

The importance of sediment for biodiversity

Rationale

“Sediment forms a variety of habitats. Many aquatic species live in the sediment. Microbial processes cause regeneration of nutrients and important functioning of nutrient cycles for the whole water body. Sediment dynamics and gradients (wet-dry and fresh-salt) form favorable conditions for a large biodiversity.” This was already stated in 2004 in the SedNet booklet (see: www.sednet.org). Thus for SedNet it is already clear from its origin that sediment is of crucial importance for biodiversity. However, so far SedNet did not yet attempt a further underpinning of this statement with ‘facts & figures’. Such underpinning of the importance of sediment for biodiversity may enable more and better attention to sediment management by policymaking and management. Hereby it is also realized that halting of biodiversity loss, and thus the degradation of ecosystem services, has moved to the core of EU environmental policy making (See: http://ec.europa.eu/environment/nature/index_en.htm).

It is against this background that the special session “The importance of sediment for biodiversity” was held at the 7th of April 2011 during the 7th International SedNet event in Venice, Italy. The session was attended by ca. 50 people.

Objective and outline

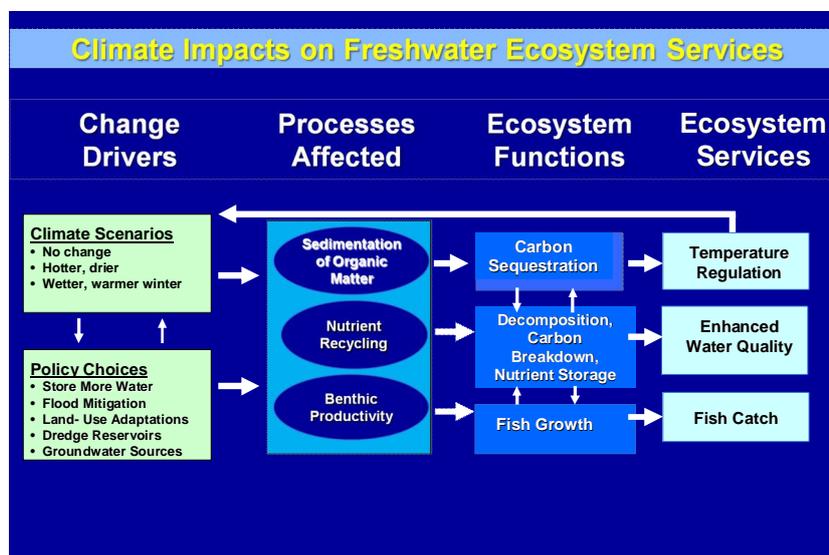
The session aimed to answer two key-questions: (1) Is sediment of crucial importance for biodiversity and (2) Can a ‘white paper’ help to increase awareness to this issue? To set-the-scene and as warming-up for the discussion, three top scientists were invited to address in a keynote the state-of-the art on the importance of sediment for biodiversity. Their talks covered the entire river basin, via estuaries/tidal zone all the way up the coastal/marine system. In the subsequent plenary discussion, the audience was challenged to discuss and answer the two questions above. The session was professionally moderated by **Adriaan Slob** (TNO, the Netherlands, E-mail: adriaan.slob@tno.nl) and the session reporter was **Jos Brils** (Deltares, the Netherlands, E-mail: jos.brils@deltares.nl).

First keynote: Fresh water sediments and biodiversity

Alan Covich, INTECOL President, University of Georgia, Athens, GA, USA, E-mail: alanc@uga.edu

“Invertebrates and microbes in sediment work 24 hours, 7 days a week for us, for free!”

The role of benthic species diversity in sustaining freshwater ecosystem processes and natural ecosystems services is well understood but not widely appreciated.



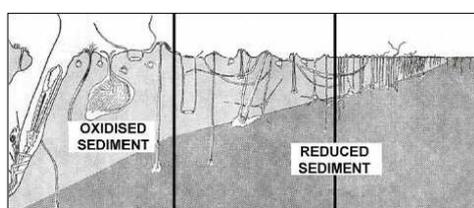
Examples of the critical services performed by filter-feeding and burrowing benthic invertebrates in providing clean drinking water were illustrated by comparative, long-term studies of freshwater biodiversity at widely distributed sites in temperate to tropical ecosystems. Native species provide important degrees of insurance in sustaining natural processes, such as organic-matter breakdown and nutrient cycling, essential to provisioning of clean water. Defining the roles of these key native species and their resiliency is essential to determine which species interact positively, negatively or independently as food-web complexity is altered. These studies help to provide new insights regarding how to sustain freshwater biodiversity in a rapidly changing world where climatic changes are altering the frequency and intensity of disturbances that directly and indirectly affect freshwater ecosystem processes. Floods, droughts, and hurricanes are predicted to increase in frequency and intensity and sea level is already rising in many coastal zones. Cumulative effects of these changes will add new challenges in sustaining ecosystem services provided by rivers, lakes and wetlands.

Second keynote: Biodiversity and sedimentary habitats in critical transitional zones: the Venice lagoon as example

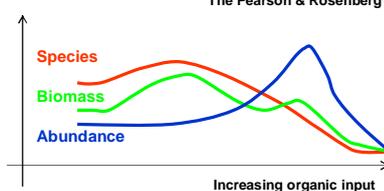
Stefano Guerzoni & Davide Tagliapietra, National Research Council, Institute of Marine Sciences (CNR-ISMAR), Venice, Italy, E-mail: s.guerzoni@ismar.cnr.it & d.tagliapietra@ismar.cnr.it

“Habitats are extremely important for biodiversity: diverse habitats = large biodiversity”

Lagoons and estuaries are characterized by progressive composite gradients that involve salinity, sediment structure, water renewal, nutrients, etc. The contribution of different components of the gradient depends on the main hydrodynamic energy sources of the system. The key effect of the transitional gradient on macroscopic biocoenosis is that the number of species that can cope with it decrease progressively, leading to a physiological reduction of biodiversity.



