SedNet WP 4

An overview of sediment and dredged material treatment

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Book:

Dredged material treatment

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Dredged material treatment

Chapter 1: *General Introduction*

Chapter 2: *National situation*

Chapter 3: *Overview on treatment and disposal options*

Chapter 4: *Description of available technology*

Chapter 5: *Beneficial use*

Chapter 6: *Assessment of treatment and disposal options*

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Chapter 8: *Costs and economical issues*

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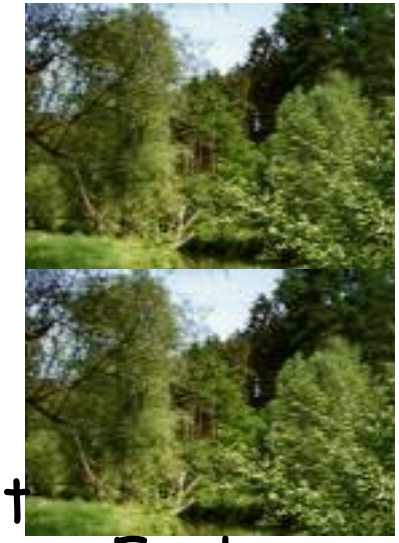
Introduction

- Sediments are an essential, integral and dynamic part of river ecosystems
- Due to human activities during the last decades, sediments have been contaminated, and it's likely that they will be contaminated also for the near future

Dredging is necessary to keep Europe‘s ports vital

Inland shipping

Urban watermanagement



Ecology

Prevent flooding

Fishery

Agriculture

Uses of watersystems (2)

drinking water

yachting

sportfishery

recreation

Dredging in Europe

- In Europe very large amounts of sediments are being dredged
- Amount/year
  - 30 – 50 Million m^3 in Netherlands, Germany, France, Flanders
  - 5-6 million m^3 in Italy
  - 100.000 m^3 in Norway
- Expenditure/year

  > 150 M€ in Germany, 130 M€ in NL
- Management costs for EU estimation at least 1 billion €/yr

Situation in Europe

- On the basis of a SedNet estimation, it can be assumed that around 100 and 200 million cubic meters of contaminated sediment might be produced yearly in Europe
- Increasing pressure for new solutions for contaminated dredged material, because of decreasing space & public acceptance and increasing costs
- Existing national legislation are very complex, borderline of water, soil and waste
- EU regulations do not adequately deal with dredged material / sediments *(WFD, Waste Catalogue, Landfill Habitats, Marine and Soil Strategy)*

Perception of dredged material

(by Pol Hakstege)

Invisible

Toxic

Difficult

Waste

Not sexy

Nimby

Sediment as resource

- Sediments are not a waste, but a valuable, natural resource that can allow protection, conservation or even restoration of water bodies

