print [1] | pdf [2]

Welcome editorial by the REFORM Coordinator [3]

Dear reader,

I am pleased to introduce the first REFORM newsletter. REFORM will prepare a newsletter every half year to inform interested people on the progress of our project and on other connected developments. You can subscribe to receive the newsletters automatically. Of course we very much appreciate when you forward our newsletter to other colleagues. At first I wish to introduce the REFORM project briefly to you.

REFORM addresses the 2010 FP7 research call on hydromorphology and ecological objectives of the Water Framework Directive (WFD). After multiple research projects that had a strong emphasis on assessment methods, the request for a new research project moved towards the effectiveness of river restoration and to more cost-effective and precise monitoring to evaluate the impact of hydrological and morphological interventions be it degradation or restoration. REFORM is therefore targeted towards development of guidance and tools to make river restoration and mitigation measures more cost-effective and to support the 2nd and future River Basin Management Plans for the WFD. REFORM will also develop a web-based tool for exchanging experiences with river restoration measures facilitated and enhanced through consultation with stakeholders.

Aims of REFORM are to provide a framework for improving the success of hydromorphological restoration measures and to assess more effectively the state of rivers, floodplains and connected groundwater systems. The restoration framework addresses the relevance of dynamic processes at various spatial and temporal scales, the need for setting end-points, analysis of risks and benefits, integration with other societal demands (e.g. flood protection and water supply). The work is being organized in three modules: (1) natural processes, (2) degradation, (3) restoration and all work packages are multidisciplinary.

Photo: REFORM partners at the kick-off meeting in Florence, Italy, 28 November – 2 December 2011.

In this first newsletter you will find an article on the WISER project (www.wiser.eu [4]). WISER already

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dedicated part of its research to restoration. WISER and FORECASTER (http://forecaster.deltares.nl [5]) were the first two international projects addressing river restoration in Europe. The coordinator of WISER, Daniel Hering, is also a key partner in REFORM giving us the best opportunity to continue with the outcome of WISER.

Our ambition is to interview a key person on river restoration and river studies in Europe for each newsletter. In the first issue Prof. Klement Tockner amongst others editor of the book 'Rivers in Europe' and coordinator of the EU-funded BIOFRESH (www.freshwaterbiodiversity.eu [6]) project is in the spotlight.

In the first newsletter we present two aspects of REFORM: the cross-cutting work package 1 and the case study catchments. Work package 1 compiles and disseminates existing knowledge and expertise on river degradation and restoration in the first phase of REFORM. Case study catchments are one of the key features of REFORM. They assess the interaction between restored stretches and the status of the wider catchment. To prepare the sampling in these catchments, a field training was organised last May in Denmark. An impression of this meeting is presented. Also one of the case studies, the Narew River in Poland, is presented in this newsletter. The Narew River will be the venue for the 2nd all partner meeting of REFORM this coming September, which includes a workshop with local stakeholders to discuss the restoration strategy for this river.

From the very beginning of the project, REFORM partners have been invited to present the project at meetings of the WFD Common Implementation Strategy, at the Working Group F on Floods meeting in Bucharest and at the ECOSTAT hydromorphology meeting in Brussels. The interaction with such working groups is very important, because many studies to assess hydromorphology and ecology of rivers are carried out within Member States. REFORM wishes to connect and support these national research efforts. Short impressions of both meetings are given.

I would like to invite you to visit our website (www.reformrivers.eu [7]), which gives further details on the REFORM project. Once deliverables are ready they will – of course - be uploaded here.

If you have recommendations to improve our website or newsletter, would like to explore the opportunity to cooperate or have questions, do not hesitate to contact me or any of the other REFORM partners.

On behalf of the REFORM team

Tom Buijse

Coordinator REFORM

For further information:

Author: Tom Buijse

REFORM Stakeholder Workshop on River Restoration (Brussels, 26-27 February 2013) [8]

On 26-27 February 2013, the REFORM project will hold a technical and interactive **Stakeholder Workshop on River Restoration to Support Effective Catchment Management** in Brussels.

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The workshop will serve as a platform for consultation and exchange between REFORM scientists, European technical experts working on river degradation and restoration, and members of the WFD CIS WG A Ecological Status (ECOSTAT).

Specifically, the workshop is aimed at experts involved in river basin management planning and participants with a good technical understanding of the methods used in their respective countries to assess hydromorphological alterations, their ecological impacts, and restoration measures that can reverse or mitigate these. The event is planned for 120 participants.

At this event, first results of the REFORM project will be presented and invited experts can give their feedback during interactive breakout sessions on how REFORM can contribute to the next round of River Basin Management Plans (RBMPs) by creating tools and approaches for managing the different types of rivers and pressures across Europe.

Keynote speeches will be given by the REFORM partners, the ECOSTAT leaders, the EEA, the WISER project, and the Life+RESTORE project, among others.

You will find the draft version of the **workshop programme** at:
http://reformrivers.eu/events/stakeholder-workshop/programme [9].

The workshop will include presentations on the following:

- An overview of the initial outcomes of REFORM to support the drafting of the 2nd River Basin Management Plans
- Feedback on assessment methods and measures for river restoration in the 1st River Basin Management Plans
- Methods for understanding the root causes of degradation and specifying the expected outcome of restoration
- Reporting on tools for assessing the effectiveness of restoration for river basin planning considering project scale and catchment status
- Discussion of a European multi-scale ecohydromorphological assessment framework (prioritisation of assessments in different scales)
- Knowledge sharing on hydromorphological degradation and restoration
- Dissemination of information about related European research projects and activities and their relationship to REFORM

Breakout sessions for interactive discussion will address the following themes:

- Highland/midland river systems
- Lowland river systems
- Mediterranean river systems
- Unraveling the impact of hydromorphological pressures in multiple-pressure settings
- Designing programmes of measures
- Dealing with heavily modified water bodies

The breakout sessions will address REFORM’s outputs and plans for the next stages of the project and also reflect on relevant activities in the Member States and other European countries.

For further information about the workshop, please consult the workshop website (http://www.reformrivers.eu/events/stakeholder-workshop [10]) or contact the workshop secretariat at: reform-workshop@ecologic-events.eu [11]

For further information:

Eleftheria Kampa

Multi-purpose river restoration, An interview with Prof. Huib de Vriend [12]

Professor Huib de Vriend is a civil engineer by training. He received his PhD from Delft University of Technology. Before his retirement in 2012, he was director of science of Deltares and part-time professor of river engineering and eco-hydraulics at Delft University of Technology. He is director of the EcoShape Foundation, which coordinates the 'Building with Nature' innovation programme executed by a consortium of government agencies, universities, research organisations, consultants, and engineering contractors. Prof. de Vriend is a member of the National Commission for the EIA, and of the think-tank on flood safety of the Netherlands Ministry of Infrastructure and Environment.

1. Please introduce yourself and explain your affiliation with rivers.

I am a civil engineer by training and I hold a PhD on river bends from TU Delft. After finishing my studies, I started working at the Coastal Department of Delft Hydraulics. In 1993, I became a professor at the University of Twente, and soon afterwards, I started a part-time professorship on River Engineering at TU Delft. In 2002, I was appointed Director of Science at Delft Hydraulics (later Deltares), combined with my part-time professorship. In 2008, I became Scientific Leader of a national programme called *Building with Nature*, which is implemented by EcoShape (www.ecoshape.nl [13]), a consortium of private parties, government organisations, and research institutes. In May last year, I retired from my work at Deltares and the university, and I am currently dedicated to Ecoshape and Building with Nature.

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2. Where do you think the emphasis should lie in the future for restoring European rivers? What key actions need to be prioritised?

European rivers, as well as those in the rest of the world, are affected by damming. Dams influence the supply and flow of sediments and nutrients in a river system. They create distortions and break the natural balance, resulting in disastrous impacts not only on the river itself, but all across the system, including coastal zones. This is, in my opinion, one of the main issues concerning rivers in Europe.

