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REstoring rivers FOR effective catchment Management

Defining the success of restoration projects

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Overview

- Why do we restore rivers
- What are the issues relating to restoration success
- Determining restoration success
  - Project planning approach
  - Benchmarking and endpoints

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Why do we restore rivers? Habitat improvement


Bank stabilization


Log weir


Large boulder placement


Reconnected floodplain

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Why do we restore rivers? Improve connectivity

Nature-like bypass channel

Pool-weir

Larinier

Pool - traverse

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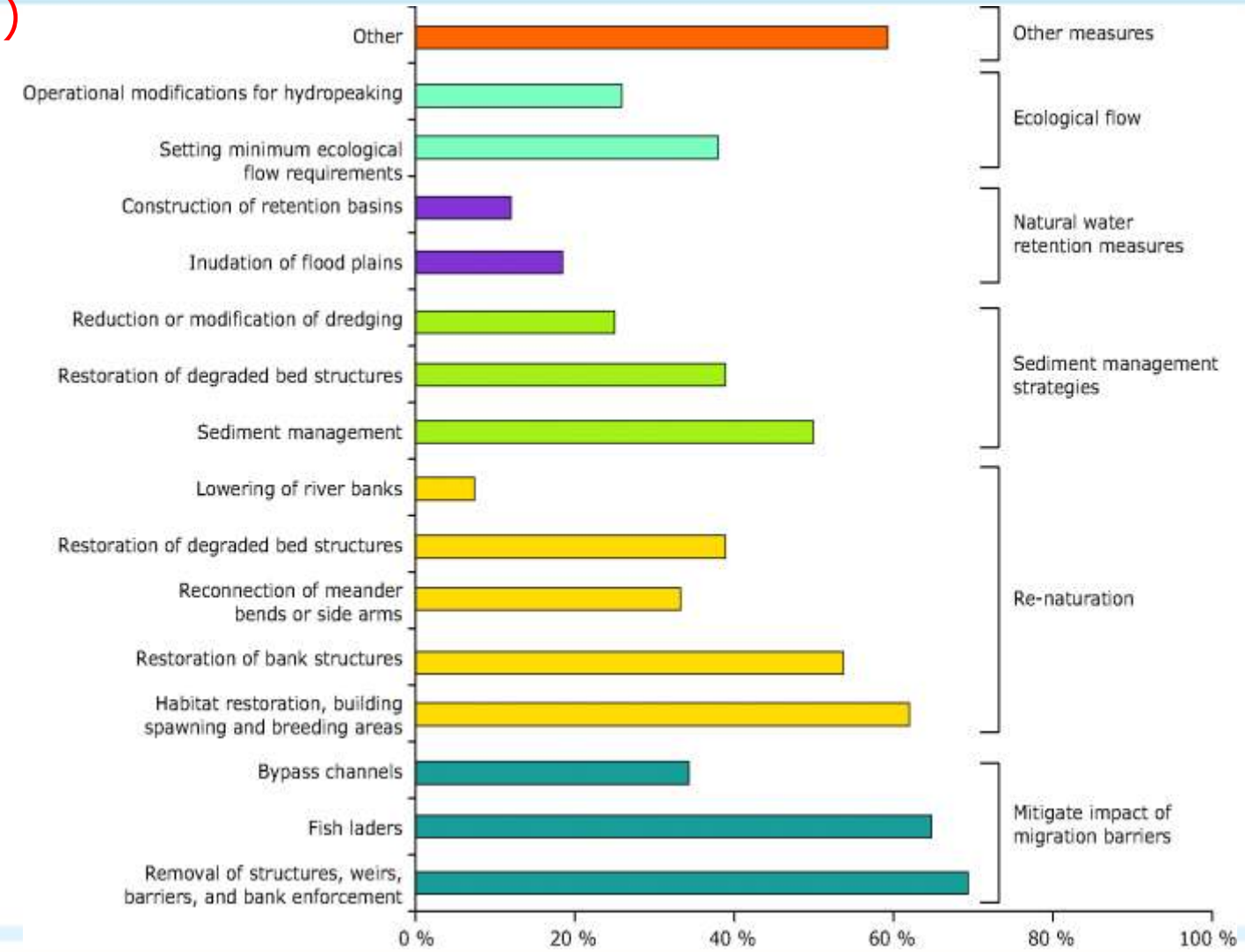
Occurrence of hydromorphology measures in RBMPs (% of RBMPs)



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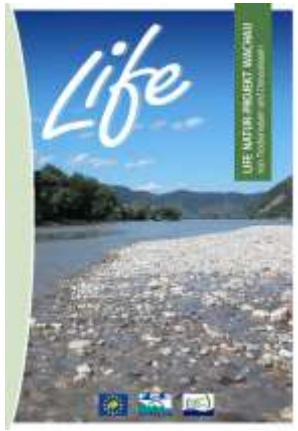
Why do we restore rivers?
Examples of EU funded River River restoration projects

Count of ProjectName	Programme		
Global objective	INTERREG	LIFE	Grand Total
Flood management	20	1	21
Integrated River Basin Management	26	1	27
River & floodplain restoration	17	114	131
Water quality improvement	4	1	5
Species conservation and management	14	55	69
Grand Total	81	172	253



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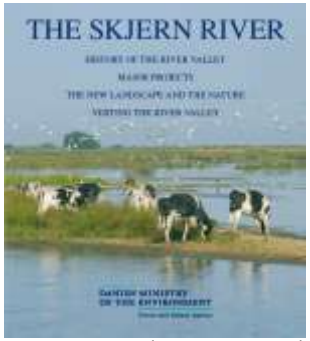

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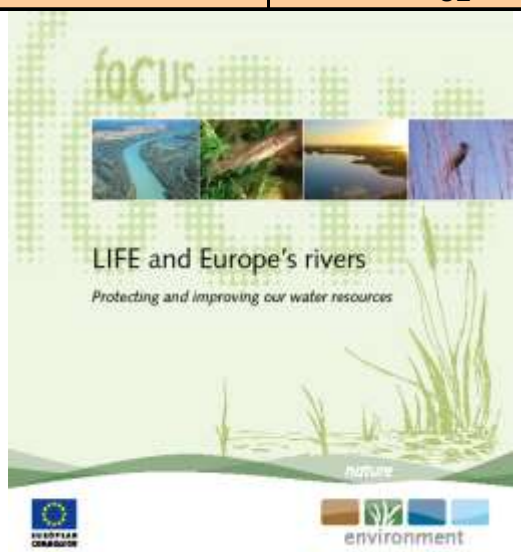

www.wwf.se/flodparlmussla

http://www.hamm.de/lifelippeauehtml

Why do we restore rivers?

Reviewed 670+ European projects, 250+ Life/Interreg, [37,000 NA projects]

- few projects establish well defined endpoint criteria
- usually linked to WFD objectives of GES/GP, HD conservation status or local actions [biodiversity improvement, habitat modification etc.]
- Rarely quantitative - weaknesses in monitoring or assessment, defining success or outcomes, and often costs and benefit information not available.

