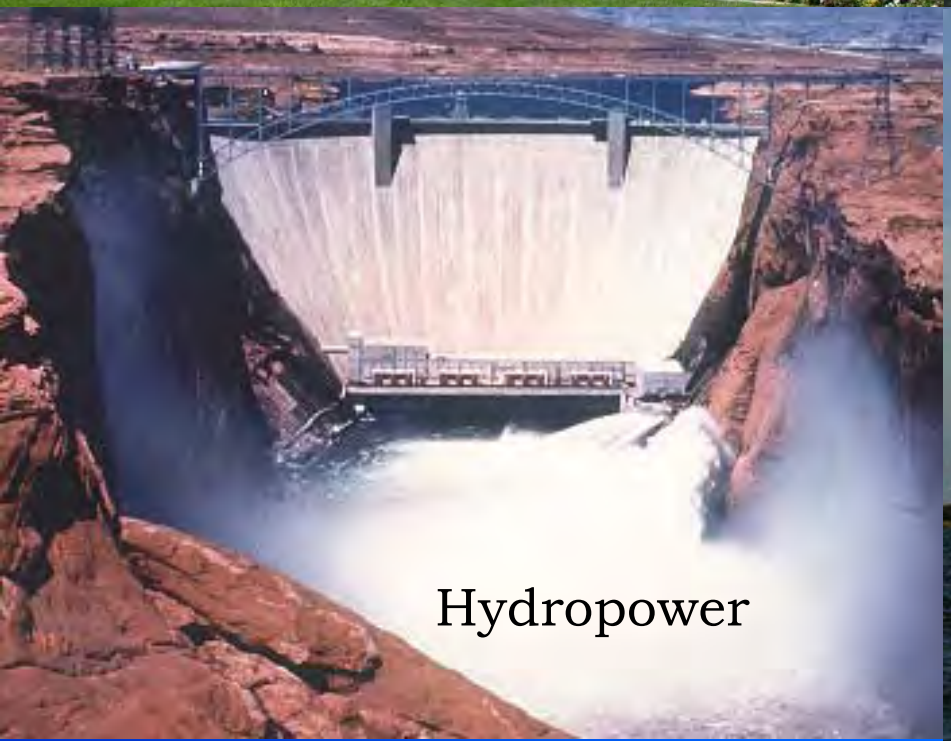
Environmental Flows and the 2015 Goal

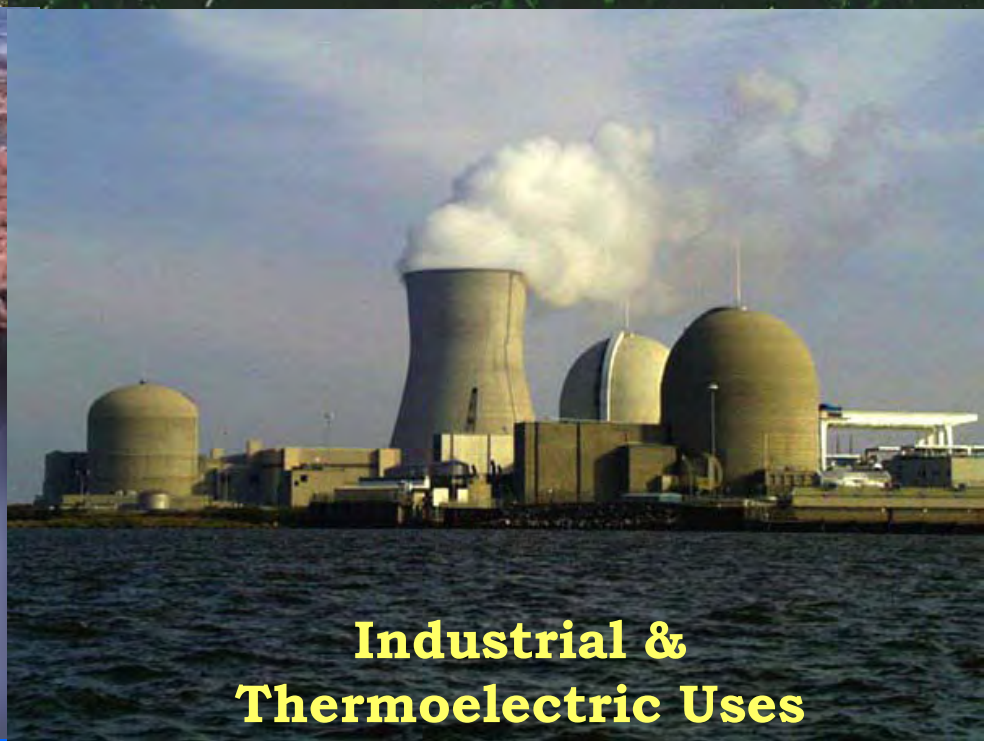
Brian Richter
Co-Lead, Global Freshwater Team

