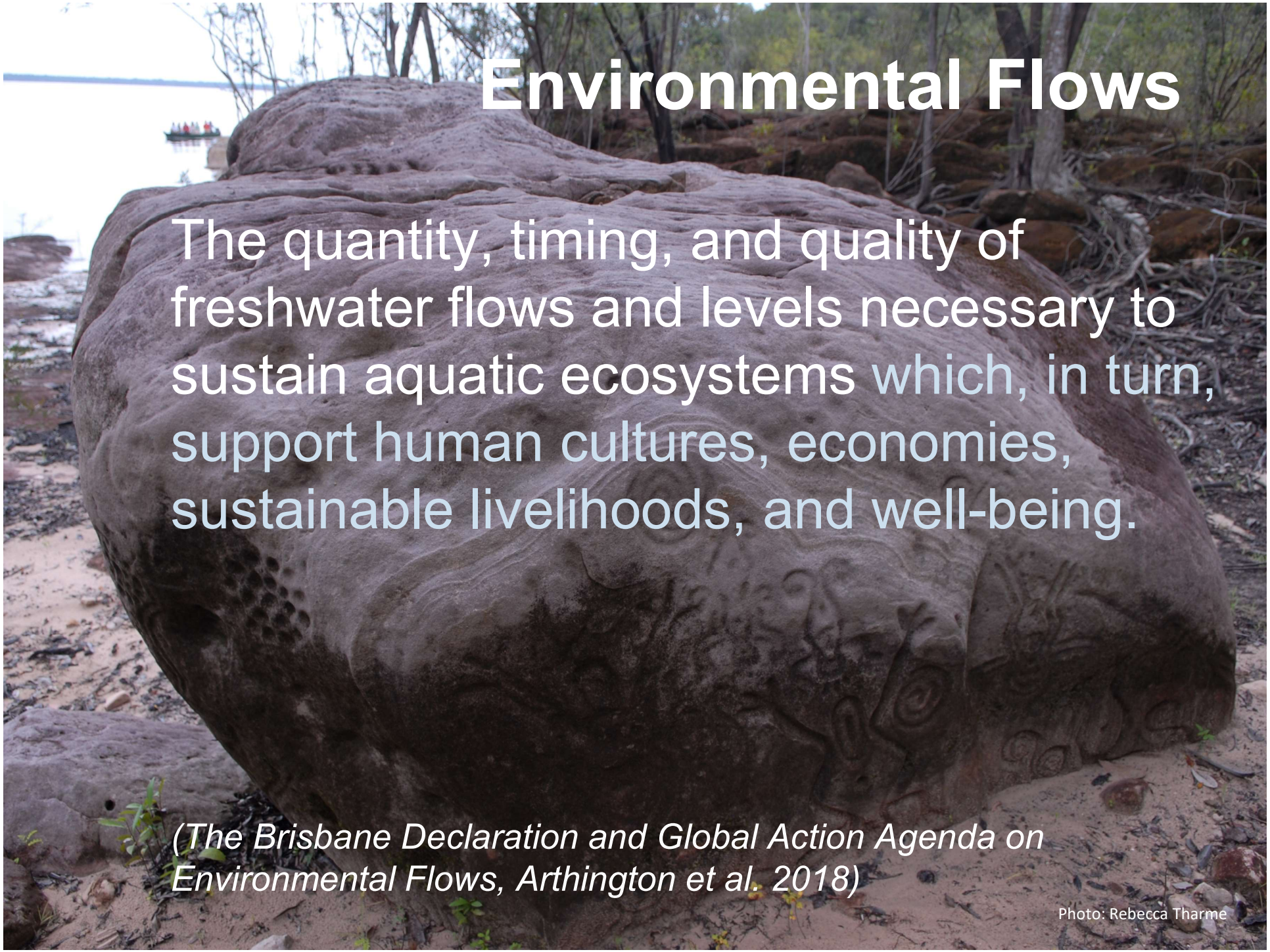
Environmental Flows in the Context of Food Security and Irrigated Agriculture

