

# Work Package 2

## Sediment management at the basin scale:

*Justification and needs*

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# Presentation structure

- What the activities of WP2 have been
  - 4 WP2 workshops
  - WP2 book (2005)
- Why we need to manage sediment at the basin scale
- What the WP2 recommendations are
- Further details are given in the following talks:
  - Kevin Taylor – sediment and contaminant sources and transfers
  - Sue White – frameworks for decision-making
  - Adriaan Slob – stakeholder participation



# WP2 Core Group

- Sabine Apitz, *SEA Environmental Decisions, UK*
  - Ramon Batalla, *Universitat de Lleida, Spain*
  - Alison Collins, *Cranfield University, Silsoe, UK*
  - Marc Eisma, *Rotterdam Municipal Port Authority, The Netherlands*
  - Heinz Glindemann, *Port of Hamburg / CEDA-ESC, Germany*
  - Sjoerd Hoornstra, *Netherlands Ministry of Transport and Water*
  - Harald Köthe, *Federal Institute of Hydrology, Germany*
  - John Quinton, *Lancaster University, UK*
  - Kevin Taylor, *Manchester Metropolitan University, UK*
  - Bernhard Westrich, *University of Stuttgart, Germany*
  - Sue White, *Cranfield University, Silsoe, UK*
  - Helen Wilkinson, *Environment Agency, UK*
- 
- Carlos Gomez, *University of Alcalá, Spain*
  - Adriaan Slob (WP1), *TNO. The Netherlands*
  - Wim Salomons (WP1), *Vrije University, The Netherlands*

# The activities of Work Package 2

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# Workshops

- WS1 – Existing guidelines and the EU framework directives, Silsoe, UK, October 2002
- WS2 – Sources and transfers of sediment and contaminants in river basins, Hamburg, Germany, May 2003
- WS3 – Modelling and other decision-support tools for sediment management, Lleida, Spain, November 2003
- WS4 – Societal cost benefit analysis and sediments, Warsaw, Poland, March 2004
  
- Copies of the summary workshop reports are available
- These and the full minutes are on the SedNet website

# WP2 book – Elsevier (2005)

1. Why manage sediment at the river basin scale
2. **Decision-making at the river basin scale**
3. Policy, legislation and guidance
4. **Sediment and contaminant sources and transfers**
5. Decision-support tools for sediment management
6. **Risk analysis at the basin scale**
7. Cost-benefit analysis for sediment management
8. **Sediment management and stakeholder involvement**
9. Towards sustainability for sediment management
10. Summary and recommendations



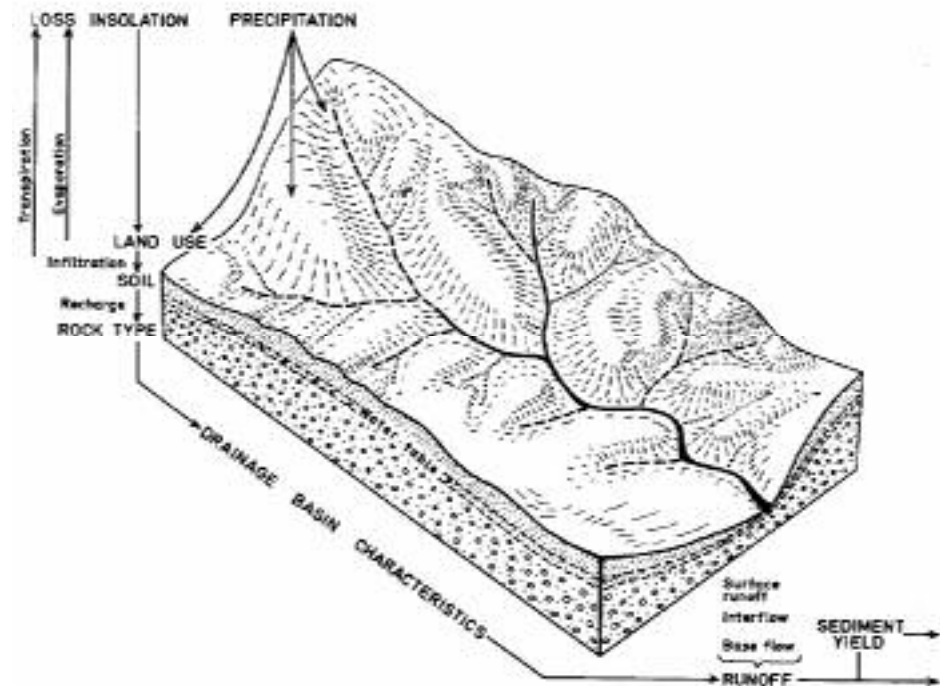
# Why we need to manage sediment at the river basin-scale