Urban Water Uses

Agriculture

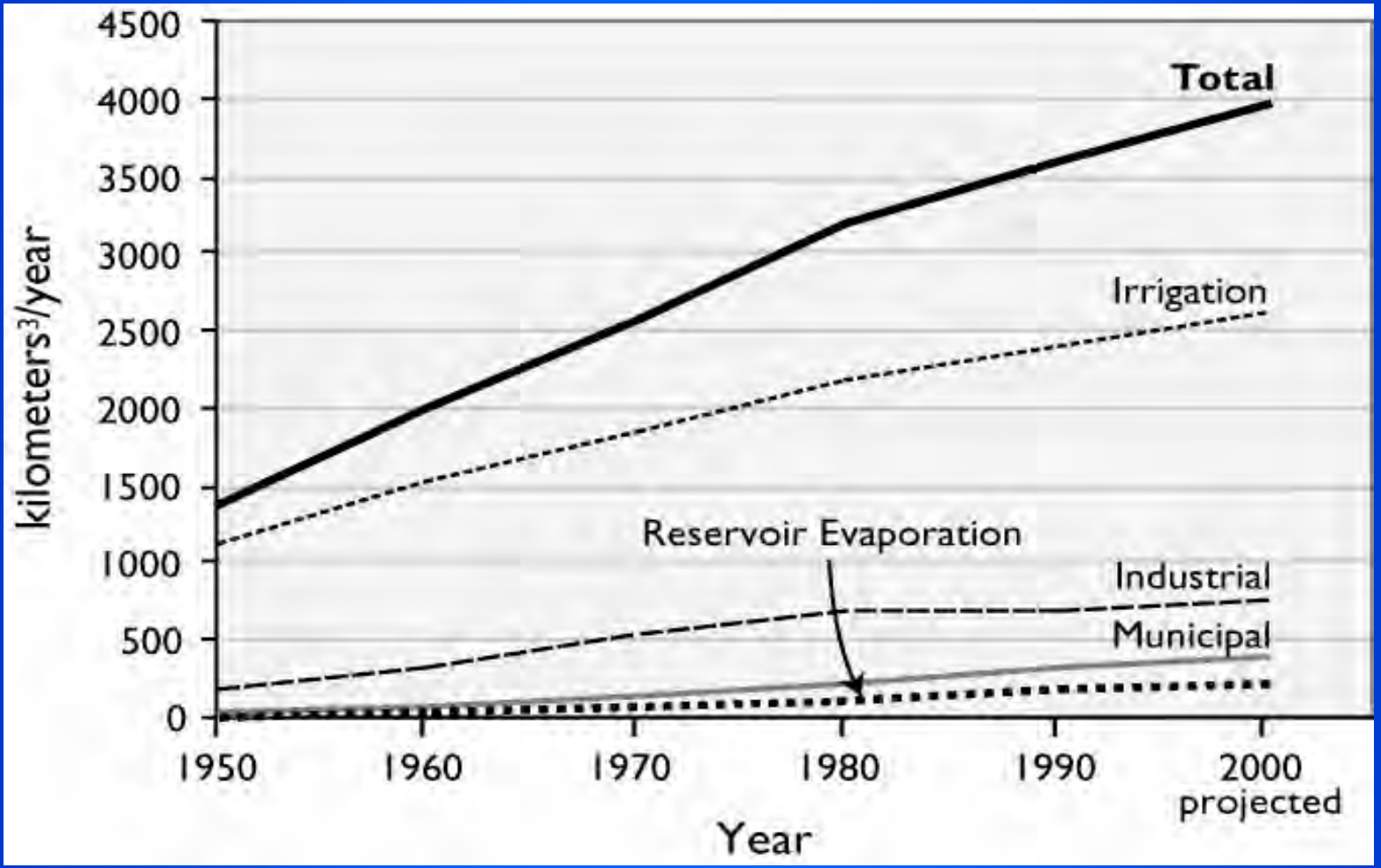


Hydropower

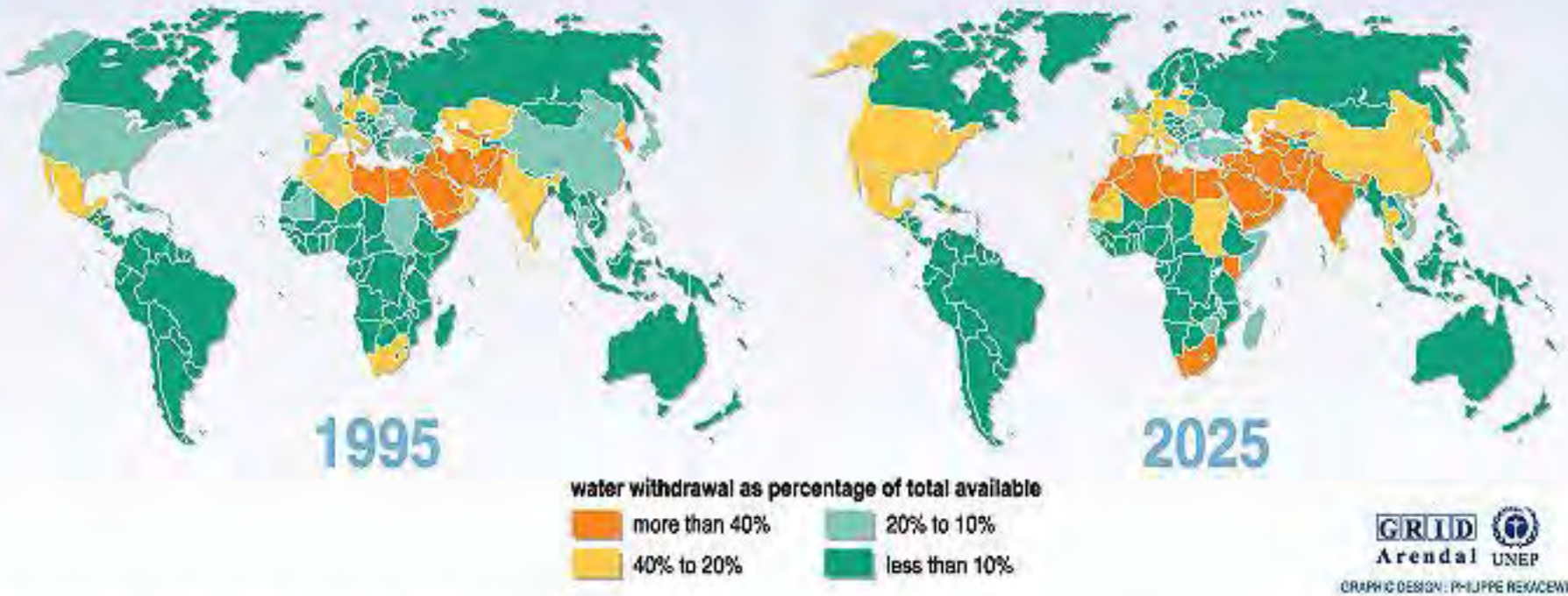


Industrial &
Thermoelectric Uses

Global Water Consumption

