

Summary Report

SedNet Special Session on „sediment in a changing environment“ held on 6 April 2011

Session Chair: Eric de Deckere, Rapporteur: Susanne Heise

Sediments are an integral part of the river basin. As such, they are affected by permanently changing conditions on different kinds of scales. On river basin scale sediment source and transport varies during flood or high water discharges as a consequence of seasonal changes. These sediment sources and transport mechanisms will result in a changing sediment balance in the coming years due to predicted changing rainfall patterns due to climate change. On the microscale, the sediment contaminant load is affected e.g. by sedimentation-resuspension cycles. Oxygen concentration, temperature, salinity, exposure to light etc – they all have some impact on mobility and availability of contaminants that at some stage have been adsorbed to sediment surfaces. All these ‘microscale’ parameters will be affected by the changes in the sediment balance on the river basin scale.

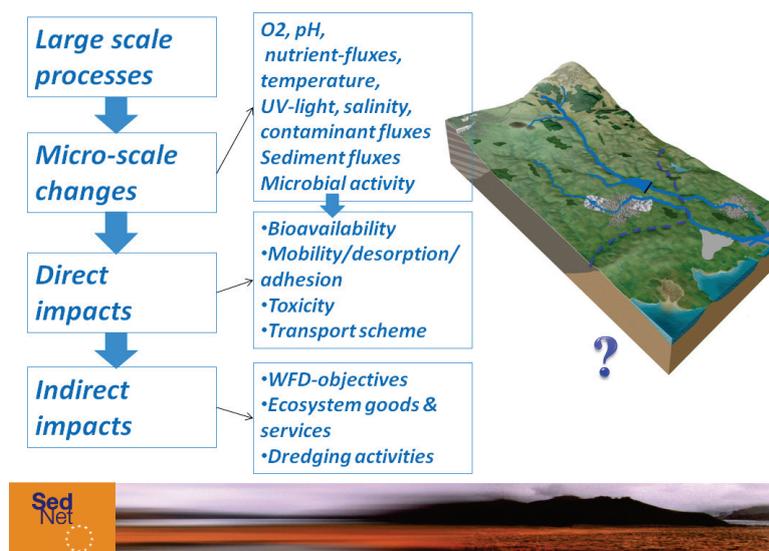


Fig. 1: Parameters influencing sediment quality and quantity in a river basin on different scales

Knowledge on the impact of the changing climatic and environmental conditions on bioavailability and toxicity of contaminants should help us linking sediment quality to ecosystem protection criteria, as well as linking river basin target values to marine target values.

For this special session, 6 experts in different fields related to sediment quality and quantity were invited to give a 10 min talk, introducing the major challenges from their perspective with regard to “sediment in a changing environment”. Subsequently, the audience was asked to join small groups, each one headed by one of the presenters, addressing the mentioned challenges as a start of the discussion. After 2 hours of discussion, results were wrapped up in the whole group.



The invited experts gave the following statements:

Sabine Apitz, SEA Environmental Decisions, UK:

- Contaminant fate and behaviour at the microscale may be very different than that expected at the bulk scale
- These processes are affected by direct anthropogenic pressures, or by changes in community structure
- Hydromorphological changes, contaminants, organic enrichment, resuspension, habitat loss, and many other pressures affect biophysical status and/or structure
- Such biophysical and structural changes may increase with increased pressures and climate change
- Understanding and ultimately monitoring, predicting and/or managing these processes will require the careful development and integration of modelling, laboratory, field, conceptual and regulatory approaches that thoughtfully cross many disciplines and scales.

Tim Iannuzzi, Arcadis, USA:

- Do our existing empirical models provide us adequate tools to predict bioavailability and toxicity under present and potentially changed conditions?
- The currently available scientific tools and techniques for addressing bioavailability have advanced in recent years, but there are still a range of issues to address in order for us to adequately evaluate/predict future bioavailability of contaminants in aquatic environments. For instance, present sediment quality benchmarks are limited in their predictive capability for benthic invertebrate toxicity.
- Are we adequately considering the changed bioaccessibility and bioavailability of contaminants that might occur following ecological/habitat restoration activities at a site, and are there engineering/remediation techniques that we can implement as part of restoration to control future bioavailability?
- On urban waterways: what will be the human/ecological use and regulatory shifts?
- On restoration of marine/estuarine habitats: do we need to consider changes in our plans and thinking?

Dick Bakker, Deltares, The Netherlands:

- River basin management should take into account that extreme river discharges and flooding may present not only physical but also chemical danger, resulting from the remobilization of historically contaminated sediments.
- Resuspension of contaminated sediment can lead to much higher initial dissolved contaminant concentrations than predicted by equilibrium partitioning theory.
- Although many factors have been identified that play a role in the desorption (kinetics) of contaminants from resuspended particles, there are still no reliable (generic) models to describe this process well enough.

Andrew Hursthouse, University of West Scotland, Great Britain:

- Can we assess and predict potential from the processes of storage and remobilisation of sediment associated contaminants in the intertidal region
- What factors enhance the mobility of aged contamination in recovering estuarine systems - under changing flow regimes (and all that entails)
- Have emerging pollutants "emerged" (what substances should we really worry about in sediment toxicity)?



David M. Paterson, University of st. Andrews, Great Britain:

- Understanding the erosional behaviour of sediments is critical to fluvial sediment transport and hence toxin and nutrient dispersal.
- By their action on biofilms, toxins may mediate their own (and particulate) transport rates.
- Salinity and stability are linked in the microbial ecology of sediment erosion.

Günther Eichweber, Waterway and Shipping Administration, Germany:

- Relocation strategies are important for the balance of fine sediment budgets.
- Sediment traps can be useful tools for the optimization of relocation and minimization of ecological impacts.
- Using dredged material to balance morphological trends seems to be a proper way, but it leads to a further distribution of toxicants in the estuary. The overall integration of aspects and goal conflicts is a challenging task.

The outcome of the discussion:

A lot of different topics were discussed, and the aspect of scales was frequently touched. How can we downscale the impact of extreme events or large scale processes to microscale processes? How can we reduce the range of uncertainty (and the functionality of monitoring devices under high water conditions...) in the data? Coming from the other perspective: can we upscale effects that have been observed on the micro scale to large-scale impacts? Which microscale processes are relevant? How and to what extent can models help us doing this “upscaling”? How can we improve those models and make them address heterogeneity of ecological processes?

What do we know about the impact of resuspension/sedimentation cycles? Under what conditions desorb contaminants from sediments? And who is responsible to have what kind of knowledge and act accordingly, e.g. in case of water managers?

It became clear during the discussions that a lot of pieces of information are known on this issue, but the integration of this information to be able to do predict changes in terms of quality sediment in a river basin is currently lacking. Hence we concluded with the statement:

Understand today, predict tomorrow.

Anticipated further activities:

The special session showed, that knowleged gaps are identifiable but still very large. As a consequence, an active discussion group will be formed comprising a number of participants from this special session. This discussion group will work on a review on the impact of changing conditions on the bioavailability and mobility of particle bound contaminants. We hope to create therewith a sound basis from which further projects and studies will start to fill the knowledge gaps on this exciting and important topic. Further participants who want to join us in this effort are very welcome and asked to contact Eric (eric.dedeckere@ua.ac.be) or Susanne (susanne.heise@haw-hamburg.de).