River basin scale

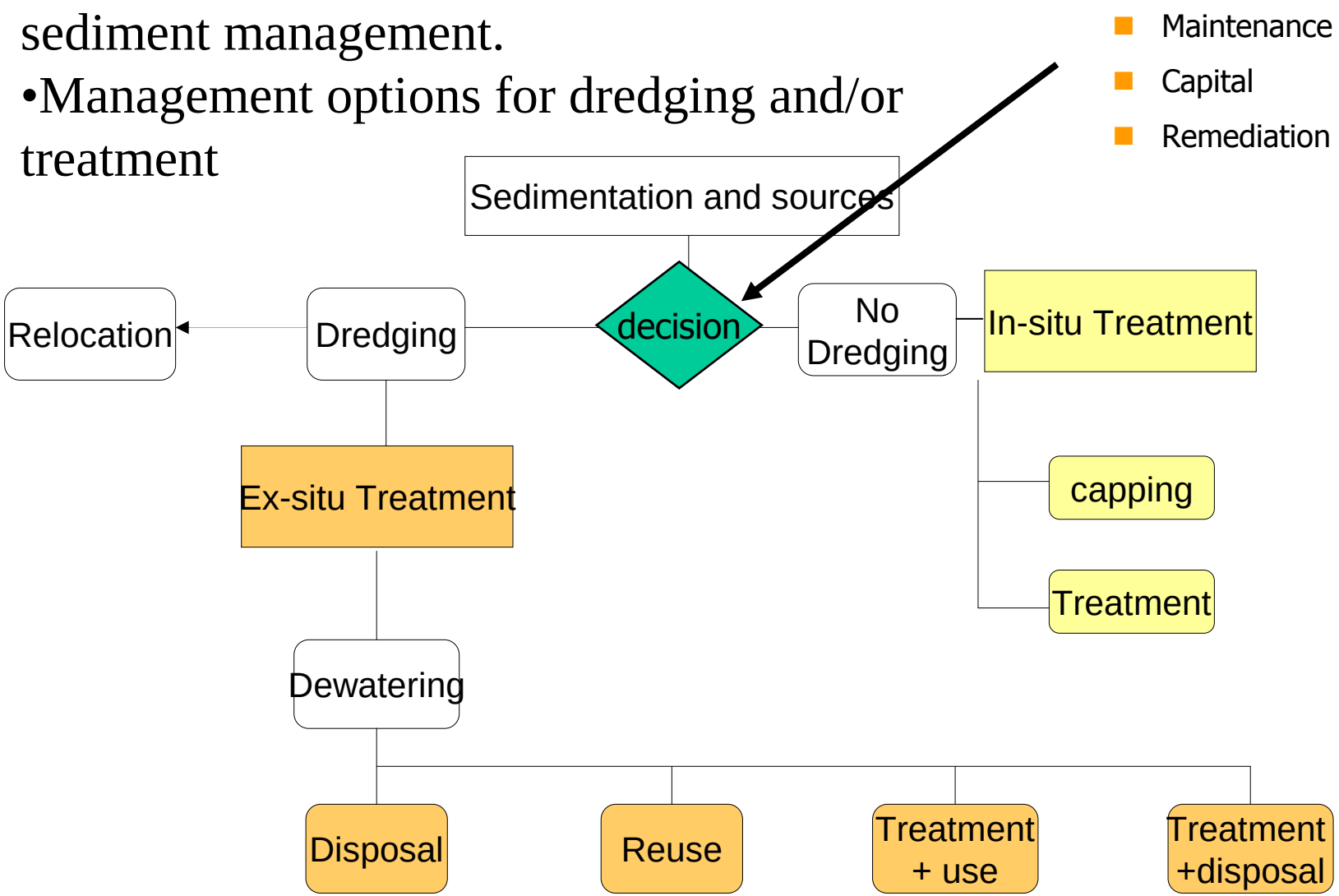
- In any case, dredging and sediment treatment/disposal need to be **integrated in the river basin management**
- they should not result in **unwanted impacts elsewhere or any time** in the river system.
- Joint effort of authorities to meet the national and EU policy targets and comply with legislation along a river system
- **Integrated approach** from inland to coastal waters

Sediment treatment strategy

- It is clear that an effective sediment treatment strategy could never only implement the so-called **'end of pipe'** approach,
- **source control** is the prerequisite to reach a sediment quality in the future, which does not pose a risk to aquatic systems or upland use (source: urban, industrial, agricultural areas).
- Investments in source control upstream are **often more economical** than treatment downstream.

•Treatment of dredged material is part of sediment management.