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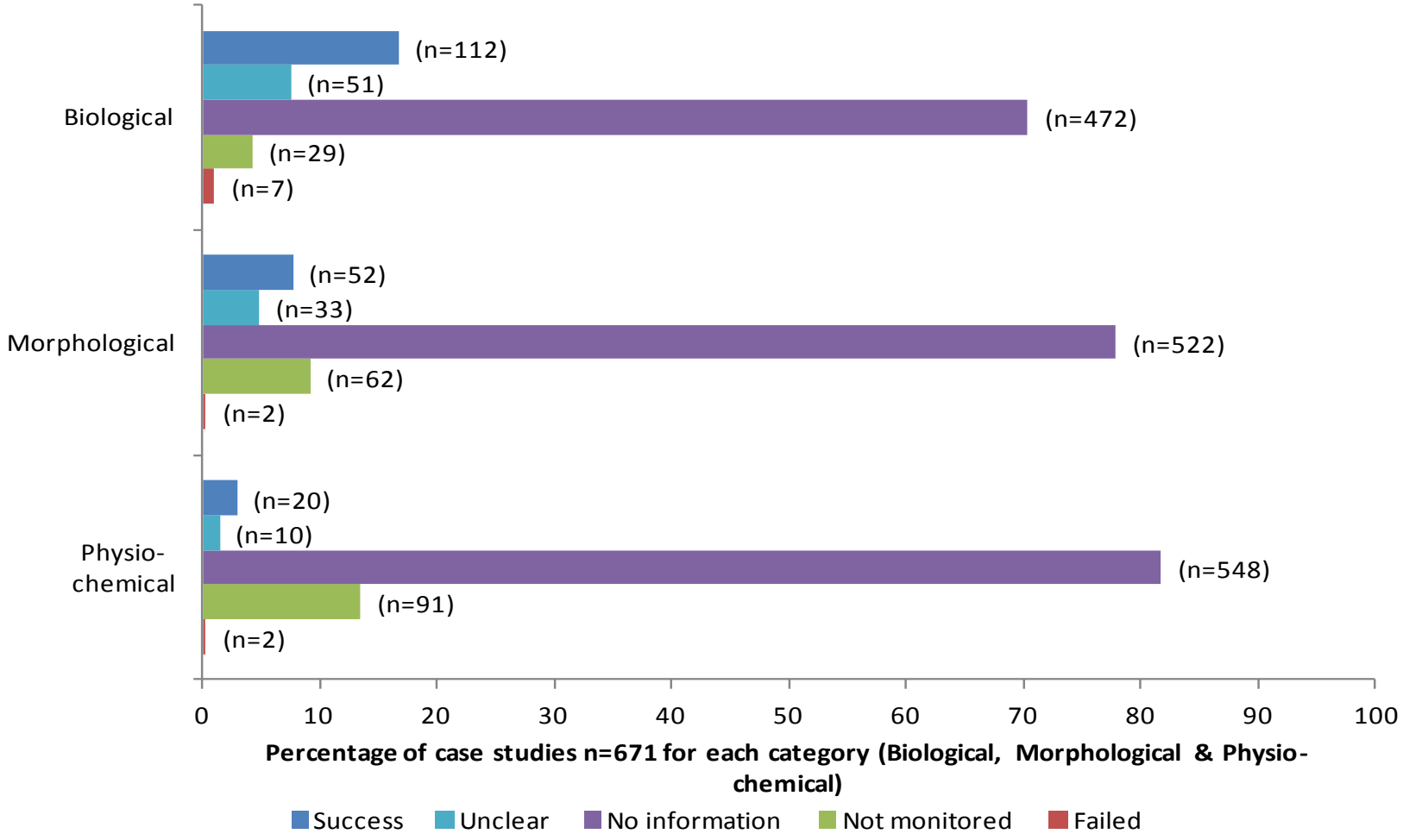
How successful are these measures? Defining outcomes Success rate of 671 European case studies



How successful are these measures? Synthesis of 37,099 US River Restoration Projects.

- 20% had no listed goals
- Only 10% of projects indicated that any form of assessment or monitoring occurred. Most of these ~3700 projects were not designed to evaluate consequences of restoration activities or to disseminate monitoring results

E. S. Bernhardt et al. *Science* 2005

Issues relating to restoration

- Restoration utopian view
- Lack of knowledge about the bottlenecks in the life cycle of target species
- Little integration with other water resource management sectors.
- Social and political override

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Issues relating to restoration

River Don, Malin Bridge Sheffield - Response to 2007 flooding

Issues relating to restoration

- Restoration utopian view
- Lack of knowledge about the bottlenecks in the life cycle of target species
- Little integration with other water resource management sectors.
- Social and political override
- Projects localised in small part of river or water body
- Lack of planning with no clear objectives

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REFORM: Restoration Planning Approach

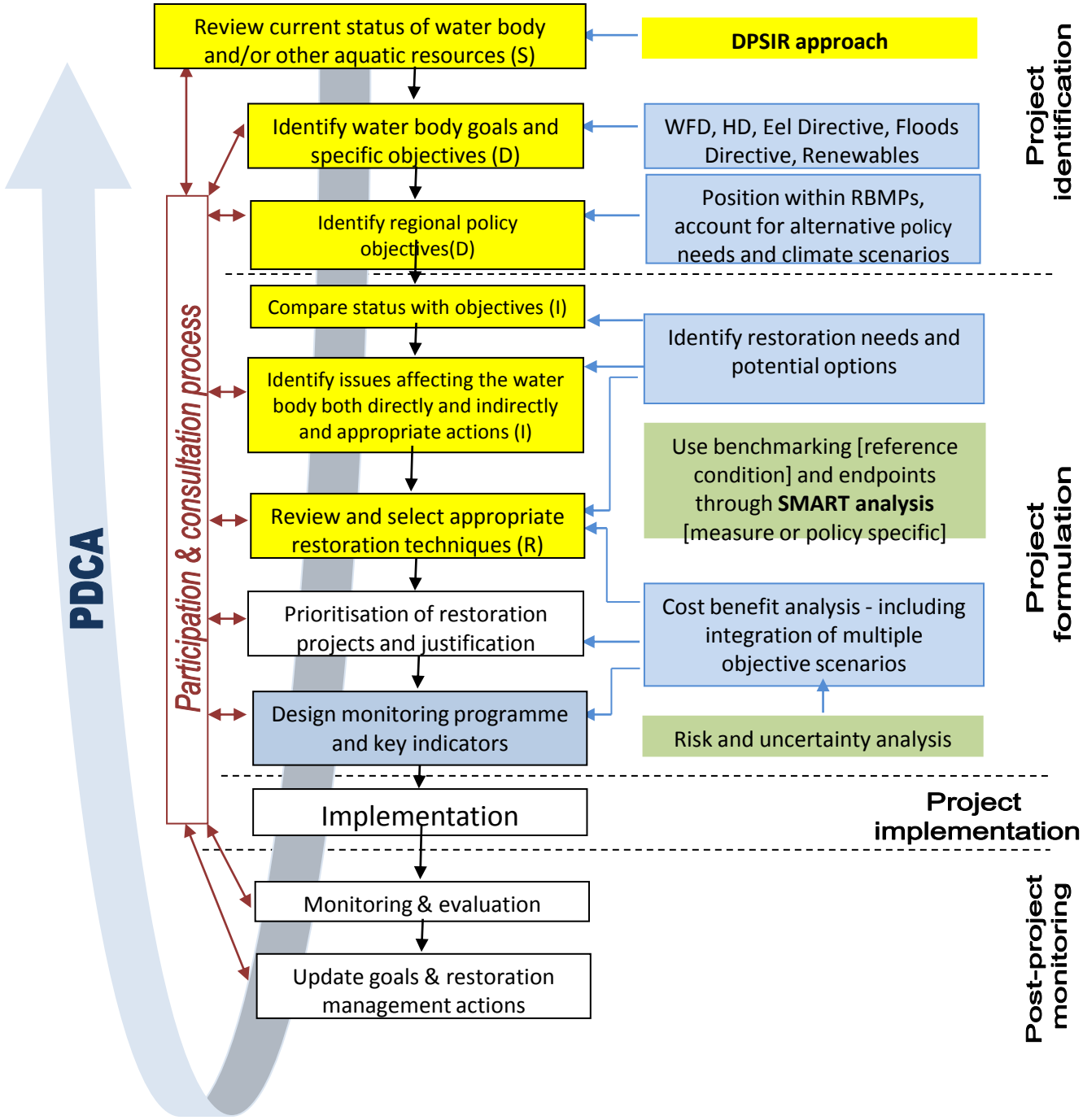
REQUIREMENTS

- Need to define objectives and outcomes
- Need to capture risks and uncertainties
- Need to consider relevance of measures in different river styles
- Need to recognise biological responses have long timescales
- Need tool that accounts for social ecological coupling (ecosystem services)
- REQUIRE TOOL FOR **MANAGING EXPECTATIONS** AND DESCRIBING MILESTONES AND INCLUDE TIMESCALES