River restoration is about re-establishing the natural dynamics of the whole river system, and that requires a large-scale perspective. My perception is that many people who are involved in river restoration focus only on small-scale projects and forget to look into the effects of restoration on the whole system. While this is understandable given the complexities involved with adopting a more holistic approach (e.g., resource limitations), I do think we have the obligation to look into the aggregated effects of small-scale interventions. When combined, all these individual interventions represent a large-scale activity to which corresponds a large-scale response from the river. When we fail to consider downstream effects and long-term impacts, we are missing a big part of the picture. I think we should be much more concerned about this issue than we currently are.

3. In your opinion, is it possible to combine river restoration with other functions, in such a way that there is an economic driver for it? How can this be achieved?

I think it is tactically clever to identify economic drivers to support restoration initiatives. River functions like water availability, flood defence, navigability, and nature protection are all economically relevant. For instance, you can use restored wetlands to store water (“sponge” effect) and maintain flow regimes even throughout the year, increasing water availability, and reducing vulnerability to extreme weather events.

A problematic issue with natural water retention is that the costs and the benefits of measures fall on different hands. This calls for a governance setting in which investors actually profit from measures and those creating the costs actually pay for them. A good example of this is navigability, a function that is maintained by the government but whose economic benefits are gathered by its users. These economic and governance settings make it a real challenge to create economic drivers for river restoration.

As to the role that the EU Water Framework Directive (WFD) can play in this context, I believe legislation leads to minimum response, that is, the minimum effort is made to stay within the law. I would like to see us going beyond that. I believe the WFD is a very good start because it triggers development, but I think it should be complemented with other drivers like public-private cooperation.

4. Can you tell us about the Dutch Room for Rivers Programme and its achievements so far?

This project is a national initiative running until 2015 which is in line with the EU Floods Directive and consists of a large number of interventions directed towards flood protection in the Netherlands. These interventions started in 1995 as alternatives to accommodate a higher design discharge without resorting to dyke strengthening and dyke raising. The programme is based on the idea that when a river is confined, flood level and propagation speed are raised. In other words, the lead-time during which prevention and mitigation measures can be implemented is reduced, resulting in more severe floods and stronger impacts. The project follows a clear sequence that starts with understanding the functioning and dynamics of a river system and its responses to interventions, and only then designing those interventions and making considerations for floodplain maintenance.

The positive effects of the programme can already be seen in the earlier implementations, e.g., on the River Meuse where some river dynamics are coming back, however most results are still limited given that the majority of the interventions are currently still being executed. Nonetheless, one important result has been the influence of the programme on the public acceptance of nature protection and river restoration. This is highly transcendent since our design floods have a

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probability of occurrence of 1 in 1250 years; such a rate combined with low public acceptance levels can cause restoration measures to fall back in the priority list.

Towards the future, the rivers vision of the Delta Commission (a programme dealing with flood safety and freshwater supply in a climate- and societal change setting) will become the natural follow-up of the Room for Rivers Programme.

5. You have led research projects addressing river morphology and nature restoration from an engineering perspective. What are main lessons learned from such activities and how can such projects connect to the work being done by REFORM?

A very important lesson we learned is that our projects had to operate in a continuum between nature, engineering and society. The complexity of implementing an initiative and the number of stakeholders involved in the process require that governance, decision-making and public support issues are attended. In the case of research projects like REFORM, this would call for the involvement of social scientists for example.

Furthermore, one must pay attention to the great array of barriers that can hinder the implementation of innovative solutions. Contracting, financing, rules, and regulations can all turn into stumbling stones which can keep a project from reaching its full potential. Project leaders have to think through the whole chain of actions and events that ultimately lead to an implemented project, and this is much more than just a good idea or good research.

Identifying and using opportunities like aligning economic and nature restoration objectives or having a “political champion” in the team can be very beneficial in overcoming barriers and complexities.

I consider REFORM a great opportunity to bring nature restoration further and activate the general interest to include nature components in engineering works.

Huib J. de Vriend was interviewed on 21 May 2013 by Eleftheria Kampa (Leader of Dissemination and Stakeholder Involvement of REFORM, Ecologic Institute) and Gerardo Anzaldua (Researcher, Ecologic Institute).

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Gerardo Anzaldua, Ecologic Institute

Eco-hydromorphological restoration in the first River Basin Management Plans [14]

About 56% of Europe’s river water bodies with a total length of 630,000 km have not reached good ecological status or potential. Of these water bodies, 48% are affected byhydromorphological pressures and 43% contain altered habitats. An early task in workpackage 1 of REFORM was to comparatively analyse the Member States' River Basin Management Plans (RBMPs), the Programmes of Measures (PoMs), and already implemented hydromorphological restoration projects. The goal was to investigate the consistency of measures with pressures, preferences for measures based on existing knowledge, knowledge gaps, and potential ecological effects of the planned measures.

A previous assessment of the German PoMs revealed a reasonable selection of measures in accordance with the analysis of pressures and impacts (Kail & Wolter 2011). At the same time, it showed a general lack of knowledge on the effectiveness of restoration measures, especially to enhance the ecological status of lowland rivers and heavily modified water bodies (HMWB).

Therefore, the objectives of this task within REFORM were to analyse the RBMPs and PoMs at the European scale and to compare the planned measures with those that are already implemented to investigate whether:

1. traditional restoration measures for which more experiences exist are favoured in the PoM,
2. more measures are planned for well-known taxa, i.e., for fish,
3. regional differences in restoration measures reflect different main pressures and impacts, and
4. there is a tendency to plan investigating studies first in order to address a general lack of knowledge on ecologically efficient measures.

The RBMPs and PoMs of the Member States have been accessed through the Water Information System for Europe (WISE) (http://water.europa.eu [15]). The supplementary measures to enhance ecological status have been translated and classified according to measure groups developed in the project FORECASTER (IWRM.NET, BMBF 02WM1031). In parallel, a restoration project database was compiled containing projects and measures targeting hydromorphological improvements of streams, rivers, and floodplains. Projects solely focusing on connectivity, i.e., fish passage facilities, or water quality have not been taken into consideration unless they were combined with measures to improve hydromorphology.

In total, 49,055 supplementary measures were listed for European river basin districts (17,341 for Continental Europe CE, i.e., excluding UK which had a more detailed list of measures than other Member States). Conceptual measures (e.g., investigations, stakeholder information, legislation) were the most frequently planned and accounted for 56% (CE) of all measures, followed by measures addressing hydromorphology (14%), and water quality (18%). The share of hydromorphological measures was dominated by floodplain rehabilitation (15%), instream habitat enhancement (11%), hydrology (16%), connectivity (17%), and riparian buffers (12%) (see Figure below, right side). The restoration project database contains 878 reports on 813 hydromorphological restoration projects (649 European and 164 non-European). Instream habitat enhancement was the dominating measure both in (68%) or outside (53%) Europe, whilst differences appeared in particular with the higher numbers of projects in Europe addressing floodplain morphology (42% *vs.* 11%) and river planform (40% *vs.* 19%).