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# Water movement on earth

- >100 years hydrologists have recognised that water movement on the earth's surface is controlled by processes that operate within the context of a river basin – i.e. from headwaters to coast
- The characteristics and morphology of the basin determine the pathways and fluxes of water and locations of rivers, lakes etc



From Gregory and Walling (1973)



# Water movement on earth

- Thus water management, especially for water quality, increasingly operates at the river basin or “watershed” scale
- Drainage basin also represents an important functional unit for landscape ecology

# Sediment movement on earth

- The shape and characteristics of a drainage basin also control sediment fluxes and pathways
- Geomorphologists have thus used the drainage basin as the unit to understand and study sediment behaviour and dynamics



# Sediment management

- Sediment management also has a long history, but has tended to focus on **local** issues – generally ones associated with sediment **quantity** in channels, harbours, reservoirs etc.
- Recently, sediment **quality** issues have become important, particularly with the introduction of policy and legislation for the removal and disposal of **contaminated** sediment



# Basin-scale sediment management

- With sediment management needing to address both sediment quality and sediment quantity issues **in combination** we need to operate at the river basin scale for several reasons



# Interventions have implications

- In virtually all cases, local site-specific sediment management interventions will have up- and/or downstream impacts
- Below Aswan Dam – 15 to 20% of the habitable land could be gone in 60 years because of subsidence due to a lack of sediment, which could displace 15% of Egypt's population



# Multiple uses and users of sediment



- Most of Europe's main river basins are heavily populated, and thus there are many different uses and users of sediment
- Need to evaluate these uses and users – stakeholder participation
- Basin scale is most appropriate scale and unit for evaluating these



