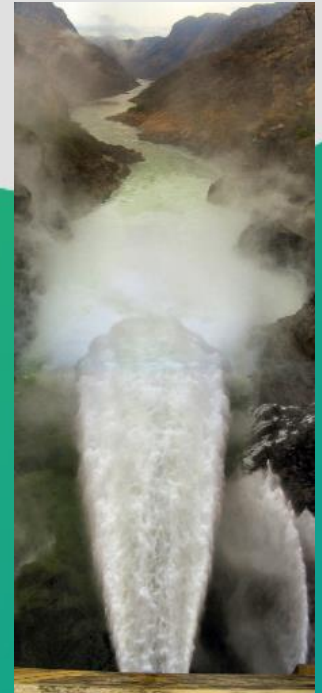


Integrating Natural and Built Infrastructure in Water Resource Development: *What's Stopping Us?*

Mark Smith & Matthew McCartney



Innovative water solutions for sustainable development

Food · Climate · Growth

NBS in the Policy Mainstream

iiED International Institute for Environment and Development
Our work ▾ About News and op

Biodiversity | Climate change > Community-based adaptation

CBA14 closing: UK minister urges countries to allocate more finance to nature-based solutions to help tackle climate change

News, 25 September 2020

UK international environment min



Action Track Discussion Starter

Action Track 3 – Boost Nature-Positive Food Production at Scale

NATURE-BASED SOLU

1. Our Context

The world needs a range of measures to limit carbon dioxide (CO₂) emissions while the protection and restoration of natural ecosystems such as forests, grasslands and wetlands, but what are nature-based solutions and what is Shell doing to support them?

Today, neither people nor the planet are healthy. Food production is the single biggest threat to nature, it has caused 70 per cent of biodiversity loss, 75 per cent of deforestation, uses 80 per

WATCH: HOW SHELL IS INVESTING IN NATURE AS PART OF ITS AMBITION TO BECOME A NET-ZERO ENERGY EMISSIONS BUSINESS BY 2050, O

Nature-based solutions and Shell | New Energies

HEINRICH BÖLL STIFTUNG BRUSSELS

Menu

High Expectations from 'Nature Based Solutions' during the Climate Action Summit



Agenda Platforms Reports Events Videos

English ▾

Sign-in 🔍

Global Agenda SDI2020 How to Save the Planet Environment and Natural Resource Security

Why the natural world is key to a green recovery

NBS: Conceptualization

Nature-based Solutions:

