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Worldwide: Lessons Learned from Shared
Experiences (Martz Summer Conference, June
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SLIDES: Environmental Flows in the Era of 'River Anthropology'

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Session 2 Rivers and People

Improving Environmental
Water Management by
Integrating
Social and
Ecohydrological Sciences





Introduction

Environmental Flows in the Era of 'River Anthropology'

Case Studies

1. Tropical North Australia (Fitzroy, Daly, Mitchell)

Michael Douglas, University of Western Australia/Charles Darwin University, and Sue Jackson, Griffith University

2. Honduras (Patuca) and Ecuador-Peru (Marañon)

Elizabeth Anderson, Florida International University

3. Southern and Eastern Africa (Rufiji, Mara)

Rebecca Tharme, Riverfutures

4. USA

Joe Flotemersch, US Environmental Protection Agency

Environmental Flows in the Era of 'River Anthropology'

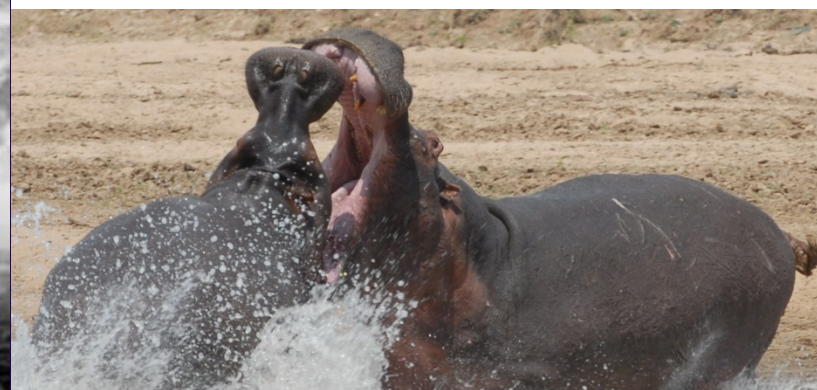
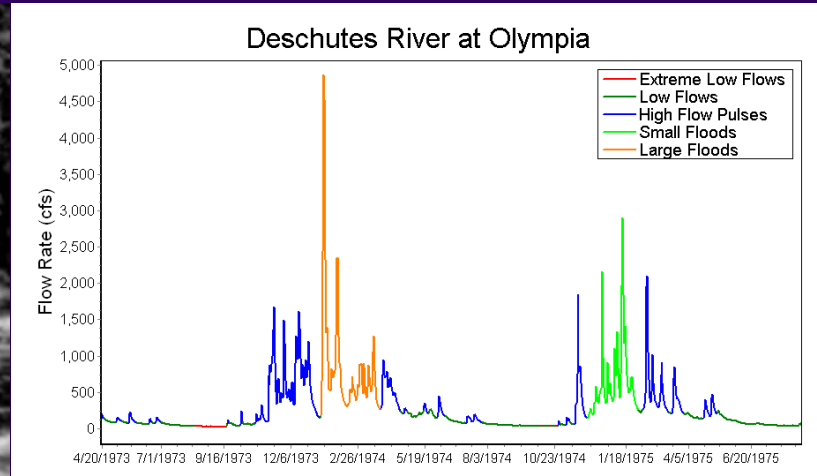
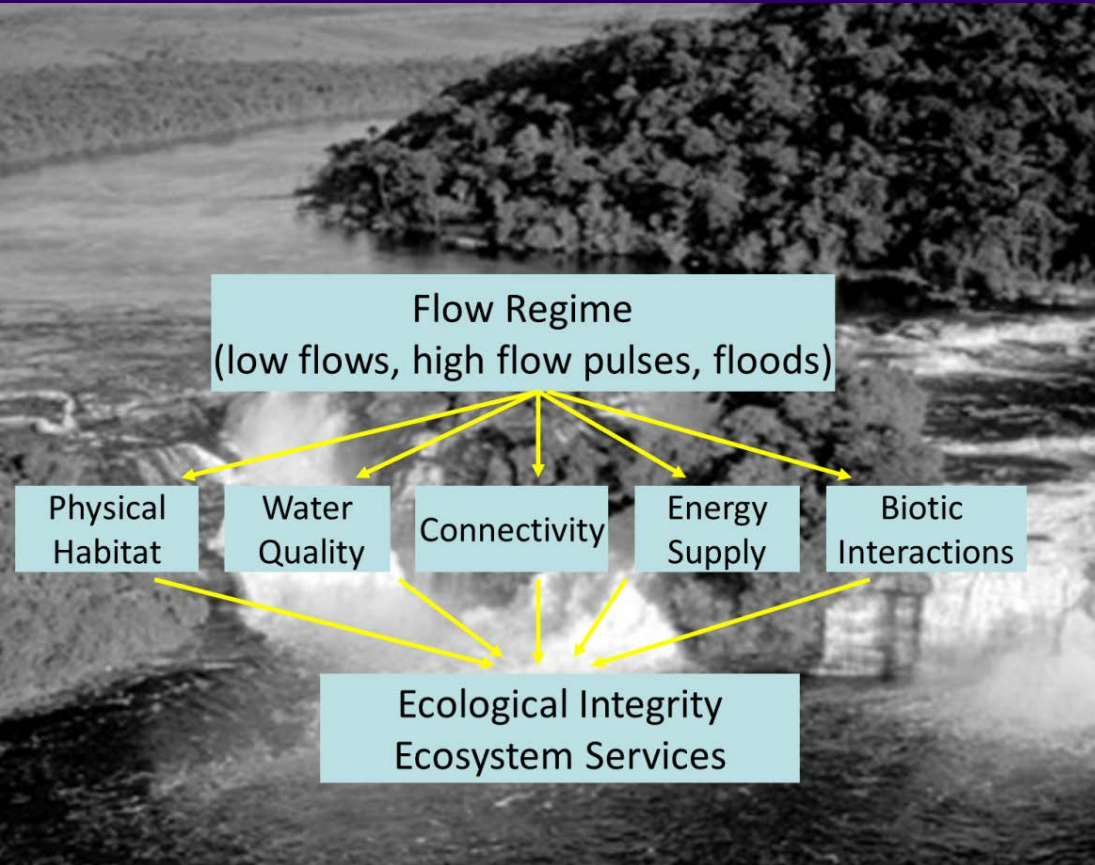
Rebecca Tharme PhD
Riverfutures