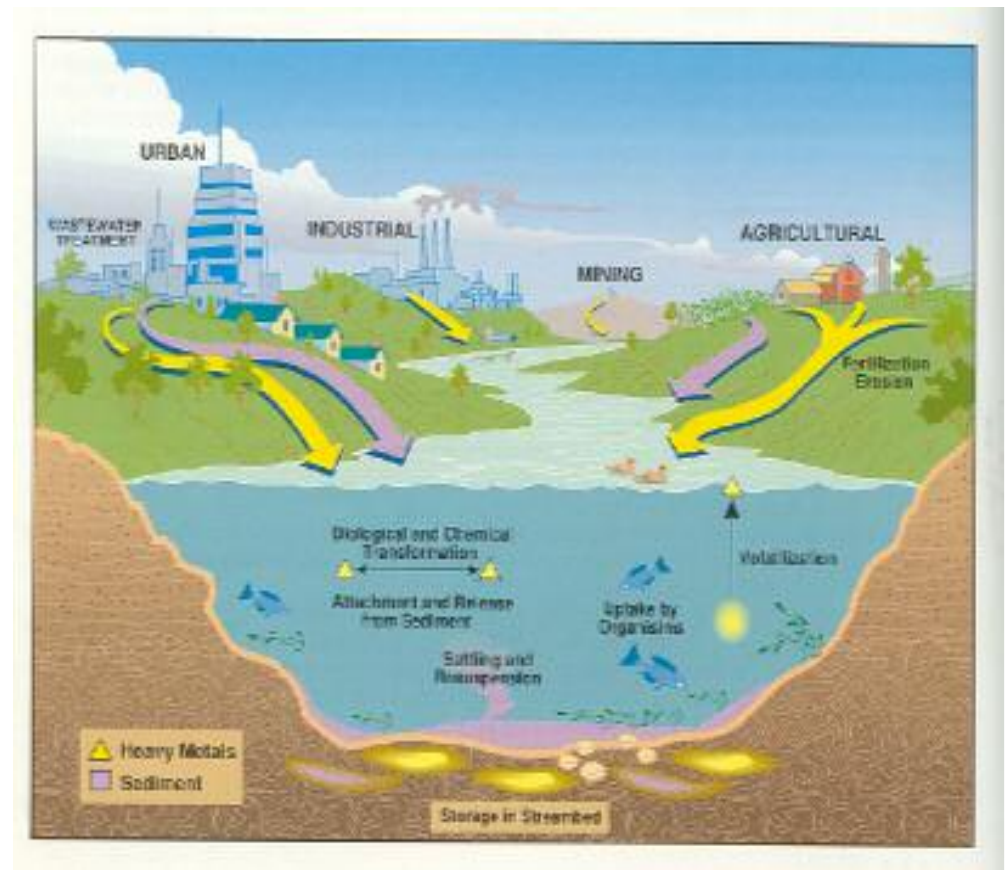
# Controlling diffuse sources

- Source control represents the optimal long-term solution: environmentally, economically and socially
- With improvements in point sources, diffuse sources are increasing in importance
- Diffuse sources tend to be spread throughout the basin and thus require a basin-scale approach for management



# Conceptual river basin sediment model

- Having identified and established that the river basin is the most appropriate scale and unit to understand sediment behaviour and to manage sediment, an important stage is to develop a conceptual river basin model (CRBM) appropriate for sediment quantity and quality.
- CRBM is a concept that stems from hydrological and ecological theory and has been used for water management
- CRBM for sediment should be part of the overall river basin management plan



From Meade (1996)