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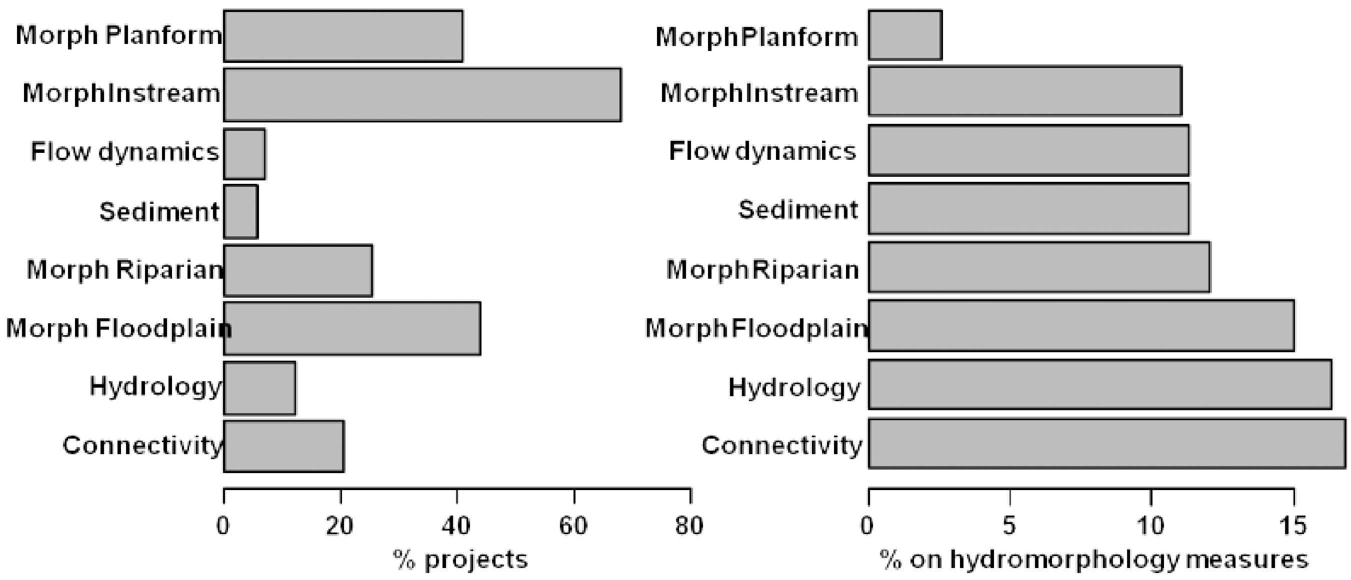

Proportion of measures targeting hydromorphological improvements in 649 implemented European restoration projects (left) and of 2,428 (Continental Europe without UK) supplementary hydromorphological measures planned for European river water bodies in the PoMs (right).

Although an analysis of pressures, ecological status, and partially measures in the European RBMPs have been performed already by the European Commission and the EEA (see EC 2012, EEA 2012, Fehér et al. 2012, Lyche-Solheim et al. 2012), our findings provide different viewpoints and new insights:

- While hydromorphological measures are planned for 96% of the designated 157 European river basin districts (EC 2012), only 14% of all planned supplementary measures address hydromorphology, despite the conclusion that hydromorphological modifications are among the most significant pressures identified throughout Europe (EEA 2012, Fehér et al. 2012).
- Further, a surprisingly low 11% of the planned hydromorphological measures address instream habitat enhancement, although this measure is implemented in 68% of European restoration projects in our database, implying that ample experience should be available.

This obvious discrepancy between implemented restoration projects and further planning of measures (in RBMPs and PoMs) raises questions on the reasons why instream measures still appeared less successful, whether they are no longer required or whether planning and implementation is hampered by other constraints which are important for successful river restoration. This discrepancy will be subjected to further research within REFORM.

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All reported RBMPs are publicly available at www.circa.europa.eu/Public/irc/env/wfd/library?l=/framework_directive/implementation_documents_1/submitted_rbmps&vm=detailed&sb=Title [16]

WISE data are available at http://water.europa.eu [15] and http://www.eea.europa.eu/themes/water/interactive/water-live-maps/wfd [17]

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Setting the stage for hydromorphological assessment: delineating spatial units [18]

One of the aims of the REFORM project is to develop a spatial hierarchical framework to assess hydromorphology in rivers. The reason why it is important to adopt a spatially hierarchical method is that the shape and behaviour of a river, as well as the landforms it creates and the habitats that it supports, are controlled by processes at a wide range of spatial scales. In other words, what we see at a river reach is the result of a cascade of influences from further upstream in the catchment. By characterising those controlling influences at their relevant spatial scales, we set the correct context in which to assess the hydromorphological condition of a reach and to develop effective restoration and management options.

The hydromorphological assessment framework consists of three main phases: delineation, characterisation, and the assessment of indicators of hydromorphological condition. All of these three phases are applied to a hierarchy of spatial units within the drainage basin that is being assessed.

Here, we focus on the first step in the framework; the delineation of spatial units. We use information on climate, topography, valley characteristics and channel and floodplain morphology to divide the river system into internally consistent spatial units. We start from the coarsest scale, the region, and work our way through the catchment, landscape unit, river segment and finally river reach levels. Delineation can continue within the reach, where geomorphic units, hydraulic units and river elements can be identified. However, we stop at the reach scale at this desk-based stage of the hydromorphological assessment.

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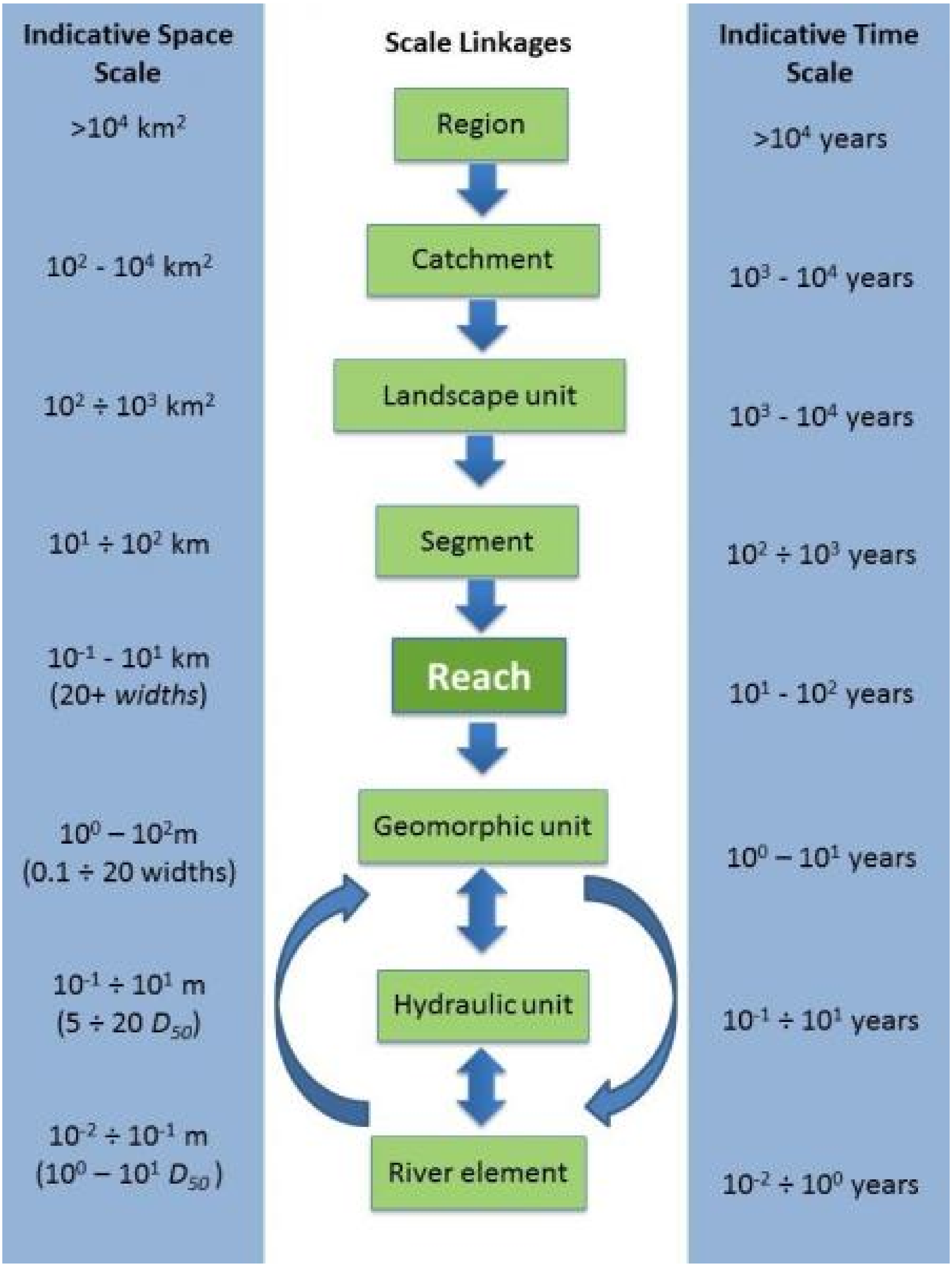

The spatial hierarchical framework for hydromorphological assessment. Image: Angela Gurnell, QMUL

The delineation process is most easily explained by applying it to an example river system, so here we use the River Frome, a lowland groundwater-dominated river in the UK, to illustrate how delineation is accomplished.