Photo © Rebecca Tharme

Rivers and People
Improving Environmental Water Management by
Integrating Social and Ecohydrological Sciences
Martz Summer Conference, Boulder, CO, USA 9-10 June 2016

Rivers as a Social-Ecological Systems



Hydrological Alteration is a Primary Driver of Ecosystem Change

Loss of river-floodplain connectivity



Presence of barriers



Altered flow pattern and timing of low and/or high flow events

Green River Below Flaming Gorge

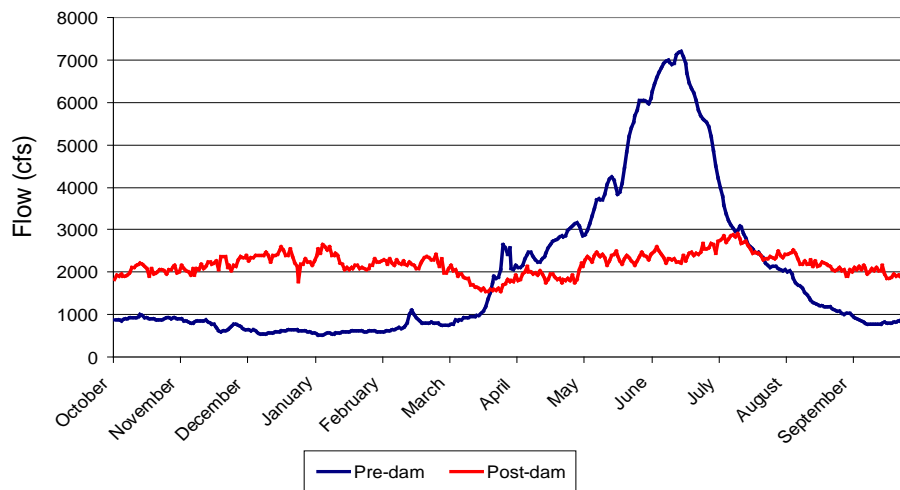
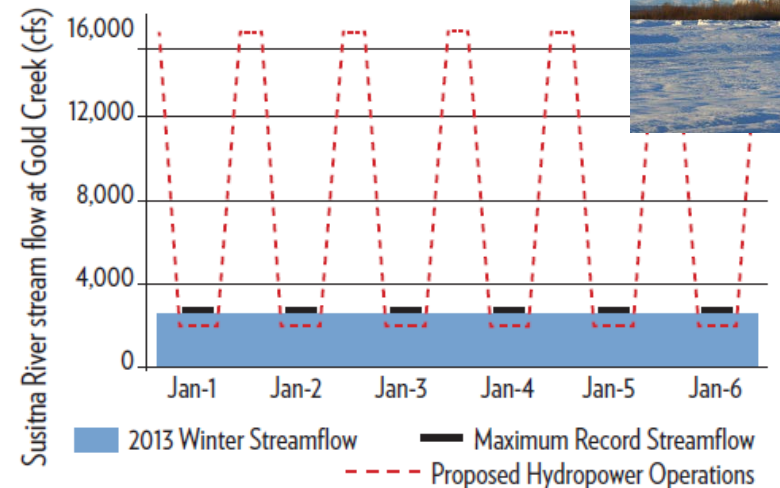
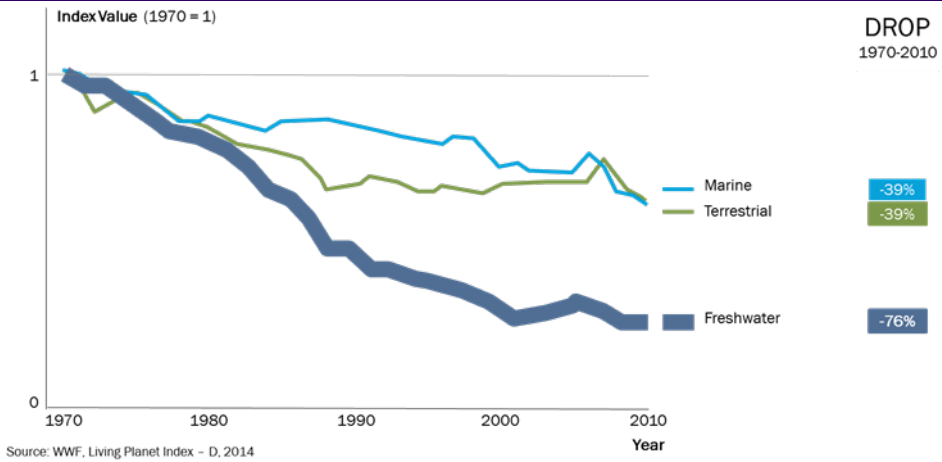


