

The importance of sediment and sediment processes for river basin management

As a working group (WG4) within the European Sediment Research Network (SedNet – www.sednet.org) comprising academic, industrial partners, consultants, policy-makers and end-user communities from a variety of disciplines (hydrology, geomorphology, geochemistry, risk management, ecotoxicology and engineering) we have recognised that the issue of sediment has been largely ignored in the management of natural systems.

Sediment is a socio-economic, environmental and geomorphological resource, as well as a tool of nature. However, changes in sediment quantity and quality can have a significant impact on a range of social, economic and environmental systems, such as those indicated below. Conversely, changes in human activities within the catchment can have detrimental effects on both sediment quantity and quality.

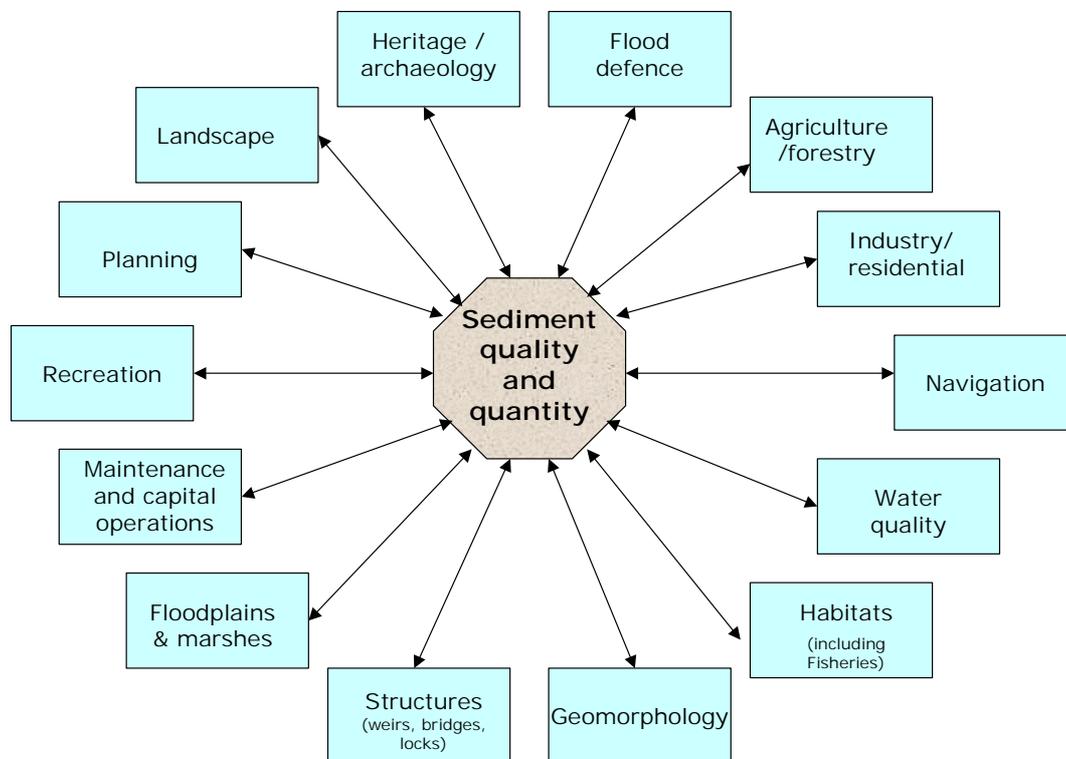


Figure 1: Sediment quality and quantity: interfacing systems

At present sediment has no dedicated legislation at local, national or European levels, but interfaces with many other legislative fields such as the Water Framework Directive, Waste Directives, Soil Regulations, and a range of treaties and conventions. Within these related policies sediment takes on a variety of roles, values and definitions. For example, sediment is often *classified as waste by legislation frameworks generating a negative image for sediment, and leading to practical difficulties in the handling and management of sediment.*

Not only is sediment insufficiently supported by legislation, but sediment also lacks integrated, comprehensive and river basin scale management guidelines or frameworks. Neglecting to manage sediment in a sustainable way, either by a lack of adequate sediment management strategies, or the cursory inclusion of sediment in generic policy and legislation, can result in costs to both society and the environment.

Why is sediment so important? What is the scale of the problem?

- Deficits of sediment in the Duero River upstream of Castel de Paiva, Portugal, caused by the capture of sediment in dams and intensive local gravel mining, resulted in 'hungry waters'. This excess energy caused massive channel incision resulting in the collapse of a bridge, killing more than seventy people in March 2001
- Sedimentation in reservoirs causes a reduction in water storage capacity estimated at US \$9 billion in replacement costs per annum
- Sedimentation in reservoirs in the upper part of the river system is responsible for the need to rebuild many river deltas in the coastal zone
- Several 100 million cubic meters of sediment are being dealt with annually as dredged material in maintaining and developing European waters for navigational purposes
- Sediment is one of the main tools in coastal zone management. Huge amounts of sediment are being used for flood protection (e.g. beach nourishment), and habitat and wetland protection
- Many nutrients, contaminants and pollutants (such as phosphorus, heavy metals and radionuclides) are attached to sediment particles and are thus transported and deposited with sediment posing risk to society and the environment

In order to effectively manage sediment a greater understanding and appreciation of the complexity of sediment balances, scales of operation and key principles requires development, including the recognition that:

- Sediment supply, transport and deposition are spatially and temporally variable
- Any changes in the delicate balance of sediment quality and quantity can be significant for many inter-related natural and anthropogenic systems
- The processes controlling sediment transport and deposition are dynamic and highly variable and therefore effective sediment management must be site specific and understand the dominant spatial and temporal processes operating at the catchment scale
- Sediment management must consider the sediment balance and its role in the hydrological and hydraulic processes within each river. Sediment cannot be unrestrictedly taken out of the river system without negative consequences for a plethora of systems that depend on its functioning

It is recognised that a European drive towards sustainable sediment management is required with the following key recommendations:

- The definitions and terms used to describe sediment must be neutral and all-embracing
- Long-term integrated sediment monitoring programmes require co-ordination and implementation to provide an information base for decision-making
- Sediment management needs to be planned in context to catchment scales and integrated into existing frameworks at this scale such as river basin management plans
- Sustainable strategies must include the 'friendly' transfer of sediments from upstream areas to river mouth, with respect to the natural processes of erosion and deposition (since these allow the healthy functioning of habitats, related environmental systems and river system equilibrium)
- A sustainable sediment balance for river systems should be budgeted to satisfy multi-objective requirements (such as good ecological and navigational status) with existing sediment deficits in floodplains, estuarine and coastal zones replenished in order to prevent habitat loss and destabilisation of river system functioning
- Management strategies for sediment should seek to work with nature, not against it, for ecological and economic sustainability

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