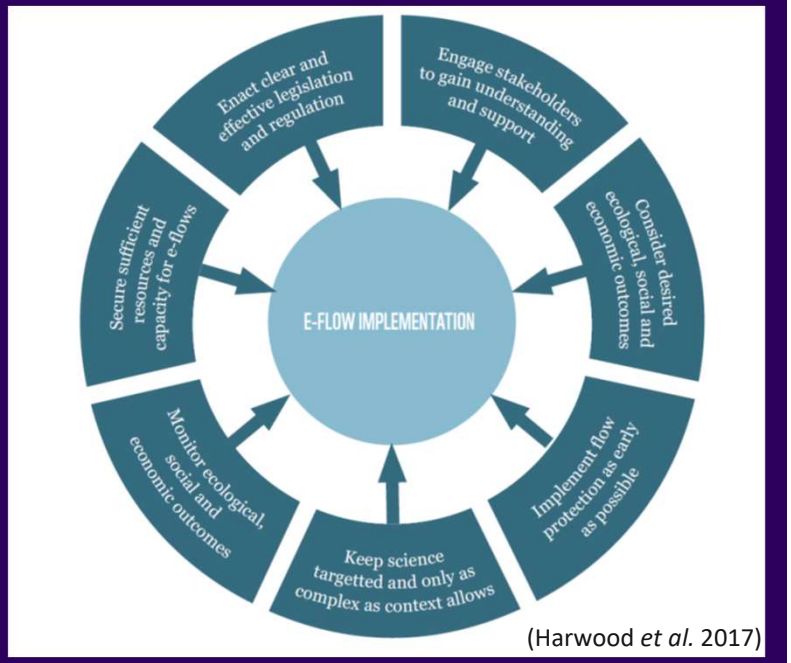
Rebecca Tharme
Riverfutures

Environmental Flow Assessments and Implementation
An International Perspective
New Delhi, India, 21 - 22 October 2019


Environmental Flows
The quantity, timing, and quality of freshwater flows and levels necessary to sustain aquatic ecosystems which, in turn, support human cultures, economies, sustainable livelihoods, and well-being.
(The Brisbane Declaration and Global Action Agenda on Environmental Flows, Arthington et al. 2018)
Photo: Rebecca Tharme

Global E-flows
Call for Action and Recommendations

- Protect and restore environmental flows (e-flows) and aquatic ecosystems for their biodiversity, intrinsic values and ecosystem services
  - As central element of integrated water resources management
  - As foundation for achievement of water-related SDGs
- Global Action Agenda (Arthington et al. 2018)
  - Guide/support e-flows implementation through legislation and regulation, water management programs, research, diverse stakeholder partnerships
  - Obstacles - lack of political will and public support; constraints on resources, knowledge and capacity; institutional barriers and conflicts of interest

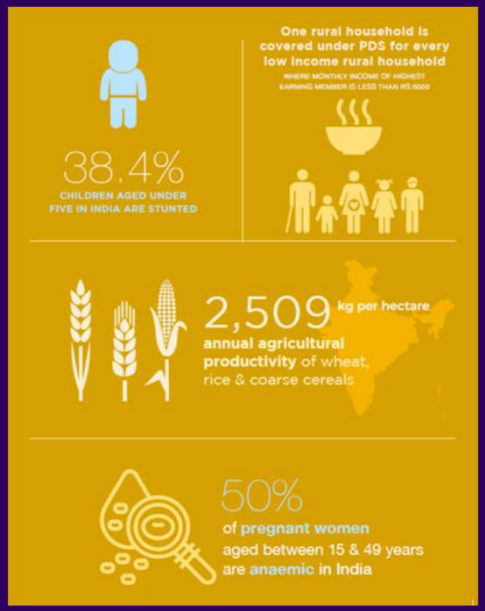


(Harwood *et al.* 2017)

Productive and Sustainable Agriculture

- Prerequisite for achieving **SDG 2 – End hunger, achieve food security and improved nutrition and promote sustainable agriculture**
- Central to SDG 1 Poverty Alleviation and to economic development
- Largest consumer of water globally at over 69% of annual freshwater withdrawals (WWAP 2019)
- > 90% of all consumptive water used for irrigation in water-scarce regions, forcing deeper assessments of values
- Higher returns on investments through sustainable intensification - benefits in crop yields, nutrition, poverty reduction and jobs, but costs for human and environmental health
- Decreasing freshwater availability and higher demand from other sectors (energy to consume 85% more water by 2035) (World Bank 2016)
- Population growth and food system changes predicted to drive allocation of more water to food production in future (Willett et al. 2019)
- Transformation of food and agricultural systems and rural revitalization to achieve SDGs (IFPRI 2019)