Figure 2a: Winter Streamflow



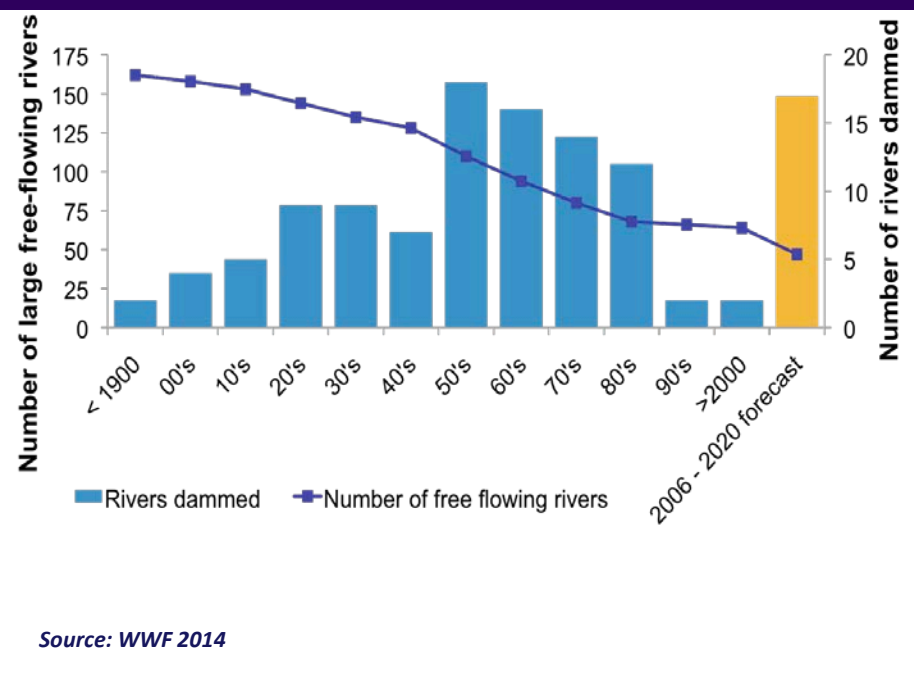
On the Decline – Ecosystem Health and Aquatic Biodiversity



- 76% decrease in populations of freshwater dependent spp. since 1970 (WWF 2014)



- Loss of free-flowing rivers
- 50% of length of all rivers with discharge > 1000 m³ s⁻¹ impacted e.g. functional network fragmentation



(Lehner *et al.* 2011)

Detrimental Impacts on Ecosystem Services Livelihoods and Human Well-being

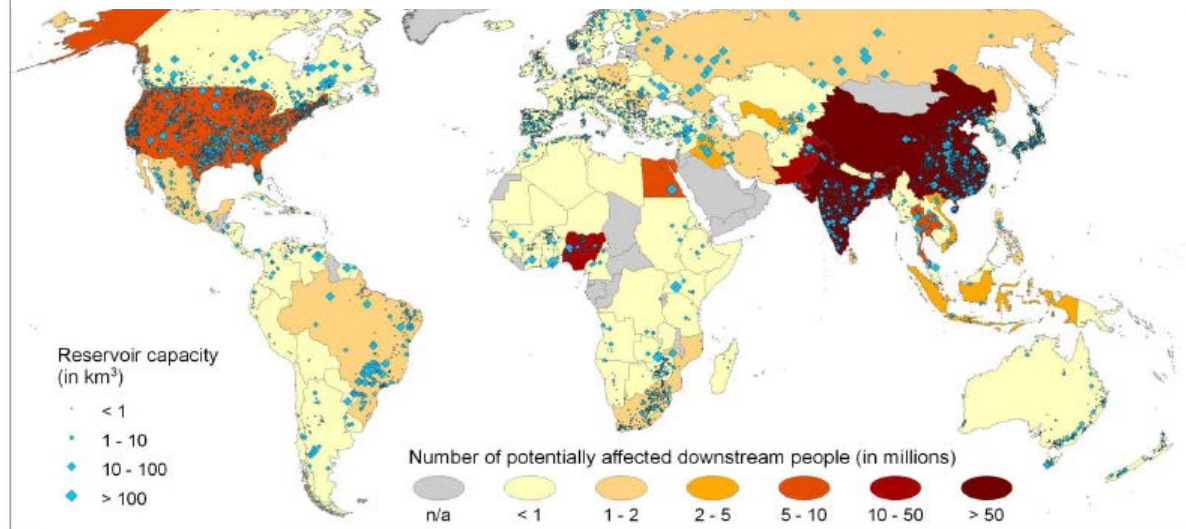
Loss of ecosystem services

- Provisioning (e.g. fish, freshwater)
- Regulating (e.g. pollution control, climate regulation)
- Supporting (e.g. sediment transport, nutrient cycling)
- Cultural (e.g. sacred sites, recreation)



Figure 6. Distribution of 'potentially affected' rural people living downstream of large dams close to impacted rivers (numbers are totals per country).