# Conceptual river basin sediment model

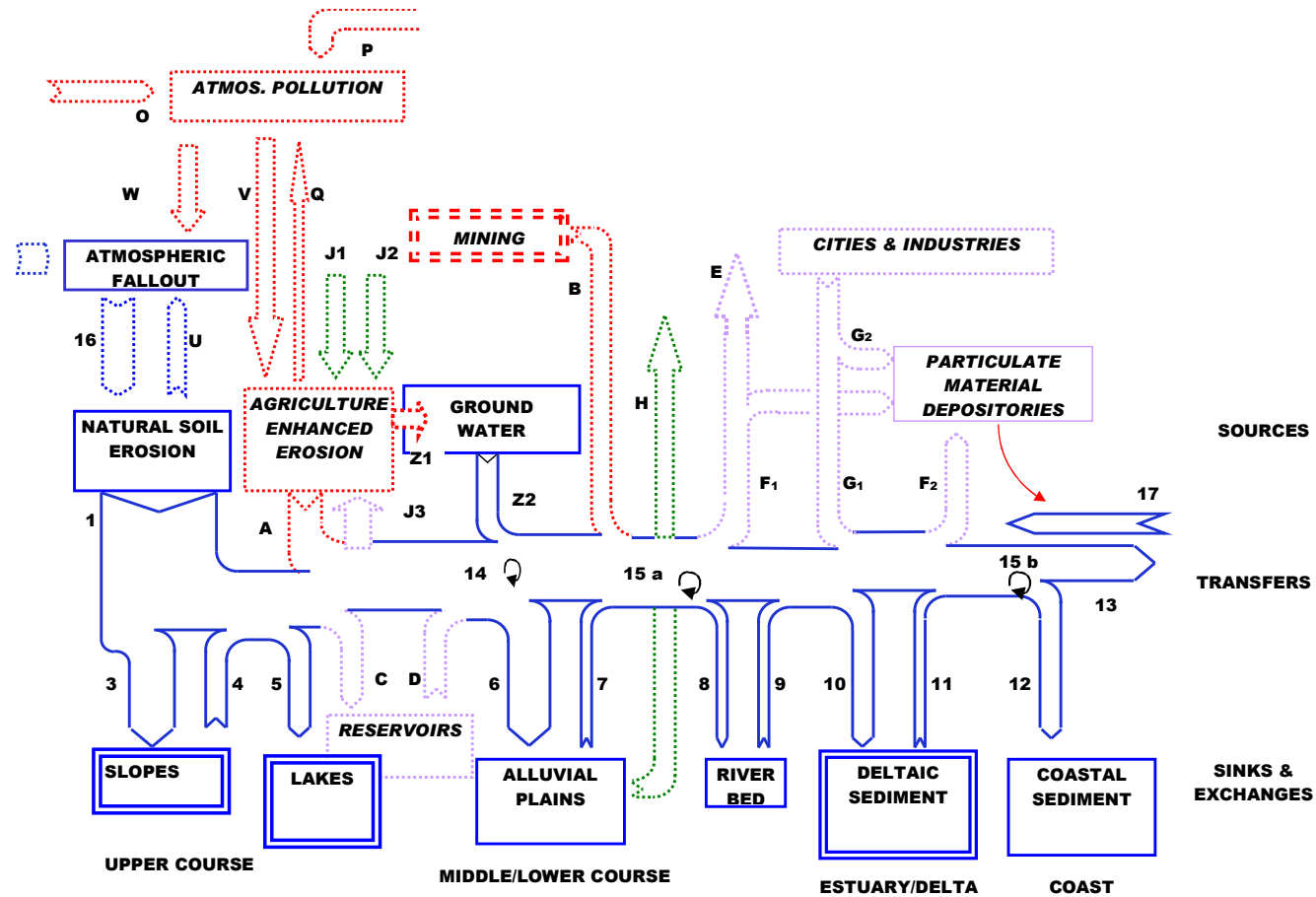
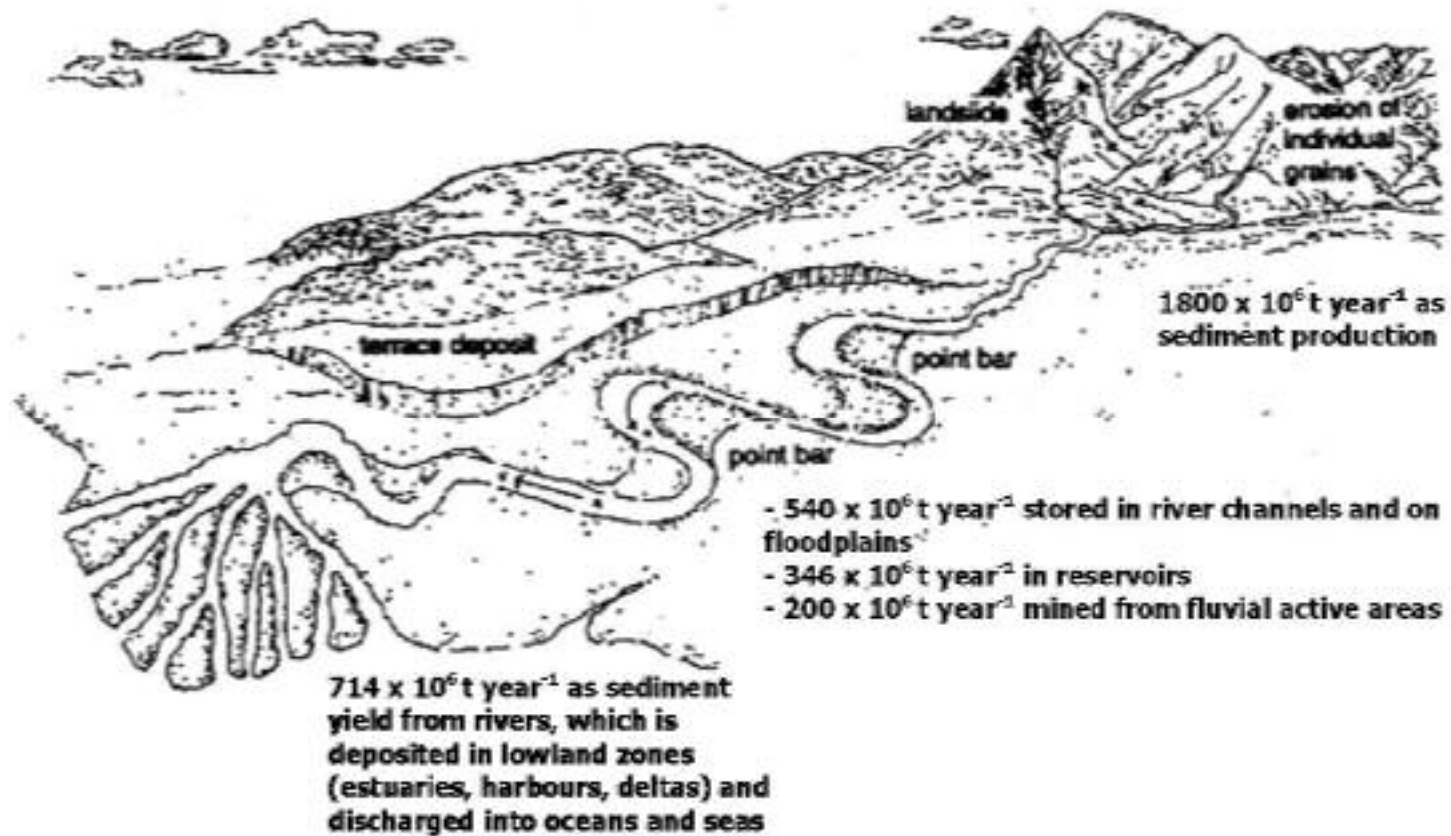