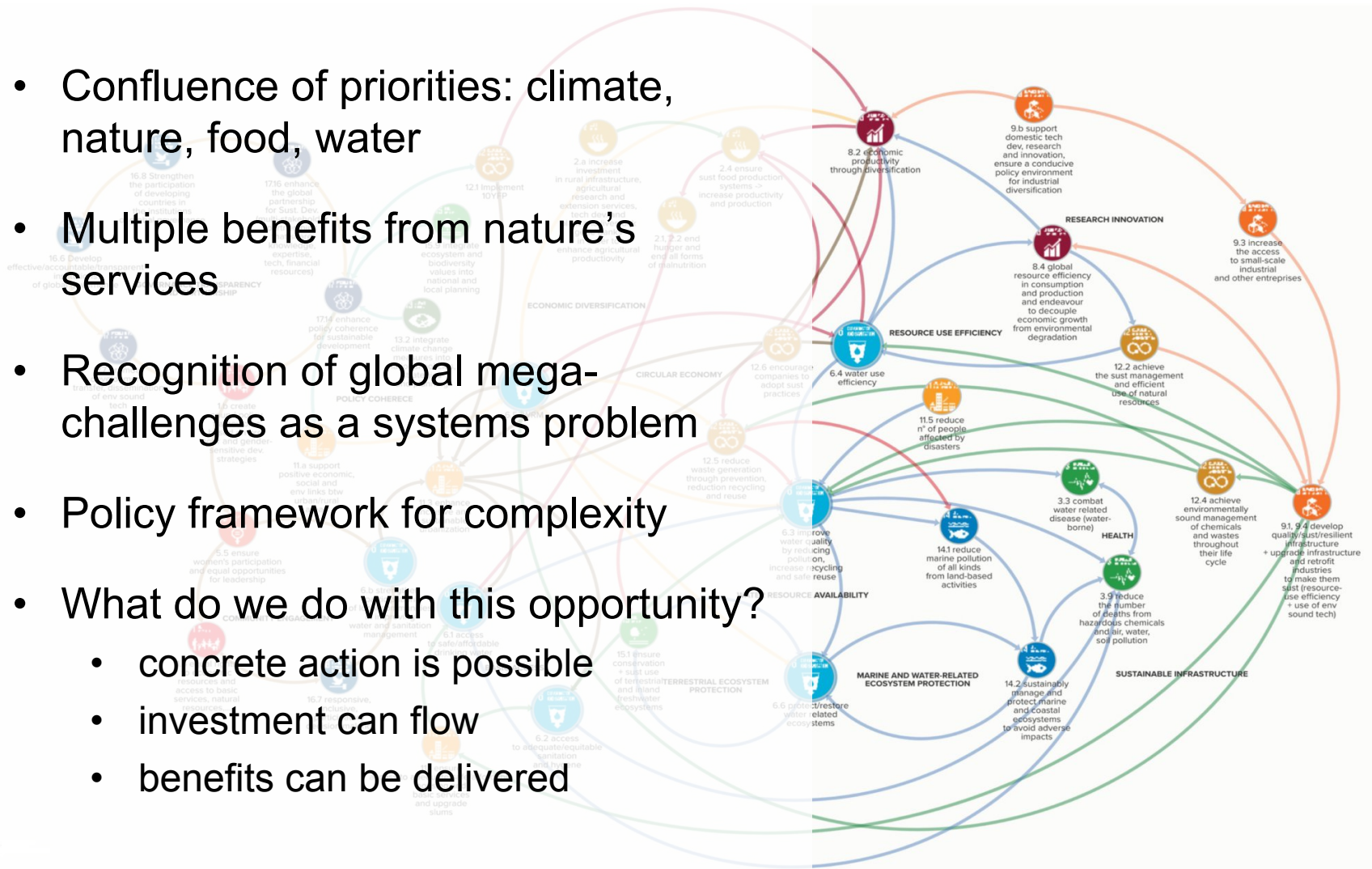
“Actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits”.



© IUCN

NBS as a Systems Tool in Policy

- Confluence of priorities: climate, nature, food, water
- Multiple benefits from nature's services
- Recognition of global mega-challenges as a systems problem
- Policy framework for complexity
- What do we do with this opportunity?
 - concrete action is possible
 - investment can flow
 - benefits can be delivered



Nature as Water Infrastructure

<i>Facility</i>	<i>Built</i>	<i>Natural</i>
Storage	<ul style="list-style-type: none">• reservoir	<ul style="list-style-type: none">• upland soils• lakes• aquifers
Conveyance	<ul style="list-style-type: none">• canals	<ul style="list-style-type: none">• rivers
Flood regulation	<ul style="list-style-type: none">• levees• dams	<ul style="list-style-type: none">• wetlands• floodplains
Water filtration	<ul style="list-style-type: none">• filtration plant	<ul style="list-style-type: none">• soils & aquifers• wetland
Coastal protection	<ul style="list-style-type: none">• sea walls• breakwaters	<ul style="list-style-type: none">• mangroves & reefs• barrier islands





*flood regulation
water purification*



coastal defence



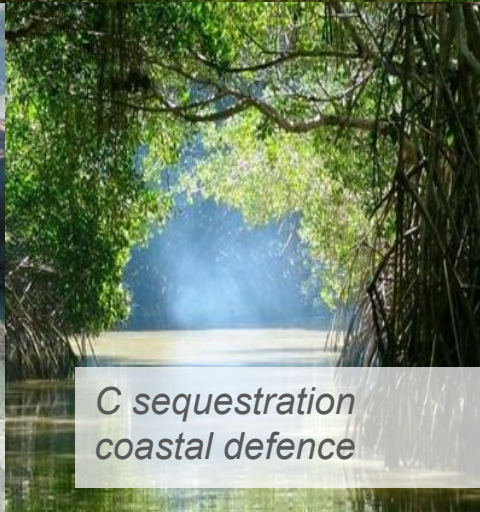
*water provision
water storage*



fisheries provision



*water conveyance
cultural services*



*C sequestration
coastal defence*

What's new? What's not new?