The Pearson & Rosenberg Model (1978)



modified from Nilsson, H. C. & Rosenberg, R. 2000

The decline in species number and diversity along the gradient has been the subject of different conceptualisations, each one putting emphasis on different aspects of the gradient, depending on the type of Coastal Transitional Ecosystem investigated: sediment type and structure, salinity, seawater renewal, sediment organic content and saprobic processes. Physical disturbance of sediment, both natural and anthropogenic, and sediment pollution are additional causes for biodiversity changes or loss. A prominent part of biodiversity is therefore explained by structural characteristic of the transitional system, whilst the rest is due to biological interactions, anthropogenic disturbance and pollution.

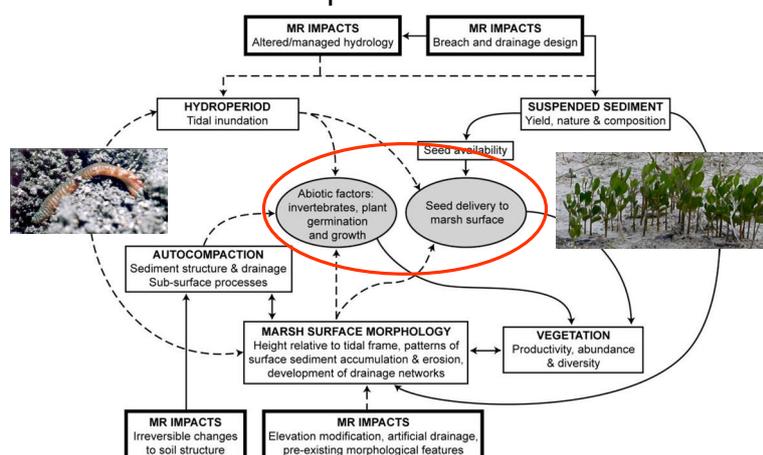
Third keynote: Physicochemical sediment processes as building blocks for delivering biodiversity in restored coastal environments

Kate L. Spencer, School of Geography, Queen Mary University of London, Mile End Road, E1 4NS, United Kingdom, E-mail: k.spencer@qmul.ac.uk

“Restoring of environments results without doubt in environmental enhancement”

Coastal sediments are highly biologically productive and perform a range of important functions that are well-recognised including nutrient cycling and wave attenuation. These environments are currently facing significant challenges associated with climate change, development and water quality deterioration leading to loss of wetland habitat and biodiversity. Increasingly, we are seeking to manage, rehabilitate and recreate these environments using soft engineering techniques, for example Managed Realignment (MR) and in Europe, this has predominantly been driven by the need for habitat (re)creation under the EU Habitats Directive. Although habitat creation and environmental enhancements have been delivered by many restoration schemes, there is an increasing need to demonstrate that these schemes maximise the full range of ecosystem services that they can provide, including biodiversity.

Linking ecological, physical and chemical processes



Spencer and Harvey in press

The development of vegetation for example, is nested within the wider hydrogeomorphic and biogeochemical salt marsh system and will be controlled by tidal inundation (hydroperiod), rates and patterns of surface flow, the delivery of suspended material and the development of marsh surface morphology. Detailed, high resolution measurements of hydrogeomorphic and hydrodynamic processes are rarely considered within restoration schemes. Yet, improving our understanding of the complex linkages between ecological, physical and biogeochemical processes in both natural and restored sediments is necessary for maintaining and restoring biodiversity in coastal sediments and wetlands.

Outcome discussion

Sediment is indeed of crucial importance for biodiversity. This was evident to all participants. It was also evident to them that a 'white paper' will help to increase awareness to this issue. However, the focus in such a paper should be broader than only on sediment and biodiversity. The focus in the white paper should be on describing the state-of-the-art on our understanding of how sediment is linked to ecosystem functioning, ecosystem services and biodiversity and its loss.

River basin managers and policy makers are anticipated as the target audience for the white paper. Thus the paper should be brief and be written in non (not too) scientific language. At least it should contain a very brief, non-scientific language management summary.

The discussion also concluded that the credibility and thus impact of the paper enlarges if a large group of global experts will aggregate the consolidated knowledge on the topics above.

SedNet could play a coordinating role in the production of this paper. The three keynote speakers together with the session reporter offered to prepare a first and draft outline for the content of the white paper. It is aimed to get that first outline ready for comments by the SedNet community by mid 2011.

We welcome your help!

Several experts already offered their help to produce the paper. This is an excellent, very promising and thus very much welcomed start. Nevertheless, we would welcome many more experts as co-author. So please make your selves know if you are willing to contribute with your specific expertise and knowledge to the production of the white paper.

Furthermore, it is anticipated that (some) sponsoring for the production of the paper will certainly speed up the production and thus effective realization of the paper. Therefore, also suggestions for possible sponsors are very much welcomed.

All suggestions please to be sent to SedNet Steering Group member **Jos Brils** (E-mail: jos.brils@deltares.nl).