Transformation Towards Sustainable Agricultural Water and Irrigation Management



c. 70% of global irrigated area is in Asia

45% in China and India

(McCartney et al. 2019)

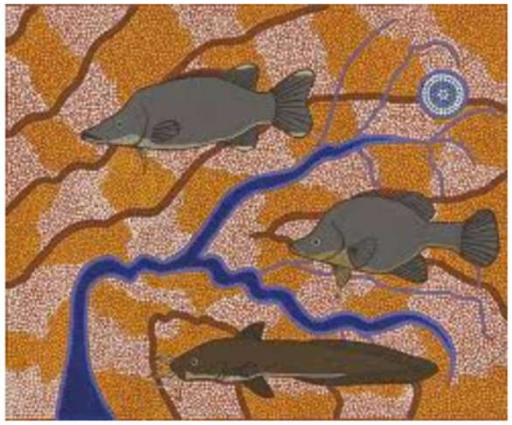
Setting Objectives for E-flows and Agriculture

- Water ecosystems are social-ecological systems – detrimental impacts of flow alteration, system fragmentation and biodiversity loss - on ecosystems and people
- Environmental water allocation - a values and objectives-based negotiated decision to share water with agriculture and other sectors - with socioeconomic and political consequences

Economic Values

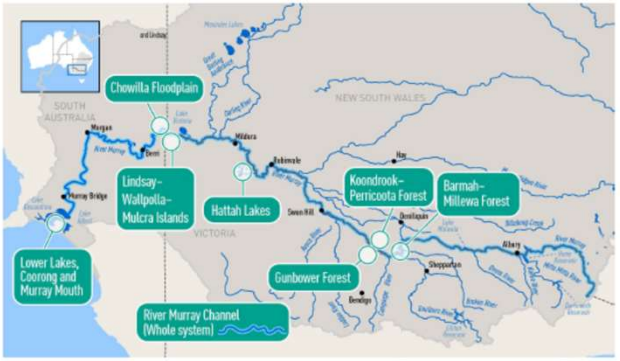
Markets to allocate water efficiently and contribute to economic growth

Cultural Values



A Confluence of Cultures and Meanings

Environmental Values



Environmental assets underpinning a healthy river

Murray-Darling Basin, Australia. Source: Dustin Garrick, Oxford University, 2017

E-flows Support Food Production and Other Ecosystem Services

Stakeholder priorities for Kilombero River-Floodplain, Tanzania

- Rufiji Basin institutional stakeholders - biodiversity conservation
- Local communities - production services for subsistence livelihoods and local economy (flood recession agriculture, water for domestic uses)

Major household economic activities along river

Crop farming 93-98 %

Fishing 33-48%

Livestock keeping 28-44 %

All activities highly dependent on a functionally intact and dynamic river flow regime, including the flood pulse

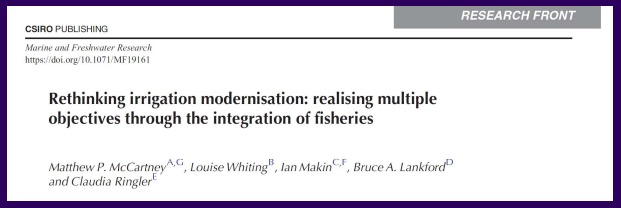
Irrigation Modernisation

- Past focus on improving and upgrading infrastructure and operation to increase irrigation performance – optimising crop production
- New emphasis on broader remit to realise multiple objectives

  Level of intervention
  - Command area (area of existing system)
  - Extended command area (incl. waterbodies that are or could be connected)
  - Whole catchment (incl. allocation)
  - National (policy)