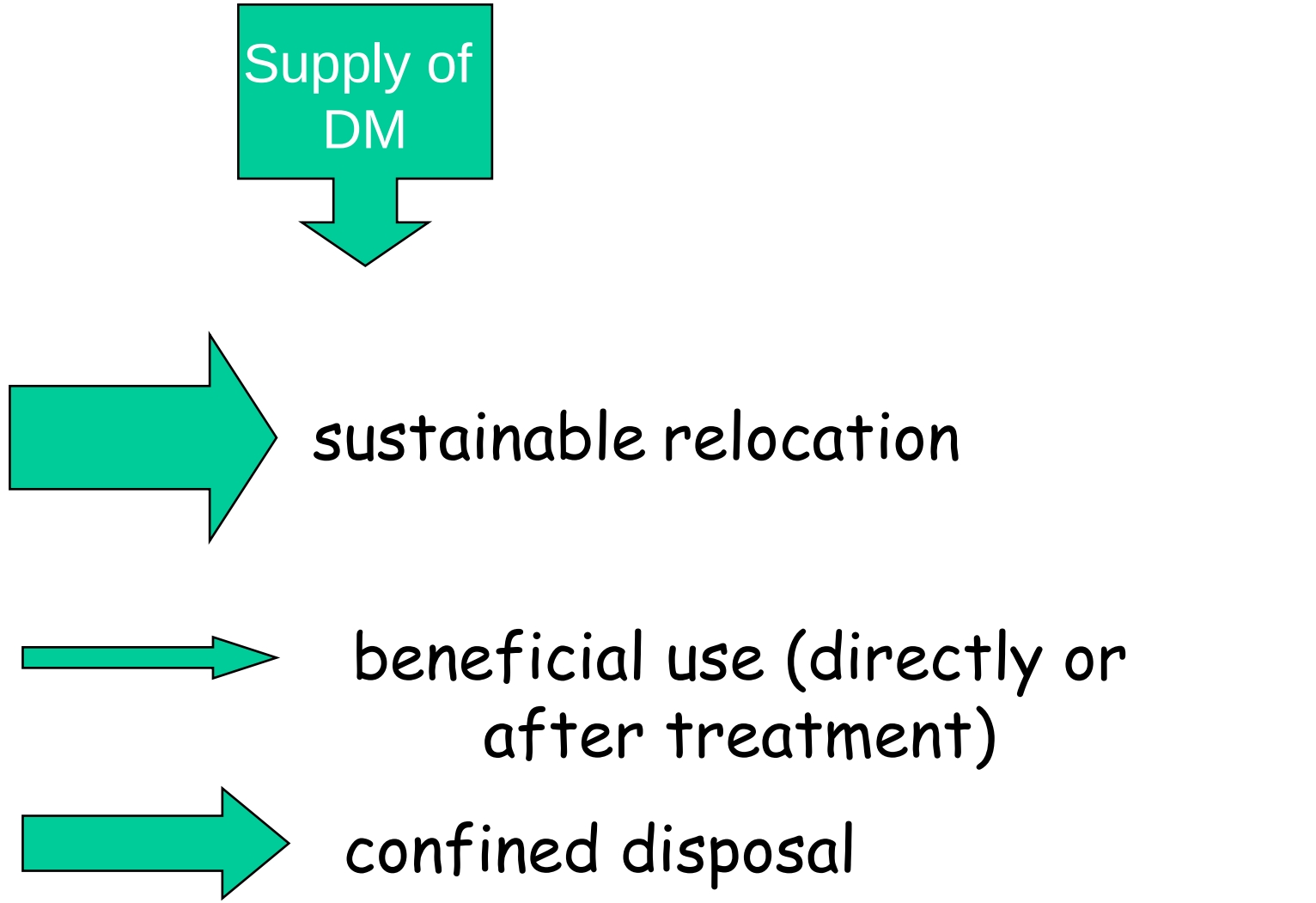
•Management options for dredging and/or treatment



Site specific solutions

- Several aspects have to be always taken into consideration when a treatment technology has to be chosen.
- Therefore, it would never be a unique solution (**it's not like to buy a washing machine!)**
- Different solutions have to be assessed every time case by case
- that means: treatment technology choice is **very much site specific.**

Preferred order of destinations of DM



Relocation to the same watersystem

Sediments are an essential part of watersystems and no waste so relocation should be first option

- Environmental restraints for environmental protection of marine and inland watersystems

- London, Ospar, Helcom
- Points of debate: quality criteria, WFD

Alternative options

- If relocation is undesirable or impossible for environmental, morphological or spatial reasons, alternative options are applied:
  - beneficial use
  - treatment
  - confined disposal.
- the term 'Beneficial use' is used for treated and untreated dredged material
- It’s questionable if dredged material should be treated before one can speak of beneficial use.
- Surely disposal can not be considered as beneficial use

Treatment and disposal

- Different treatment and disposal technologies are well known world wide
- In many cases, the experiences of soil remediation technologies as well as mining tech can be useful adapted
- All types of treatment options are technically available
- Treatment and disposal are complementary options

