REFORM

REstoring rivers FOR effective catchment Management

SEVENTH FRAMEWORK PROGRAMME

European River Restoration Conference

Featuring the RF Riverprize

Celebrating Successes and Addressing Challenges

5th edition | 11-13 September 2013 | Vienna

River restoration under global change

Harm Duel
Deltares
the Netherlands

Outline:

- Brief introduction to the REFORM project
- Tools to support river restoration
- Climate change: friend or enemy?
- Conclusions

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REstoring rivers FOR effective catchment Management

November 2011 – October 2015

Consortium consists of:

21 Research Institutes
4 Stakeholder organisations

Partners from 14 countries

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

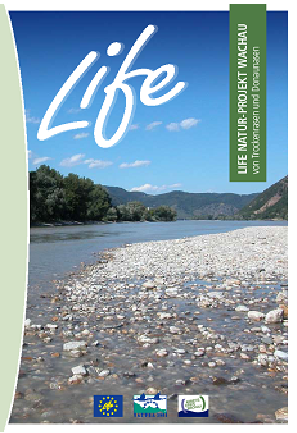
1. Enlarge appreciation for the benefits of restoration

Reviewing existing information from river restoration projects

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



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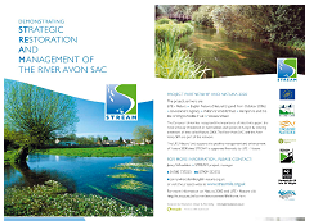

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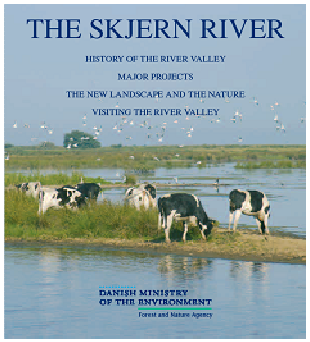

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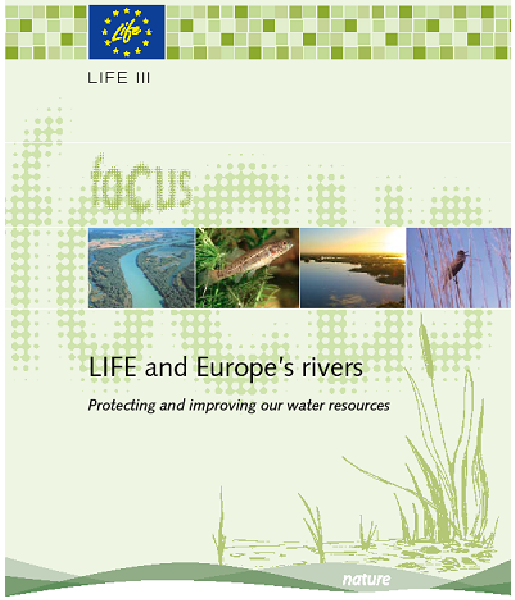


www.wwf.se/flodparlmussla

http://wwwhammde/lifelippeauehtml

REFORM Stakeholder Workshop (Brussels, February 2013)

BREAKOUT SESSIONS

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

- 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

REFORM wiki (www.reformrivers.eu)

REFORM Wiki: what you can find there…..

- Conceptual framework for restoration
- Drivers and pressures
  - Water abstraction, flow regulations, river fragmentation, morphological alterations
- Measures
  - Over 60 measures: brief description, applicability, expected impact, cost-efficiency, examples (cases)
- Tools
  - Monitoring protocols, assessment methods, analytical methods, modelling tools
- Case studies
  - Information on almost 200 case studies across Europe
- Background info on biological quality, HYMO quality, ecosystem services, water policies

Hydromorphological pressures in large rivers in the Netherlands

Hydromorphological modification	Total # of water bodies	5	4	3	2	1
Embankments	23	21	0	0	2	0
Shore protection	23	10	11	0	2	0
Loss of active floodplain	21	6	15	0	0	0
Normalisation	18	17	1	0	0	0
Channelisation	13	11	2	0	0	0
Groynes	15	12	0	0	0	3
Sluices and weirs	12	7	1	2	2	0
Impoundments	11	8	2	0	0	1

5 No significant effect on ecology
4 No essential constraint to achieve good ecological status
3 Intention to restore, rehabilitate or mitigate
2 Possible to restore, rehabilitate or mitigate
1 Irreversible modification

All large rivers are designated as heavily modified and can only to a limited part be rehabilitated

Classification of restoration measures

1 **WATER FLOW QUANTITY IMPROVEMENT**
- Reduce surface water abstraction without return
- Reduce surface water abstraction with return (eg cooling water)
- Improve water retention (catchment, basin, capillaries)
- Reduce groundwater extraction
- Improve/Create Water storage
- Increase minimum flows
- Water diversion and transfer
- Recycle used water
- Reduce water consumption

2 **SEDIMENT FLOW QUANTITY IMPROVEMENT**
- Add/feed sediment
- Reduce undesired sediment input
- Prevent sediment accumulation in reservoirs
- Reduce erosion
- Improve continuity of sediment transport
- Manage dams for sediment flow
- Trap sediments