Programme of measures

- What is the way forward?
- We cannot wait for a complete understanding of river ecosystem before we decide how to target improvement programmes.
- Need some type of **benchmarking** to define objectives
- Benchmarking as a tool should be feasible, practical and measureable to guide future decision support tools.
- Questions need to be answered on what needs to be restored, why and how?
- This must be coupled within a social and economic framework to meet societal needs and aspirations to address stakeholder/user interactions and conflicts.

Restoration Planning Approach



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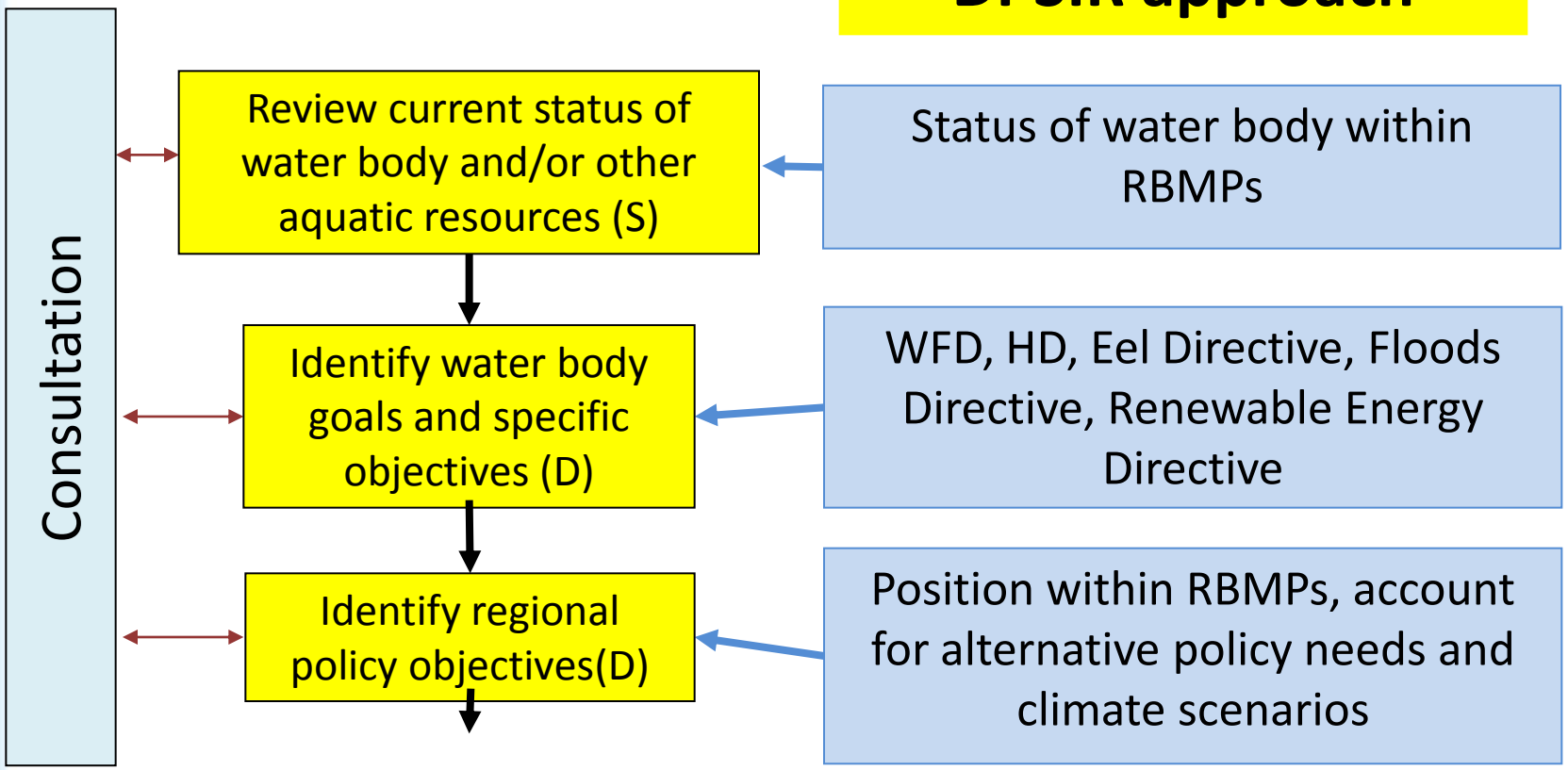
Project identification

DPSIR approach



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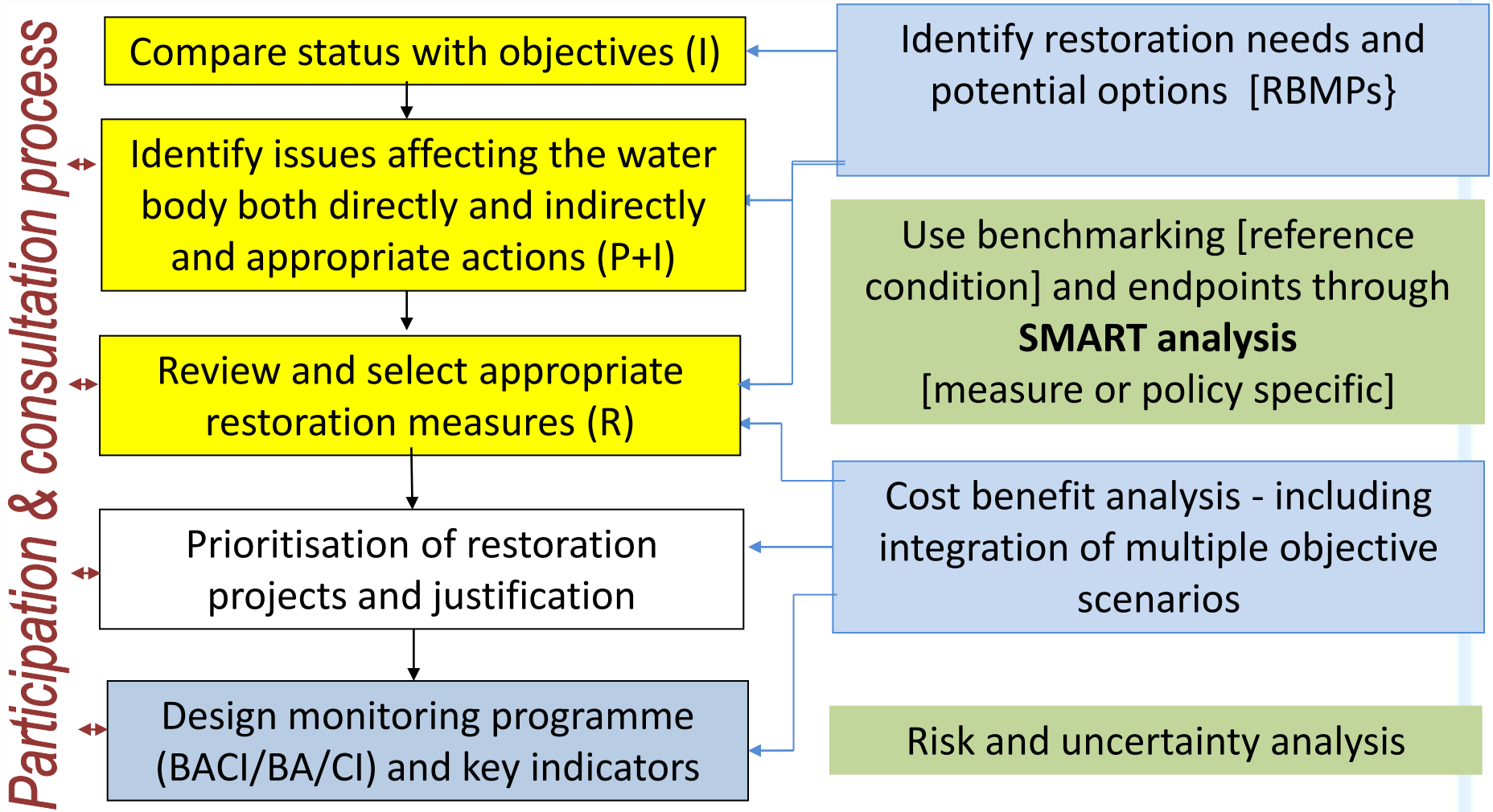
Project formulation