Region

The region is a large geographic area that contains characteristic assemblages of natural ecological

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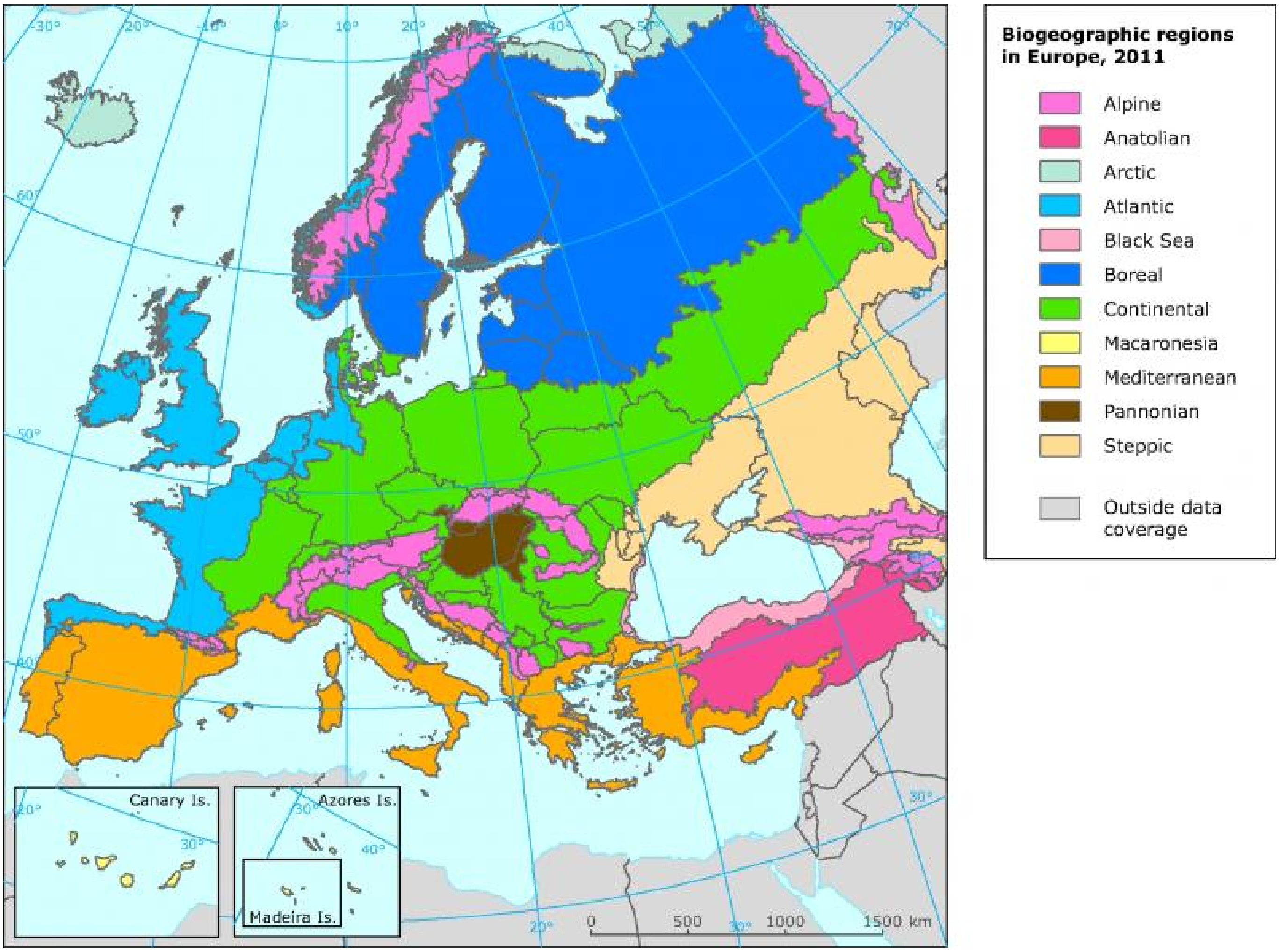
communities which are the product of broad influences of climate patterns. This scale is important because it is these climate patterns and natural land covers that are the primary controls on all spatial scales of hydromorphological processes. The region can be identified from online maps and publications (www.globalbioclimatics.org; [19] EEA 2002).



The River Frome is located in southern England, which lies within the Atlantic European biogeographic region. The climate is characteristically mild and humid and strongly influenced by the Atlantic Ocean.Image: European Environment Agency 2012, *http://www.eea.europa.eu/data-and-maps [20], accessed on 10 May 2013.*

Catchment

A catchment is an area of land that is drained by a river and its tributaries. Delineation can be made based on the topographic divide (watershed) using digital terrain models (DTM). DTMs are freely available online from a variety of sources, such as the 30 m resolution ASTER GDEM from NASA and Japan Space Systems (http://asterweb.jpl.nasa.gov/gdem.asp [21]).