3 **FLOW DYNAMICS (BOTH WATER AND SEDIMENT) IMPROVEMENT**
- Ensure minimum flows
- Establish environmental flows / naturalise flow regimes
- Modify hydropeaking
- Increase flood frequency and duration in riparian zones or floodplains
- Reduce anthropogenic flow peaks (eg drainage, urban run-off)
- Favour morphogenic flows
- Shorten the length of impounded reaches
- link flood reduction with ecological restoration ('ecoflood')
- manage aquatic vegetation

4 **LONGITUDINAL CONNECTIVITY/CONTINUITY IMPROVEMENT**
- Remove barrier (eg weir, dam)
- Install fish pass/bypass/side channel for upstream migration
- Facilitate downstream migration
- Modify culverts, syphons, piped streams (eg daylighting)
- Manage sluice and weir operation for fish migration
- Fish-friendly turbines and pumping stations

5 **RIVER BED DEPTH AND WIDTH VARIATION IMPROVEMENT**
- Remeander water courses
- Widen water courses
- Shallow (ie opposite to deepen) water courses
- Allow/increase lateral channel migration or river mobility
- Narrow water courses
- Create low flow channels in over-sized channels

6 **IN-CHANNEL STRUCTURE AND SUBSTRATE IMPROVEMENT**
- Initiate natural channel dynamics to promote natural regeneration
- Remove sediments (eg eutrophic, polluted, fine)
- Modify aquatic vegetation ('weed') maintenance
- Introduce large wood
- Add sediments (gravel, sand)
- Recreate gravel bar and riffles
- Remove or modify in-channel hydraulic structures (eg groynes, deflectors)
- Reduce impact of dredging

7 **RIPARIAN ZONES IMPROVEMENT**
- Adjust land use (eg buffer strips) to develop riparian vegetation
- Revegetate riparian zones
- Remove bank fixation
- Remove non-native substratum
- Adjust land use (eg buffer strips) to reduce nutrient, sediment input or shore erosion
- Develop riparian forest

8 **FLOODPLAINS/OFF-CHANNEL/LATERAL CONNECTIVITY HABITATS IMPROVEMENT**
- Lower river banks or floodplains to enlarge inundation and flooding
- Set back embankments, levees or dykes
- Reconnect backwaters (oxbows, side channels) and wetlands
- Remove hard engineering structures that impede laterel connectivity
- Restore wetlands
- Retain floodwater (eg through local sluice management)
- Improve backwaters (eg morphology, vegetation)
- Construct semi-natural/artificial wetlands or aquatic habitats
- Isolation of water bodies

