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REstoring rivers FOR effective catchment Management

Hydromorphology of rivers and floodplains – What is at stake and how will REFORM contribute?

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Iberian Stakeholder Workshop
Sevilla
2 June 2014

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Hydromorphological pressures in European surface waters

- 127 000 surface water bodies
  - 82% rivers
  - 15% lakes
  - 3% coastal and transitional waters
- HYMO pressures affecting ..
  - 40% river and transitional waters
  - 30% lakes
- Causes
  - Hydropower
  - Navigation
  - Agriculture
  - Flood protection
  - Urban development

Source: EEA report 8/2012 European waters – assessment of status and pressures

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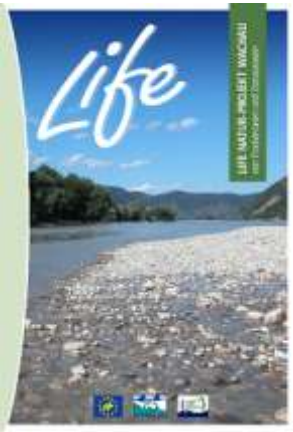
European Commission supports River Restoration and Management

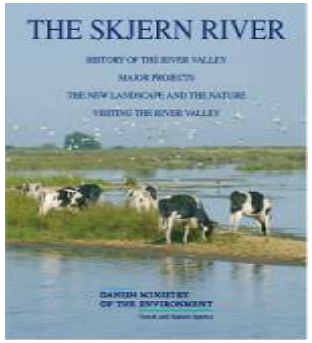
Examples of EU funded River River restoration projects

http://wwwlife-donau-ybbsat/

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



http://wwwlife-wachauat/



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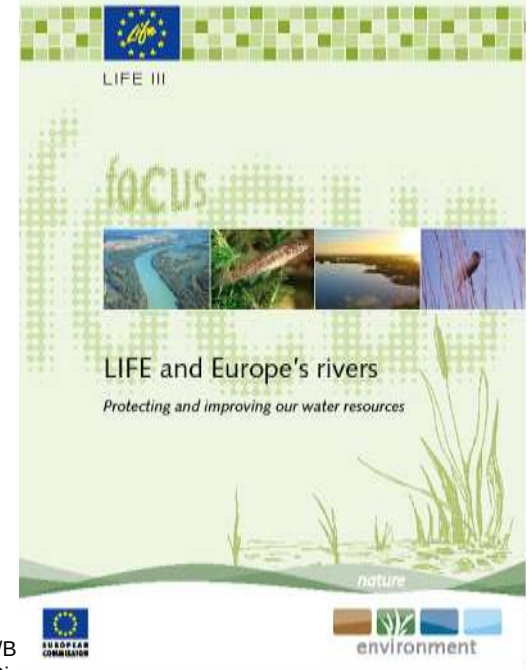

http://wwwnaturstyrelsendk/Naturoplevelser/Beskrivelser/Vestjylland/SkjernEnge/Skjern_River_Wetlandshtm

www.wwf.se/flodparlmussla

http://wwwhammde/lifelippeauehtml

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November 2011 – October 2015

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Partners

26 partners from 15 European countries

No	Name	Short name	Country
1	Stichting Deltares	Deltares	Netherlands
2	Stichting Dienst Landbouwkundig Onderzoek	Alterra	Netherlands
3	Aarhus University	AU-NERI	Denmark
4	Universitaet fuer Bodenkultur Wien	BOKU	Austria
5	Institut National de Recherche en Sciences et des Technologies pour l'Environnement et l'Agriculture	IRSTEA	France
6	Institutul National de Cercetare-Dezvoltare Delta Dunarii	DDNI	Romania
7	Swiss Federal Institute of Aquatic Science and Technology	EAWAG	Switzerland
8	Ecologic Institut Gemeinnützige Gmbh	Ecologic	Germany
9	Forschungsverbund Berlin E.V.	FVB.IGB	Germany
10	Joint Research Centre- European Commission	JRC	Belgium
11	Masaryk University	MU	Czech Republic
12	Natural Environment Research Council - Centre for Ecology and Hydrology	NERC	United Kingdom
13	Queen Mary University of London	QMUL	United Kingdom
14	Swedish University of Agricultural Sciences	SLU	Sweden
15	Finnish Environment Institute	SYKE	Finland
16	Universitaet Duisburg-Essen	UDE	Germany
17	University of Hull	UHULL	United Kingdom
18	Universita Degli Studi Di Firenze	UNIFI	Italy
19	Universidad Politecnica de Madrid	UPM	Spain
21	Warsaw University of Life Sciences	WULS	Poland
22	Centro de Estudios y Experimentacion de Obras Publicas	CEDEX	Spain
23	Dienst Landelijk Gebied	DLG	Netherlands
24	Environment Agency	EA	United Kingdom
25	Istituto Superiore per la Protezione e la Ricerca Ambientale	ISPRA	Italy
26	Norsk Institutt for Vannforskning	NIVA	Norway
27	Stichting VU-VUmc	VU-Vumc	Netherlands

