REFORM: Towards the development of tools to support cost-effective implementation of restoration measures and monitoring

IAIN GUNN (CEH Edinburgh)
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• Application of research

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<th>Short name</th>
<th>Country</th>
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<tr>
<td>1</td>
<td>Stichting Deltares (Coordinator)</td>
<td>Deltares</td>
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<td>Stichting Dienst Landbouwkundig Onderzoek B.V. – Alterra</td>
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<td>3</td>
<td>Aarhus University – National Environmental Research Institute</td>
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<td>4</td>
<td>Universitaet fuer Bodenkultur Wien</td>
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<td>French Research Institute for agricultural and environmental engineering</td>
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<td>European Commission Joint Research Centre</td>
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<td>Masaryk University</td>
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<td>Istituto Superiore per la Protezione e la Ricerca Ambientale</td>
<td>ISPRA</td>
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</table>

25 partners from 14 European countries
Kick-off meeting (Florence, 28 Nov – 1 Dec 2011)

67 participants
Overall aims of REFORM

To provide a framework
  – improve *success* of HYMO restoration measures
  – to reach *cost-effective* ecological targets of rivers

**Success** = HYMO sustainable, Ecol effective, and Socio-Economic potential

**Cost-effective** = optimisation of ecosystem health, goods and services

Thus REFORM will develop protocols and procedures
  – to *monitor* biological response to HYMO change with greater precision
  – to *support* the design of *PoM* for the WFD, in particular the 2nd RMBPs (2015)
  – to *integrate* restoration better with socio-economic activities.
**Natural processes**

**Degradation**

**Restoration & Mitigation**

**WP 1 Meta-analysis**

- Review existing information on river degradation and restoration
- Understand how disturbed sediment dynamics and multiple stress constrain restoration

**WP 2 Hydromorphological and ecological processes and interactions**

- Develop a process-based and ecologically relevant hydromorphological framework

**WP 3**

- Effects of hydromorphological changes on rivers and floodplain ecosystems
- Assess the importance of scaling and catchment conditions on the effectiveness of restoration

**WP 4**

- Effects of river restoration

**WP 5 Restoration potential and strategy**

- Develop instruments for benchmarking, end-points, risk and benefit analysis to support successful restoration

**WP 6 Applications and tools**

- Enlarge appreciation for the benefits of restoration

**WP 7 Knowledge dissemination and stakeholders participation**

**WP 8 Consortium coordination and management**

- Translate science to practice
- Select indicators for cost-effective monitoring
- Improve tools and guidelines for restoration
### WP 1: Reviewing existing information on river degradation and restoration

Examples of EU funded River restoration projects

<table>
<thead>
<tr>
<th>Count of ProjectName</th>
<th>Programme</th>
<th>Global objective</th>
<th>INTERREG</th>
<th>LIFE</th>
<th>Grand Total</th>
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<td>Integrated River Basin Management</td>
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<td>26</td>
<td>1</td>
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<tr>
<td>River &amp; floodplain restoration</td>
<td></td>
<td></td>
<td>17</td>
<td>114</td>
<td>131</td>
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<tr>
<td>Water quality improvement</td>
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<td>Species conservation and management</td>
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<td>14</td>
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<tr>
<td>Grand Total</td>
<td></td>
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<td>81</td>
<td>172</td>
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[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-donau-ybbsat/)

WP 1: Reviewing existing information on river degradation and restoration

**Examples of EU funded River restoration projects**

- [http://wwwstreamlifeorguk/](http://wwwstreamlifeorguk/)
- [http://wwwlife-donau-ybbsat/](http://wwwlife-donau-ybbsat/)
- [http://wwwlife-donau-ybbsat/](http://wwwlife-donau-ybbsat/)
- [http://wwwlife-donau-ybbsat/](http://wwwlife-donau-ybbsat/)
- [http://wwwwwfse/flodparlmussla](http://wwwwwfse/flodparlmussla)
- [http://wwwhammde/lifellippeauehtml](http://wwwhammde/lifellippeauehtml)
WP 1: Review on effects of hydromorphology on biotic interactions

• Various concepts reduced to the very basics – over-simplification or way forward?