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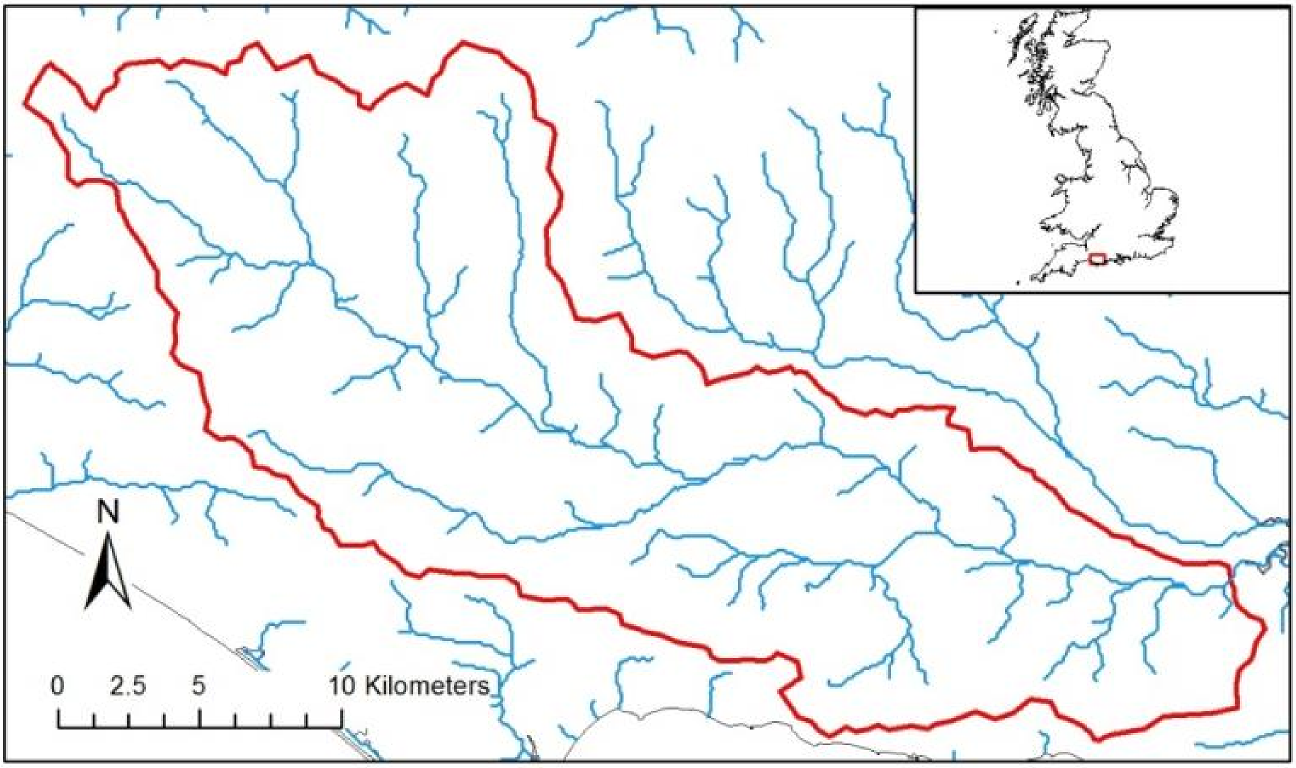
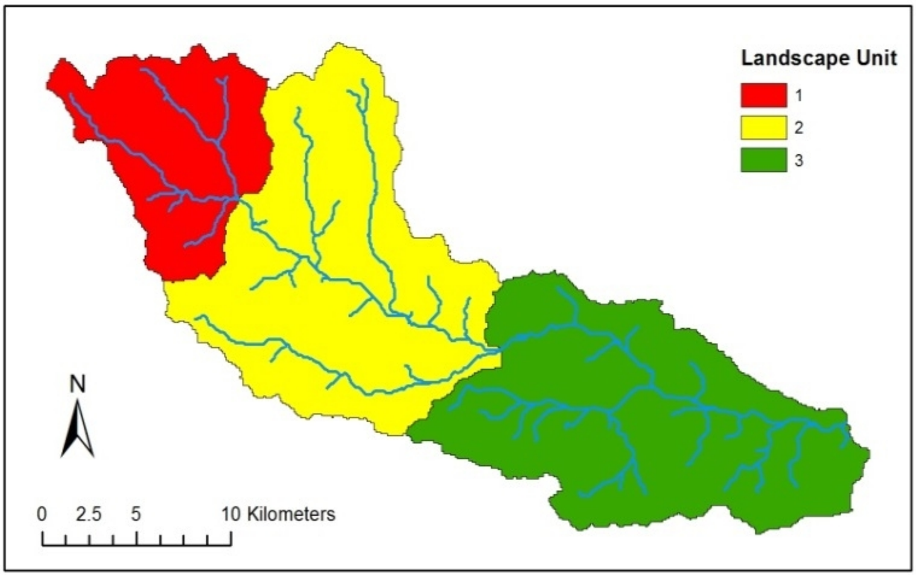


The Frome catchment was delineated using a 10m resolution DTM and the Hydrology toolset in ArcGIS 10.0. It is a medium-sized, lowland, calcareous catchment according to the Water Framework Directive typology (catchment area = 457 km^2, median elevation = 104 m). Profile DTM: © Crown Copyright/database right 2012. Image: Robert Grabowski, QMUL.

Landscape units

Landscape units are portions of the catchment with similar morphological characteristics. The catchment is divided into landscape units that are broadly consistent in terms of their topography, geology and land cover, as these factors determine the hydrological responsiveness of a catchment and the source and delivery of sediment to the river system.



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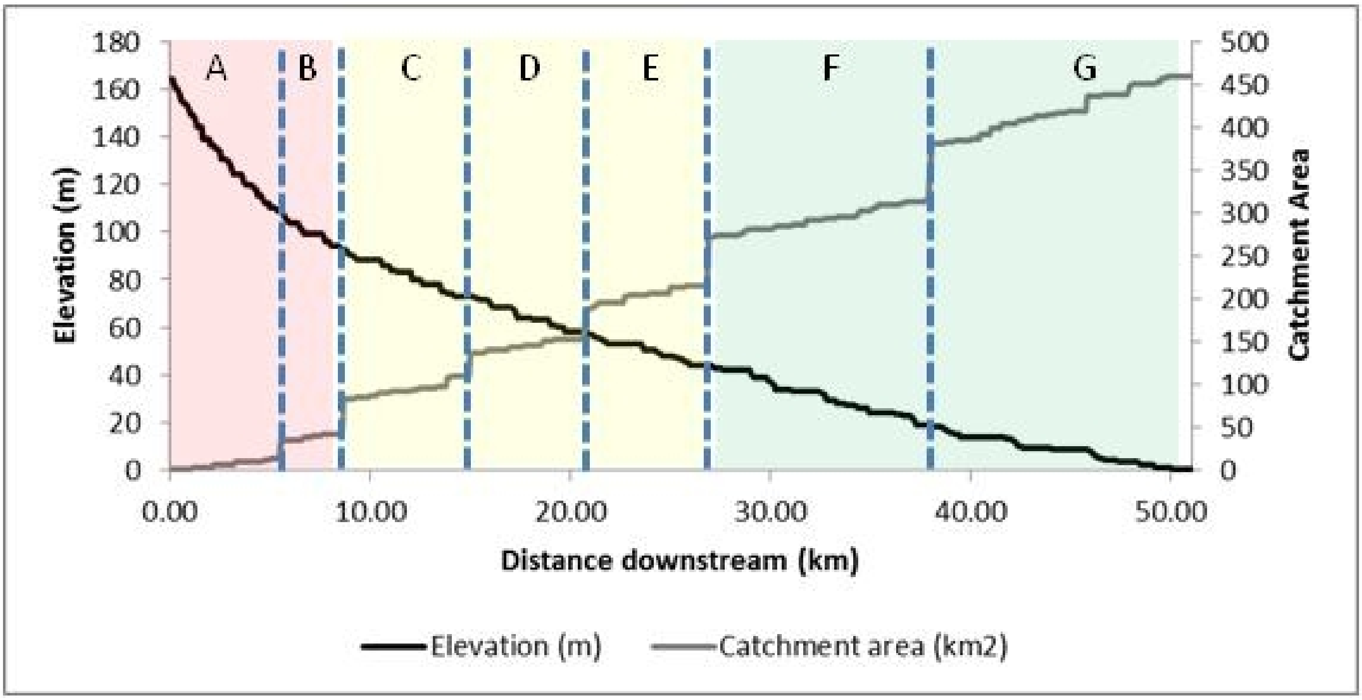
	1	2	3
Area (km²)	83	189	186
Elevation (m)			
< 200	78%	91%	100%
200 - 800	22%	9%	0%
Gradient	0.0088	0.0031	0.0021
Geology	Calcareous	Calcareous	Siliceous
Land Cover	Pasture	Arable Land	Arable Land

The Frome catchment was delineated into 3 landscape units based on elevation, geology and land cover. Data analysis was conducted in ArcGIS using datasets obtained from the UK Environment Agency (elevation and gradient), onegeology.org (geology; freely available), and the European Commission's Joint Research Centre (Corinne land cover; freely available). Profile DTM: © Crown Copyright/database right 2012. Images: Robert Grabowski, QMUL.

River segments

River segments are sections of the river network that are subjected to similar valley-scale influences and energy conditions. Delineation is based on major changes in valley gradient, major tributary confluences, and valley confinement.



The River Frome is delineated into 7 river segments (A-G), separated by dashed blue lines in the above graph. These divisions are primarily associated with significant increases in catchment area (grey line) due to major tributary confluences and align with the landscape unit divisions. The long profile was extracted from the DTM and the flow accumulation layer generated by ArcGIS during the watershed delineation process. Profile DTM: © Crown Copyright/database right 2012. Image: Robert Grabowski, QMUL.