Treatment Technologies

Processing Principle	
1. Relocation	1. Open water disposal
	2. Injection dredging
2. Mechanical separation	1. Classification
	2. Sorting
3. Dewatering	1. Evaporation
	2. Mechanical dewatering
4. Contaminant separation	1. Chemical extraction
	2. Thermal desorption
5. Contaminant destruction	1. Biological reduction
	2. Chemical oxidation
	3. Thermal oxidation
6. Contaminant immobilisation	1. Chemical immobilisation
	2. Thermal immobilisation
7. Disposal	1. Sub-aquatic confined disposal
	2. Upland disposal

Applicability

- The decision if a given technology is applicable depends on different factors.
- For instance, the chemical-physical characteristics of the sediment itself defines whether a process principle is applicable or not.
- there will be in many cases a relation between the grain size distribution and the contamination of the sediment.
- The finer the particles and the higher the content of organic matter in the sediment, the higher will be the content of contamination

Decision frame

	Type of sediment			Level of contamination		Type of contamination	
processing principle	silty	silty / sandy	sandy	low	high	organic	in-organic
2.1. Classification	+	+	+	+	+	+	+
2.2. Sorting	+	+	+	+	+	+	+
3.1. Evaporation	+	+	+	+	+	+	+
3.2. Mechanical dewatering	+	+	+	+	+	-	+
4.1. Chemical extraction	+	+	+	-	+	-	+
4.2. Thermal desorption	+	+	+	-	+	+	-
5.1. Biological reduction	-	+	+	+	+	+	-
5.2. Chemical oxidation	+	+	+	-	+	+	-
5.3. Thermal oxidation	+	+	+	+	+	+	-
6.1. Chemical immobilisation	+	+	+	+	+	+	+
6.2. Thermal immobilisation	+	+	+	+	+	+	+

\+ process complies with environmental standards

\- process does not comply with environmental standards

COSTS

- Of great importance are the costs of different treatment options.
- They depend very much on the specific circumstances: large variations in costs occur
- Simple technologies such as sand separation and land farming/ripening are generally slightly more expensive than disposal
- while costs for stabilisation and thermal immobilisation technologies are significantly higher