Objectives of REFORM

APPLICATION

1. Select indicators for cost-effective monitoring
2. Improve tools and guidelines for restoration

RESEARCH

1. Review existing information on river degradation and restoration
2. Develop a process-based hydromorphological framework
3. Understand how multiple stress constrains restoration
4. Assess the importance of scaling on the effectiveness of restoration
5. Develop instruments for risk and benefit analysis to support successful restoration

DISSEMINATION

1. Enlarge appreciation for the benefits of restoration

REFORM Stakeholder Workshop (Brussels, February 2013)

BREAKOUT SESSIONS

- Lowland rivers
- Highland/midland rivers
- Mediterranean rivers
- Unraveling the impact of hydromorphological pressures in multiple-pressure settings
- Designing programmes of measures
- Heavily modified water bodies

IMPORTANT TOPICS

- Cause-effect between HyMo and biota
- Ecological indicators of HyMo impacts
- Sediment assessment methods & sediment continuity issues
- Disentangling effects of HyMo pressures
- Use HyMo to define GEP of heavily modified water bodies
- Guidance on environmental flows
- Robust ways to confidently demonstrate success of RR
- Cost-effective methods for RR monitoring
- Process-led RR & account for cumulative impacts within a catchment scale approach
- Decision support tools to emphasise benefits of RR
- General framework for ecosystem services

Confronting prioritised requests from participants with foreseen output of REFORM

Cooperation with …

WISER

Restoring Europe's Rivers

European Centre for River Restoration
ECRR

Evdokia Achilleos, Gary Brierley, Johan Kling, Margaret Palmer, Hervé Piégay, Peter Pollard, Ursula Schmedtje, Bas van der Wal

make use of earlier research projects (e.g. REBECCA, WISER, FORECASTER)

RESTORE (LIFE+ Information & Communication)

European Centre for River Restoration (ECRR)

WFD Implementation: common implementation strategy (CIS)

Advisory Board of REFORM

What is yet available?

- D1.1 Review on eco-hydromorphological methods
- D1.2 Review on effects of pressures on hydromorphological variables and ecologically relevant processes
- D1.3 Review on ecological responses to hydromorphological degradation and restoration
- D1.4 Inventory of the cost of river degradation and the socio-economic aspects and costs and benefits
- D2.3 Framework to analyse ecosystem services provided by European river systems
- D3.1 Impacts of hydromorphological degradation and disturbed sediment dynamics on ecological status
- D4.1 Field protocols and associated database
- D5.1 Review of methodologies for benchmarking and setting end-points for restoration projects
- D6.1 Synthesis of interim results for practical application to support the compilation of the 2nd RBMPs
- D7.1 Communication and Dissemination Strategy
- D7.3 Proceedings of the End-user workshop