Operations

Resource Management

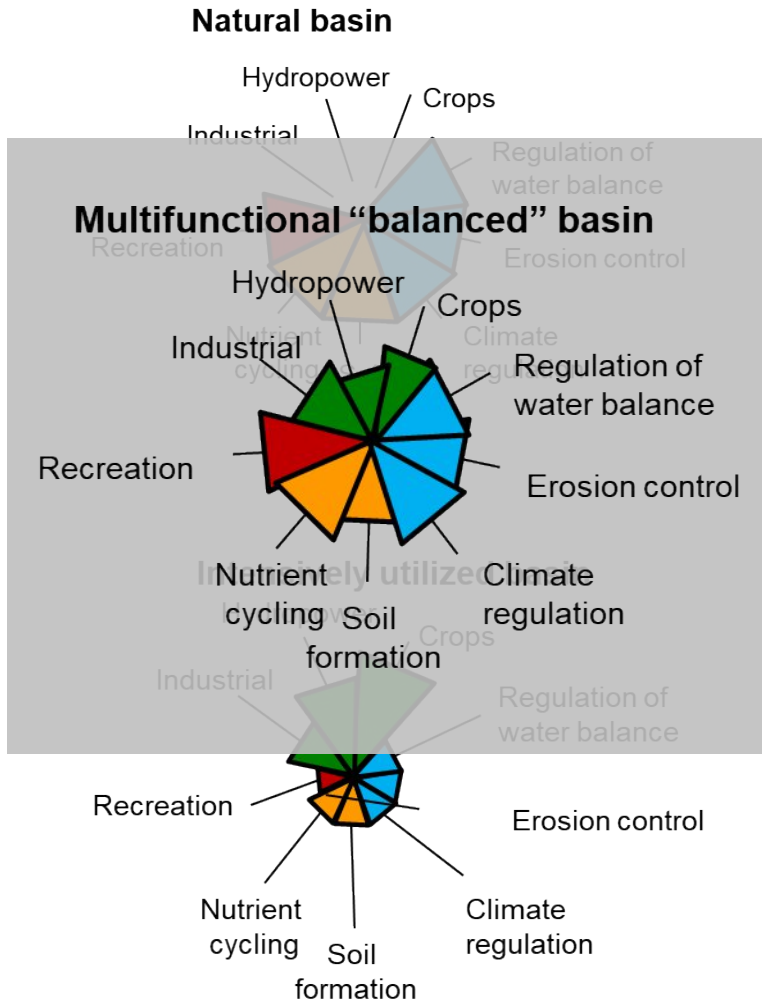
Maintenance

Conservation

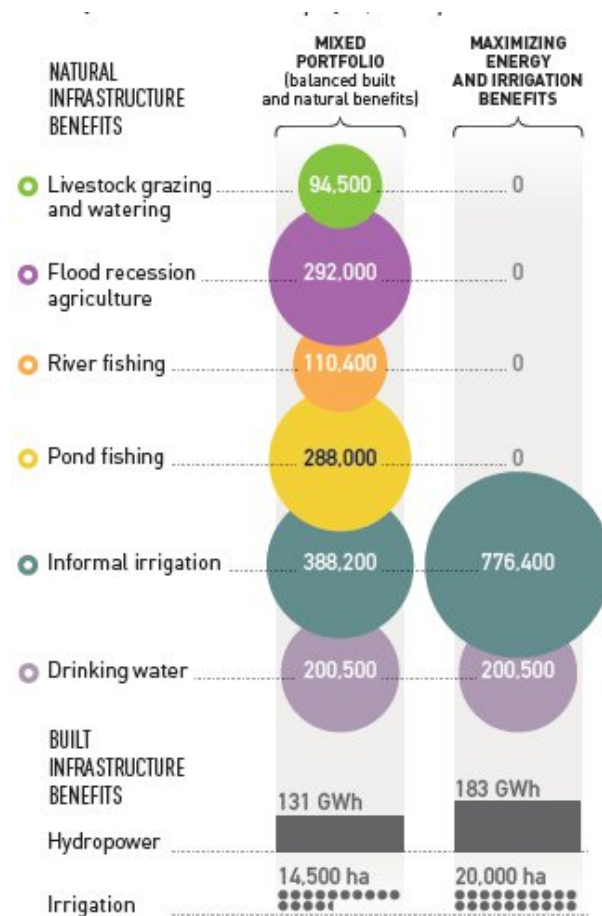
Refurbishment

Restoration

NBS for Water in Policy & Investment



Pawlugu Multi-Purpose Dam, Ghana



US\$/yr
Pwalugu
communities

Coupling of Natural and Built Infrastructure

UPSTREAM

DOWNSTREAM

ECONOMIC AND SOCIAL BENEFITS

HYDROPOWER AND IRRIGATION

NATURAL INFRASTRUCTURE

RUNOFF GENERATION

NATURAL INFRASTRUCTURE

FLOODPLAIN GRAZING

RIVER FLOW

BUILT INFRASTRUCTURE
"NOVEL ECOSYSTEMS"