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River reaches

The reach is the scale at which most people view and interact with the river, and the scale at which most restoration projects are focused. Hydromorphologically speaking, it is a section of river along which boundary conditions are sufficiently uniform that the river maintains a near consistent set of process-form interactions. In other words, the controlling factors that we identified in the earlier delineation steps produce characteristic patterns and landforms in the channel and floodplain, like river meanders and gravel bars. Delineation is based primarily on channel planform and confinement and results in a simple classification of river types.

Landscape unit	Segment	Reach	Confinement	Threads	Planform
1	A	1	Unconfined	Single	Sinuous
	B	2	Unconfined	Single	Sinuous
		3	Unconfined	Single	Meandering
		4	Partially confined	Single	Sinuous
2	C	5	Unconfined	Single	Sinuous
	D	6	Unconfined	Single	Sinuous
		7	Unconfined	Multi-thread	Anabranching
	E	8	Unconfined	Multi-thread	Anabranching
		9	Unconfined	Multi-thread	Anabranching
3	F	10	Unconfined	Multi-thread	Anabranching
		11	Unconfined	Multi-thread	Anabranching
		12	Unconfined	Multi-thread	Anabranching
	G	13	Unconfined	Multi-thread	Anabranching
		14	Unconfined	Single	Meandering
		15	Unconfined	Single	Meandering

The River Frome is subdivided into 15 river reaches using satellite imagery from Google Earth and large-scale maps from the UK's Ordnance Survey. At first instance, reach divisions align with landscape and segment divisions. Further divisions are made when there are changes in valley confinement, the number of threads or channel planform within a segment, for example reaches 2-4 in segment B, or because of the presence of major weirs that disrupt water and sediment transfer, for example reaches 10-12 in segment F.

Next steps

Now that the river has been delineated into spatial units, the next step is to characterise the spatial units to more fully describe the hydromorphological processes at work. With this detailed information at hand, we are then able to assign an extended river typology and apply a suite of indicators to assess current hydromorphological condition.

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Angela Gurnell, Queen Mary, University of London

Robert Grabowski, Queen Mary, University of London

Measuring success of river restoration actions: the role of end-points and benchmarking [23]

With an increasing emphasis on river restoration comes a need for new techniques and guidance. These are tools to assess stream and watershed condition, to identify factors degrading aquatic habitats, to select appropriate restoration actions, and to monitor and evaluate restoration actions at appropriate scales. Unfortunately, despite the rapid increase in river restoration projects, little is known about the effectiveness of these efforts (see Figure 1). Restoration outcomes are often not fully evaluated in terms of success or reasons for success or failure. This seems an anomaly if restoration measures are to be carried out in an efficient and cost effective manner. REFORM strives to meet this need by developing a protocol for benchmarking and setting specific and measurable targets for restoration and mitigation. This is carried out in work package 5 (Task 5.1).

Example of a restoration action - Remeandering of the River Dearne at Pastures Bridge, England: But was it successful? (photo: Ian Cowx)

Despite large economic investments in what has been called the “restoration economy”, many practitioners do not follow a systematic approach for planning restoration projects. As a result, many restoration efforts fail or fall short of their objectives, if objectives have been explicitly formulated. This often appears not to be the case. Some of the most common problems or reasons for failure include:

- Not addressing the root causes of habitat degradation
- Not considering upstream processes or downstream barriers to connectivity
- Inappropriate uses of common techniques (one size fits all)
- No or an inconsistent approach for prioritizing projects

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- Poor or improper project design
- Failure to get adequate support from public and private organizations
- Lack of or inadequate monitoring to determine project effectiveness

These challenges and problems can be overcome by systematically following several logical steps that are crucial to developing a successful restoration programme or project. One of the first steps is to establish benchmark conditions against which to target restoration measures. This requires i) assessment of catchment status and identifying restoration needs before selecting appropriate restoration actions to address those needs, ii) identifying a prioritization strategy and prioritizing actions, and iii) developing a monitoring and evaluation programme. In addition to these steps, a basic understanding of the social dimension of watershed restoration is needed.

This work should take place within the context of the River Basin Management Plans for the Water Framework Directive. Nevertheless, it is our impression that this diagnosis is inadequately specified and insufficiently quantified to identify the causes and bottlenecks of degradation. Thus, it does not necessarily help plan the most effective ways for improvement. Goals and objectives need to be set at multiple stages of the restoration process. There are multiple steps within each stage, but the initial stage is to identify endpoints and benchmarks against which to measure performance. This needs to be reviewed against reference conditions, to determine appropriate targets for restoration, rehabilitation and mitigation activities. Unfortunately, this step is often missing from most restoration planning, although excellent examples exist on which to base the process e.g. Kissimmee River Restoration (Anderson et al. 2005).

To support this process, REFORM is developing a protocol for benchmarking and setting specific and measurable targets for restoration and mitigation measures. This includes the following steps.

- Step 1: Data mining of existing projects to determine how scheme objectives were established, if at all, and against what criteria
- Step 2: Determine whether the objectives have been achieved and if not, determine why
- Step 3: Determine criteria for establishing endpoints and benchmarks against which to measure performance - and determine appropriate targets for restoration activities
- Step 4: Develop a protocol to set realistic quantifiable endpoints for restoration projects

This process of evaluating restoration is ongoing and will be finalized in summer 2013, but examples of good restoration practice are limited to assist the outcomes of REFORM. Readers are therefore encouraged to provide examples of restoration actions that have assessed outcomes, whether successful or otherwise.

Reference

Anderson, D.H., S.G. Bousquin, G.E. Williams and D.J. Colangelo (eds.), 2005 Defining success: expectations for restoration of the Kissimmee River. South Florida Water Management District, West Palm Beach FL USA Technical publication ERA 433

Authors: Ian Cowx (UHULL), Natalie Angelopoulos (UHULL), Tom Buijse (Deltares), Deborah Slawson (IRSTEA)

For further information:

Ian Cowx

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REFORM wiki now online [24]

The REFORM wiki presents generic river restoration knowledge and specific restoration case studies, using the same technology as Wikipedia. The contents are organized in layers with increasing levels of detail. Interactive maps of case studies across Europe (Figure 1) form the portal from which live links provide access to other case studies as well as related background information in thematic sections (knowledge components in Figure 2).

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Figure 1. Case-study page of the REFORM wiki.