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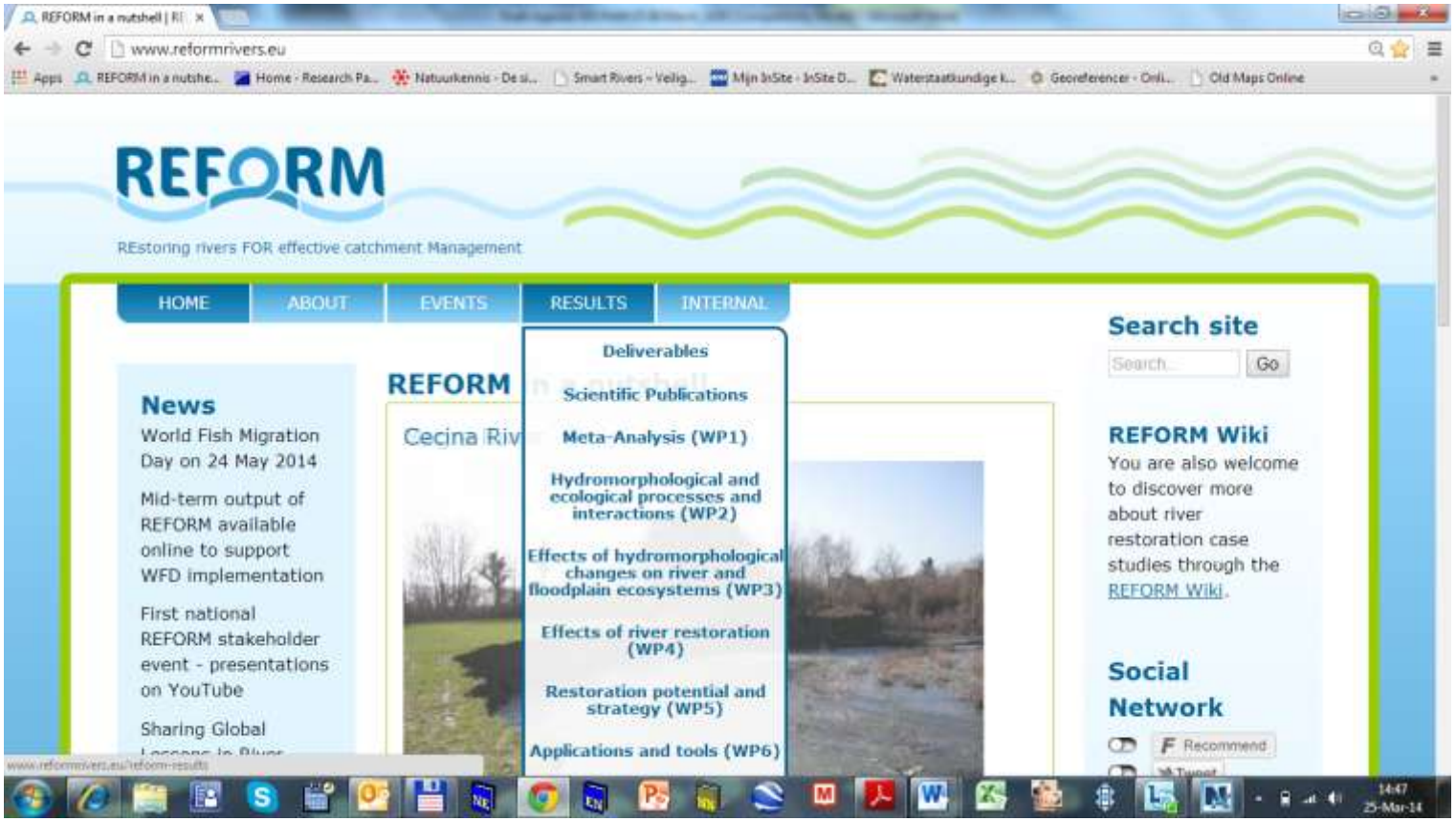
Where can you find our results?



www.reformrivers.eu -> results

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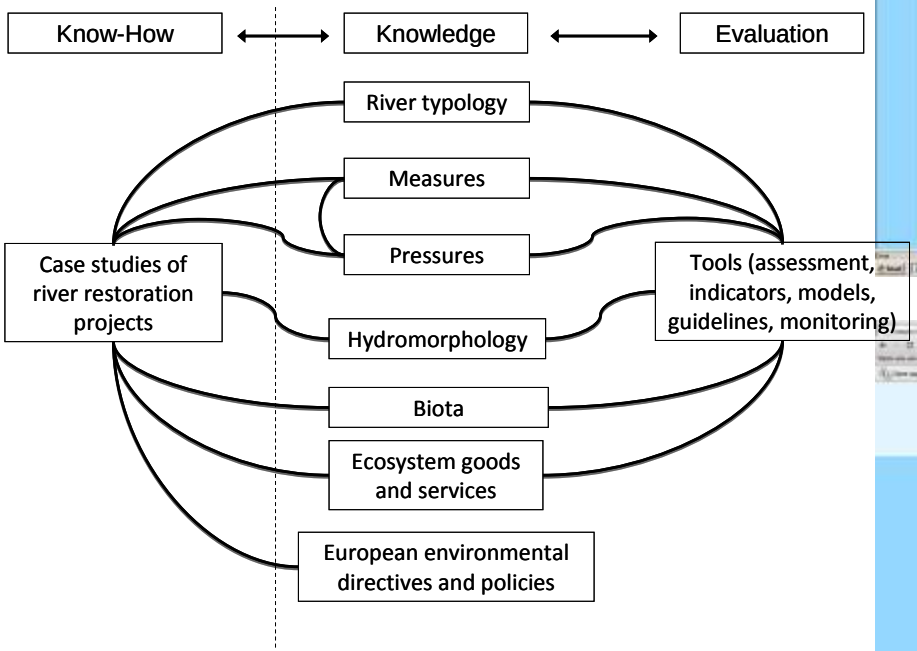
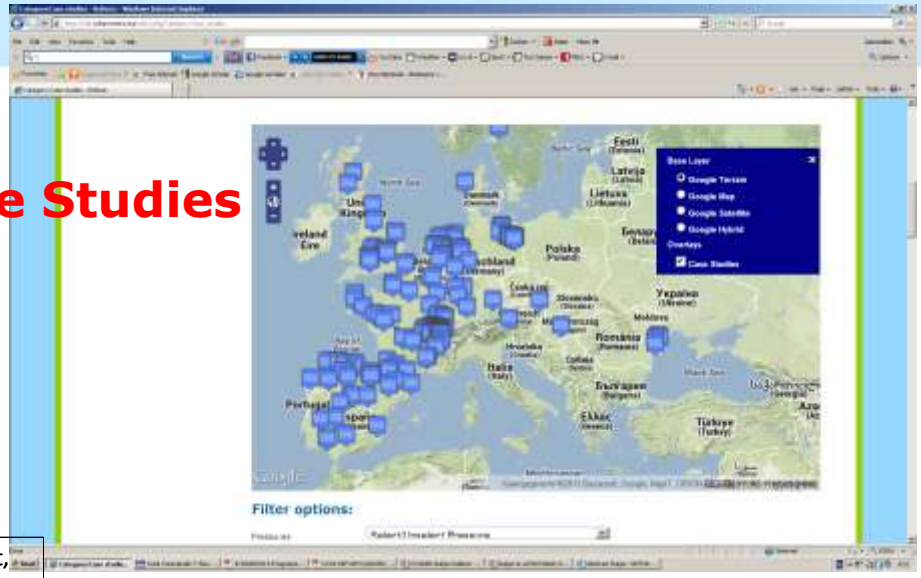
REFORM GEO-WIKI