RIVER FLOW

RIVER AND ESTUARY FISHERIES

RESERVOIR FISHERIES

RECESSION AGRICULTURE

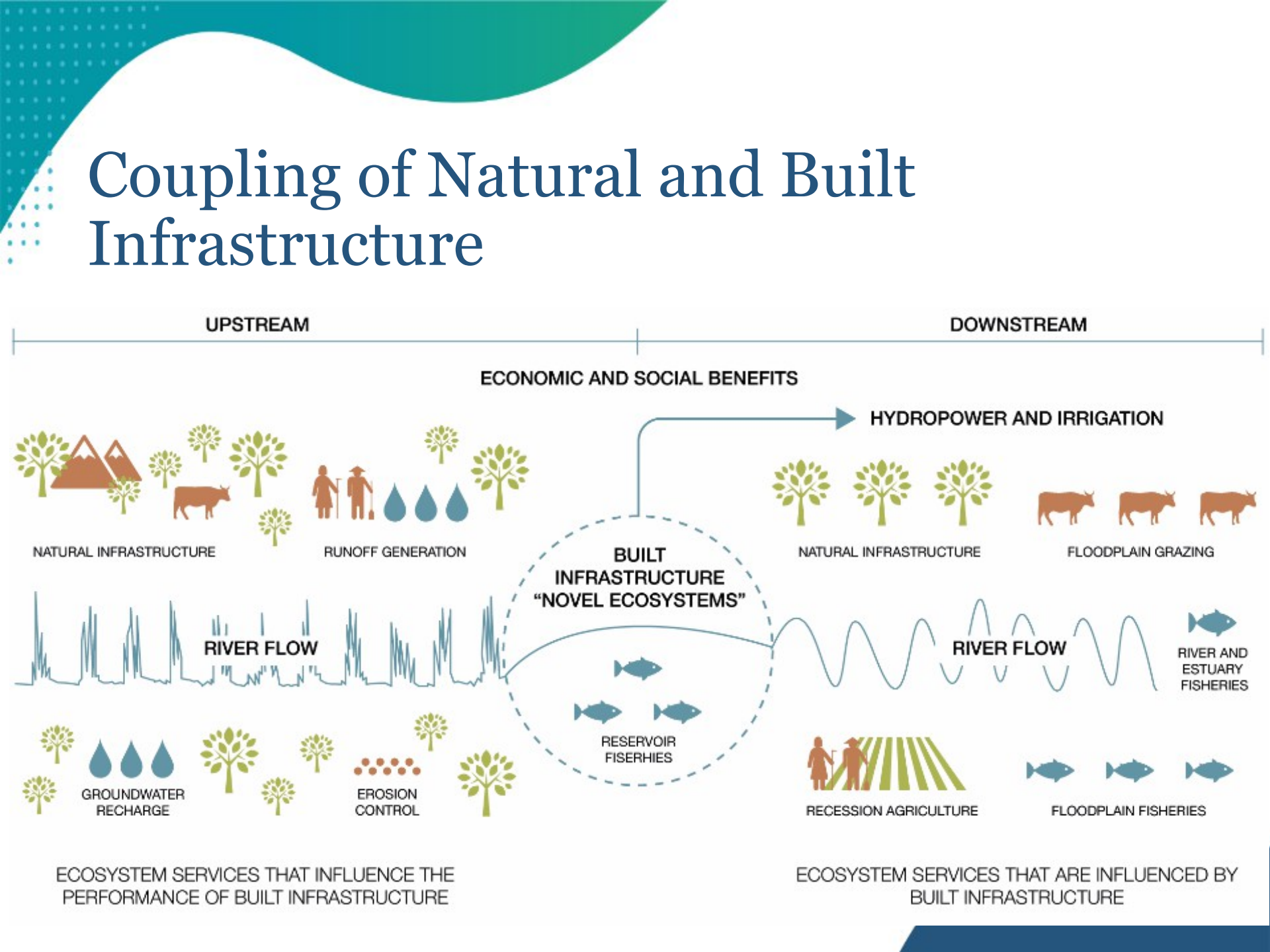
FLOODPLAIN FISHERIES

GROUNDWATER RECHARGE

EROSION CONTROL

ECOSYSTEM SERVICES THAT INFLUENCE THE PERFORMANCE OF BUILT INFRASTRUCTURE

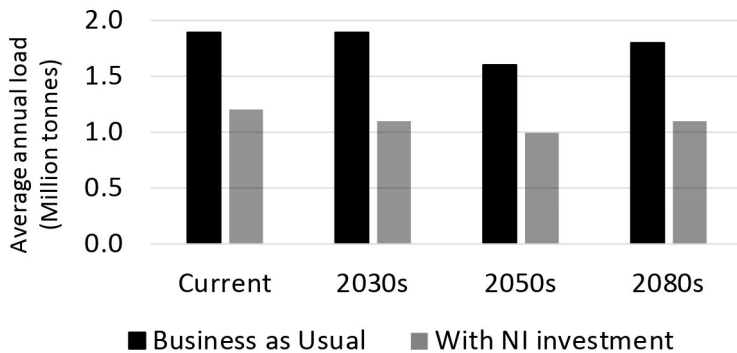
ECOSYSTEM SERVICES THAT ARE INFLUENCED BY BUILT INFRASTRUCTURE



