

**Water
management and
the environment
in India – can
outside
experience help?**

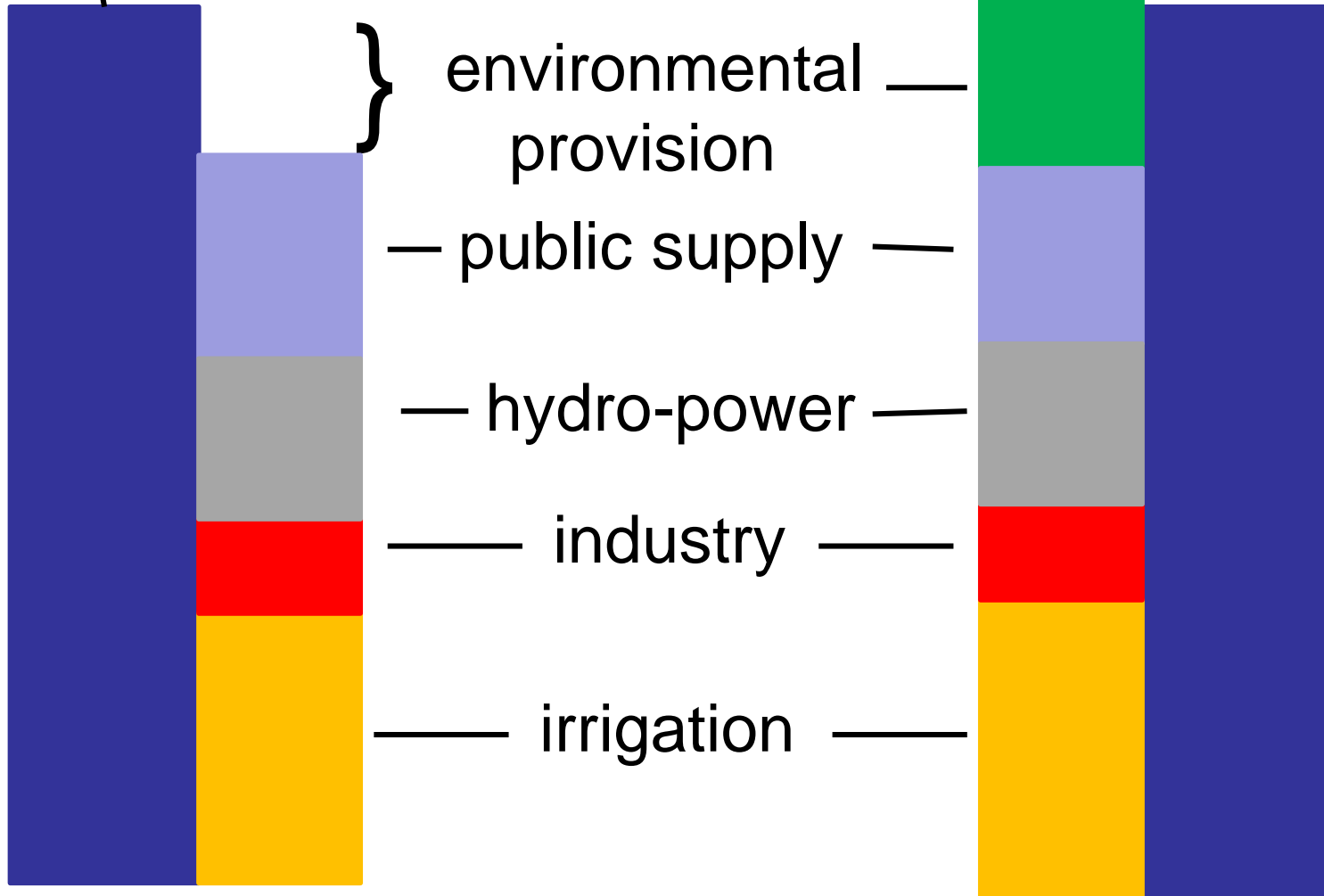
Mike Acreman



Managing water allocation

water resource

over allocation



Local livelihoods

Fish for fisheries



Grass for cattle

Fertile soils and
natural irrigation



Biodiversity

- Nature conservation
- Biodiversity (e.g. river dolphins)