Figure 5.2.2.c: Anthropogenic impacts on river matter transfers. #1 to 17: Fluxes in natural systems. #A to Q: fluxes generated within the Anthroposphere. Blue fluxes: mostly natural fluxes. Red fluxes: uncontrolled anthropogenic fluxes. Purple fluxes: controlled anthropogenic fluxes. Green fluxes: fluxes of economic materials. The position of industrial and urban inputs in river catchments is highly variable. From Meybeck et al. (2003)



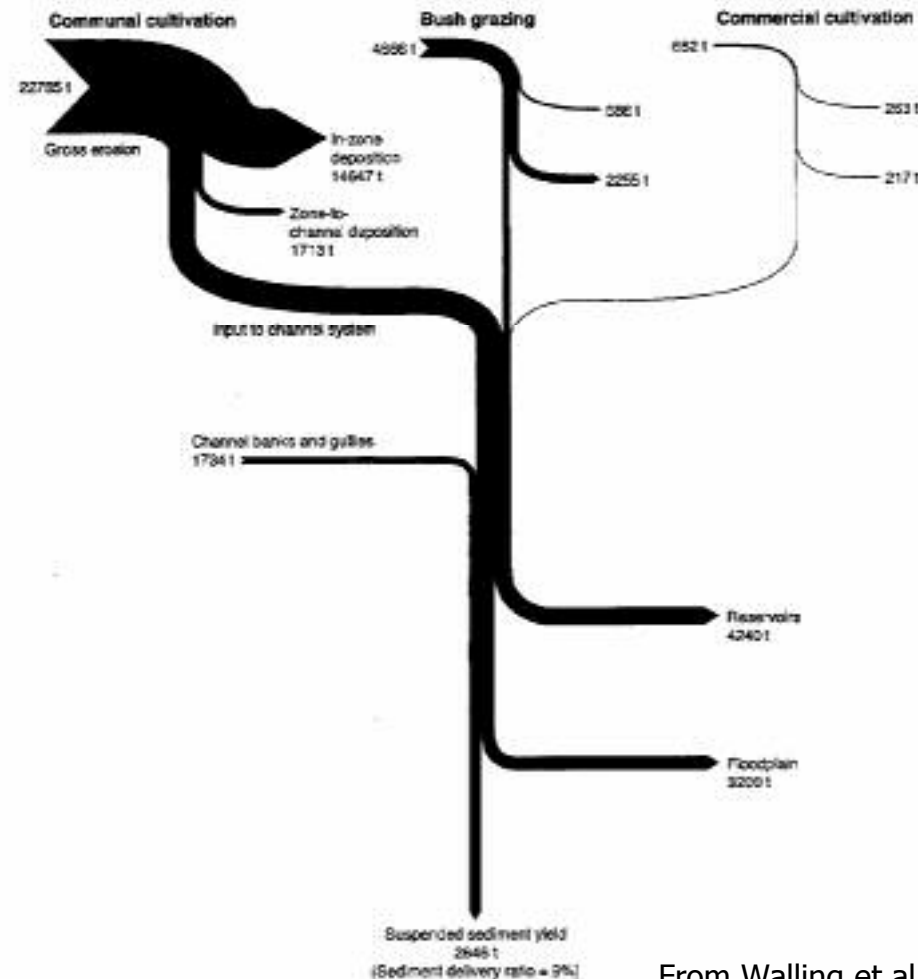
# Conceptual river basin sediment model



From Owens and Batalla (2003)