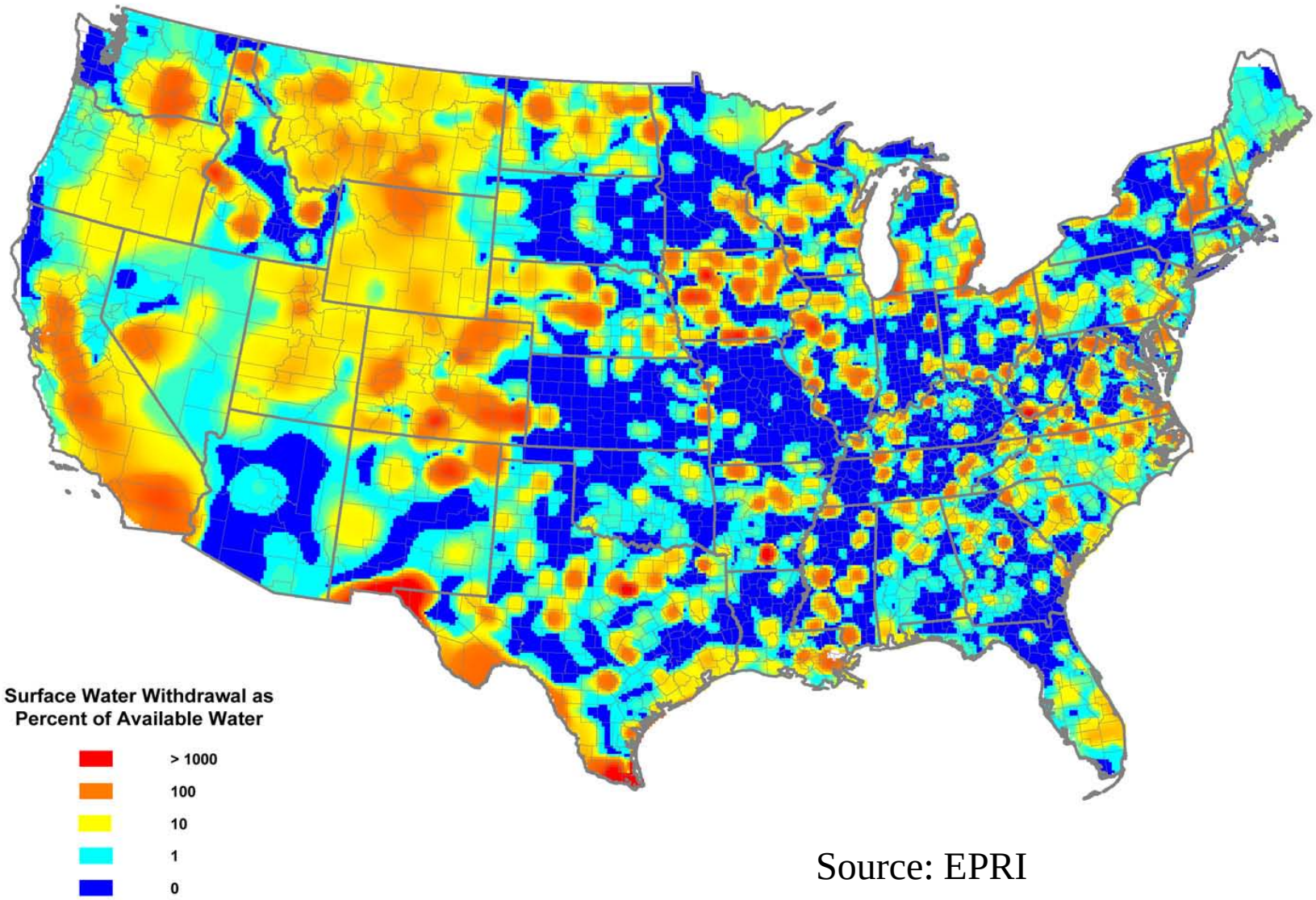


Freshwater stress



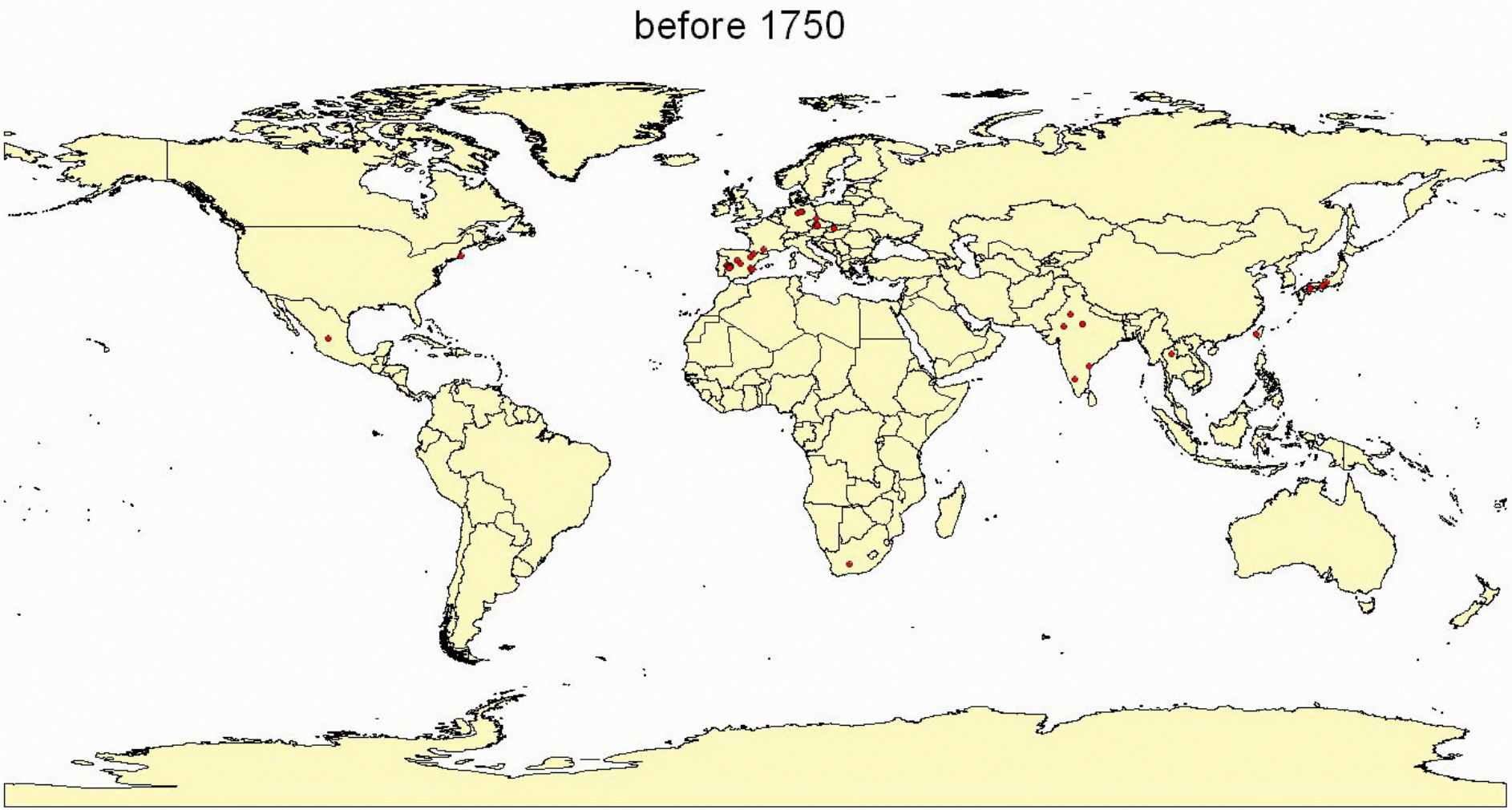
Source: Global environment outlook 2000 (GEO), UNEP, Earthscan, London, 1999.