(McCartney et al. 2019)

e.g. Framework for fisheries integration at different scales


RESEARCH FRONT

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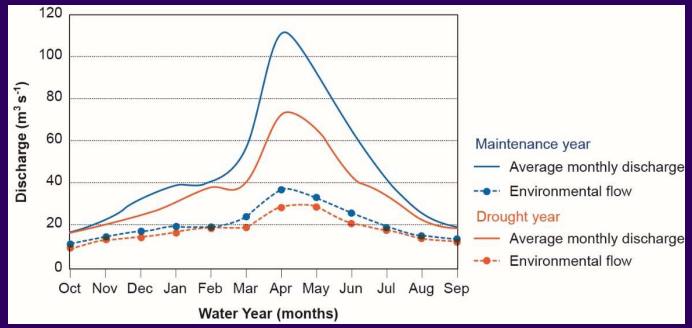
Rethinking irrigation modernisation: realising multiple objectives through the integration of fisheries

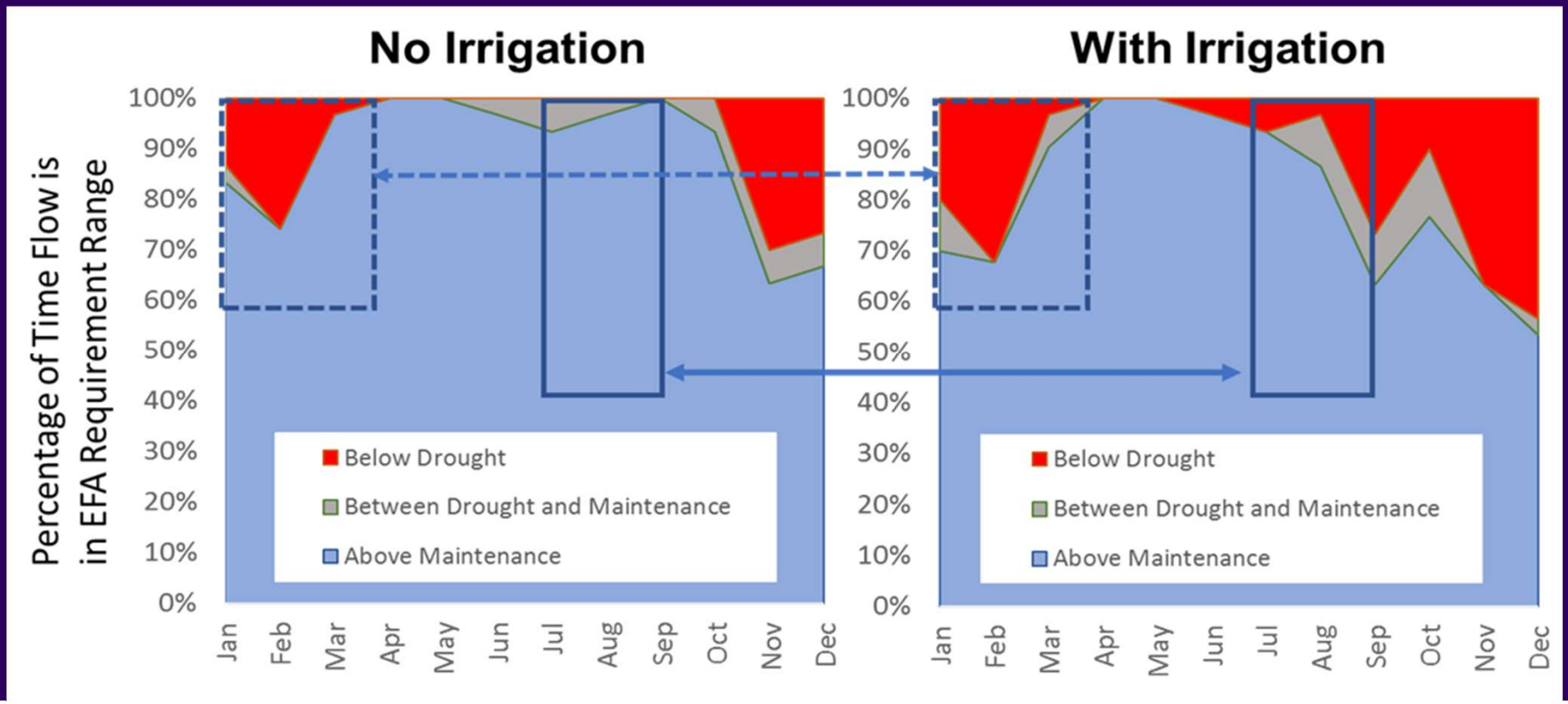
Matthew P. McCartney[A,G], Louise Whiting[B], Ian Makin[C,F], Bruce A. Lankford[D] and Claudia Ringler[E]

