

River restoration in need of priorities and a process-oriented approach - An interview with Professor Klement Tockner



*Klement Tockner is a full professor for Aquatic Ecology at the Free University Berlin and director of the Leibniz-Institute of Freshwater Ecology and Inland Fisheries (IGB), the largest freshwater ecology institute in Germany (www.igb-berlin.de). He received a PhD at the University of Vienna, and a titular professorship at ETH. He has special expertise on freshwater biodiversity, ecosystem functioning, and river and wetland restoration and management. He is Editor-in-Chief of the journal *Aquatic Sciences* and Subject Editor of the journal *Ecosystems*. He has published more than 180 scientific publications including 100+ ISI papers. At present, he coordinates a large EC-funded project on freshwater biodiversity (www.freshwaterbiodiversity.eu). He is member of several scientific committees including the crosscutting group on freshwater biodiversity of DIVERSITAS. Within REFORM, Professor Klement Tockner and Professor Huib de Vriend (Deltares) are jointly responsible for the internal scientific quality control process.*

1. Professor Tockner, what is your affiliation with rivers?

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I have worked on river floodplains since the beginning of my career, mostly on large rivers and Alpine streams. During the past 15 years, I have had the great opportunity to study rivers in Africa, the USA, Japan, Australia, and several European countries. These experiences have broadened my view on river system functioning. In particular, I am interested in integrating the hydrogeomorphic, ecological, and social dimensions of river corridors. I have been involved in large river restoration programs where scientists and managers closely cooperated from the beginning on, for the benefit of both.

2. What are the greatest challenges at the moment in restoring rivers in Europe?

The major anthropogenic impacts, and the challenges, differ across Europe. River fragmentation, due to hydropower production, is critical in Northern Europe, pollution in Eastern Europe, channelization in Western Europe, and water scarcity in the Mediterranean area. There are, however, common challenges across the regions:

First, the non-deterioration principle of the WFD must be granted higher priority than the objective of achieving a good ecological status; restoration cannot compensate for the loss of the last free-flowing rivers. We are currently witnessing a rapid loss of the remaining free-flowing and near-natural rivers, for example in the Balkans but also in the Alps.

Second, it will be impossible to achieve good ecological status or even good ecological potential of all modified European rivers within the next 10 to 20 years. Therefore, clear priorities must be set for where restoration should be carried out, which measures are required, and when they should be implemented.

Third, we need to shift to a process-oriented approach in management by integrating geomorphic, hydrological, and ecological functions. Furthermore, we lack long-term data, in particular about the ecological conditions, which limit our ability to assess and forecast trends. A solid database is critical for successful restoration.

3. How can research contribute to addressing these challenges? What do you consider to be the importance of a EU-level project such as REFORM to improve the success of hydromorphological restoration measures?

One way to address these challenges is to focus on the key processes and landscape features. For example, vegetated islands, pivotal landscape elements that were once very common along all European rivers (and still are in many rivers), are among the first elements that disappear as a consequence of river and flow regulation. Remaining vegetated islands are usually in a more natural state than adjacent riparian areas, forming “nuclei” for restoration and conservation. However, the formation of vegetated islands requires space, a dynamic flow regime, and sediment and large wood supply. Another approach is to focus on succession processes. Biodiversity depends on a full range of succession stages, from bare gravel to mature forests. Research projects like REFORM can deliver good practice examples as well as a network of large restoration sites in order to establish the links between lessons learned from science and lessons learned from practice.



Photo: Artificial riffles in the Belgian - Dutch border stretch of the River Meuse were recently created to maintain groundwater levels in the adjacent Natura 2000 areas and enlarge local habitat diversity in the main channel

4. You are the coordinator of the EU-funded project BioFresh on freshwater biodiversity. Do you see commonalities between BioFresh and REFORM and ways for the two projects to connect?

These are highly complementary projects. BioFresh, which runs until April 2014, focuses on freshwater biodiversity (i.e. the response side), while REFORM’s focus is more on fluvial geomorphic aspects (i.e. the stressor side). In this sense, BioFresh and REFORM form a bridge connecting drivers and responses.

REFORM can benefit from the publicly available database that BioFresh is building. The compilation of a European biodiversity database allows the identification of priority areas for management. Such a tool is also required for the key stressors. Combining both databases would allow to identify areas that have the highest conservation value and restoration potential.

Additionally, BioFresh will produce an interactive Global Freshwater Biodiversity Atlas which might serve as a major information source for REFORM too.

5. How important is it for REFORM to be integrated in relevant (research) networks within Europe and beyond? To whom should REFORM connect to as priority?

In Europe, REFORM needs to connect to the implementation of the WFD, the Habitats and the Flood Directives, and to Sednet (the European Sediment Network). At the global scale, REFORM should explore links with GEO BON (Group on Earth Observations) and the Global Water System Project.

Among the great challenges in the water sector is the development of synergies among the currently competing objectives in agriculture, navigation, industry, and ecology. The discussion on the water-energy-food nexus must integrate waters as ecosystems too. Ecosystem services are currently

used in a very narrow, simplified approach, purely from a human use perspective. Therefore, it remains a major challenge to manage rivers not just for the optimization of a few services but to consider intrinsic values and ethical aspects too. Otherwise, we will lose most of the rich biodiversity of rivers and floodplains within the coming decades.

6. What do you believe should be done to support the achievement of WFD objectives with regard to hydromorphology more effectively?

Despite major merits, there are limitations to the concept of the WFD:

First, using past reference conditions as a goal for future ecosystem management under rapidly changing environmental conditions is disputable. The question will not be “which organisms lived in a specific system”, but “which can live in the system”. Novel communities, a combination of native and non native assemblages that have no shared history, will dominate future ecosystems. We need to understand how novel assemblages form, what their ecological and economic consequences are, and how they should be managed.

Second, the WFD is based on a rather static view of rivers; a process-oriented approach is required for their future management.

Third, many restoration projects fail because they mainly focus on the channel but underestimate the functional linkages with the terrestrial and subsurface realms. Aquatic insects, for example, exhibit a higher mortality during the short terrestrial phase - when they emerge, disperse and mate - than during the larval stage. However, we have scant information about the various habitat requirements of organisms that have complex life cycles.

Last but not least, restoration efforts - in particular for heavily modified water bodies - will need to be complemented by, or perhaps even replaced by, increasing levels of management intervention, in order to create and maintain the desired ecological values of ecosystems. This includes the manipulation of the hydrology, the construction of artificial habitats, as well as combining technical with more natural systems.

Professor Tockner was interviewed by Eleftheria Kampa (Leader of Dissemination and Stakeholder Involvement of REFORM, Ecologic Institute) on 7 June 2012 in Berlin.

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