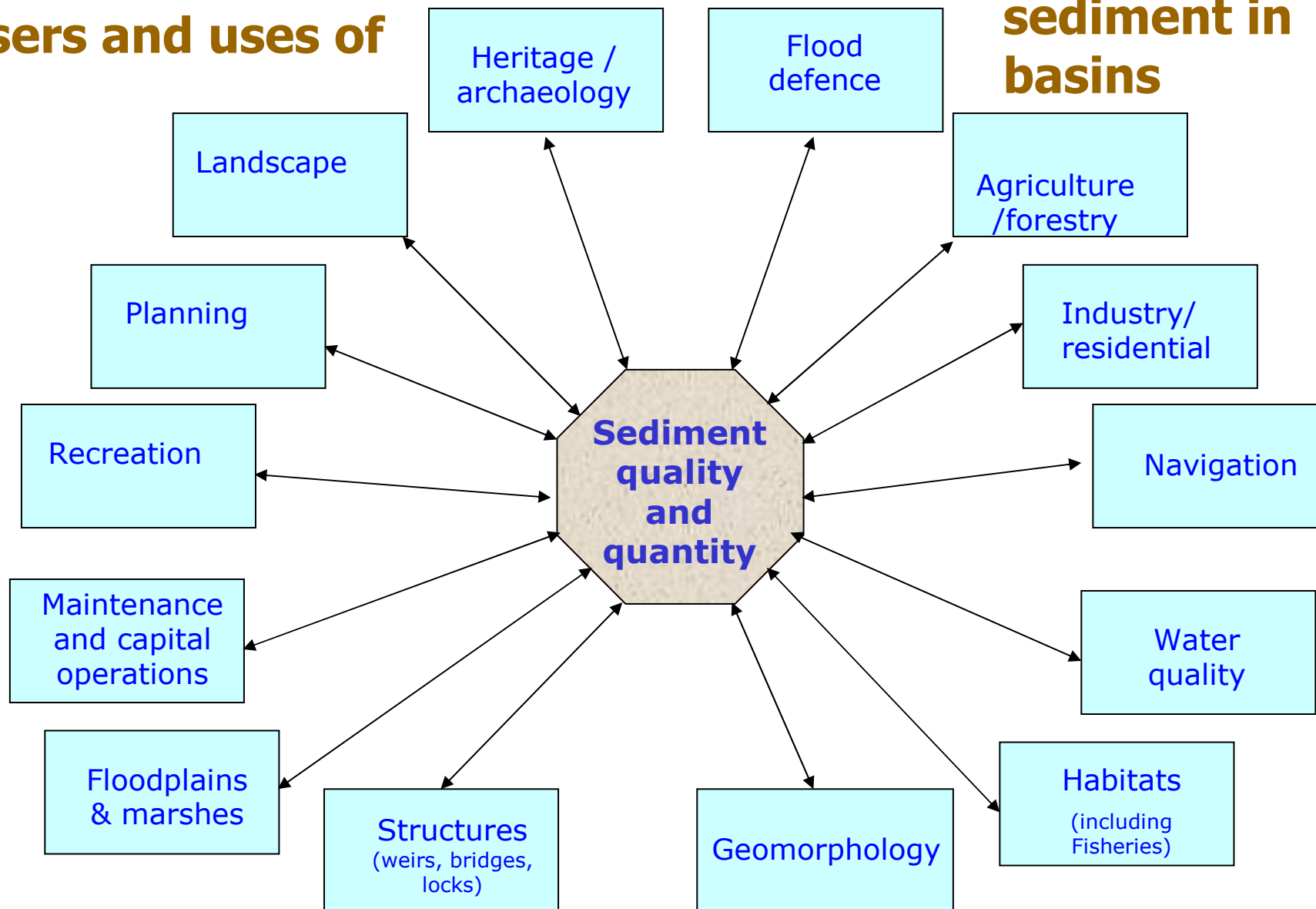
# Information to personalise the CRBM

- Identification of various environments
- Information on sources, fluxes and pathways
- Identification of users and uses – stakeholders
- Use of tools to inform the management decision-making process
  - Modelling
  - Cost-benefit analysis
  - Risk assessment
  - Scenario analysis