Surface water withdrawal as a percentage of renewable water supply



Source: EPRI

The History of Global Dam Development



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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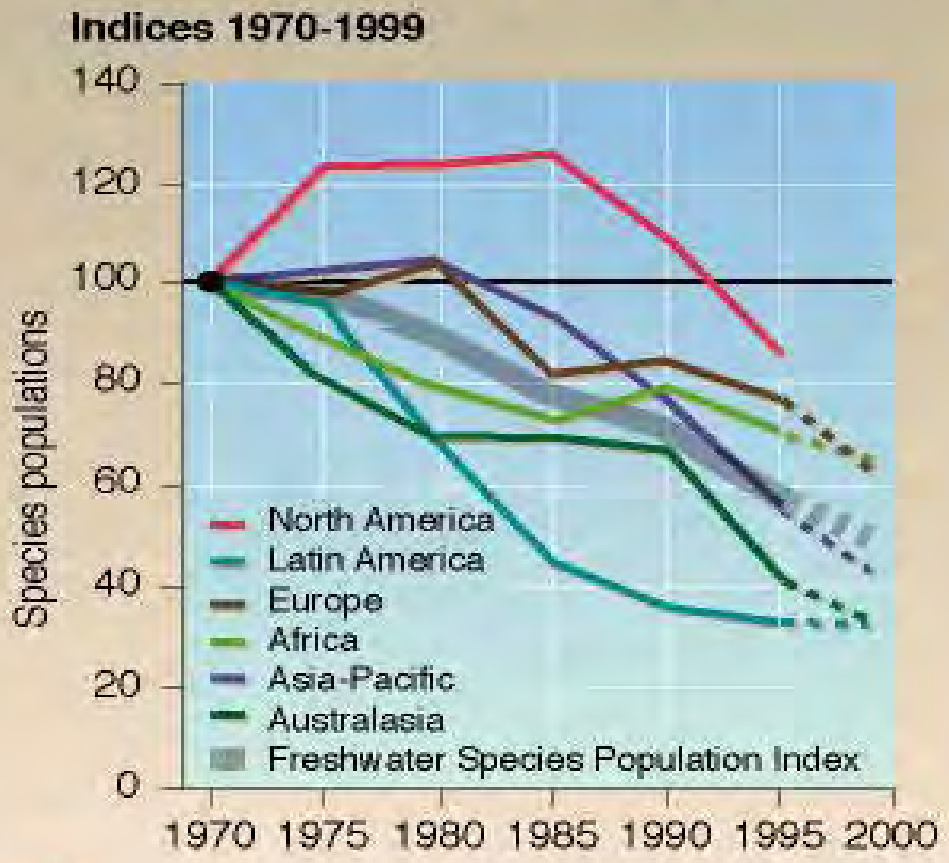
Sustainable Water Management

Managing human uses of water such that enough water of sufficient quality is available for use by future generations

Biodiversity & Ecosystem Services

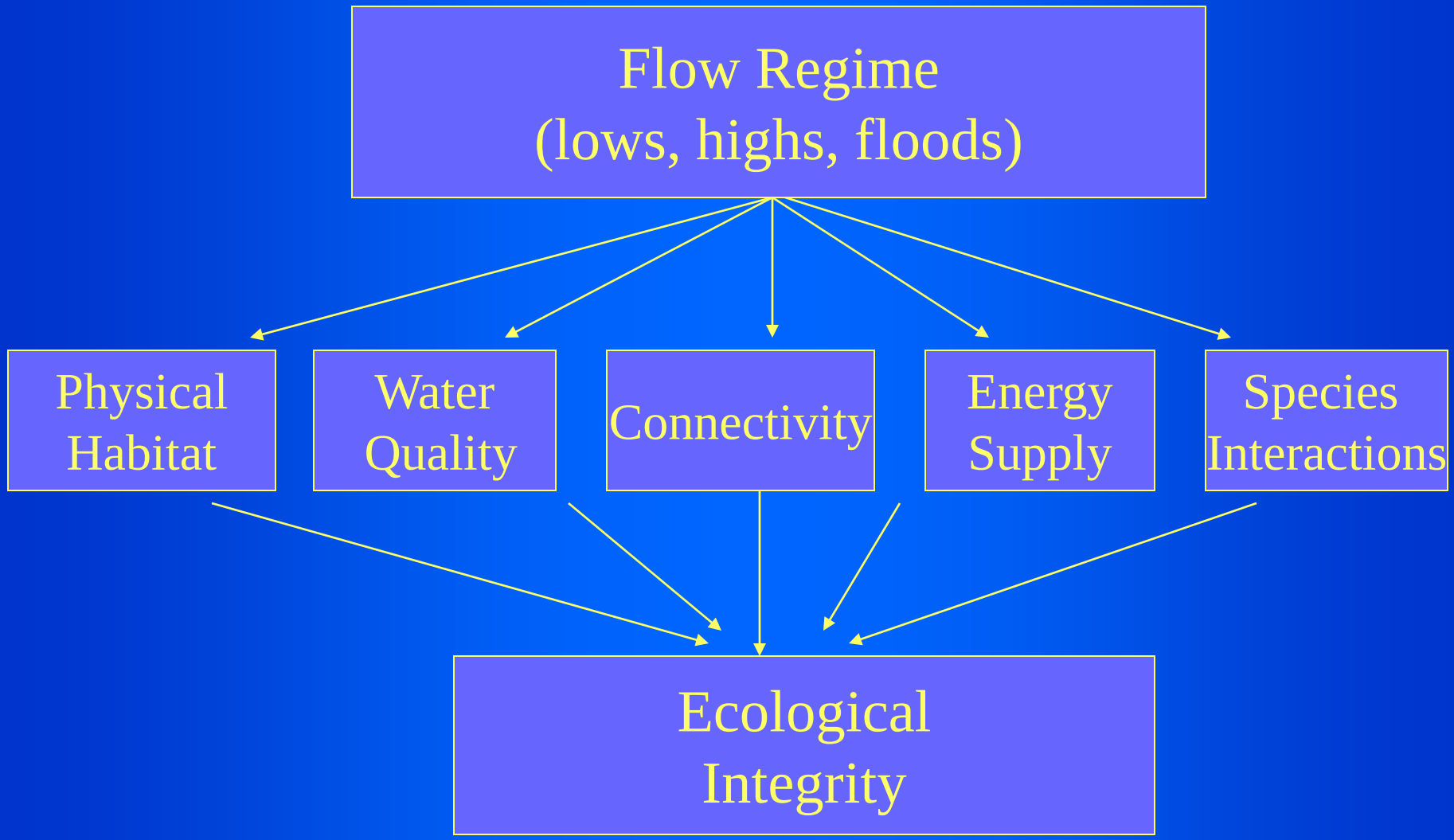
Changes in Freshwater Species Populations