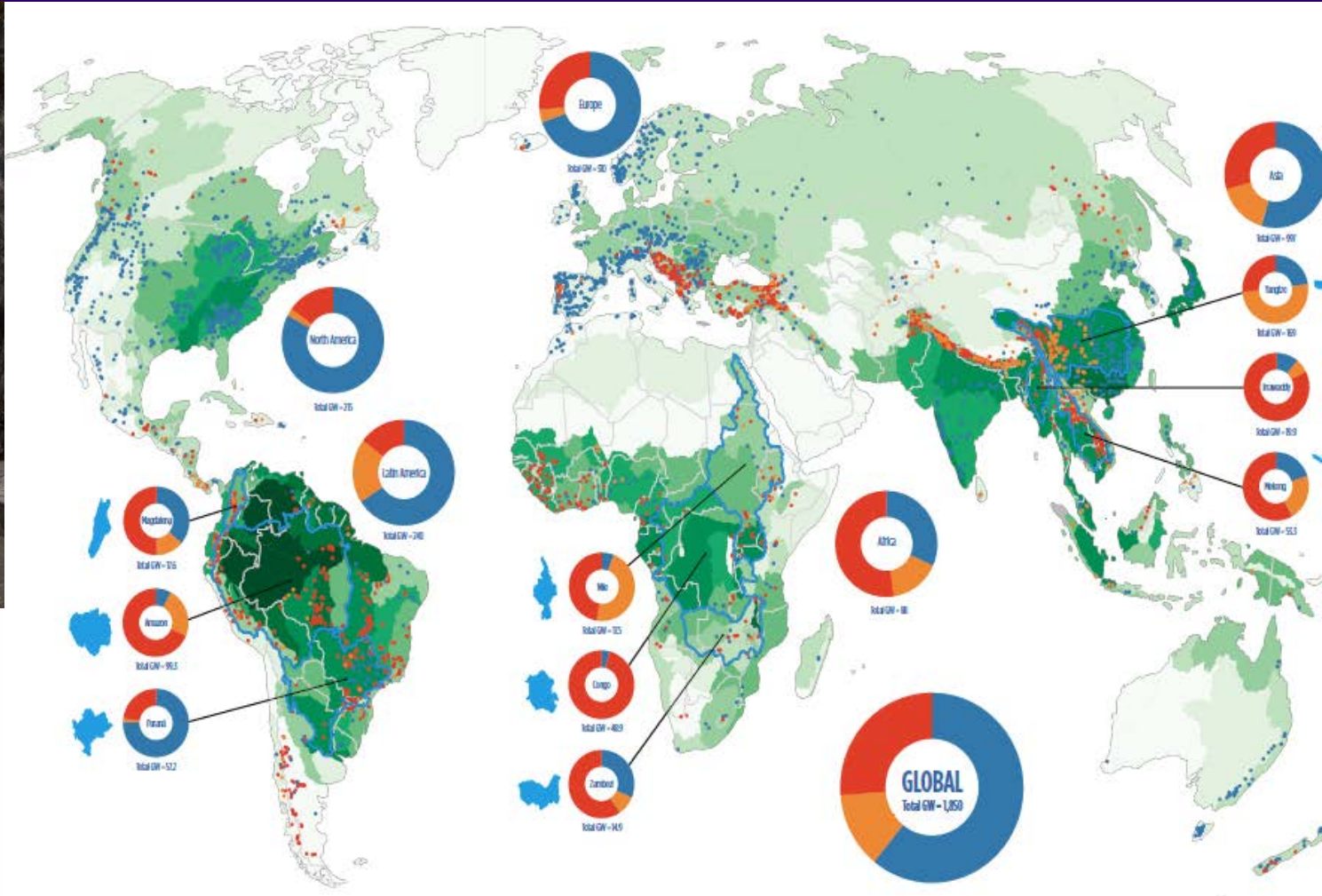
2 Billion people dependent c. 472 M impacted/at risk