Results available in factsheet form



.... with links to background info

Case Studies



HTTP://WIKI.REFORMRIVERS.EU

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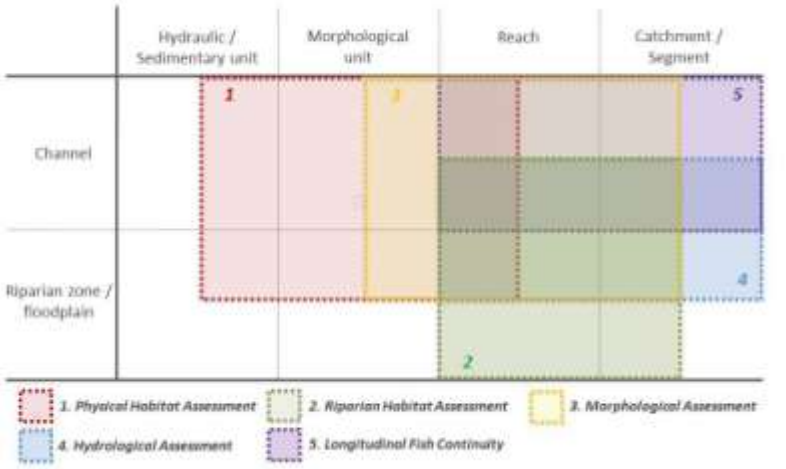
D1.1 Review of eco-hydromorphological methods

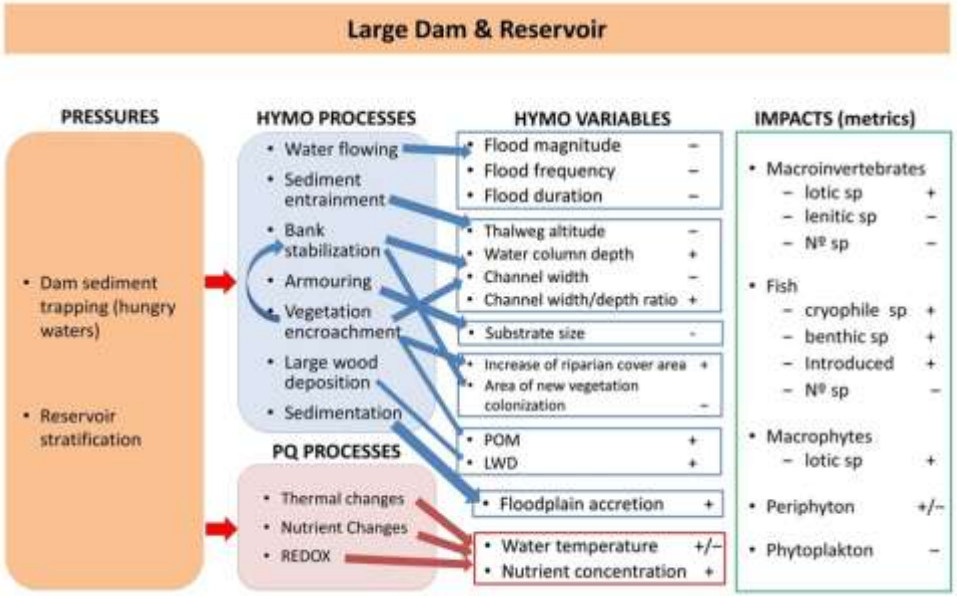


- Most applied is physical habitat assessment
- Main gap is insufficient consideration of physical processes
- Little information available on specific response of individual methods to hydromorphological pressures
- Recommendation: a framework for integrated HyMo analysis