UNEP

DELPHINE DIGOUT
MAY 2002

Source: *Living Planet Report 2000*, World Wide Fund for Nature (WWF).


Flow Regime
(lows, highs, floods)
Physical Habitat
Water Quality
Connectivity
Energy Supply
Species Interactions
Ecological Integrity

Killer Threat: Hydrologic Alteration

- Water withdrawals for farms
- Water withdrawals for cities
- Dams for water supply, flood control, hydropower
- 60% of all freshwater ecoregions report as critical threat
- 400 of 900 TNC sites report this threat

Top Freshwater Threats

- Hydrologic alteration
- Water quality degradation
- Invasive species
- Direct habitat destruction
- Over-harvest
- Climate change

Global Freshwater Strategies

- **Reducing the Ecological Impacts of Dams**
- **Environmental Flow Policies**
- **Watershed Protection**
- Freshwater Invasive Species
- Naturalizing Water and Sediment Regimes in Agricultural Landscapes
- Summits to the Seas: Protecting Coastal Watersheds and Estuaries

The Nature Conservancy
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the campaign for a **sustainable planet**

Oceans

North Pacific Marine
Temperate Western Atlantic Coast
Gulf of Mexico
Caribbean Basin
Pacific Islands Challenge
Coral Triangle
Balboa's Southern Seas (Eastern Tropical Pacific)
West Indian Ocean (Coastal East Africa)
Humboldt Current

Lakes & Rivers

Mississippi River
Colorado River
Southeast US Rivers
Murray Darling Basin
The Great Lakes & St. Lawrence River
Pacific Salmon Ecosystems
Yangtze River
Zambezi River
Paraguay / Parana River
Rivers of the Northern Tropical Andes

Grasslands

The Great Plains of North America
Mongolia & China Grasslands
African Grasslands & Savannas
Northern Australia Grasslands
Orinoco / Llanos Grasslands (Venezuela & Colombia)
The Grasslands of the Patagonian Steppe

Forests

Sustainable Forests of North America
Forest Bridge of the Americas
Amazon Indigenous Reserves
Forest Parks of the Tropical Andes
Brazil's Atlantic Rainforest
Highland Forests of Kenya & Tanzania
Yunnan Forests, China
Sustainable Forests in Indonesia & Papua New Guinea
New Forest Trade

Deserts & Drylands

Las Californias
Sonoran / Chihuahuan Desert Borderlands
Central Australia
Gondwana Link
South America's Humboldt Coast
Aridlands of Namibia

Climate Change Action

Cooling the Planet through Reforestation
Reducing Emissions by Protecting Tropical Forests
Understanding & Buffering the Impacts on Climate Imperiled Places
Reducing the Threat of Climate Change through Policy

Global Strategies

Engaging the Private Sector in Conservation
Strengthening our External Affairs Capacity
Leading with Science
Leveraging our Conservation Knowledge
Protected Areas Forever
Supporting Conservation Partners in Africa
Advancing a National Conservation Agenda in China
Conservation in Brazil's Working Landscapes

Conservation Capacity

Global Priorities Fund
Catalyst Fund for Global Conservation

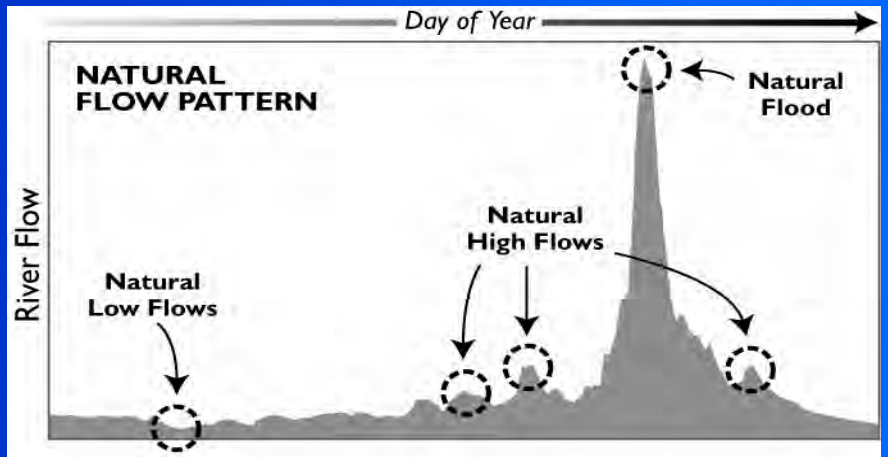
Ecologically Sustainable Water Management:

Ecologically sustainable water management protects the ecological integrity of affected ecosystems while meeting inter-generational human needs for water and sustaining the full array of other products and services provided by natural freshwater ecosystems.