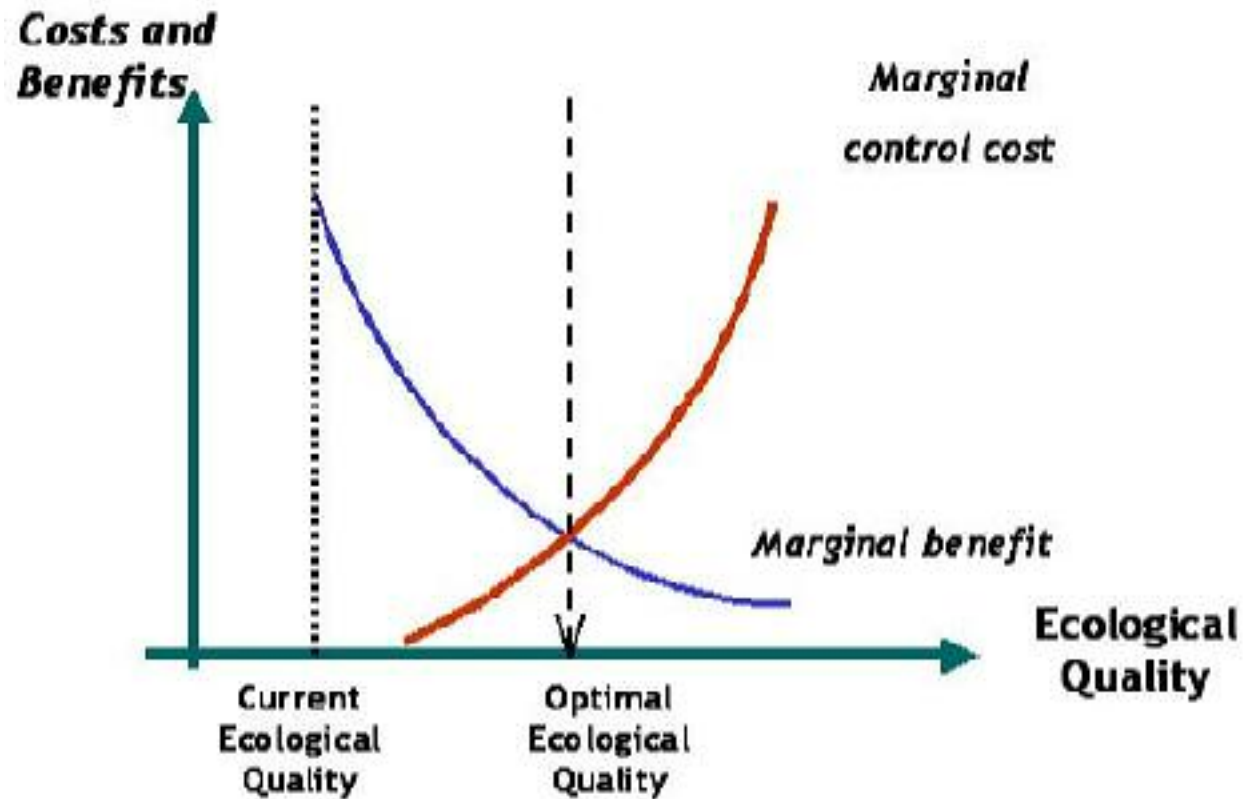


From Walling et al. (2001)

