Water Use Efficiency:
Colorado River Basin Residential GPCD
DRAFT
Colorado Basin
Average Residential
GPCD: 104.71
Legend
Rivers
Reservoirs
Colorado Basin
Cities
Residential GPCD
76 - 80
81 - 90
91 - 100
101 - 125
126 - 150
151 - 175
176 - 200
201 - 250
251 - 358
Brownfield
Seminole
Lamesa
Andrews
Odesa
Brownwood
San Angelo
Burnet
Lago Vista
Pflugerville
Manor
Elgin
Bastrop
Buda
Fredricksburg
Marble Falls
Lakeway
Austin
Texas
Colorodo
Basin
0 130 260 520
Miles
Map created by
The Nature Conservancy
of Texas
1/28/2014
0 15 30 60 90 120
Miles

www.nature.org/water
www.sustainablewaters.org