Cultural services

Family/community
history

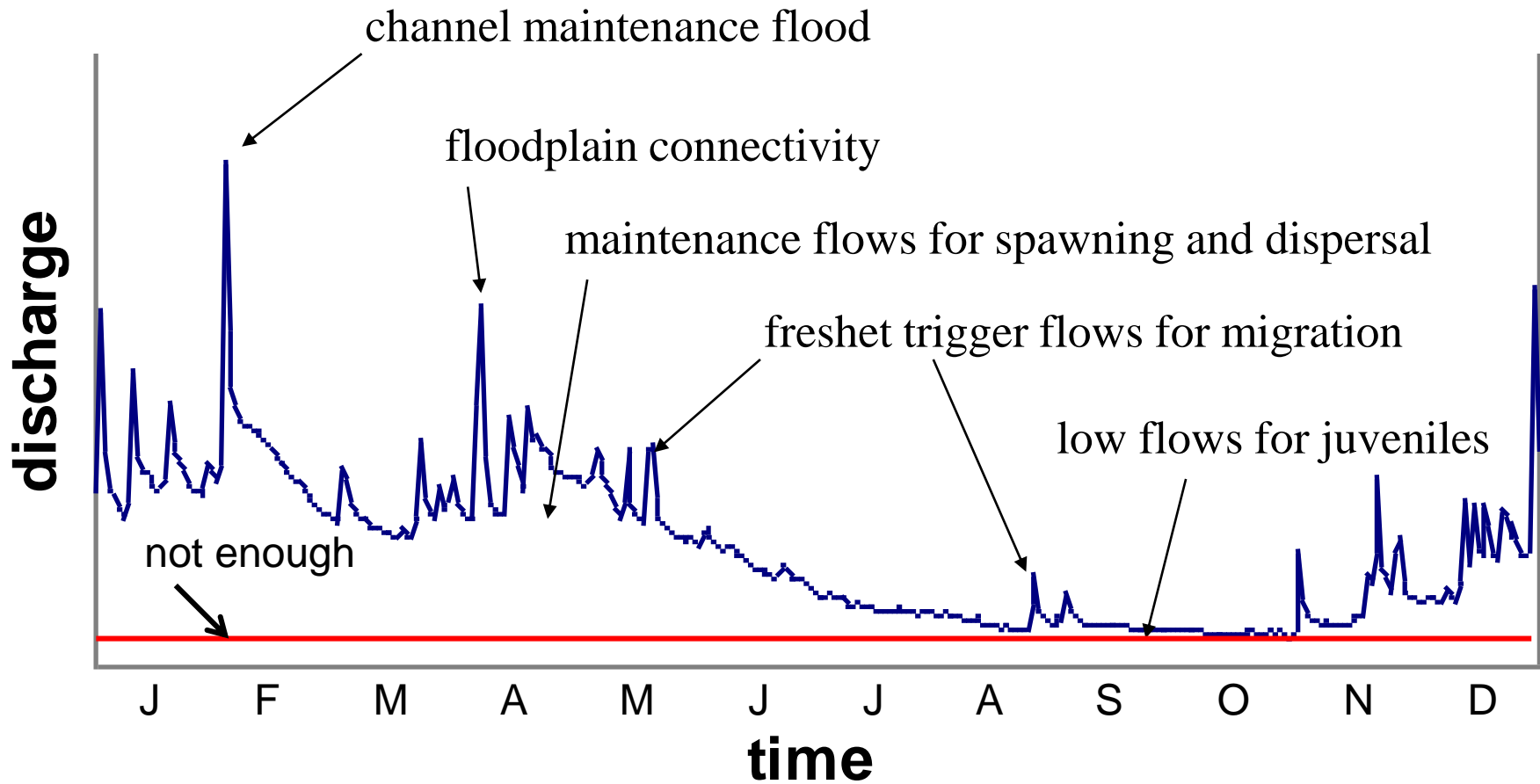
Spiritual/religious
connection

Tourism

Quality of life



Why is the whole flow regime important?



All aspects of the flow regime are important for some element of the river ecosystem

Environmental flows

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

Brisbane Declaration 2007



6. Sustainable water management

- **6.3** improve water quality ... reducing pollution ... chemicals ... untreated wastewater
- **6.4** ensure sustainable withdrawals ...
- **6.6** protect and restore ... ecosystems ... forests, wetlands, rivers, aquifers, lakes

How much water does a river need?

- No single answer
- Over 250 methods
- Big questions

What sort of river do you want?

What are the pressures on the river?

What will the future bring?