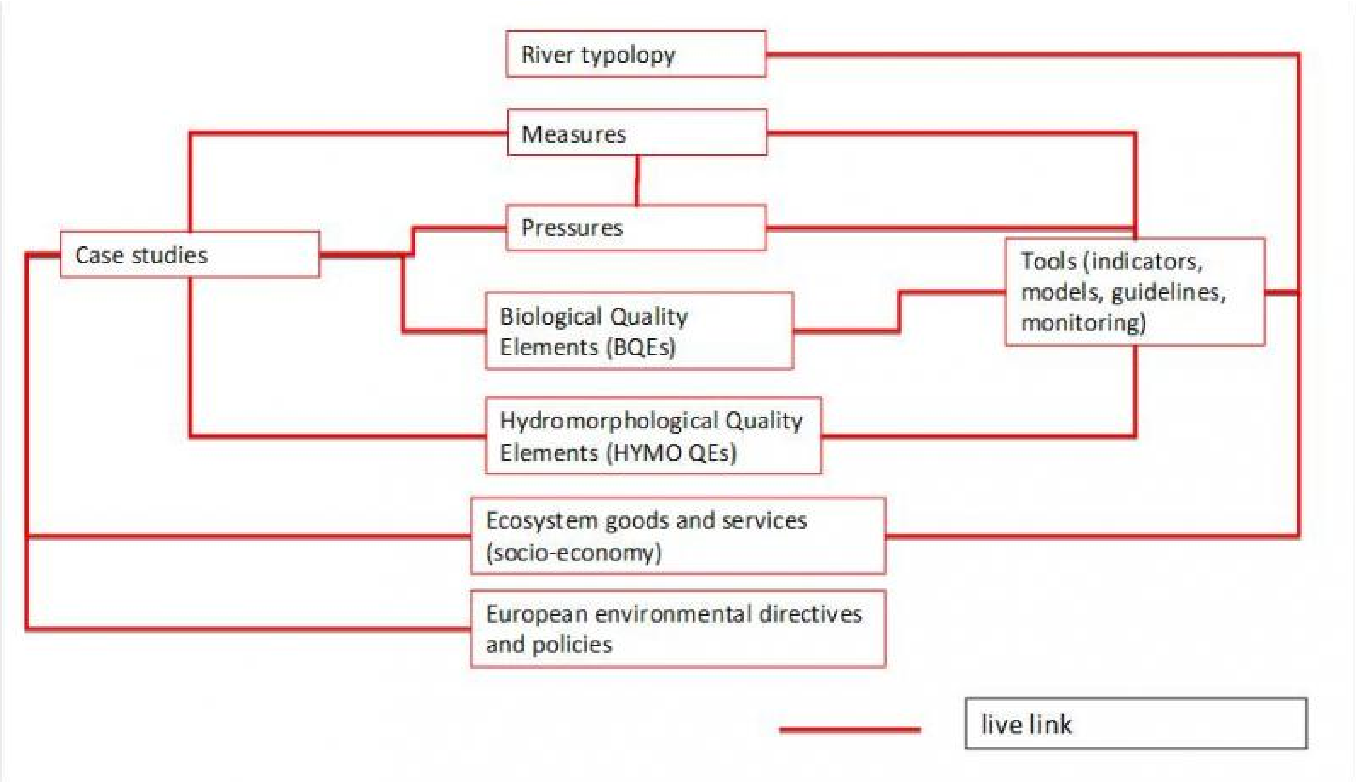


Figure 2. Structure of REFORM wiki with live links between knowledge components.

The wiki uses the language of water management as the point of departure, following WFD categories and terminology. A filter for thematic items allows users to search case studies with selected features, thus effectively tracing relevant information. The background information in the wiki links to multiple other sources, such as scientific publications, photographs, movies, grey literature in multiple languages, and weblinks.

The wiki will be filled with contents from the work packages in the REFORM project. Although this activity is spread over several years, we already invite you cordially to visit the present version at

http://wiki.reformrivers.eu
[25]

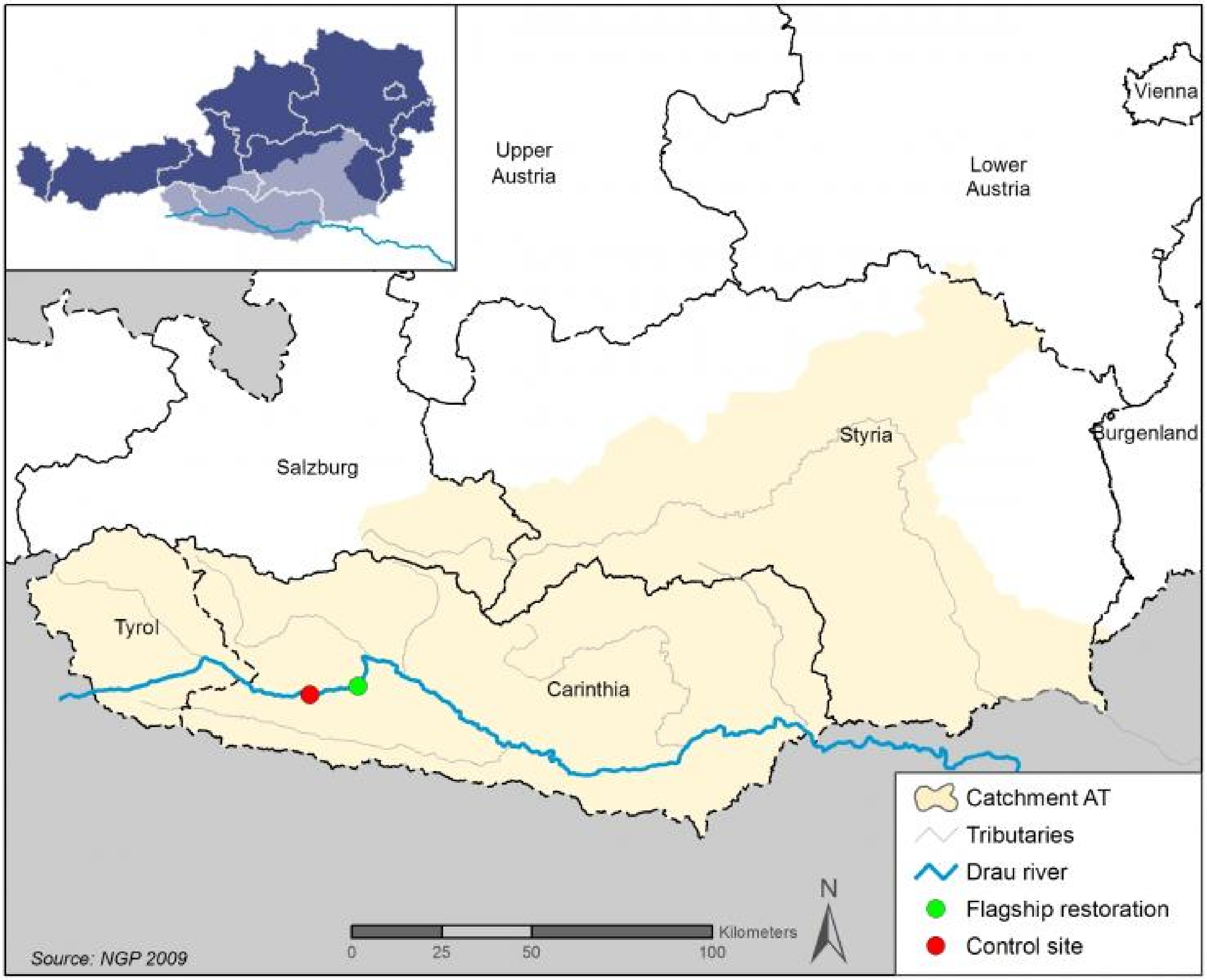
If you visit the wiki regularly in the coming years, you will see that it grows in time. If you are interested in contributing, please go to the wiki and open an account. Be sure to provide a valid email address, and we will contact you.

For further information:

Gertjan Geerling and Erik Mosselman, Deltares

The River Drava changes... [26]

The Austrian River Drava (in German “Drau”) is part of the Danube catchment. The Drava flows 264 km along the border between the Central Alps and the Southern Alps and across the Austrian federal states Tyrol and Carinthia. In Osijek (Croatia), the river joins the Danube River.



Catchment of the Austrian River Drava

Until approximately 140 years ago, the Upper Drava was a free flowing, meandering mountain river with numerous braiding stretches due to alluvial cones of the tributaries. In this dynamic river system with its annual floods and high bedload transport, the river course frequently changed. A braiding river - floodplain system with large gravel banks, grey alder, willow wetlands, and wetland meadows characterized the valley bottom (cp. Amt der Kärntner Landesregierung, 2004).

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Side arm restoration measure, Kleblach - Lind (S. Kaufmann / A. Loach)

Human impacts

The first substantial human changes began with the building of the railroad line through the Upper Drava valley in 1868. In the following years, river-engineering channelized the river to reduce flood risk, as well as to allow intensive agricultural land use and the expansion of settlements. When the river was forced into a single main channel, the river dynamics were restricted and the number of side arms, gravel banks, wetland water bodies, and other natural habitats decreased.

Due to the regulation processes and reduced sediment supply by the tributaries caused by torrent control structures, river bed incision occurred. This incision resulted in a decreased ground water level, causing desiccation of the remaining wetlands (cp. Amt der Kärntner Landesregierung, 2004).