Variability of Habitat Depth Width Substrate Structures Flow

# species, species diversity abundance, density

= general, unspecific indicators

Key factor flow velocity
- limits habitat use
- sorts substrates, provides substrate for specialized species

= specific indicators (in limited numbers)
WP2: Developing a process-based hydromorphological framework

- Set HYMO assessments into a process-based framework (process management particularly important for high energy rivers) to reflect river dynamics
- Riverine landscapes structured by interplay of HYMO processes, geology & vegetation structure
- Processes essential to rejuvenate channels, riparian zones and floodplains
- Distinguish spatial and temporal scales to explain river physical appearance & functioning

<table>
<thead>
<tr>
<th>APPROACH</th>
<th>SCALE OF ANALYSIS</th>
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<tbody>
<tr>
<td>Top-down explanation</td>
<td>Catchment, landscape units</td>
</tr>
<tr>
<td>Bottom-up constructivist</td>
<td>Reach</td>
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<tr>
<td></td>
<td>Geomorphic units</td>
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<tr>
<td>Controls on river character and behavior</td>
<td>River Style</td>
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</table>
PROCESS-BASED FRAMEWORK

REGION

Catchment

Landscape unit

Segment

Reach

Geomorphic unit

Hydraulic unit

River element

CONTROLS ON RIVER BEHAVIOUR
(affect delivery of water and sediment to river reaches)

RIVER AND FLOODPLAIN TYPE, DYNAMICS, SENSITIVITY

DYNAMIC SUITE OF RIVER AND FLOODPLAIN FEATURES
(physical habitats)
The Framework will:

- Guide users on information required at different spatial scales
  How to collect or estimate
  How to describe and explain variation in river character and behaviour.

- Predict how a reach might react to changes
  e.g. Removal of engineering modifications
  Flow regime re-naturalisation
  Reinstatement of sediment supply

- Form the basis to define site-specific, “reference” conditions
  Against which present-day hydromorphological condition can be assessed
WP 3: Effects of HYMO change on river & floodplain ecosystems

- Assessing the impact of HYMO pressures on river biota
  - Including altered sediment dynamics
  - Analysing existing data sets from across Europe

- Better understanding of how biotic indicators of HYMO pressures respond in multiple-pressure environments
  - Experimental and water quality modelling work
WP 4: Case studies: “Flagship” restoration vs. “normal” restoration

Catchment with large restoration measure(s)

Catchment without large restoration measure(s)

(Long) restored reach

Degraded reach upstream

Short restored reach

Degraded reach upstream

REFORM makes use of existing data.

Besides additional new data will be collected in 9 catchments
WP 4: Restoration scale and catchment conditions

Do dimensions influence restoration success?

Do catchment conditions support or constrain restoration and direct the choice of measures?

- Flow regimes of water and sediments
- Barriers
- Colonisation potential from source populations
- Water and sediment quality (nutrients, micropollutants)

„Spoiling variables“
- Land use
- Pollution
- Colonization potential

Cause
- Restoration

Effects
- Habitats
- Biota
- Ecosystem services

Economy
- Project costs
- Societal benefits
WP 5: Benchmarking, end-points

There is a need to benchmark when restoration is successful.

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

... 

This is however often not done
WP 5: Synergy 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; hydropoaking)

To ...

Expand the potential for restoration
Support the intercalibration of Good Ecological Potential of heavily modified and artificial water bodies (ECOSTAT)
Deliverables - >publications, WIKI & Tools

- Deliverables = formal reporting of results
- Accessible and Ready for Use = publications, WIKI & tools
REFORM WIKI

Open Access Web-based Knowledge Management System

Expansion of the FORECASTER WIKI (2008 – 2010)

WIKI to give end-users access to results of REFORM
REFORM WIKI
Open source web-based knowledge management system

Know-How

Knowledge

Evaluation

River typology

Measures

Pressures

Hydromorphology

Physico-chemistry

Biota

Ecosystem goods and services

Case studies of river restoration projects

European environmental directives and policies

Tools (assessment, indicators, models, guidelines, monitoring)
WP 7: Interaction with end-users

Communication & Dissemination Strategy (March 2012)

End-user groups: policy makers, practitioners, scientists

Standard
- Website, Newsletters (2/yr), Policy Briefs (3)

Advanced
- WIKI linking theory to practice and experience
- Interactive preparation of end-user workshop
- Interaction with ECOSTAT

Events
- Interactive end-user workshop (Feb/Mar 2013)
- Local workshops in case study catchments (tbd)
- Summer school (2015)
- Final conference (2015)
Cooperation with …

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

RESTORE (LIFE+ Information & Communication)

European Centre for River Restoration (ECRR)

WFD Implementation: ECOSTAT common implementation strategy (CIS)

Advisory Board of REFORM

Gary Brierley, Johan Kling, Margaret Palmer, Hervé Piégay, Peter Pollard, Ursula Schmedtje, Bas van der Wal
Thank you for your attention

www.reformrivers.eu

Stay informed: register to our newsletter on the website