Richter, B.D., R. Mathews, D.L. Harrison, and R. Wigington. Ecologically sustainable water management: managing river flows for ecological integrity. *Ecological Applications* 13:206-224

Environmental Flow:

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



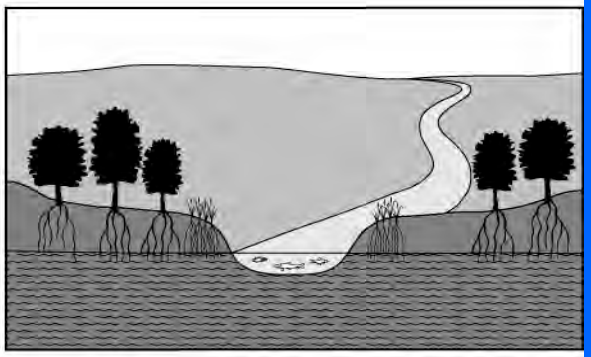
Natural Low Flow

Fish have adequate oxygen and can move up- or downstream to feed

Riparian vegetation sustained by shallow ground water table

Insects feed on organic material carried downstream

Birds supported by healthy riparian vegetation and aquatic prey



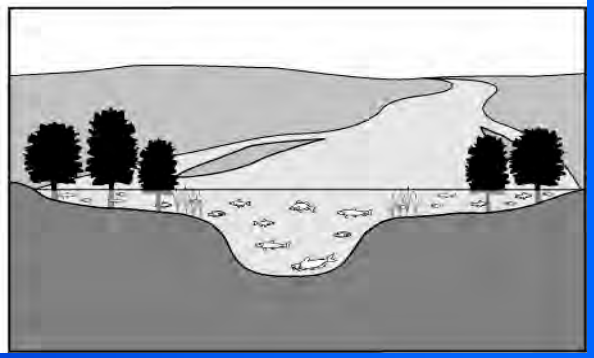
Natural Flood

Fish are able to feed and spawn in floodplain areas

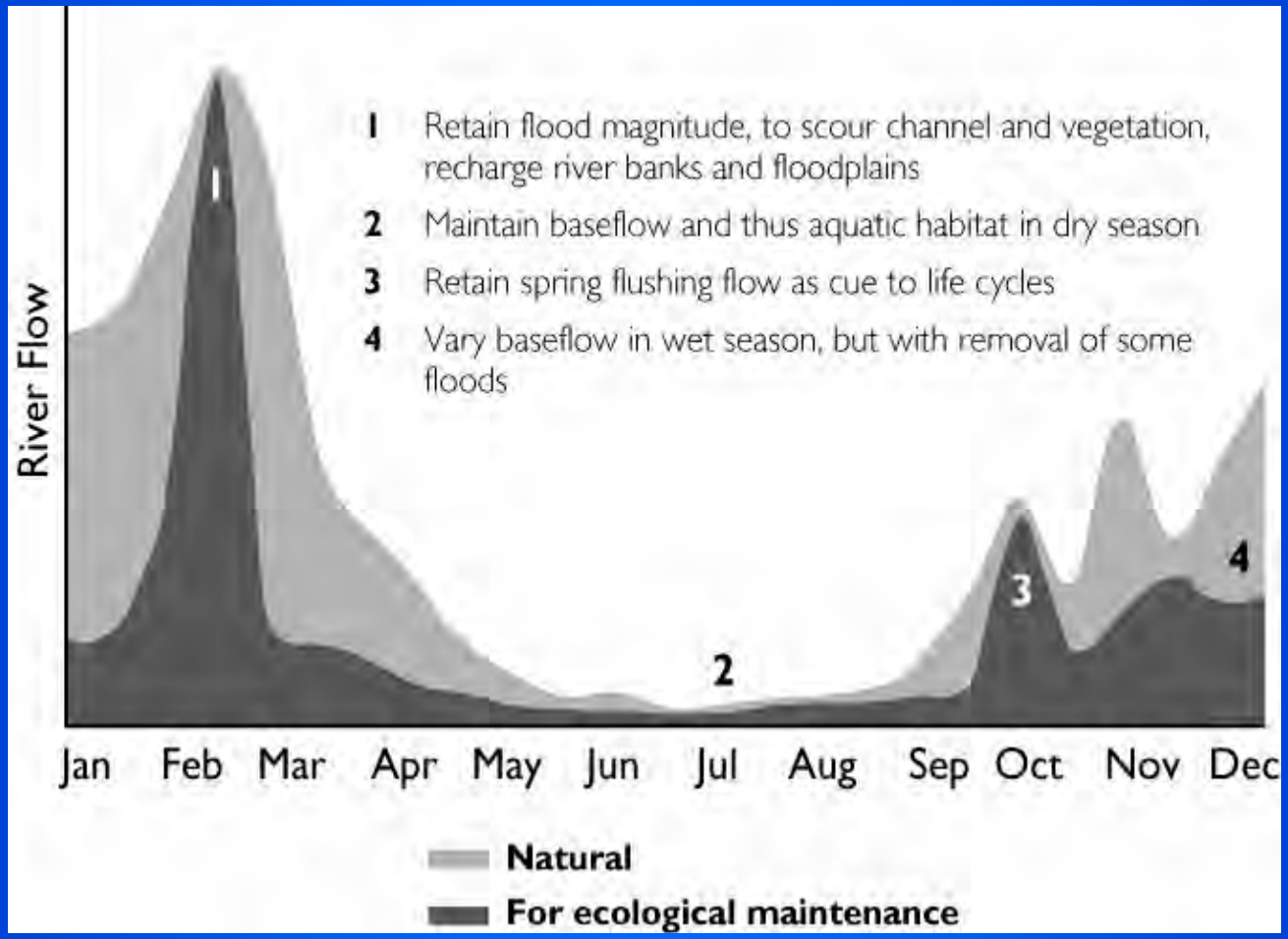
Riparian plant seeds germinate on flood-deposited sediments