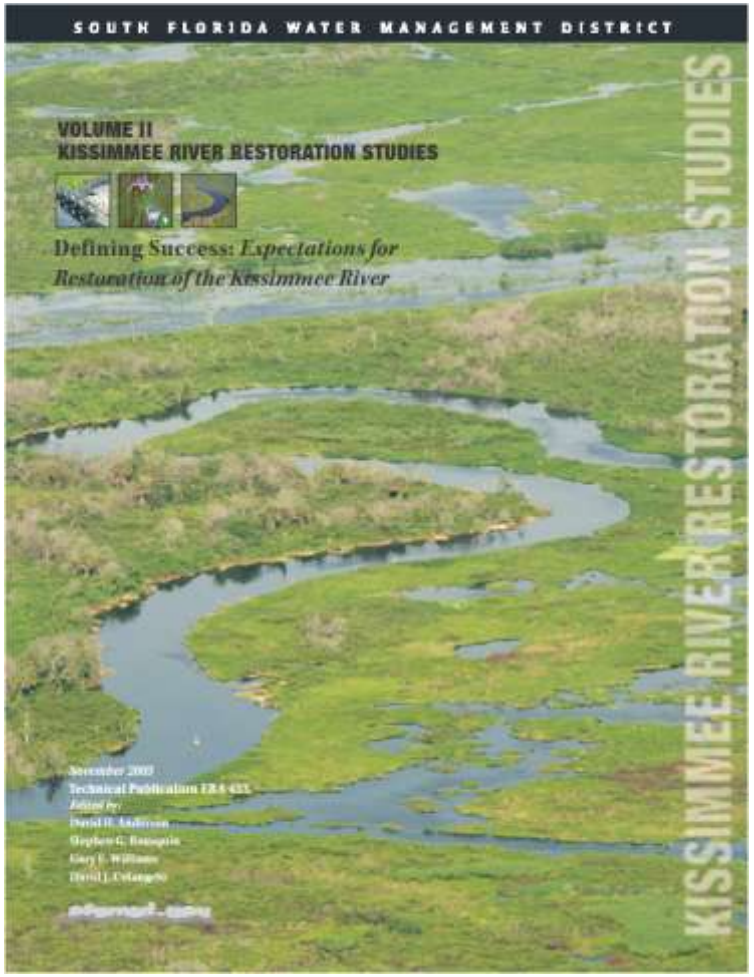
Benchmarking, end-points

There is a need to benchmark to determine if restoration is successful.

There is a need to set realistic end-points for restoration

…

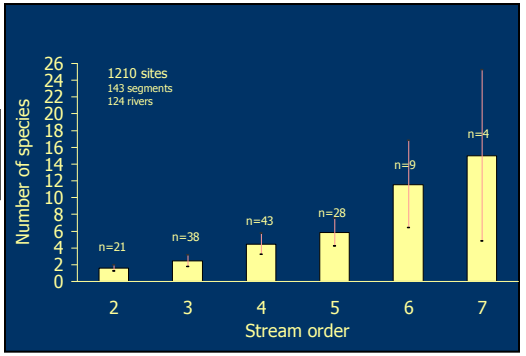
This is often not done!!



Developing benchmarking conditions

Reference sites

Predictive models



Historic information

Benchmarking

Abiotic habitat characteristics

From Schumtz 2011

Setting endpoints: Deficit or gap analysis

- Deficit analysis based on a comparison with the pristine state i.e. reference condition. This would have to examine the current environmental state and establish 'benchmark' target conditions.
- The outcome will be a selection of potential management and restoration measures, including their dimensions, that will meet the objectives for restoration.
- The sum of such management and measures will yield a new ecological end-point.

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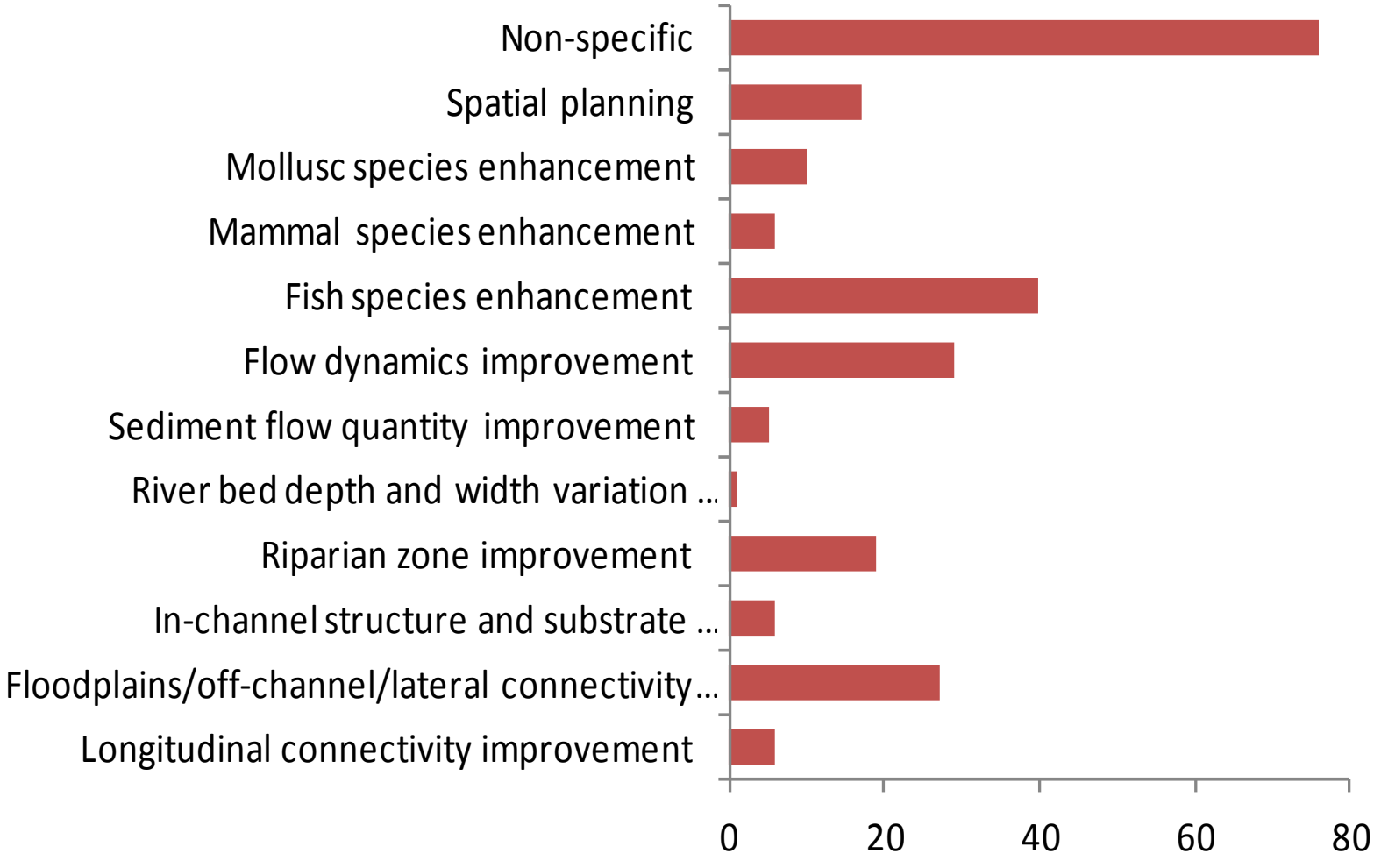
Endpoint criteria from LIFE projects



