

**4<sup>th</sup> European Centre for River Restoration Conference on River Restoration  
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**Workshop WS3: How much sediment is needed for a well functioning river system?**

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Within the Water Framework Directive (WFD) there is little explicit mention of sediment and the role it may play in achieving good ecological and chemical status. However, at a round table event organised by SedNet in 2006 river basin managers from 4 river basins around Europe (the Elbe, the Danube, the Humber and the Douro) identified sediment related issues as crucial to successful achievement of the WFD objectives. The issues in each river basin were different – from concerns about lack of knowledge of sediment budgets, to sustainable extraction rates, to remobilisation of contaminants in sediment deposits and the impacts of managed retreat to allow for increasing sea levels.

There is a need for more evidence (system understanding) to support sediment management decisions in relation to both WFD and other legislative drivers such as the Birds and Habitats Directive. A review of all UK river basins, carried out by ADAS in the UK (Collins & Anthony, 2008) identified that most passed the Fisheries Directive guideline value of 25ppm mean annual suspended particulate matter (a form of sediment) concentration – based on available data. However, it is known that many of these river basins have sediment related issues and problems. There may be at least three reasons for this:

1. Inadequate temporal scale of data – routine monitoring is at 4-week time steps, whilst bulk sediment transport is highly skewed to high flows.
2. Inadequate spatial resolution of data – data may not be collected at places most relevant for increasing our system understanding.
3. Meaningless guideline value in terms of whole ecosystem functioning - if any numerical target is to be set then it may need to take into account the highly dynamic nature of rivers. Furthermore it needs to be differentiated by river type, to be inclusive of the whole river ecosystem and may need to look at the continuum of sediment quantity gradient and biological response.

So, given the complexity of sediment supply and transfer, should we be monitoring sediment load at all – or should we first rather look more fundamentally at the role of sediment quantity – in relation to quality – in river system functioning (to increase our system understanding)?

The workshop in Venice set out to address these themes through a sharing of experience and practice from an international group of participants. Key points from the workshop were:

- In Europe, White and her team (White et al, 2005 and Becvár, 2006) have looked at sediment load in relation to flow exceedance values for 44 major river basins. Those rivers which are not predominantly groundwater fed show a clear tendency to transport the majority of sediment in high flows. On average for the European rivers studied, 62.9% of sediment moves in the top 10% of flows. The exact percentage changes from year to year, from river to river and even from location to location on one river. **Monitoring should reflect this, but does not currently do so.**
- Work has been done in the USA on characterising sediment concentration in relation to different flow exceedance values. Analysis has been done by ecoregion and by stable versus unstable reaches (Simon et al, 2004, Simon & Klimetz, 2008, Simon & Klimetz, in press). **It is clear that great variation in sediment concentration is seen for rivers in different environmental contexts and this must be borne in mind when considering sediment “target values”** (see for example, Cooper et al, 2008).
- Sediment is just one of a number of stressors which affect the ecological status of our water bodies. An integrative approach is needed if we are to achieve WFD goals. **Sediment MUST be included in this integrative approach.**
- We do not understand the cause-effect linkages between sediment and ecosystem health. Should we be looking at dose-effect response relationships? Or is it more important to think about exposure duration? Can we define an exposure time for which a certain sediment concentration should not be exceeded for a certain river or location? **Further research is needed on the sediment quantity related implications for ecosystem functioning.**
- Sediment is a natural and necessary part of healthy functioning aquatic systems. The problems largely arise when there are anthropogenically driven changes in sediment supply, which can either

increase or decrease load. **Work is needed to enable quantification of natural versus anthropogenic sediment flux.**

- Sediment has historically largely been considered as an end of catchment issue (the catchment sediment yield or sediment flux) in relation to e.g. sedimentation of reservoirs, dredging. **We need a much clearer understanding of sediment budgets across river basins, including variability in supply over the short, medium and long-term** (see for example White et al, 2006; Walling and Collins, 2008).
- There is little evidence that historical monitoring of sediment concentration internationally has provided the information required to make informed management decisions on sediment management in relation to ecosystem functioning. **Well designed and focused monitoring is required in which sediment forms part of an integrated monitoring programme.**
- The predicted changes in climate for much of the world suggest that the channel forming flow is likely to change in the short to mid-term. This means that many rivers will begin to remobilise, cutting into deposited alluvial material in flood plains. Such river bank erosion will enhance sediment concentrations at least locally and will change sediment load and flux budgets. **The implications of changing river flow patterns on sediment supply and transfer are not well understood and require further research.**
- The focus of this workshop was largely on sediment quantity. However, it was acknowledged that we probably know even less about the role of sediment in binding, storing, releasing and recycling pollutants. **The remobilisation of historical sediment deposits and associated contaminants from floodplains was considered to be a particular issue of concern.**

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