Objective-based flows

- **Conservation objective**
 - maintain nature character
e.g. Ramsar site

- **Ecosystem service objective**
 - Maintain depth for river festival

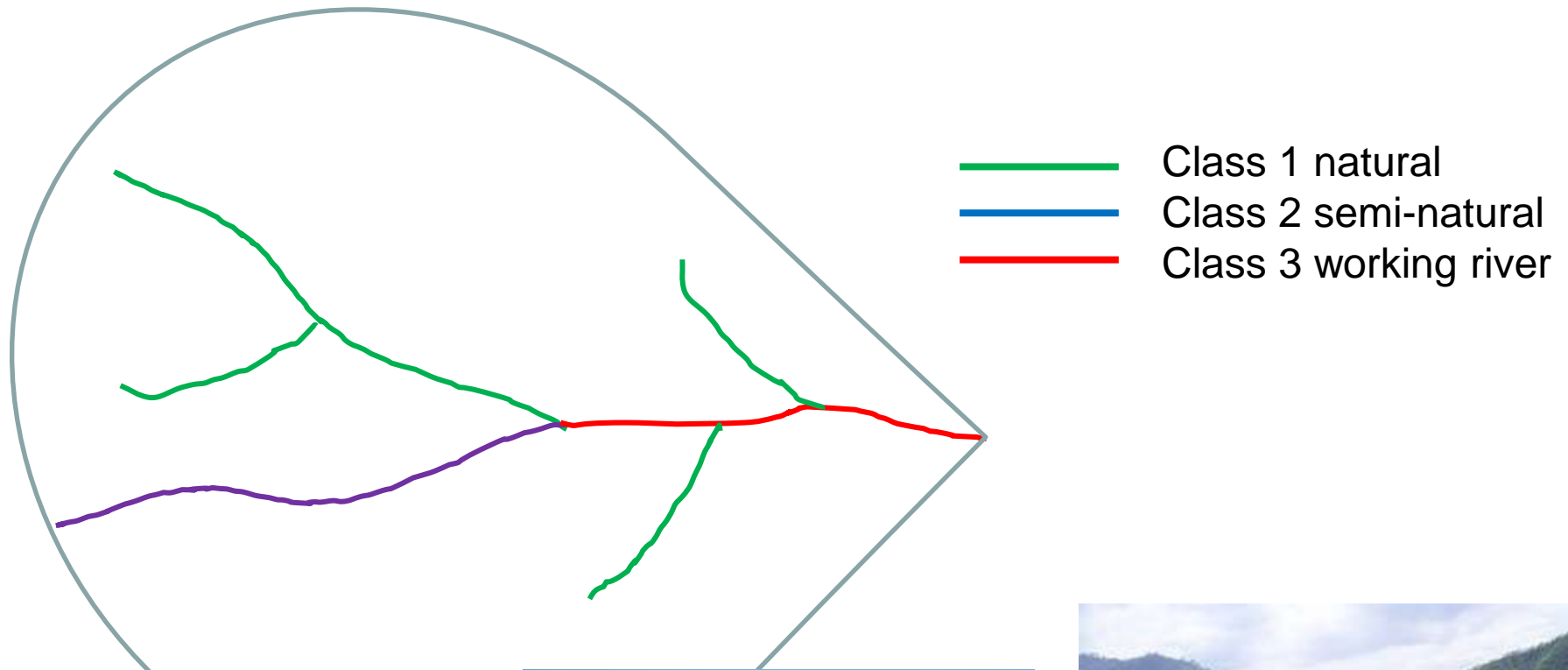


Scenario-based flow setting

- **No pre-set objective**
- **Stakeholder participation**
 - awareness raising
 - local community action
- **Trade-off between water uses**
 - economic value
 - political decision



River management classes



Lateral connectivity

Flood pulse
concept

Linking the river to
its floodplain
wetlands

Exchange of
species, carbon,
nutrients

Human well-being



Longitudinal connectivity

River continuum concept

Dams disrupt continuum

Need to release water and sediment downstream

Allow fish and other species to move upstream



What can be learnt from elsewhere?