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Example of the Kissimmee River Restoration

DEFINING SUCCESS: EXPECTATIONS FOR RESTORATION OF THE KISSIMMEE RIVER

Edited by D.H. Anderson, S.G. Bousquin, G.E. Williams, and D.J. Colangelo (2005)

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Expectations of the Kissimmee River Restoration

Nine describe abiotic responses for hydrology, geomorphology, and water quality.

Five expectations describe changes in plant communities in the river channel and floodplain

Six expectations describe invertebrate and amphibian and reptile communities.

Five expectations describe anticipated changes in fish and bird communities.

1 Continuous River Channel Flow
2 Annual Distribution and Year-to-Year Variability of Monthly Mean Flows
3 Stage Hydrograph Characteristics
4 Stage Recession Rates
5 River Channel Velocities
6 River Channel Bed Deposits
7 Sand Deposition and Point Bar Formation Inside River Channel Bends
8 Dissolved Oxygen Concentrations in the River Channel
9 Turbidity and Suspended Solids Concentrations in the River Channel

10 Width of Littoral Vegetation Beds Relative to Channel Pattern
11 Plant Community Structure in the River Channels
12 Areal Coverage of Floodplain Wetlands
13 Areal Coverage of Broadleaf Marsh
14 Areal Coverage of Wet Prairie

15 River Channel Macroinvertebrate Drift Composition
16 Increased Relative Density, Biomass, and Production of Passive Filtering-Collectors on River Channel Snags
17 Aquatic Invertebrate Community Structure in Broadleaf Marshes
18 Aquatic Invertebrate Community Structure in River Channel Benthic Habitats
19 Number of Amphibians and Reptiles Using the Floodplain
20 Use of Floodplain for Amphibian Reproduction and Larval Development

21 Densities of Small Fishes within Floodplain Marshes
22 River Channel Fish Community Structure
23 Guild Composition, Age Classes, and Relative Abundance of Fishes Using
24 Density of Long-Legged Wading Birds on the Floodplain
25 Winter Abundance of Waterfowl on the Floodplain

Source: Anderson et al. 2005

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Expectations of the Kissimmee River Restoration

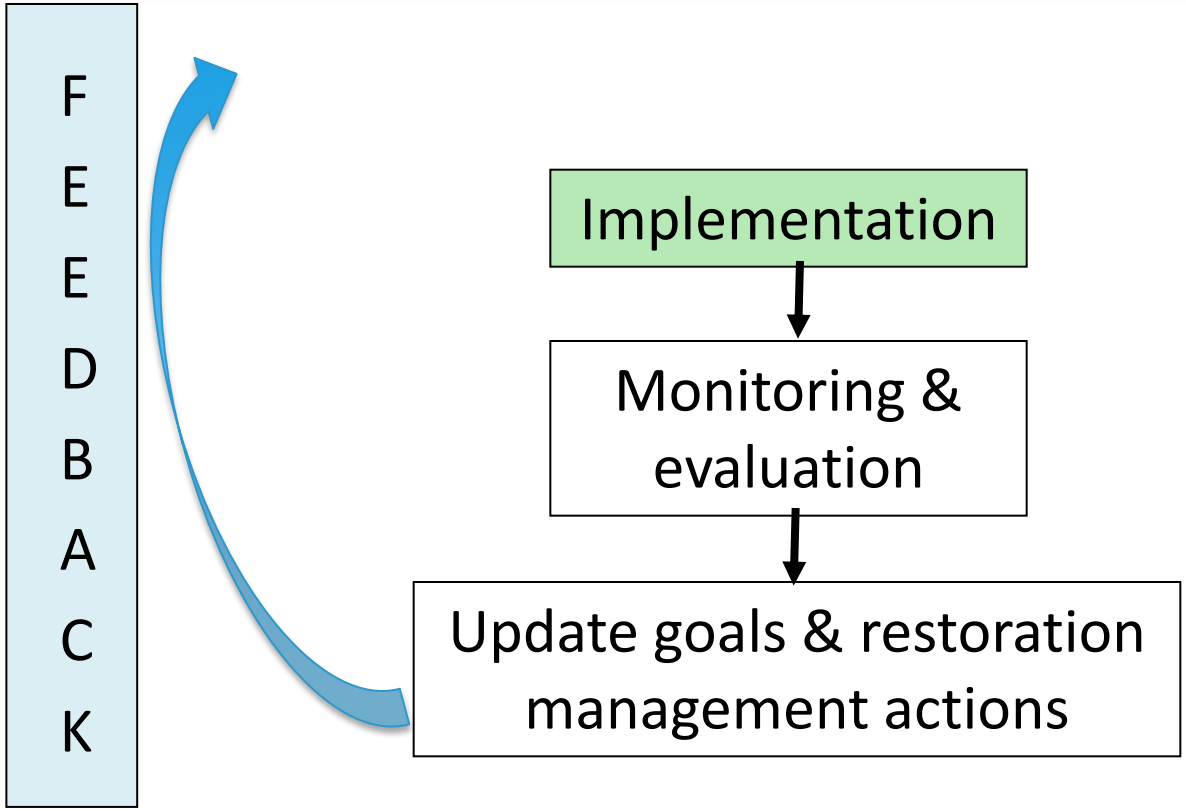
Modify standardized format from Kissimmee: each expectation document contains the following twelve pieces of information

Title	identifi
Expectation	states concis
Author	identifi answe
Date	identifi
Relevant Endpoints	identifi
Metric	identifi
Baseline Condition	charac
Reference Condition	describ ecosys
Mechanism for Achieving Expectation	explain expect
Adjustment for External Constraints	explain restora
Means of Evaluation	describ control sites, sampling methods, replication, and frequency), the calculation of metrics, and the evaluation of the expectation (statistical test, comparison to a threshold).
Time Course	estimates the time required to achieve an expectation.