Operational Allocation of Water to E-flows and Irrigation

- Calculation of e-flows and operational rules for sector water use
- Trade-offs in meeting recommended e-flows and potential irrigation allocations under maintenance and drought conditions
- Irrigation scheme redesign

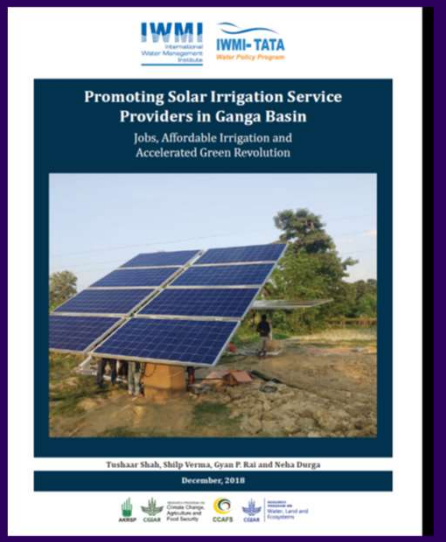


Lwipa River, Kilombero SubBasin, Tanzania (CDM Smith 2018)

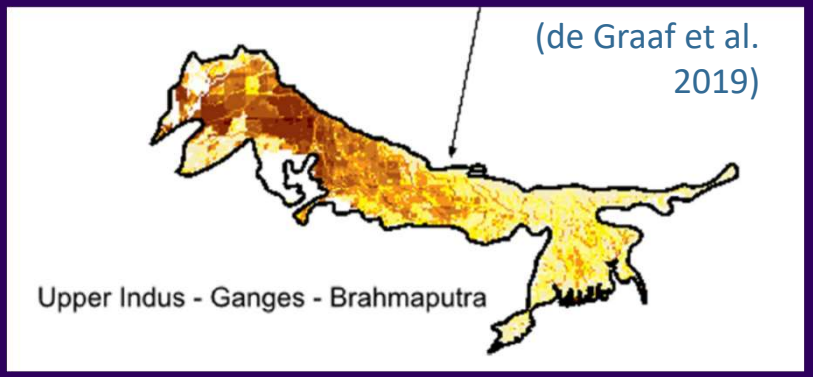


Agricultural Groundwater Use

- World's largest freshwater resource and critical for irrigation (70% of GW use) and food security
- Use of groundwater for irrigation promoted and increasing in India - e.g. solarisation of GW pumping
- India extracting GW *c.* 56% faster than it can be replenished
  (Rasul and Sharma 2016)
- By 2050 e-flow limits will be reached for 42 - 79% of basins with GW pumping worldwide (de Graaf et al. 2019)
  - Generally occurs before significant GW storage losses experienced
  - Basins already over-exploited – depletion of SW and GW
- Negative impacts on rivers and other GW-dependent ecosystems