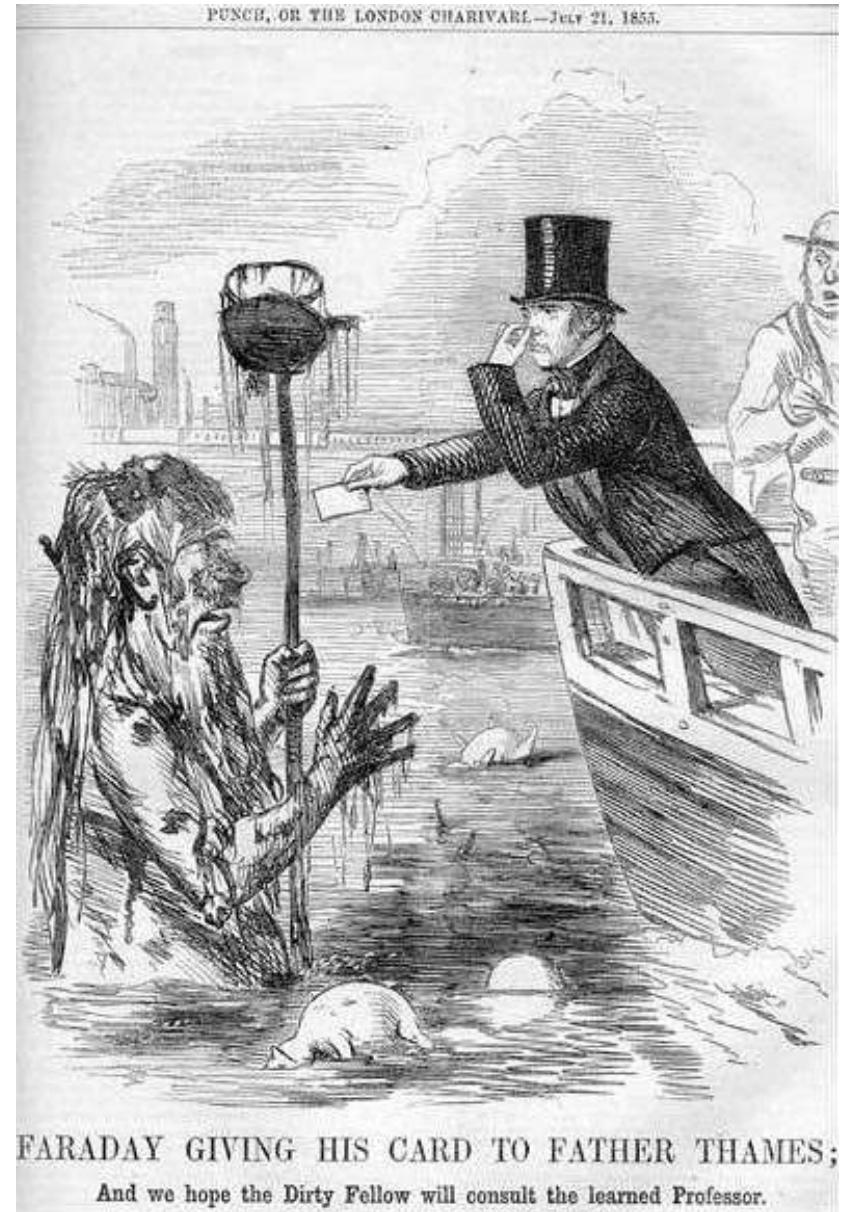
Thames basin
10,000 km²

650 mm rainfall
15 million people

significant water stress
recycled 7 times

The River Thames 1858

- The Great Stink
- Smell of Thames - untreated human waste and effluent
- Parliament suspended
- Prompted sewerage



The River Thames 2008

- Fishing, boating, swimming
- Spiritual re-connection
- Eco services restored e.g. water purification
- 2010 Winner of International Theiss River Prize



150 years of work



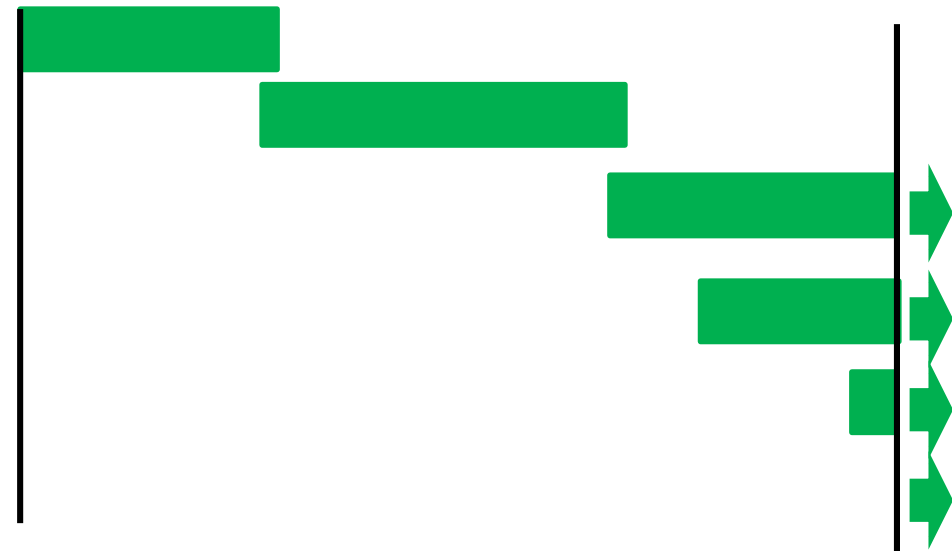
Clear long term vision
A journey with people

Key steps

sewerage installed
industrial pollution control
environmental flows
nutrients (P stripping)
nano-particles, oestrogen
water trading

1865

2015



What sort of river do you want?



natural
10,000 BC



golden age
1821



recent past (when I was young)

European Water Framework Directive

Reference Conditions



Ecological Status

(nearly) totally undisturbed
slight alterations
moderate alterations
major alterations
severe alterations

High
Good
Moderate
Poor
Bad

OK



measures
needed



can't do

Good Ecological Potential

Realistic objectives



- 2000 years of management
- Important heritage
- Protected for managed habitats
- Natural conditions not desirable