- Capture risks and uncertainties as new attribute
- social ecological coupling and integration with other drivers incorporated into external constraints
- Time course provides milestones where adjustments are made to expectations and expected outcomes.

Source: Anderson et al. 2005

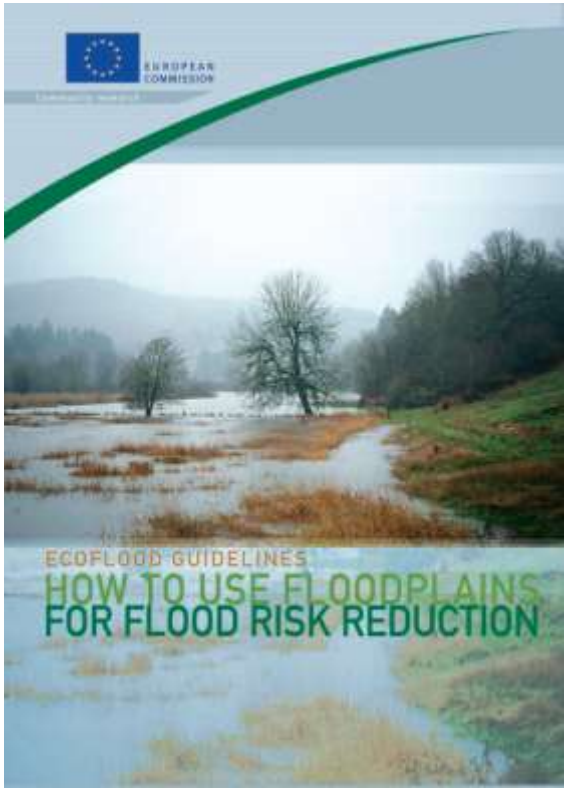
Project implementation and appraisal



QUESTIONS

5.3 Synergies between ecological restoration and ….

- Flood protection (Room for Rivers, Ecoflood)
- Navigation (parallel dams; wave action)
- Agriculture (land use of riparian zones; sediment dynamics)
- Hydropower (Environmental flows; hydropeaking)
- Urban development



To …

Expand the potential for restoration

Support the intercalibration of Good Ecological Potential of heavily modified and artificial water bodies (ECOSTAT)

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SYNERGIES-things have become more complicated demanding couple socio-ecological research and inclusion of diverse groups

Primary sector interactions

Climate change

- Flood protection/mitigation
- Navigation
- Hydropower
- Water storage for irrigation and abstraction

Land use change

- Agricultural practise
- Catchment land cover
- Urban development
- Wetland/floodplain use

Drivers of flood risk management

Flood Risk Management:

- EU Floods Directive (Nov 2007)
- Flood & Water Management Act (England & Wales 2010)

Ecosystem conservation:

- Water Framework Directive
- Habitats Directive

Drivers towards '**Sustainable**' Flood Risk Management Solutions

Shifting Paradigm

Flood Protection

- Economic
- Social

Flood Risk Management

Multidisciplinary

- Economic
- Social
- **Environmental**

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The June 2007 Flooding of Sheffield

Affected:

- Residents (1,200 homes)
- Businesses (1,000)
- Schools
- Roads
- Public transport

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EA Flood Risk Management Plan - Sheffield

Channel clearance work:

- Removing obstructions
- Removal of trees and gravel shoal

Small scale river rehabilitation:

- Replanting suitable native species
- Triangular flow deflectors
- Boulder clusters
- Rock riffles

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Flood protection– Incorporating rehabilitation into flood risk management

Pre 2009

Post 2009

2010

Pre 2013

Renewable Energy Directive

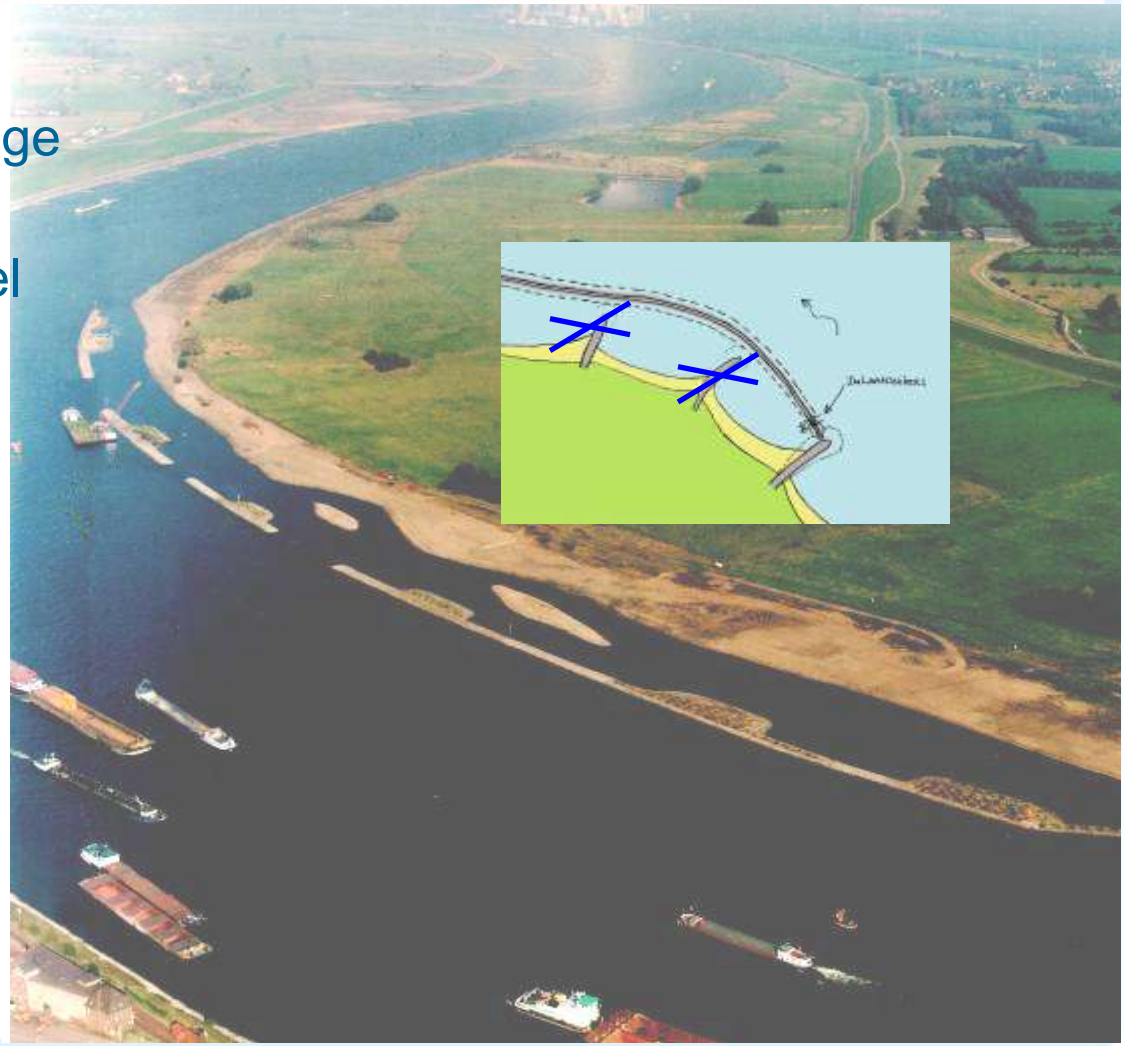
Synergies

- Construction of fish passage facilities
- Zonation of hydropower (where impact is less intense, e.g. headwaters about waterfalls)
- Allocation of 'environmental' flows
- Screening options/ diversion channels