Countries	Categories of methods					TOT
	1. Physical habitat	2. Riparian habitat	3. Morphological assessment	4. Hydrological assessment	5. Fish continuity	
Europe	**40**	**5**	**13**	**4**	**13**	**75**
Austria	6				1	**7**
Belgium	2				2	**4**
Czech Republic	1		1			**2**
Denmark	5					**5**
England & Wales	4		4		2	**10**
France	3		2		2	**7**
Germany	5				1	**6**
Ireland	1		1			**2**
Italy	2	1	1	1	1	**6**
Netherlands	2				1	**3**
Poland	3		1			**4**
Portugal	1					**1**
Scotland			2	1	1	**4**
Slovakia	1					**1**
Slovenia	1					**1**
Spain	2	4	3	2	2	**13**
Sweden	2					**2**
US	**24**	**5**	**8**	**4**	**5**	**46**
Australia	**4**	**2**	**1**			**7**
Switzerland	**1**					**1**
Others*	**4**	**2**	**2**	**2**	**2**	**12**

*South Africa, Canada/Quebec, China, New Zealand, Ukraine

D1.2 Review on effects of pressures on hydromorphological variables and ecologically relevant processes



Conceptual DIAGNOSIS pressure – process – impact framework

- 18 most significant HyMo pressures that impact aquatic biota
- Help to identify appropriate restoration measures

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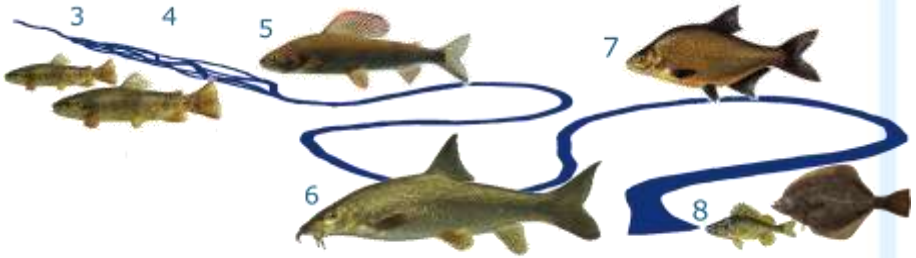
D1.3 Hydromorphology – biota interactions

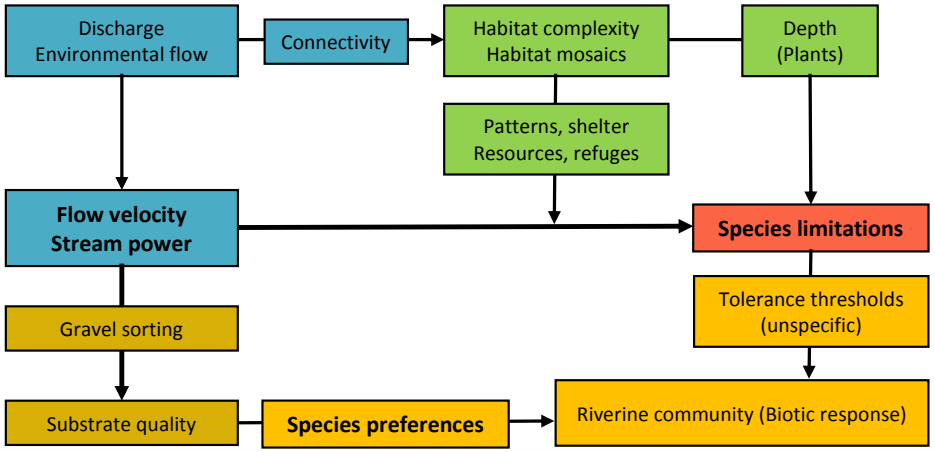
Specific indicator species

~500 aquatic plants	~23,000 invertebrates	~550 fish species
94 studied (lit. refs)	1118 oper. taxa list	218 classified
39 rheotolerant 13 gravel pref.	72 substrate preferences 60 gravel size info	26 with reported, gravel prefs

- High flow velocities and coarse gravel key indicators for HyMo integrity relevant to aquatic organisms.
- Species depending on coarse substrates specific indicators for HYMO degradation, rehabilitation, and integrity
- Review on the substrate and flow velocity preferences: quantifiable data are rather limited



Conceptual flow chart to link HyMo with biota



Recommendation

river region approach using biotic indicators

D1.4 Inventory of river restoration measures: effects, costs and benefits

Measure	Germany	Spain	UK	Netherlands
Flow Quantity (1)	1%	0%	0%	0%
Sediment Flow Quantity (2)	4%	**29%**	5%	**23%**
Flow Dynamics (3)	1%	0%	0%	0%
Longitudinal Connectivity (4)	**21%**	**32%**	7%	**55%**
Depth and Width Variation (5)	13%	0%	**53%**	9%
In-channel Structure and Substrate (6)	**27%**	7%	**19%**	9%
Riparian Zone (7)	4%	11%	7%	5%
Floodplains/Lateral Connectivity (8)	**29%**	**21%**	9%	0%
Total of Measures	453	228	45/55	30