Solutions in Thames

Clear vision through participation

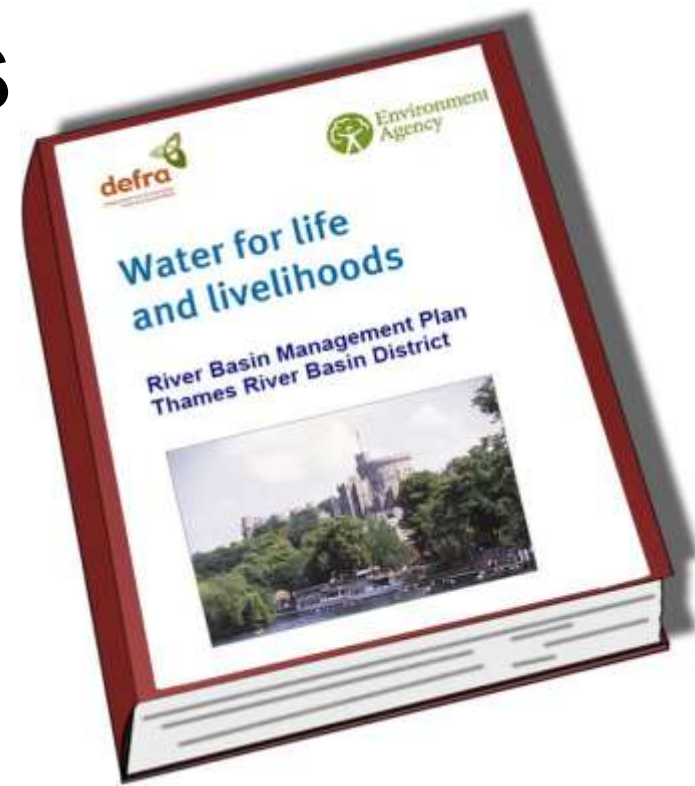
Water provision for London

Ensuring water is returned to the river; good quality

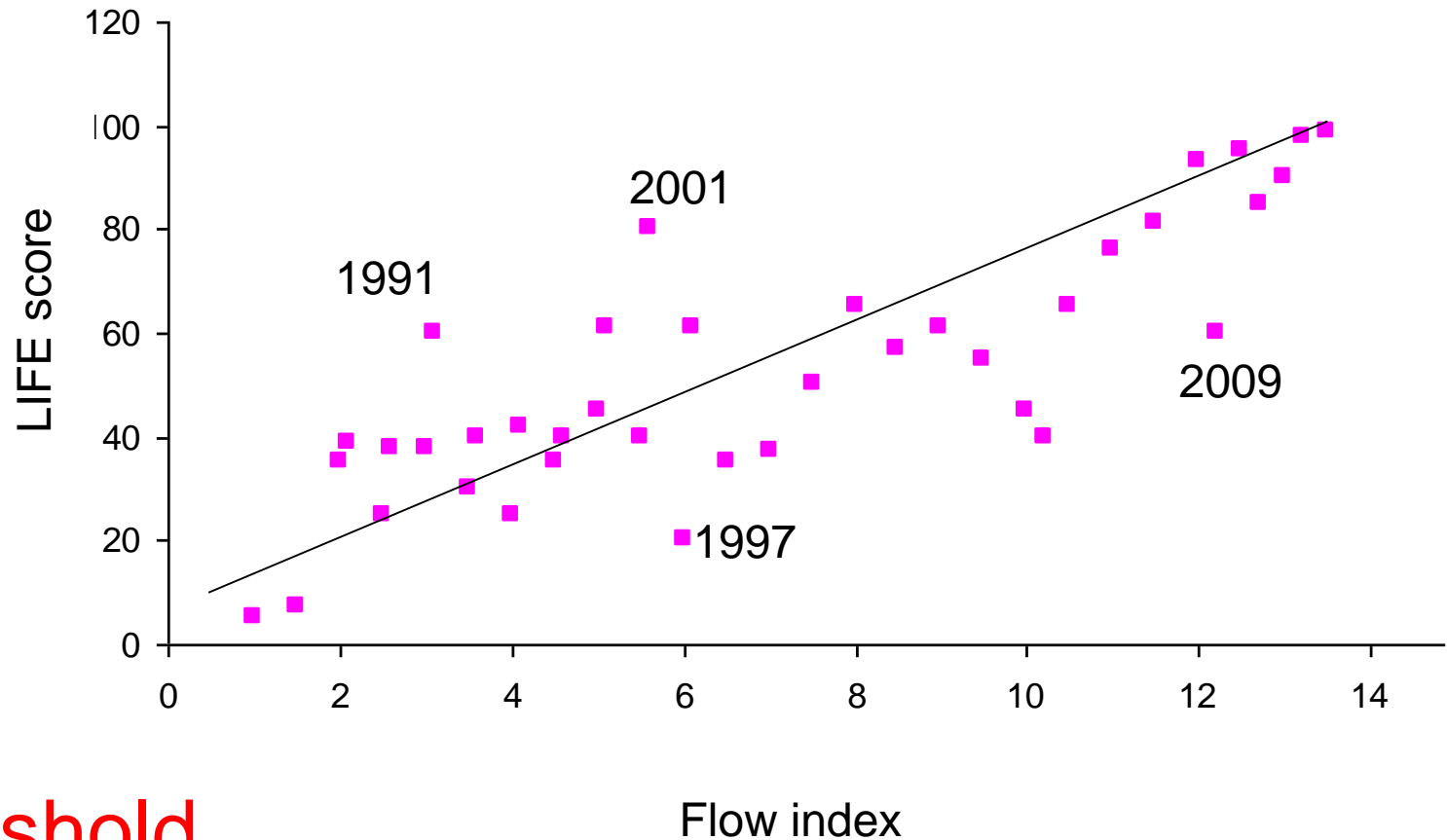
Restoring floodplains for multiple benefits

Connectivity through barriers (fish passes)