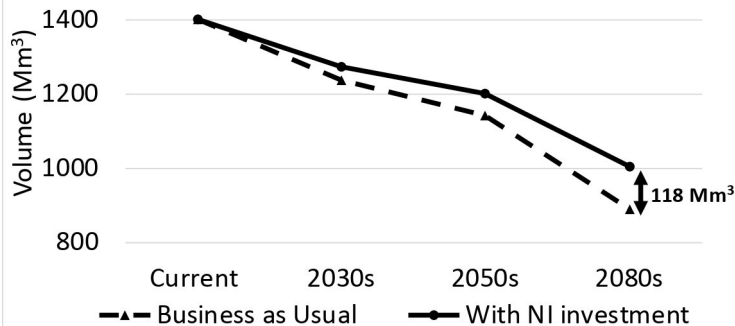
River Tana: Benefit functions

Upstream

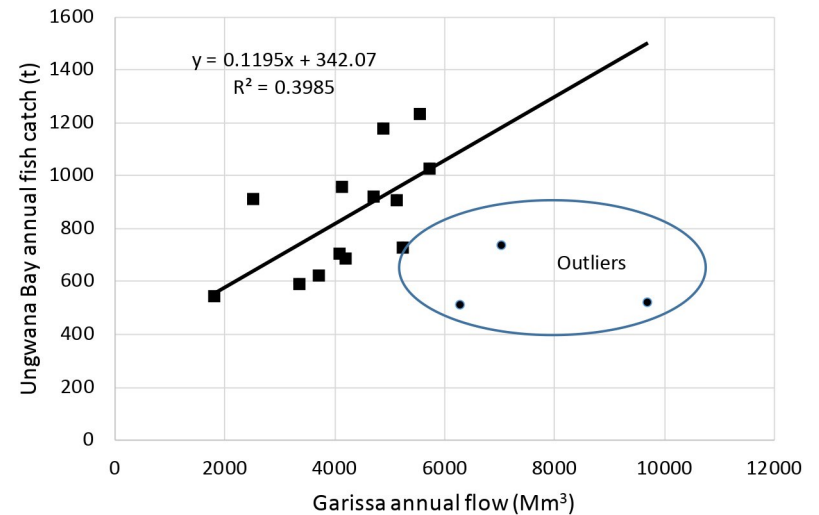
Sediment Load from Thika/Chania



Storage in Masinga



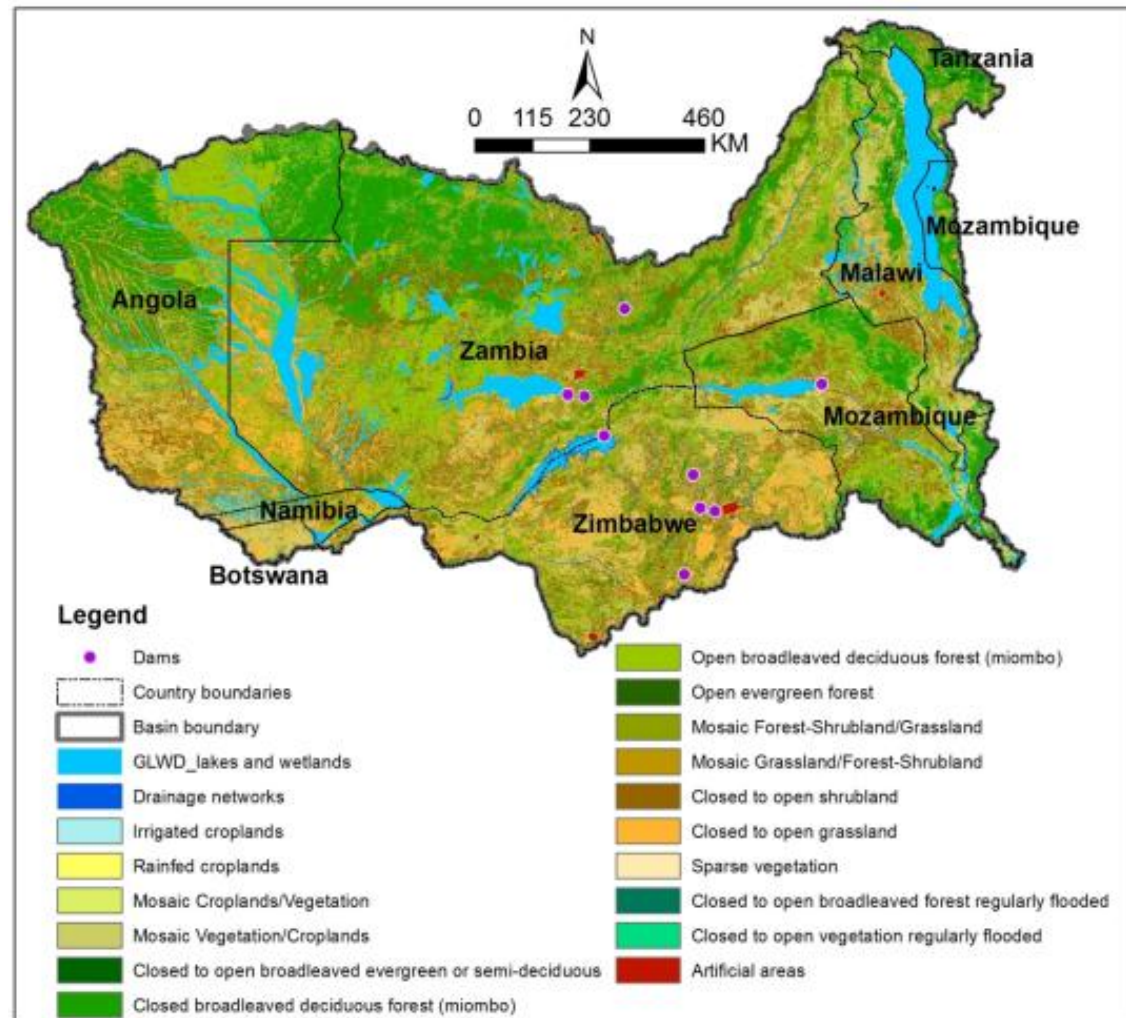
Downstream



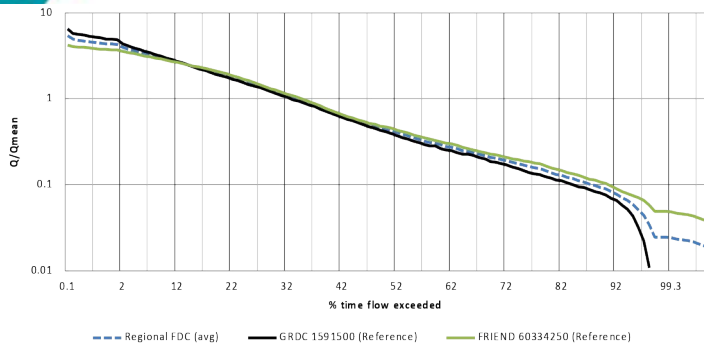
Near-shore artisanal fisheries

Quantifying flow regulation of ecosystems in the Zambezi

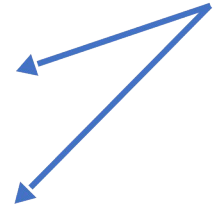
Engineers and water resource planners **need numbers** but natural systems are **intrinsically complex** and **dynamic**. There is little **quantitative understanding** of how, in any **given circumstances** they will influence flow