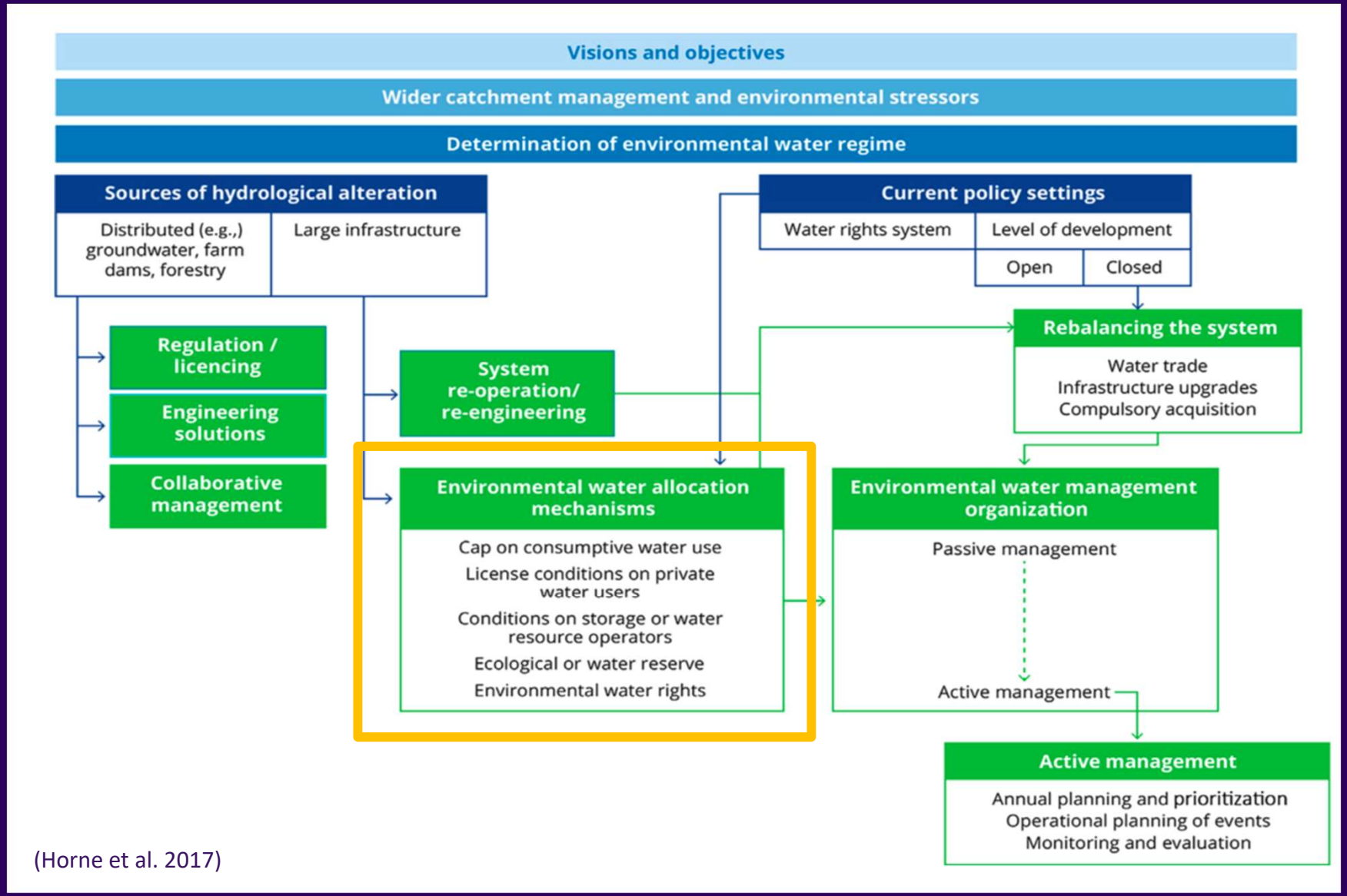


GW depletion hotspot



Water Resource Planning and Management Across Sectors

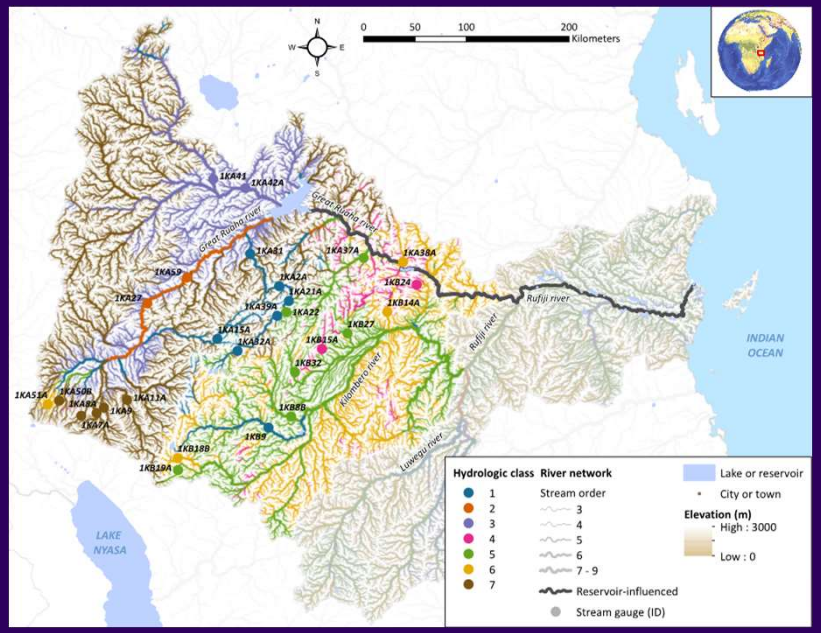
Options for Securing Environmental Water Needs