Good data to assess options



No substitute for good data

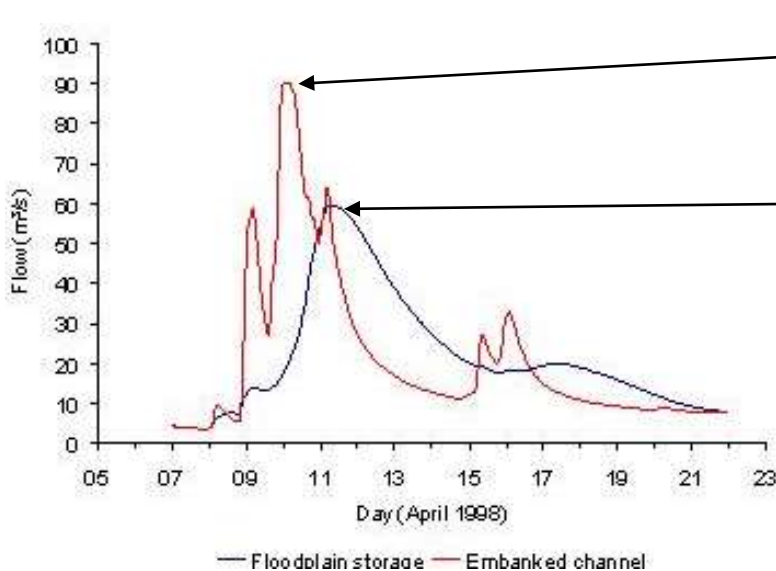


No threshold

Flow index

Studies of ecosystem services

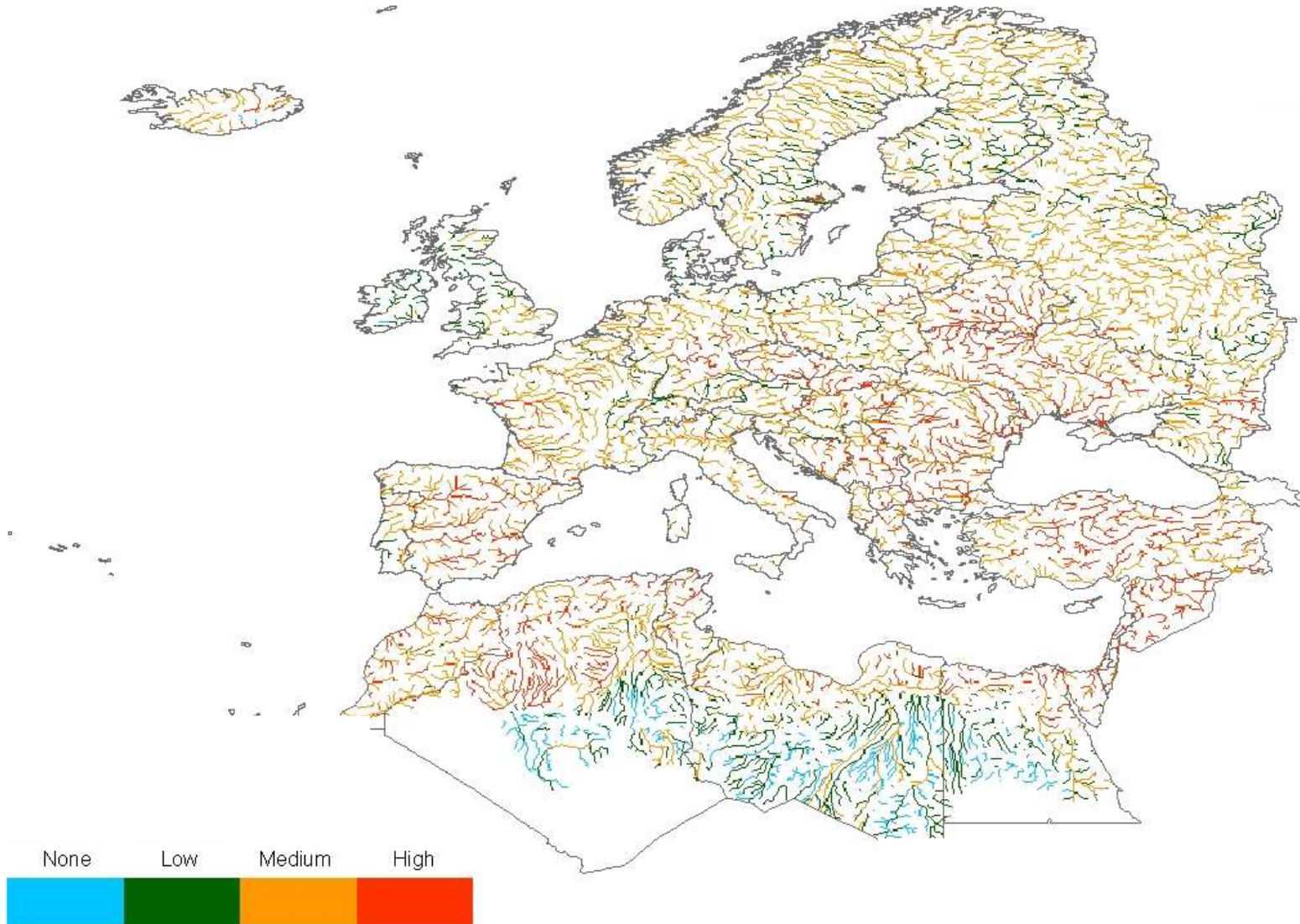
Floodplain wetlands control floods



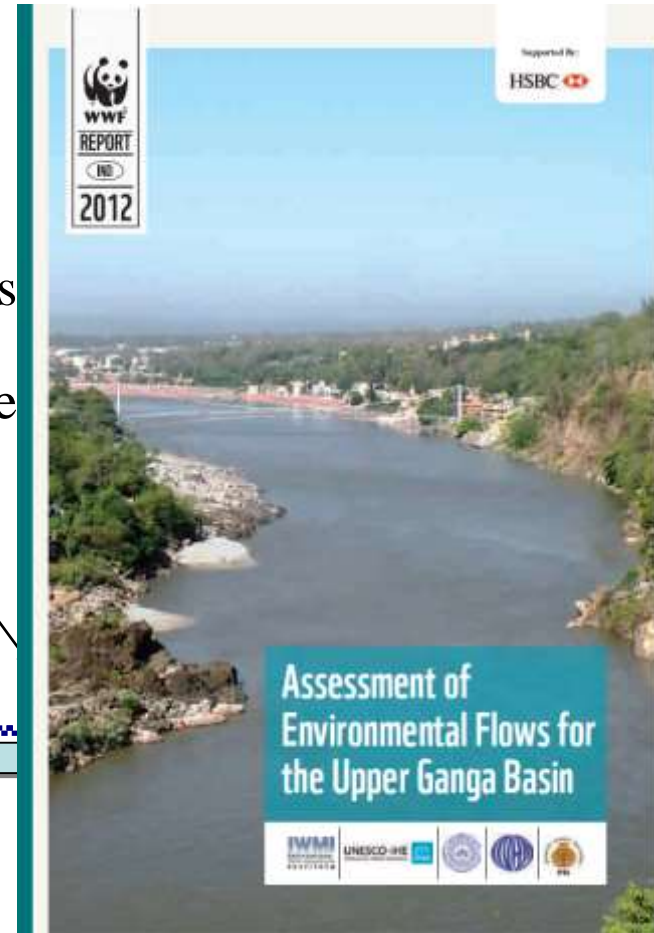
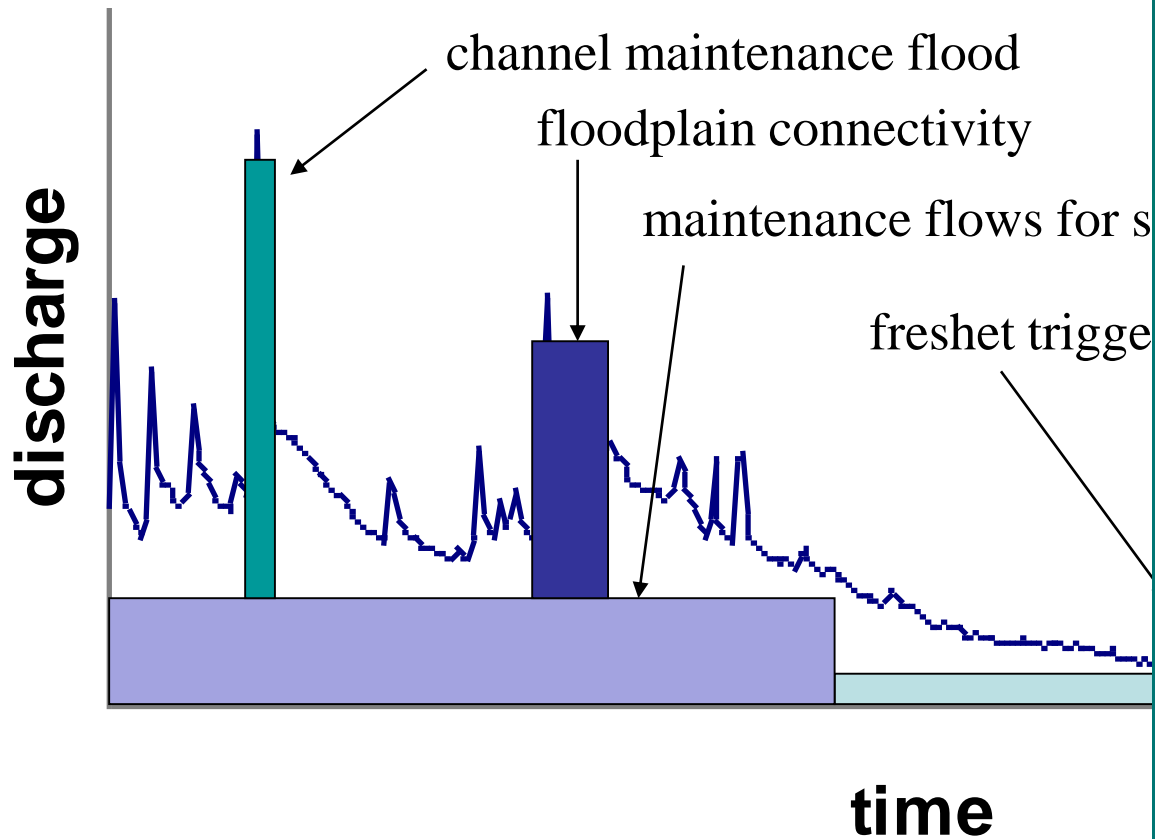
with no floodplain

1998 flood flow Oxford

Assessment of future risk ecological impact from hydrological alteration



E-flow methods releases from dams



Quantity – magnitude, timing, duration, frequency
Quality – temperature, sediment

Logone floodplain, Cameroon



- Maga dam led to reduced floodplain inundation
- Loss of eco services to local community
- Environmental flow releases made
- Value of fisheries, grazing, water resource
- € 1.4-2.7 million per annum
- Better than natural conditions?