Conclusions & recommendations

- Incorporating cost information into decision making prerequisite to increase river restoration efficiency -> more effort needed
- Difficult to determine ecosystem benefits and services from restoration projects both individually and as a whole

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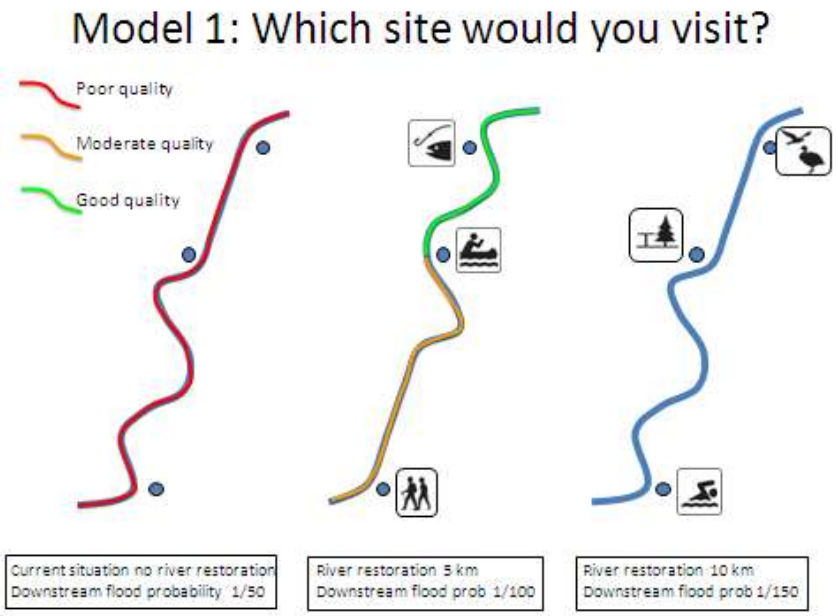
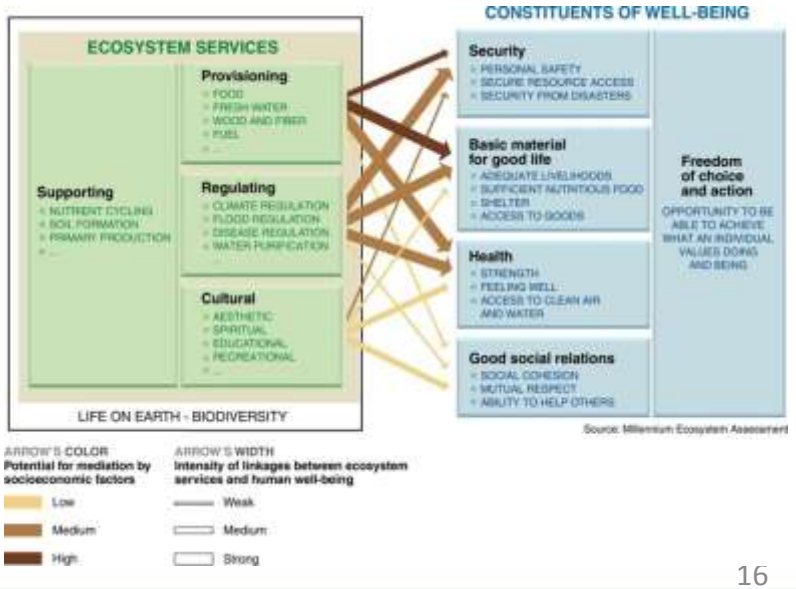
D2.3 Valuing the ecosystem services provided by European river corridors – an analytical framework

Generic Design Economic Survey



- Applied to REFORM case studies catchments
- Combining Corine land cover typology with MEA Ecosystem services



D3.1 Impacts on hydromorphological degradation and disturbed sediment dynamics on ecological status