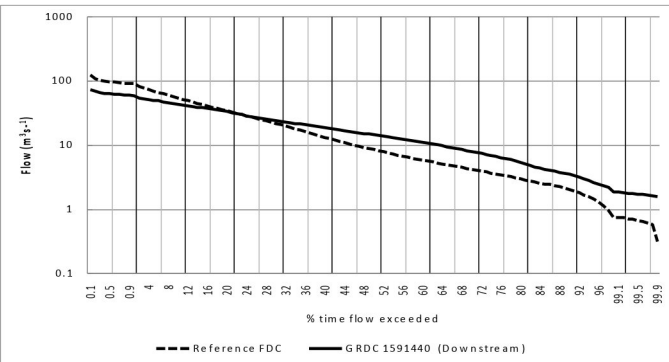
1. Generate a reference FDC



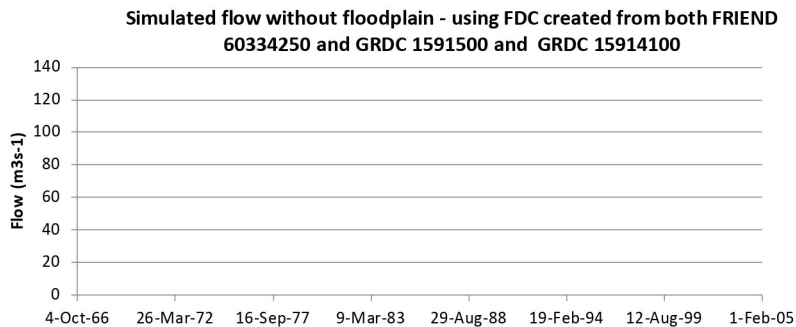
Method



2. Transfer reference FDC to site of interest

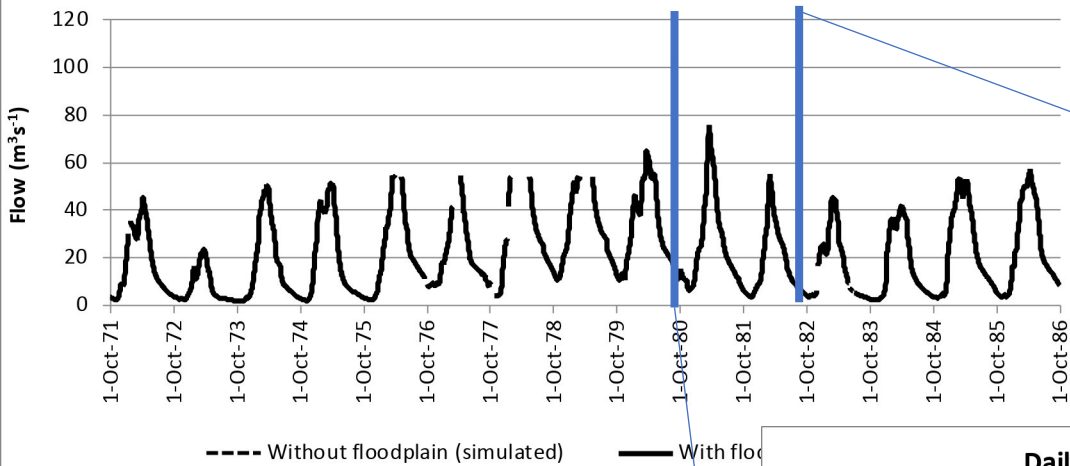


3. Generate a site specific flow series

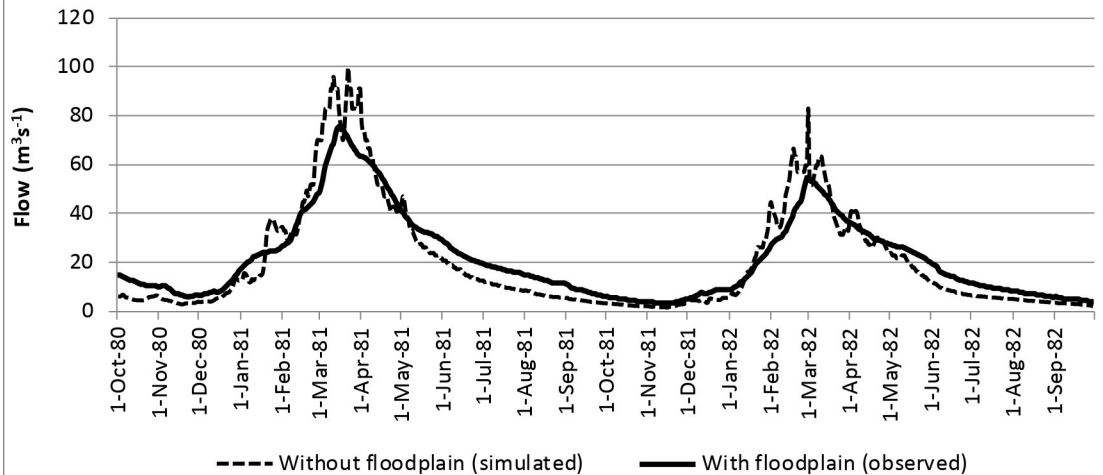


Example results

Daily flow with and without floodplain: HY1971-1986

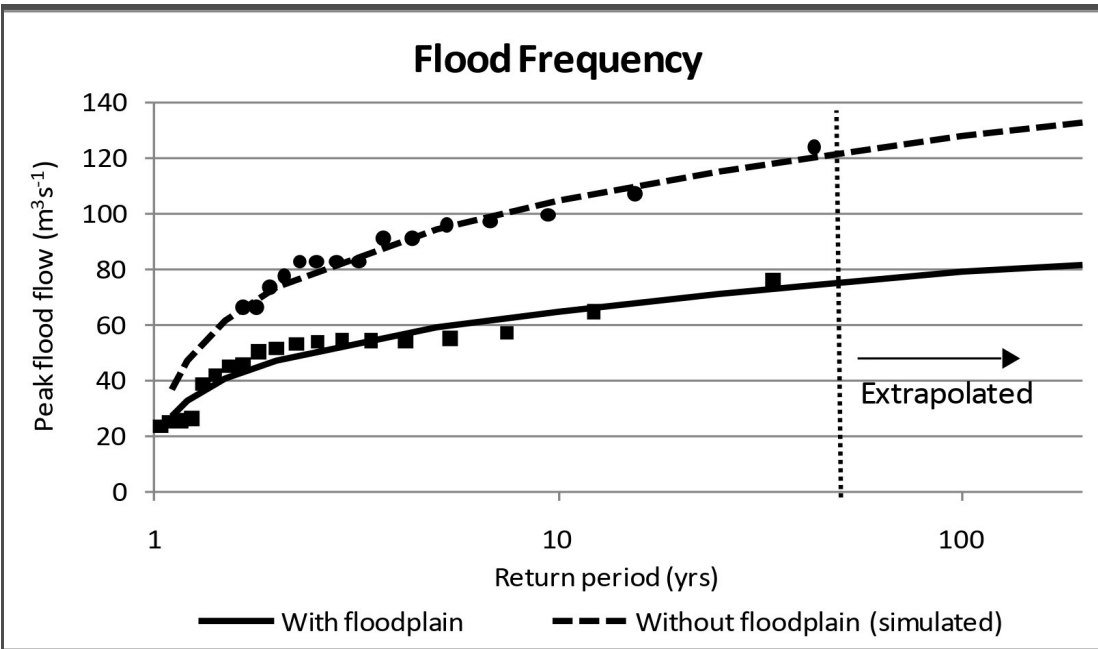


Daily flow with and without floodplain: HY1981-1982



Example results

Luswishi Floodplain



Return Period (yrs)	Flood magnitude (m^3s^{-1})	
	With floodplain	Without floodplain
2	47	73
10	65	105
25	71	115
50	75	122
100	79	128
200	82	133

Conclusion

- Required future investment in the water sector must exceed US\$ 6.5 trillion by 2030 if water related SDGs are to be achieved.
- Natural infrastructure **MUST** be a part of this investment for sustainability and resilience.
- Simple approaches (such as those demonstrated) provide a common framework for quantitative assessment of both built and natural infrastructure “performance”.



Copyright: © 2026 International Water Management Institute. Some rights reserved. This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0)

Disclaimer: This publication has not been independently peer-reviewed. Responsibility for editing, proofreading, and layout, opinions expressed, and any possible errors lies with the authors and not the institutions involved.

Thank You

Map Disclaimer (*if maps are included*): The boundaries, colors, denominations and any other information shown on maps do not imply any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries, on the part of IWMI, its funders, or its partners.