(Richter et al. 2010)

Future Benefits to and Impacts on People and Nature Expected

e.g. Hydropower Expansion in River Basins



Hydropower dams

- existing
- under construction
- planned

Fish species richness

- very high
- high
- medium
- low

Basin development

- existing
- under construction
- planned

Basin Outline

a. Fish species richness from Freshwater Ecoregions of the World (Abell et al. 2008)

b. Distribution of existing hydropower dams from Global Reservoirs and Dams (GRanD) database (Lahner et al. 2011)

An aerial photograph of a river system, showing a network of channels and floodplains. The water is a mix of dark blue and green, with some areas appearing more turbid. A small boat is visible in the upper left corner. The overall scene is a natural, somewhat desaturated landscape.

Environmental Flow (E-flow)

The quantity, timing, and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and wellbeing that depend on these ecosystems.

(Brisbane Declaration 2007)

“Live in the rhythm of the waters”

(Wantzen et al. 2016 – River Culture)

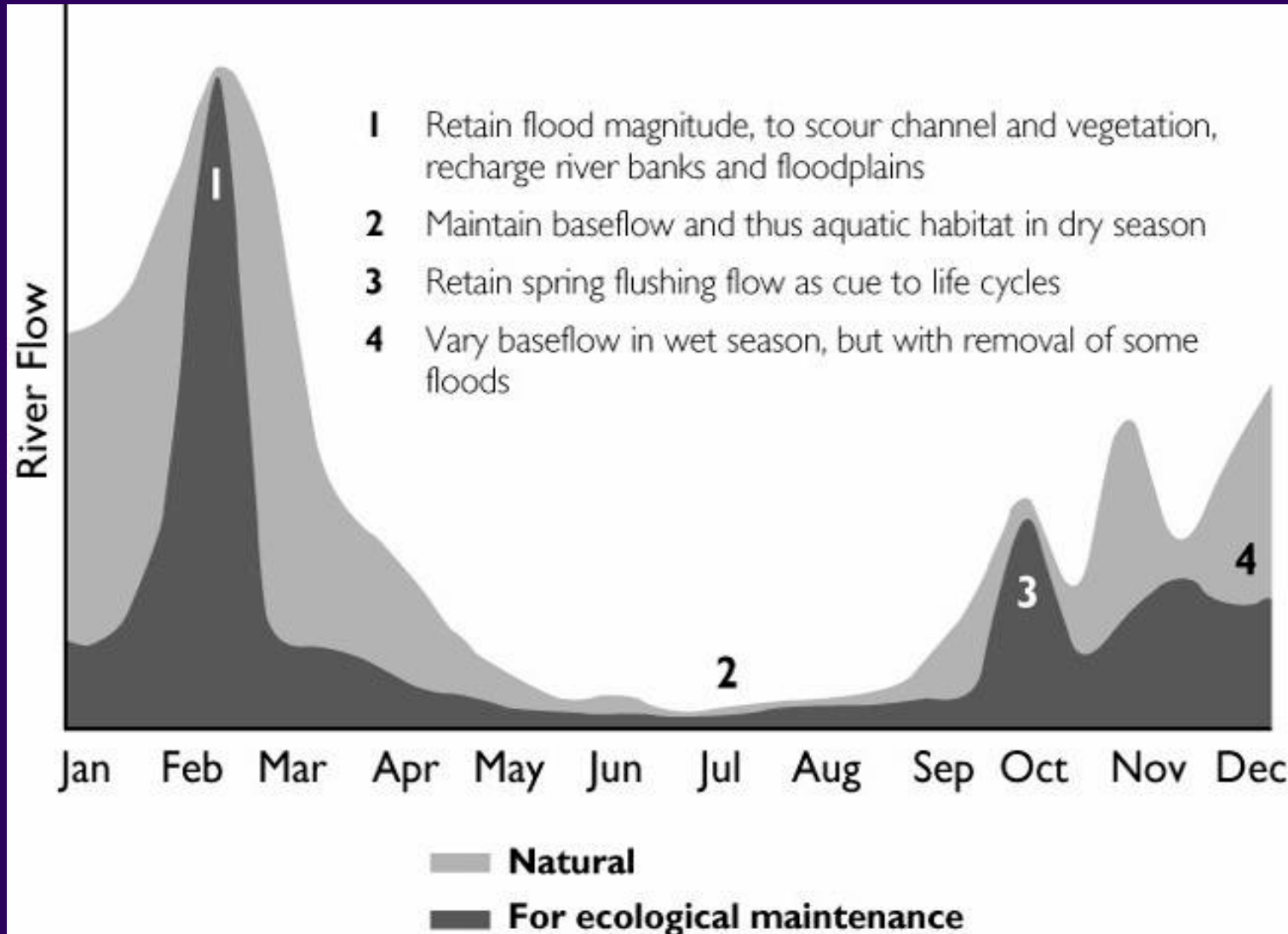
Evolution of E-Flows

(Tharme 2003, Poff & Matthews 2013)

- Engineering Era (1940s-70s)
 - Water resource development for society
 - Minimum flows for pollution dilution
- Early Conservation Era (1970s-80s)
 - Minimum flows for important fish species
 - Simple flow-index and habitat methods
- Ecological Era (1990s)
 - E-flow regimes for entire ecosystems
 - First holistic methods, some with social factors
 - Data poor contexts
- Social-ecological Era (1990s-today)
 - Integrated values for people and nature
 - Scaling up e-flows to regions
 - Scenarios and tradeoffs with stakeholders
 - Implementation and allocation mechanisms
 - Climate adaptation, novel systems and sectors



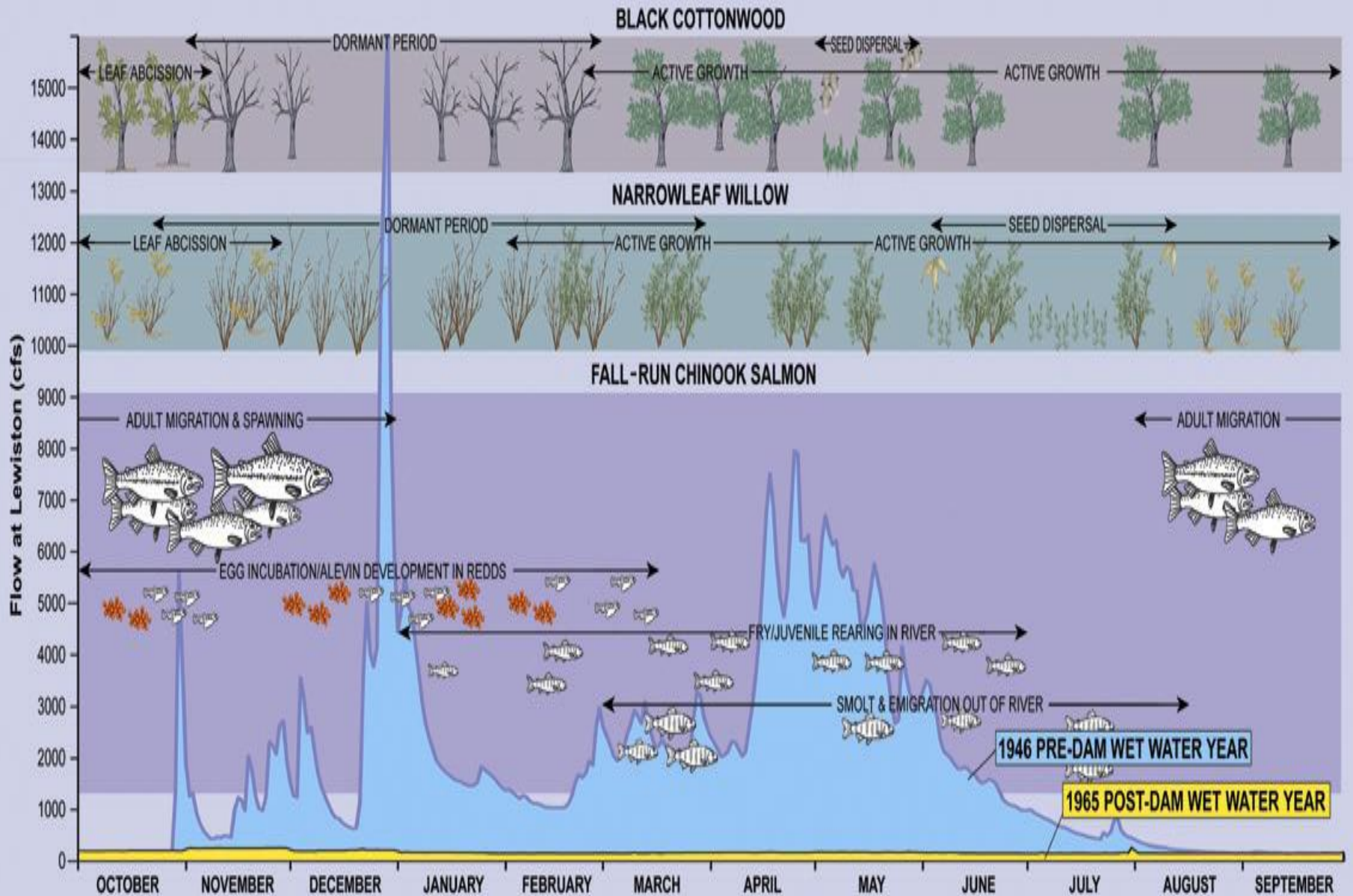
Identification of ecologically relevant flow events with supporting reasons