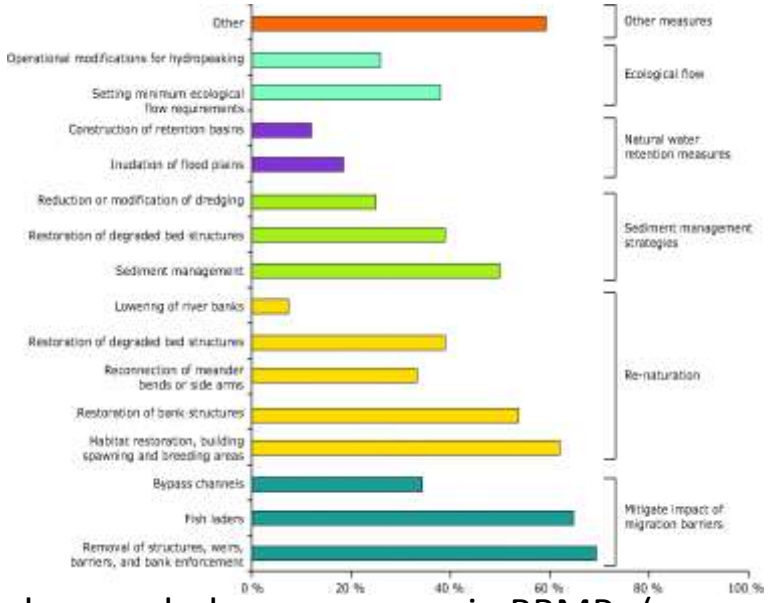
Conclusions & recommendations

- For fish and macrophytes metrics indicating HYMO impacts could be developed from monitoring data
- Many existing macroinvertebrate metrics lack specificity and can provide false positive responses to HYMO pressure
- Potential to derive metrics sensitive to fine sediment loads
- HYMO pressures should be considered in the protection of specific habitats in particular under changing climate
- Land-use data on a spatial scale beyond the reach scale (corridor and catchment) relates to site-specific macroinvertebrate metrics and could be a more robust way of assessing impacts

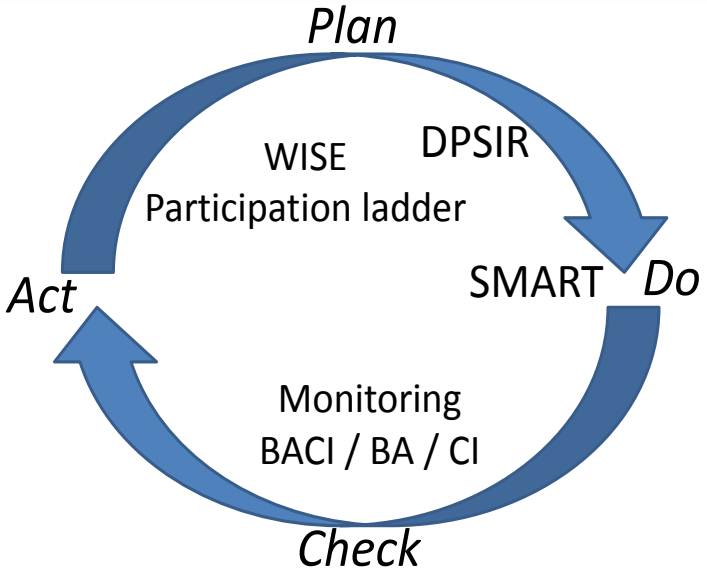
Country	Biological quality element	Number of sites	Hydrology
The Czech Republic (MASARYK)	Macroinvertebrates - indices		No
Denmark (AU-NERI)	Macroinvertebrates - species Macrophytes – species Fish - species	~200	Yes, available data
Finland (SYKE)	Macroinvertebrates – species Macrophytes – species Moss - species Fish – species Diatoms - species	~80	Yes, for ~30 of the 80 sites
Great Britain (CEH, QMUL)	Macroinvertebrates – species Macrophytes - species	250 265	Yes
Italy (UNIFI)	Macroinvertebrates – family Macrophytes – family Diatoms – species	~100	Yes, for a subset
The Netherlands (ALTERRA)	Macroinvertebrates – species Macrophytes – species Fish – species Diatoms – species	~100 ~10 ~10 8	Only for a few sites
Sweden (SLU)	Macroinvertebrates – species Macrophytes – species Fish – species	~800	Yes
Spain (Universidad Politécnica de Madrid, CEDEX)	Macroinvertebrates – family Fish – species Diatoms - species	~70 ~200 ~50	Yes
STAR project	Macroinvertebrates – species Macrophytes – species Fish – species Diatoms - species	~100	No
WISER project	Macroinvertebrates – species Macrophytes – species Fish – species Diatoms - species	~1500	Yes

D5.1 Measuring success of river restoration actions using end-points and benchmarking

- Many practitioners do not follow a systematic approach for planning restoration projects.
- Many restoration efforts fail or fall short of their objectives.
- Objectives often have not been explicitly formulated.



Hydromorphology measures in RBMPs (source: EEA 2012)