Navigation

Synergies

- Construction of fish passage facilities
- Construction of off channel habitat
- Realignment of floodplain habitat
- Bank protection and stabilisation using natural processes



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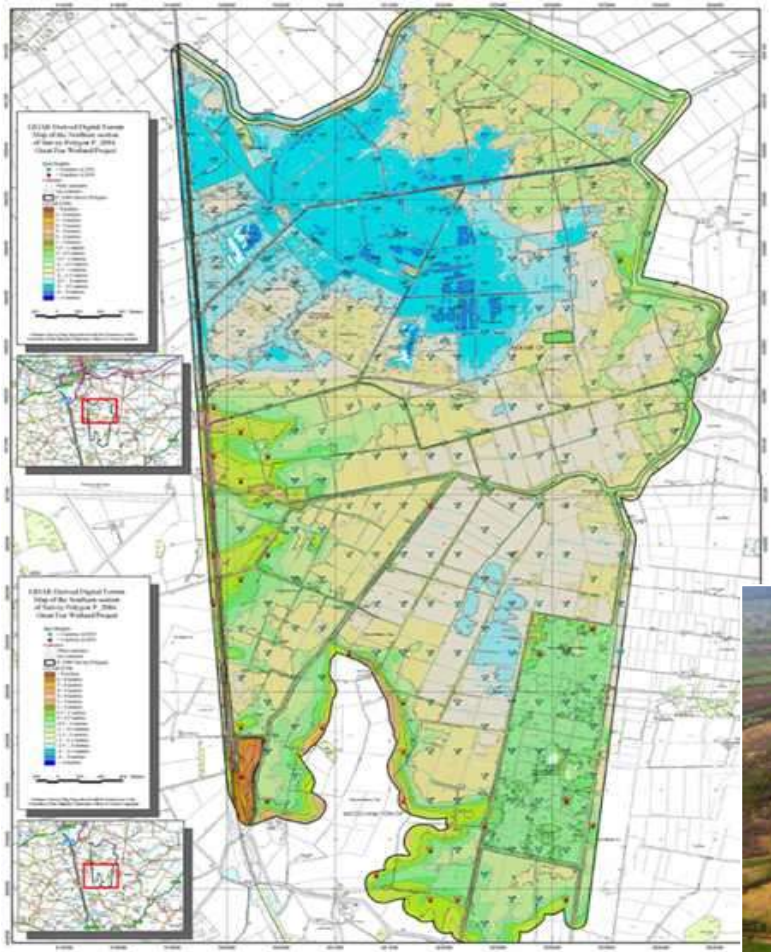
Evolving strategy – catchment scale linked to optimising ecosystem services

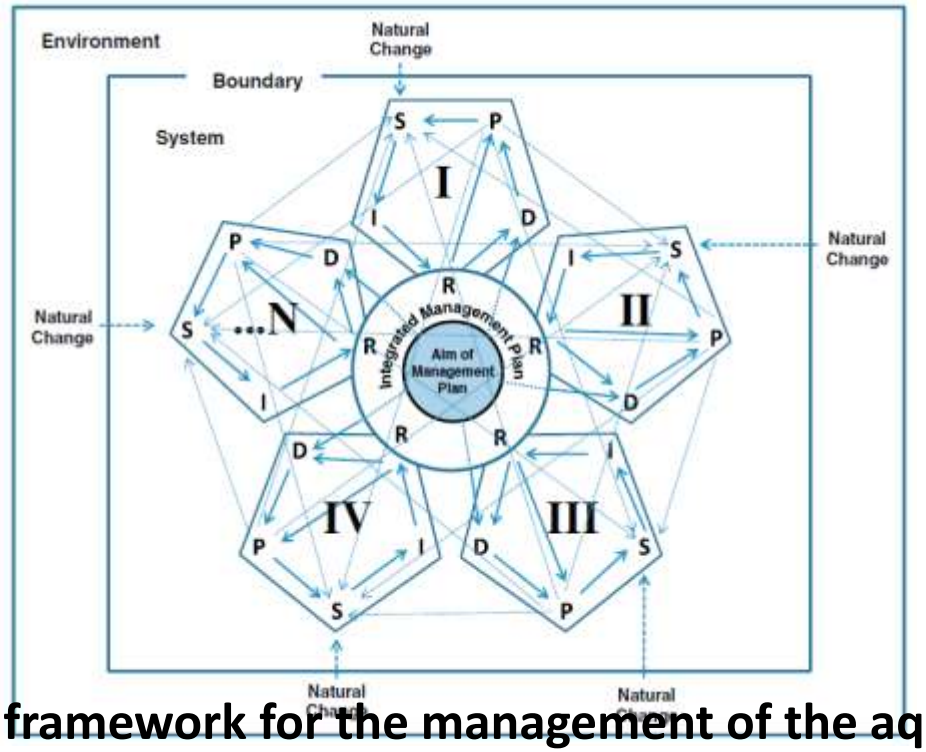


e.g. Great Fen project: large-scale wetland restoration to maximize flood alleviation potential a
biodiversity loss

Large

River Basin management

Use nested DPSIR approach to assess scope for coupled strategies to incorporate responses to climate [flood protection] and land use [e.g. sedimentation] and renewable energy demands [hydropower] with improvements of ecological status – win-win scenarios..



Nested DPSIR framework for the management of the aquatic environment (from Atkins *et al.*, 2011a).