Insects emerge from water to complete their lifecycle

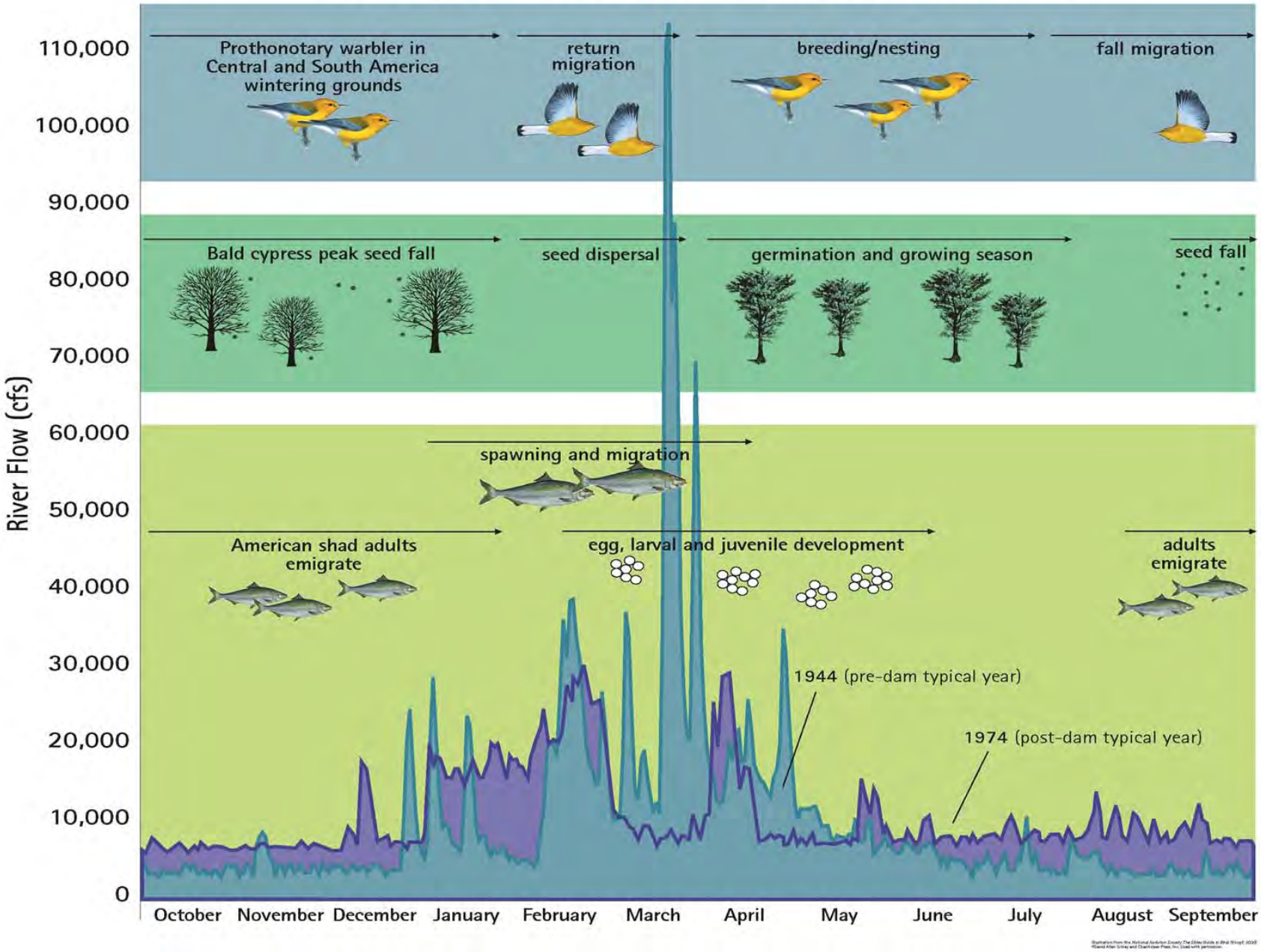
Wading birds and waterfowl feed on fish and plants in shallow flooded areas



From “Rivers for Life: Managing Water for People and Nature” by Sandra Postel and Brian Richter, Island Press


River Flow
1 Retain flood magnitude, to scour channel and vegetation, recharge river banks and floodplains
2 Maintain baseflow and thus aquatic habitat in dry season
3 Retain spring flushing flow as cue to life cycles
4 Vary baseflow in wet season, but with removal of some floods
1
2
3
4
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Natural
For ecological maintenance

Ecological Model of the Savannah River



Environmental Flow Building Blocks

Savannah River, below Thurmond Dam (*River-Floodplain*)

Floods

50,000-70,000 cfs; 2 weeks, avg every 2 yrs
- Maintain channel habitats
- Create floodplain topographic relief
- Provide fish access to the floodplain
- control invasive species
- Maintain wetlands and fill oxbows and sloughs
- Enhance nutrient cycling & improve water clarity
- Disperse tree seeds

High Flow Pulses

>30,000 cfs;5 pulses, >2 days with 2 events of 2 week duration (March and early April)

20,000-40,000 cfs; 2-3 days, 1/month
- Provide predator-free habitat for birds
- Disperse tree seeds
- Transport fish larvae
- Flush woody debris from floodplain to channel
- Floodplain access for fish
- Fish passage past NSBLD