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River bed widening, Kleblach - Lind (A. Loach)

Restoration measures

In 1998, the river and its riparian zones became protected by designation as a Natura 2000 area. From 1999 to 2003 two EU LIFE projects were initiated under the title "Restoration of the wetland and riparian area on the Upper Drau River" and 2006 to 2011 ("Life vein – Upper Drau river").

These projects defined goals such as species and habitat protection and water management interests. Approximately 15 km of bank protection structures were removed, and several large scale river bed widening measures including new arms were realised.

Furthermore, the development of new wetland water bodies and floodplain forests was initiated, providing adequate habitats for formerly typical animal and plant species. In total, approximately 42 hectares of alpine river habitats were created.

The restored river stretches comprise habitat types according to the EU Habitats Directive (e.g., dynamic gravel banks (3220) and tamarisk and willow pioneer communities (3230, 3240)), which will further develop to alluvial forests (91 E0). These sites provide:

- improved spawning habitats for amphibians and fish, in particular the Danube salmon (*Hucho hucho*), Souffia (*Leuciscus souffia*), European bullhead (*Cottus gobio*), Ukrainian brook lamprey (*Eudontomyzon mariae*), and Atlantic stream crayfish (*Austropotamobius pallipes*);
- extended habitats for 140 bird species, including 51 red listed species, and resting places for migrating birds crossing the Alps. Typical species that will benefit include the common kingfisher (*Alcedo atthis*), the common sandpiper (*Actitis hypoleucos*), the grey wagtail (*Motacilla cinerea*), the lesser spotted woodpecker (*Dendrocopos minor*), and the golden oriole (*Oriolus oriolus*);
- extended habitats for two plants which were both nearly extinct in Austria: German tamarisk (*Myricaria germanica*) and the dwarf bulrush (*Typha minima*);

In the framework of the project, an additional 5 hectares of water bodies in the floodplain area were created. These areas connect habitats for amphibians, such as the Italian crested newt (*Triturus carnifex*) and yellow-bellied toad (*Bombina variegata*). They provide important habitats for small fish species, such as the Amur bitterling (*Rhodeus sericeus*) and crucian carp (*Carassius carassius*) and improve valuable food supply for the white stork (*Ciconia ciconia*). The European otter (*Lutra lutra*) re-settled in the region, also benefitting from the Life Nature restoration measures.

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The River Drava in the Austrian federal state Carinthia is one of the flagship restoration case study sites in work package 4 of REFORM. The project aimed to increase flood retention, to reach good ecological status, and to provide an appropriate river landscape for recreational use. The restoration measures were implemented in 2003 as part of the already mentioned LIFE Nature project "Restoration of the wetland and riparian area on the Upper Drau River". Bank stabilization structures were removed and the river bed was widened. Lateral erosion increased the sediment input and initialized the development of gravel / sand bars and islands. One of the former side arms was reconnected to the river for annual flooding, and a second side arm was widened to a width of 30 m, creating diverse instream structures and increasing aquatic habitat diversity. This project was designed to reduce human intervention as much as possible and to promote dynamic, self-sustaining river processes.

Reference:

AMT DER KÄRNTNER LANDESREGIERUNG (2004): LIFE-Projekt Auenverbund Obere Drau, Endbericht; Klagenfurt; 2004

For further information:

Susanne Muhar and Andreas Loach, BOKU Vienna - University of Natural Resources and Life Sciences

Evaluating Ecosystem Services in Finland **[27]**

From 21-25 April 2013, Tiina Nokela from the Finnish Environmental Institute SYKE and Dutch student Maarten Plug (VU University Amsterdam) visited the river Vääräjoki to conduct surveys on ecosystem services with local residents (figure 1). The aim of this research was to compare ecosystem services of the river Vääräjoki in restored and unrestored stretches. The research is part of workpackage 5 of REFORM, whereby ecosystem services are assessed in 12 case studies and rivers across Europe. The aim of the case studies is to enhance the framework for improving the success of hydromorphological restoration measures to reach the target of ecologic status or potential of rivers in a cost-effective manner. In the field visit to the river Vääräjoki, almost all respondents reacted very positively to the survey. Although some had never visited the Vääräjoki, most of them were concerned about the state of the river.

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Figure 1:The Vääräjoki (photo: Maarten Plug)

In the beginning of the 1900's, the Vääräjoki was dredged and most of the boulders were removed to enable timber floating. Due to changes in the forest industry, timber floating ended by the end of the 1970's. Major rapids in the lower reach of the river were restored in the beginning of the 21th century. The restoration included replacement of stones and gravel beds to create spawning areas for salmon. The goal of the restoration was to increase fish catch, but also to improve other ecosystem services such as ecological quality and aesthetics which are not easily evaluated.

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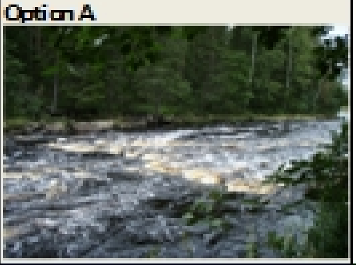
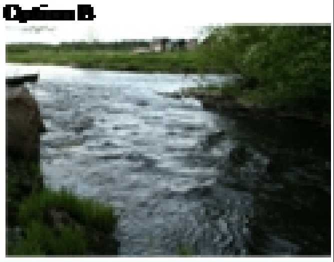
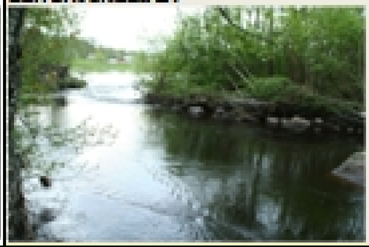
Card nr. 8	Option A	Option B	Current situation
			
Ecological status	Very good	Good	Moderate
kilometres restored	100 kilometers	50 kilometres	5 kilometers
Accessibility	Good	Good	Reasonable
Increase in the annual municipality tax	70 Euro	30 Euro	0 Euro
I prefer	Option A ◯	Option B ◯	Current situation ◯

Figure 2: One of the Choice Cards used in the survey (photo: SYKE)

The methods used in the survey were Willingness to Pay (WTP) and Choice Experiment. By assessing how much people are willing to pay (WTP) for a restoration measure that enhances some ecosystem services, the value attached to these services can be derived. The Choice Experiment, a relatively new method to determine WTP, was also applied in the surveys. Local residents were presented a Choice Card with two alternative future states and an option to maintain the current situation (figure 2). WTP was included as an increase in municipal tax. To find sufficient respondents in the sparsely populated Vääräjoki basin (around 40 inhabitants per square kilometre), three different methods were used. The first method consisted of approaching visitors to nearby gasoline stations. This approach worked remarkably well: A relatively large number of respondents could be easily approached and respondents had the time to fill in the survey over a coffee (figure 3). However, this method could only be applied in the two population centres that were large enough to sustain a gasoline station. The second method used was ‘door to door’ interviews with inhabitants of small towns and farms, who were not all available for participation. The last method consisted of driving around and approaching pedestrians. This method was more time consuming than the gasoline station method, but it ensured a good spatial distribution and almost everyone agreed to being interviewed (figure 4). In total, 67 survey responses were collected in 5 days, which is relatively good “yield” from the total population of approximately 6000 people.

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Figure 3: Tiina Nokela (SYKE) conducting a survey (photo: Maarten Plug)

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Figure 4: Conducting the survey at local cafeteria in Sievi (photo: Maarten Plug)

Many of the older respondents remembered those days when the water was clearer and fish and crabs were more plentiful. On some occasions, the surveys turned more or less into small interviews, for example with an older couple living next to the river for over seventy years or a retired professor of ecology who could name and locate all endangered species living near the river. During their week of field work, Maarten and Tiina quickly gained “local fame” due to articles published in a local newspaper just a few days before the survey. This publicity positively influenced people’s attitudes towards the research and enhanced their appreciation of the water courses near their home.

For further information:

Maarten Plug

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