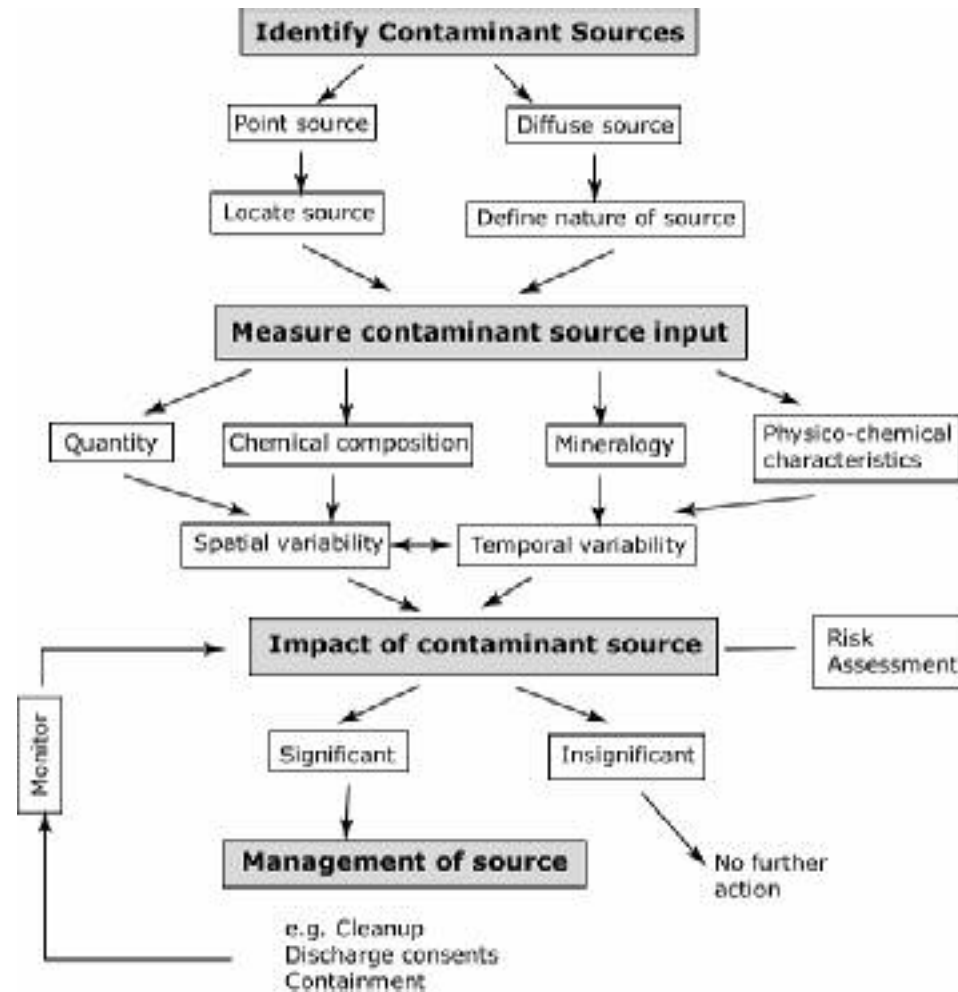
# Users and uses of sediment in basins



# Societal cost-benefit analysis



# Decision frameworks





# Policy, legislation and guidance (drivers)

- Conventions for the protection of the marine environment
  - Oslo-Paris Convention
  - HELSINKI Convention
- Conventions for trans-boundary movement of hazardous waste
  - Basel Convention
- International recommendations for the management of dredged material
  - PIANC – International Navigation Association
  - CEDA – Central Dredging Association
- EU regulations
  - Water legislation (Water Framework Directive)
  - Waste legislation
  - Soil legislation (Soil Thematic Strategy)

# Summary

- Some of the important considerations and requirements for sediment management at the river basin scale are the identification and evaluation of the:
  - relevant stakeholders within a river basin;
  - various uses and users that interact with sediment in a river basin;
  - various environments within a river basin;
  - pathways and fluxes of sediment and water between these environments;
  - tools that can be used for assembling the data and information for sediment management;
  - options for management so as to select the optimum solution; and
  - various drivers (especially legislation and policy) for sediment management.



# Recommendations

- Sediment should be managed at the scale of the river basin.
- The development of a conceptual river basin model (as described previously) should be one of the first steps in the decision-making process for sediment management in river basins.
- Stakeholders possess important and valuable knowledge and information about sediments. They should, therefore, be involved in the decision-making process.
- Sediment and associated contaminants in river basins influence the chemical and ecological status of rivers, lakes and coastal waters and thus it is necessary for sediment issues to be addressed as part of the EU Water Framework Directive and similar legislation.

# Recommendations

- Sediment (quantity and quality) should be routinely measured and monitored (at least at a minimum, basic level) as part of a European-wide sediment monitoring network, in order to identify and quantify the main sources of sediment and associated contaminants, and their movement within river systems. One way forward would be to include such a network in national programmes to implement the WFD, and possibly the STS.
- There is a clear need for an assessment of existing sediment data for European river basins. There is a need to assess what is already available and what is needed, and who would manage this European sediment database.
- Societal Cost Benefit Analysis should be incorporated into the decision-making process because sediment management has to be based on both technical and societal considerations.
- Sediment management at the river basin scale requires appropriate sediment management guidelines, legislation and policies that can operate at the river basin scale.

# Conclusions

- Scientists have long recognised that the most meaningful unit for understanding water and sediment fluxes within the landscape is the river basin.
- It is, therefore, promising that water policy in the EU has moved towards this scale for water management.
- What is perhaps lacking, however, is the recognition of the role of sediment within river basins (especially in terms of its effects on water quality, aquatic ecosystems and human health) and that sediment should also be managed at the river basin scale.