Integrated management



dams

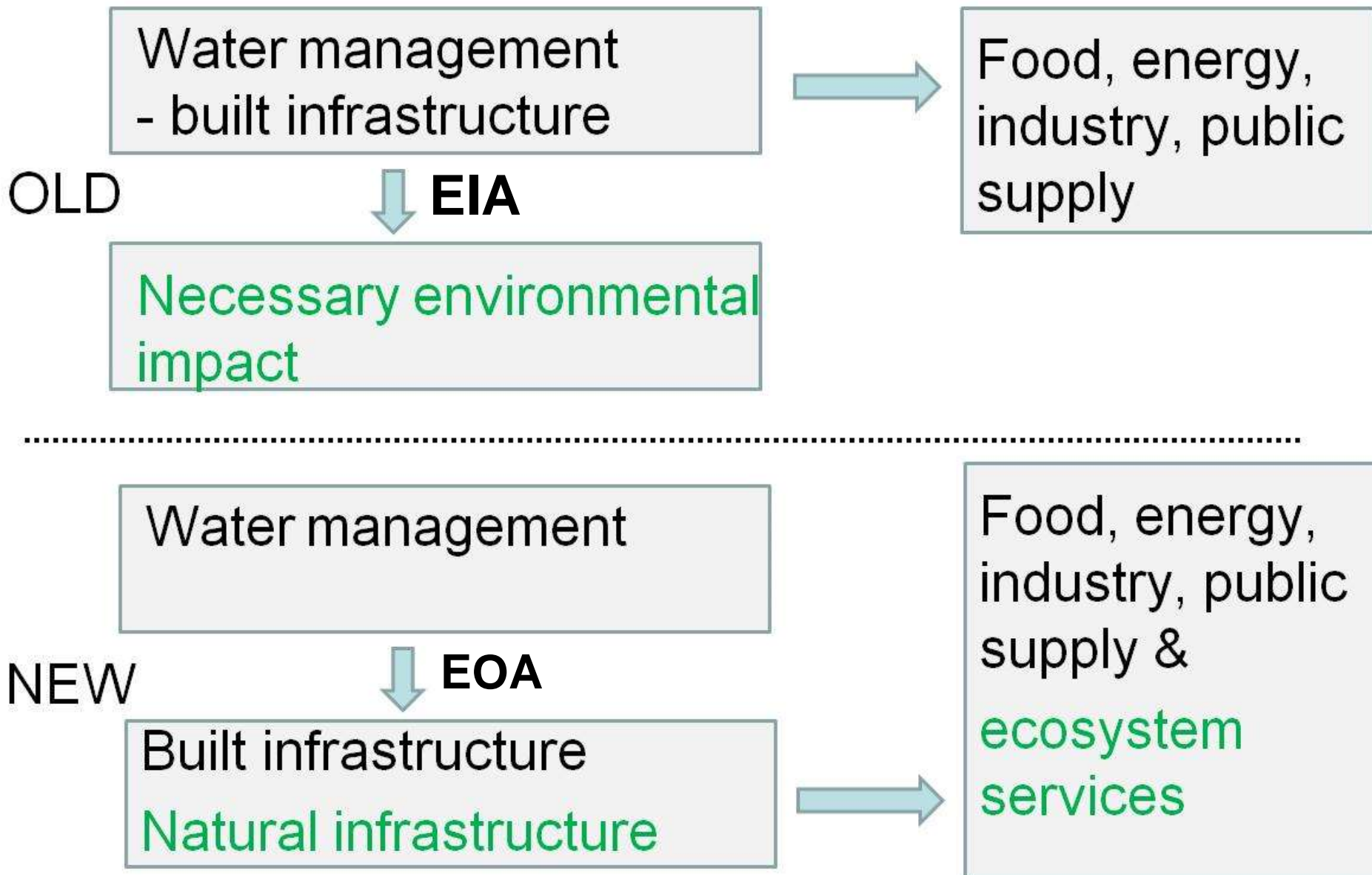


embankments



barrages















































Paradigm change



River Ganga - Environmental flow Scorecard

Scoring progress and prioritising future activities in Ganga environmental flows

- 1) Delegates placed green dots to show how much progress has been made in the environmental flows
- 2) Delegates placed gold dots to show where priorities should be in developing environmental flows in the future

Future priorities	themes	progress 				
		Not yet considered	Initial thinking completed	Practical aspects considered	Some aspects in place	Fully operational
	Definition of e-flows for India					
	Options analysis and planning to include e-flows					
	Aims and objectives of e-flows					
	Centralised coordination of e-flows					
	Public engagement on e-flows					
	Training in e-flows methods					
	Research, data collection on e-flows					
	Centralised e-flows knowledge base					
	Preliminary e-flows assessments using desktop methods					
	Implementation of e-flows					
	Monitoring e-flows outcomes	