Interdisciplinary Specialists for Holistic Environmental Flow Assessment

<i>River flow</i>	surface-groundwater hydrology, hydraulics, water resources modelling, climate change
<i>Channel form</i>	geomorphology, sedimentology, land use
<i>Biota</i>	vegetation, fish, invertebrates, amphibians, reptiles, mammals, birds
<i>Water quality</i>	chemistry, microbiology
<i>Subsistence users</i>	sociology, anthropology, domestic water supply, public health, animal health
<i>Economics</i>	resource economics, macro-economics
<i>Process</i>	co-ordinator, international mentor

Eco-Hydrological Model for Trinity River USA



Examples of Social Sciences Integration in Environmental Flow Assessments

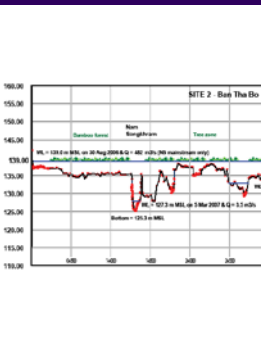
*Upper Ganges
Basin
India*

Cultural services (e.g. ritual bathing) and values, spiritual beliefs and livelihoods were major focus of Building Block Methodology application to Mother Ganga



*Nam Songkhram River
Mekong Basin Thailand*

Thai Baan research with local communities to define river-floodplain subtypes, establish flow-habitat transects, identify critical flow events and resources for people



Examples of Social Sciences Integration in Environmental Flow Assessments

Magdalena Basin Colombia

Flow-fish life cycle relationships for species important in local diets described by scientists working with communities on types of floodplain wetlands



Willamette and Penobscot basins USA

Recreation and salmonid fishery values to Tribal Nations are key elements of ongoing flow restoration, dam decommissioning and retrofitting



Environmental Flows and Social Sciences

Current Status and Where to Next?

- Concentrated on establishing and scaling up ecohydrology – exponential growth in past 15 years
- Vital social dimensions—and methods, knowledge, capacity and institutions essential to support them—weakly developed and disconnected from these efforts
- Knowledge of human dependencies on flow regimes scant and dispersed
- Few institutional bridges linking social scientists to natural scientists with e-flows expertise
- Neglected topic in international policy on sustainability in water management

BUT

Efforts to address this situation are gaining momentum





Thanks

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