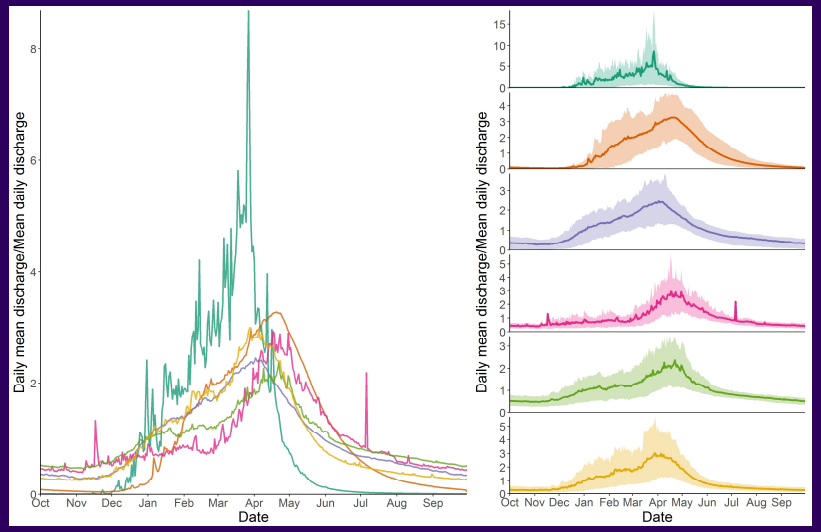


(Horne et al. 2017)

Scaling Up E-flows

Agro-Ecosystem and Infrastructure Typologies





Agricultural Response Options and Best Management Practices in E-flows Context

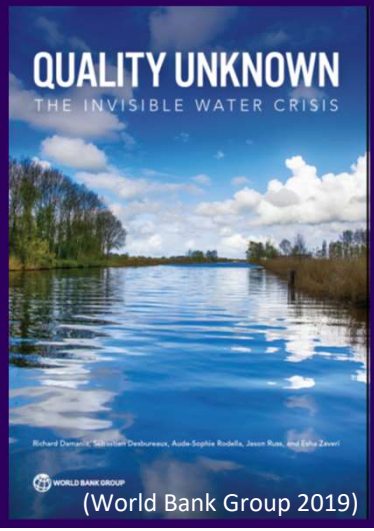
- Shifts in crop types and use of high yield varieties
- Irrigation scheduling and targeted agrochemical application
- Water productivity increases and real-time assessment - water accounting and footprints
- Multiple use and ‘eco-agri-food systems’
- Irrigation efficiency - reallocation of water savings to the environment
- Infrastructure design, operation and modernisation
- Source water protection and land BMPs
- Water stewardship and alliances
- Digital water technology – smart design, use and control

Photos: Rebecca Tharme

Water Quality and Water Quantity Interrelationships

- Water quality is a component of e-flows assessment – synergistic effects
- Diffuse agricultural pollution – negative human and ecosystem health impacts
- Annual national costs of water pollution from diffuse sources exceeds billions of dollars each year in OECD countries alone
- Cumulative pollution impacts of different economic activities requires improved water quality policies and management
  e.g. valuing different types of water and resources they contain (reuse, not disposal)

Complementary and well aligned with approaches to e-flows



(World Bank Group 2019)


Thank you
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