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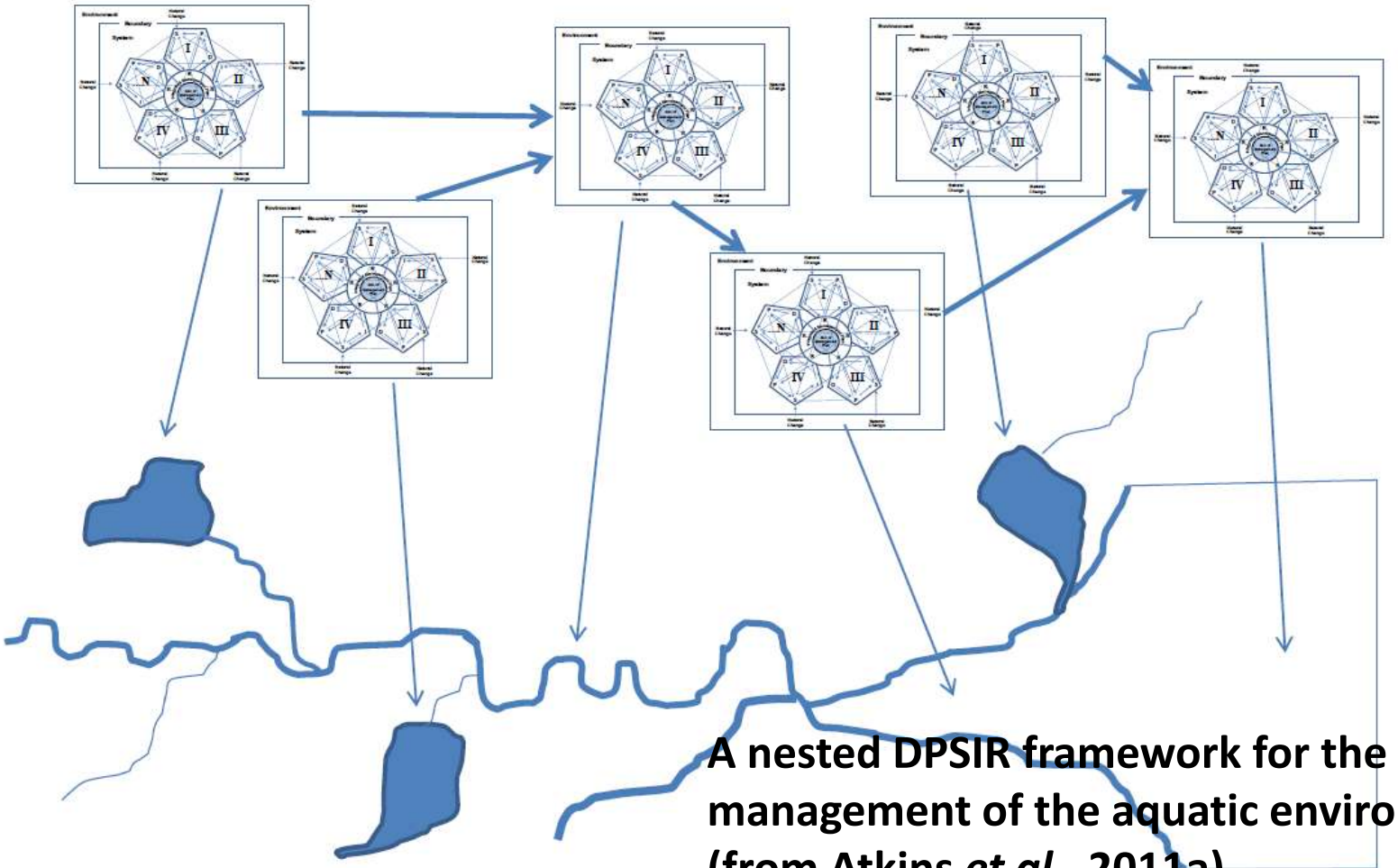
Catchment scale adaptation of nested DPSIR



A nested DPSIR framework for the management of the aquatic environment (from Atkins *et al.*, 2011a).

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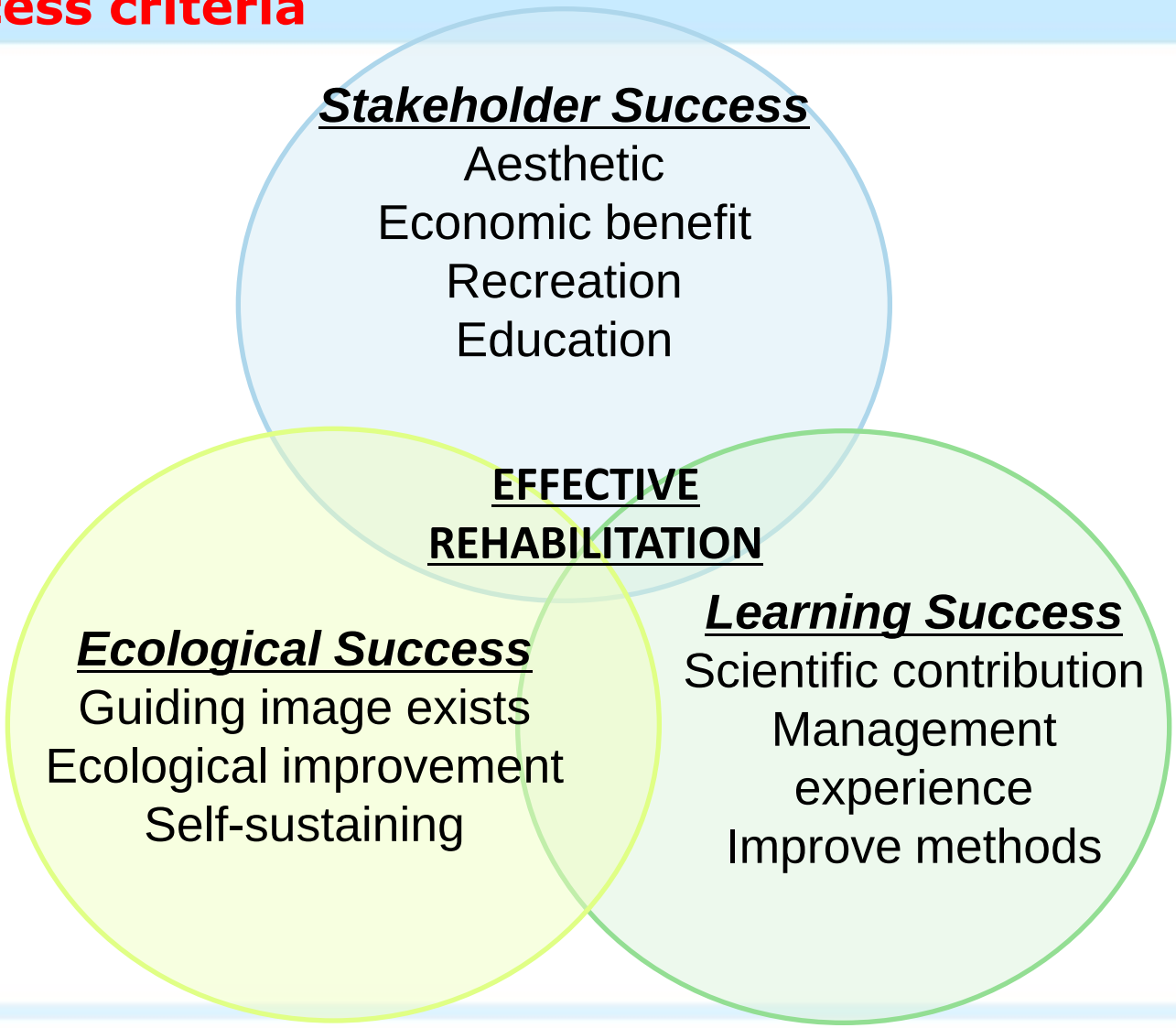
Success criteria



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Questions for workshop

Restoration project planning

- What is the key information you need to develop a restoration plan for a particular site or reach?
- What criteria do you use to select which restoration measure you adopt at a particular site or reach?
- How do you define restoration end-points and evaluate project success?

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Questions for workshop

Restoration project planning

- How do you priortize restoration projects in single and multi-sector scenarios
- What risk and uncertainty procedures do you adopt to mitigate failure?
- How do you apply ecosystem services in river restoration policies and projects

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Questions for workshop

Restoration project planning

What interactions can be explored between sectors to deliver multiple objectives?

- Constraints – drivers and motives
- Synergies – benefits: what, how and why
- Who are the key actors to engage to achieve multiple benefits?

CASE STUDIES- plea

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Questions for workshop- SILENT DISCUSSION

Heading: What do you consider is the major issue (problem; open question) with regard to Unraveling the impact of hydromorphological pressures in multiple-pressure settings
Name:
Either formulate a question or a statement to describe your issue
Reply 1
Reply 2
Reply 3

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REFORM GEOWIKI WEBTOOL

Presentation of REFORM GEOWIKI tool – structure and functionality

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End-user engagement

Information tool to support hydromorphological restoration programmes

- What expectations do you have for an information system linking hydromorphology and ecology of running waters?

- How and in what format do you want reporting on methods for rehabilitation of rivers (guidelines)?

- Do you have information (in any language)? available and would you be willing to contribute? Please give your contact details.