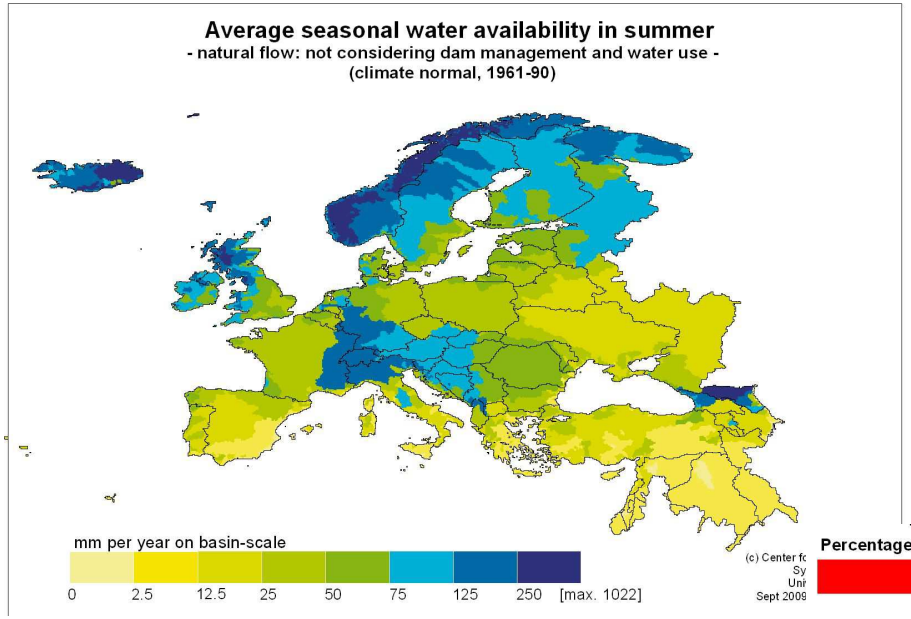
9 **OTHER MEASURES**

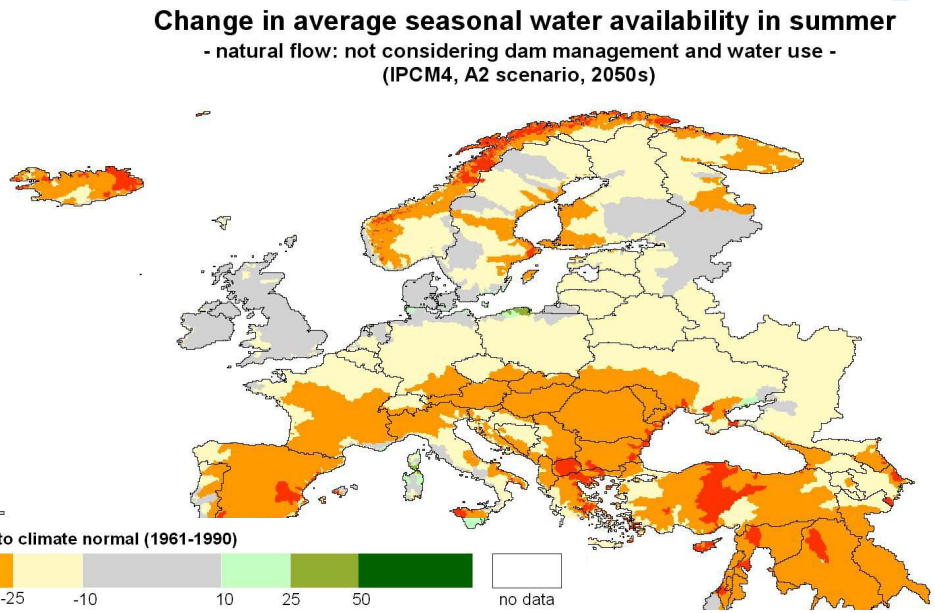
Measures that are restoring the natural hydro-morphodynamic processes create the best opportunity to improve the ecological quality

Changing climate: more pressures

Changing climate:

- Extremes (floods, droughts) will be become more extreme and will happen more frequently
- Flow regimes will change, water temperature will increase as well as water quality problems





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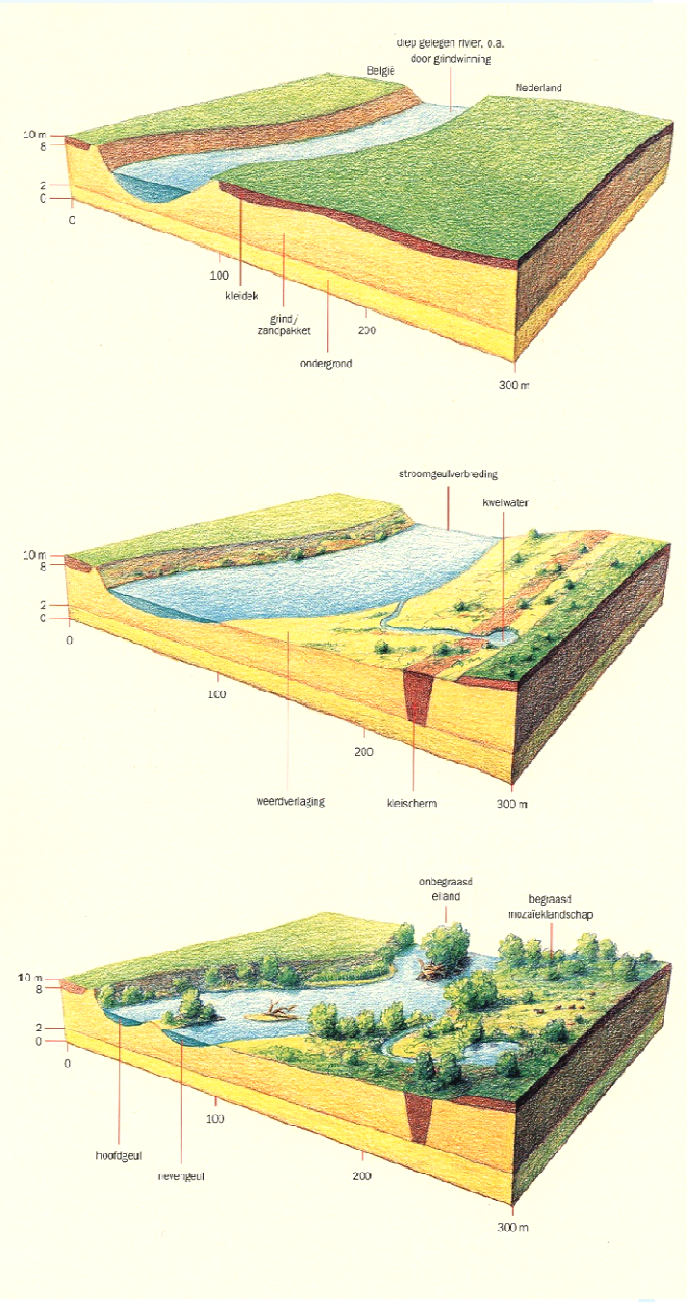
Climate adaptation: opportunity for restoring rivers

- Flood protection strategies:
  - room for the river
  - natural flood defenses
- Natural water retention measures
  - promoting natural hydrological processes
  - catchment level
- Water-Food-Energy nexus
  - resource use efficiency
  - sustainable resource management
  - equitable benefit sharing
  - sustaining ecosystem services



Conclusions

Restoring rivers:

- a matter of scale and processes
- natural water retention
- balancing the use of (water) resources
  - water-food-energy-biodiversity nexus
  - guiding principle sustain biodiversity and ecosystem services
- go for synergies
  - For example: Flood Protection

- integrated water resource management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