<13,000 cfs; 3 successive years, every 10-20 years
- Floodplain tree recruitment

8,000-12,000 cfs;
- Exchange water with oxbows

Low Flows

>8,000 cfs
- Larval drift for pelagic spawners

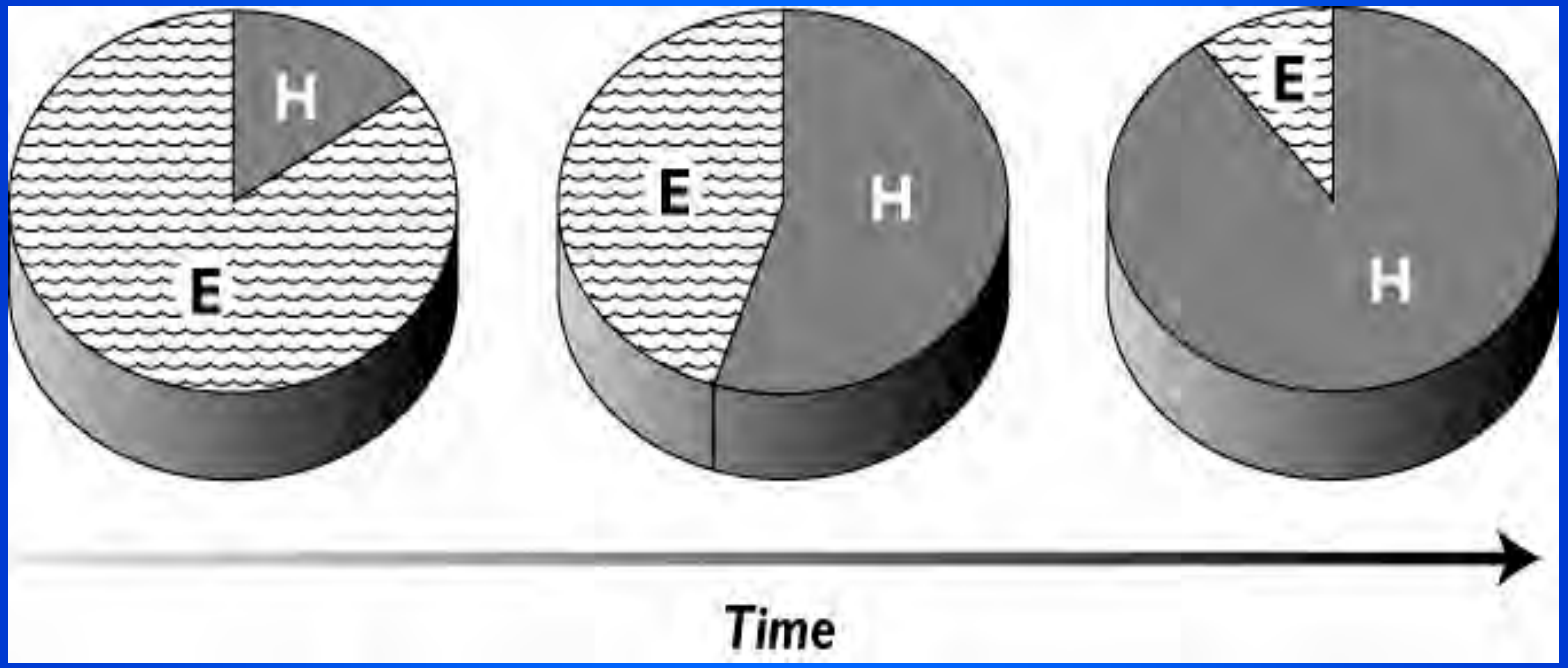
<5,000 cfs
- Adequate floodplain drainage
- Create shallow water habitat for small-bodied fish

3,000 cfs; 3 successive years every 10-20 years
- Floodplain tree recruitment

Key
- Wet Year
- Avg Year
- Dry Year

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

Traditional Approach to Water Management



E = ecosystem support
H = human use

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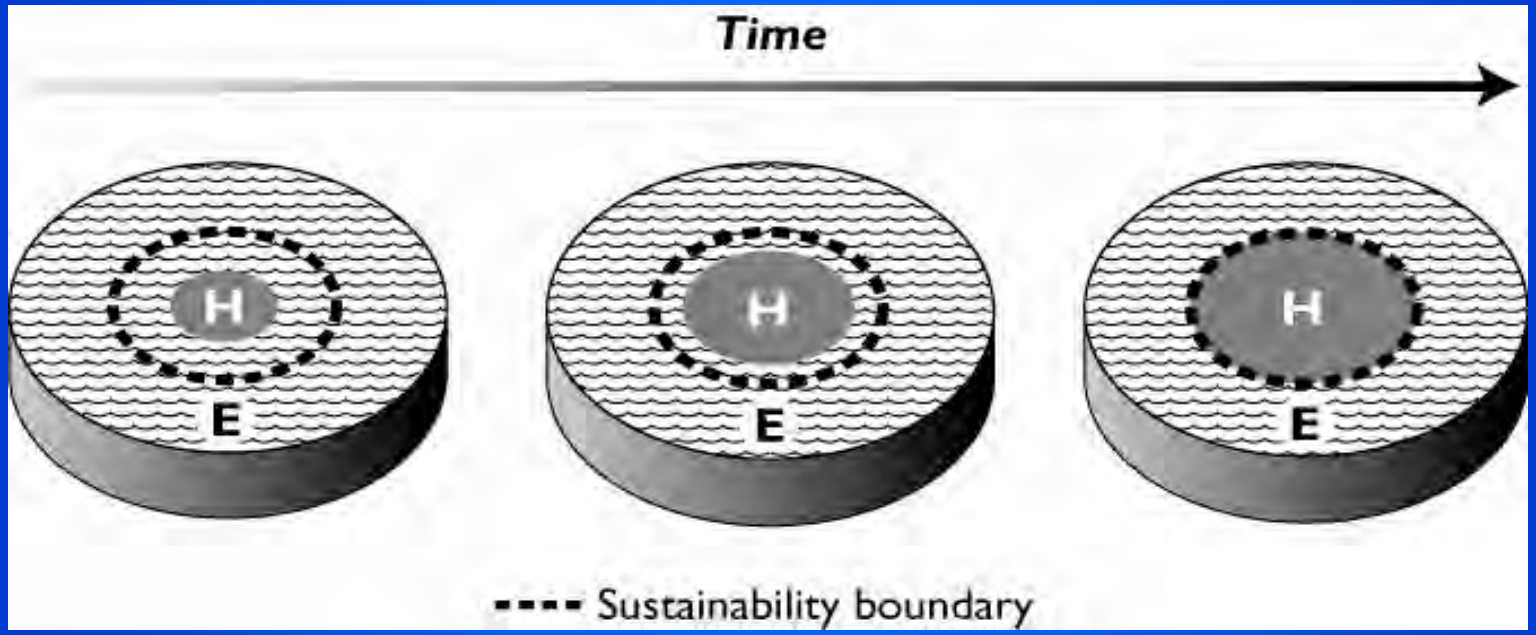
A Sustainable Approach to Water Management



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Implementing E-Flow Protection

- Urban water supplies – surface and ground water
- Dams – hydropower, flood control, water supply
- State and national water policies

For more information:

www.nature.org/freshwater