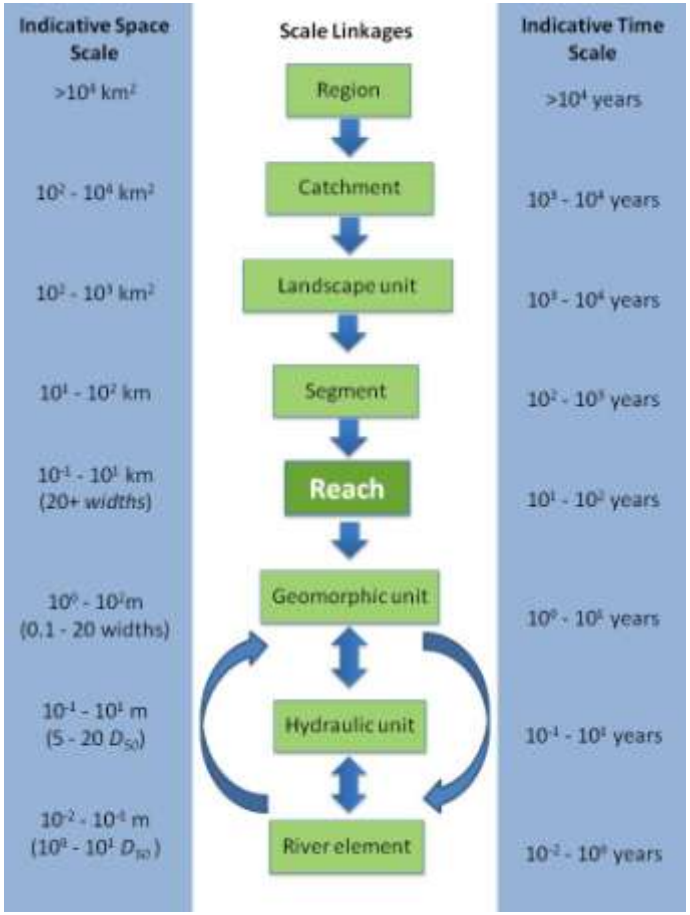
Decision support tool

- Project management techniques to solve problems and produce a strategy for the execution of appropriate projects to meet specific environmental and social objectives

What is there to come?

- D2.1 Multi-scale framework and indicators of hydromorphological processes and forms (October 2014)
- D2.2 Influence of natural hydromorphological dynamics on biota and ecosystem services (July 2014)
- D3.2 Understanding biological responses to degraded hydromorphology sediment dynamics and multiple stress (October 2014)
- D3.3 Evaluation of candidate indicators for case studies including uncertainty (April 2015)
- D3.4 Guidance on how to identify impacts of hydromorphological degradation on riparian ecosystems (April 2015)
- D4.2 Evaluation of hydromorphological restoration from existing data (April 2014)
- D4.5 Fact sheets for restoration projects (October 2014)
- D5.2 Cost effective restoration measures that promote wider ecosystem and societal benefits (January 2015)
- D5.3 Effects of climate and land use changes on river ecosystems and restoration practices (October 2014)
- D5.4 Risks and uncertainty of different restoration strategies and options analysis (April 2015)
- D6.2 Methods, models, tools to assess the hydromorphology of rivers (July 2015)
- D6.3 Guidelines and decision support for cost-effective river-floodplain restoration and its benefits (October 2015)

Hierarchical process-based HYMO framework that is ecologically relevant



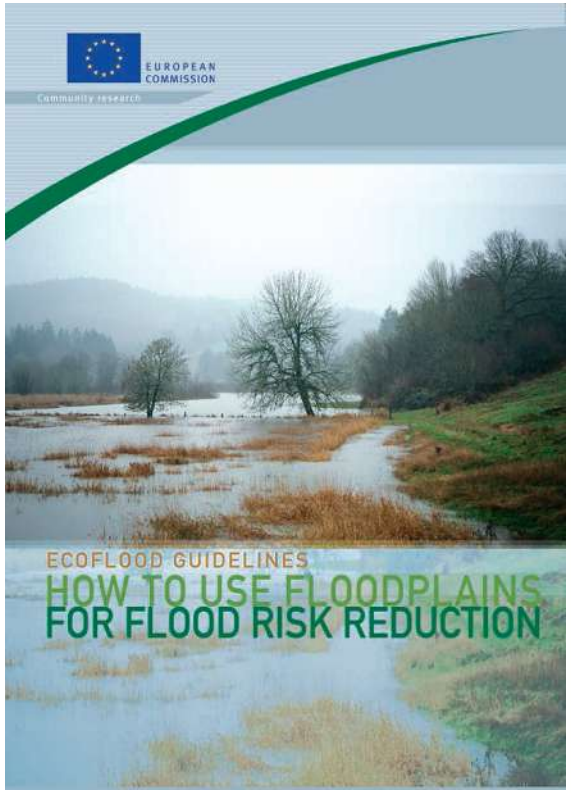
CONTROLS AND SIGNIFICANCE OF RIVER-FLOODPLAIN FORM, STRUCTURE AND DYNAMICS

Synergy between ecological restoration and ….

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

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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Acknowledgements

REFORM receives funding from the European Union's Seventh Programme for research, technological development and demonstration under Grant Agreement No. 282656

Thank you for your attention

-Stay informed –

Register to our newsletter on the website

Our project website is our display window

www.reformrivers.eu

COLLABORATIVE PROJECT
LARGE SCALE INTEGRATING PROJECT

ENV.2011.2.1.2-1
HYDROMORPHOLOGY AND ECOLOGICAL OBJECTIVES OF WFD

GRANT NO. 282656