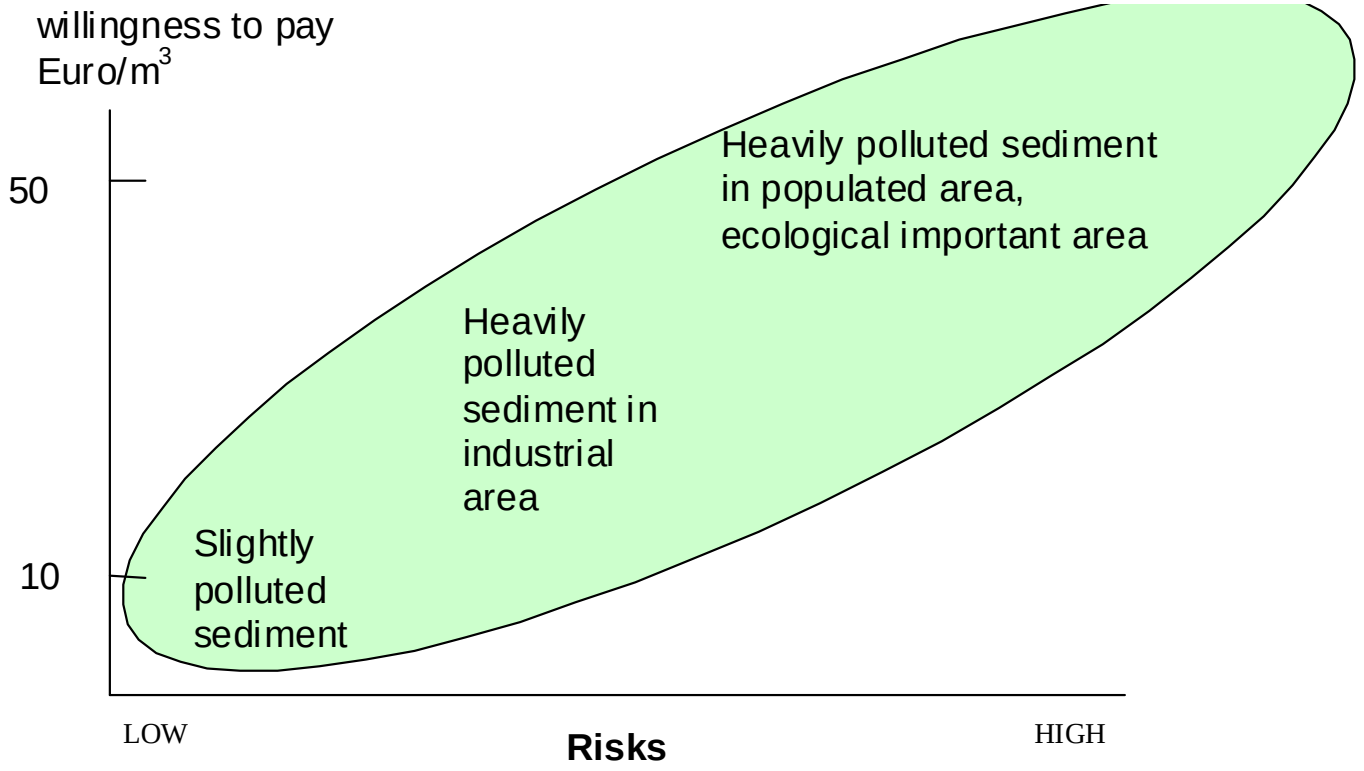
Treatment choice

- Nowadays, the costs of the treatment is often that high that the funds for continuous financial support for dredging activities might be not sufficient.
- This is true for the treatment as well as for the confined disposal, with the only difference that treatment is more expensive than disposal (except if landfilling is forbidden, limited or taxed) ,
- and therefore more treatment means that more budget is needed
- **unless the treated product for beneficial use is marketable.**

Choosing treatment options

- Since each treatment option processes the dredged material into a product, and the latter might be clean sediment, sand, bricks etc,
- the first consideration in the treatment choice should be, "are these products accepted by private or public users?".
- If the products are not accepted, the options are not feasible

Treatment costs



- **all benefits (economical and societal) should be included!**

Social cost benefit analysis

Economic sectors

- Navigation
- Fishery
- Agriculture
- Recreation

Social sectors

- Ecology
- Urban environment
- Drinking water
- Flood protection

All benefits expressed in € for each sector and compared with management costs dredging.
Tool for policy-making to set priorities for investments

Beyond cost/benefit analysis

- How to apply sustainaibility
- **No general definition of treatment sustainibility assessment**
- Site specific approach for the treatment choice based on a long perspective **integrated environmental, economic and social assessment**
- **OBJECTIVE**: Interventions should not result in unwanted impacts elsewhere in the river basin (up- or downstream) and/or should not have **an adverse impact tomorrow**

Assessment

- An assessment approach accounting for the complete range of effects associated to a process remains a complex problem.
- An example of this new way of process assessment is the development of the methodology of the life-cycle assessment (LCA) and its progressive introduction to decision making schemes and even strategies for policy making in the public sector.

Assessment recommendation

- It must be recommended that a combination of tools (costs, LCA, costs benefit analyses, risk assessment studies) should become assessment routine for decision-makers
- Indeed, the present structures for decision-making are mostly at local level with a very short timeframe (usually a political mandate)
- However, decisions have often consequences on a larger scale: the river basin, and might show long-term-effects
- Decisions have to be based on a new spatial and time scale.

Final recommendation

- Experience has still to be gained for the large-scale application of technologies, logistics and the market potential of the products
- For beneficial use at a larger scale it is imperative to develop markets for the application of dredged material and products from treatment of dredged material
- Additional financial tools and markets for beneficial use are strongly required
- Smart and innovative tendering, large-scale contracting of dredging projects
- Public procurement

Final recommendation

- It is of crucial importance to involve the public and other stakeholders in the decision-making process of treatment and disposal options.
- Public support is a critical factor, not only for the location of disposal sites, but also for the location of treatment plants and **the beneficial use of the products**

THANK YOU VERY MUCH!