SedNet - Effective river basin management needs to include sediment

Prof Helmut Habersack
BOKU
SedNet steering group member
helmut.habersack@boku.ac.at

Workshop Hydropower and Fish - Research and Innovation in the context of the European Policy Framework, Brussels, Belgium, 30 May 2016

SedNet

Mission:

European network aimed at incorporating sediment issues and knowledge into European strategies to support the achievement of a good environmental status and to develop new tools for sediment management.

Identity:

- Network of sediment professionals (since 2002)
- Independent platform to expert advice
- Positioned between science and stakeholders
- Window on sediment issues to EC DG Environment

Focus:

- Sediment quality AND quantity issues
- River basin scale
- Including marine / estuarine sediments in a ICZM context

More info: www.sednet.org

Outline:

- Sediment and its management
- Sediment continuum as a key-management issue example
- Key-messages

Outline:

- Sediment and its management
- Sediment continuum as a key-management issue example
- Key-messages

What is sediment?

Sediment is:

- suspended or deposited solid, of mineral as well as organic nature, acting as a main component of a matrix, which has been, or is susceptible to being transported by water*
- an essential, integral and dynamic part of our river basins**

Some appearances of sediment:

suspended particulate matter (SPM)

silt / mud

clay

sand

gravel

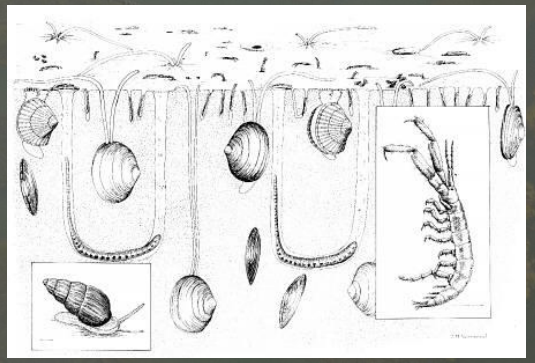
* *Brils (2004) The SedNet Strategy Paper – The opinion of SedNet on environmentally, socially and economically viable sediment management, SedNet, June 2004*

** *Salomons & Brils (eds) (2004) Contaminated sediments in European River Basins, SedNet publication*

Sediment needs management

Due to:

Too much sediment	Too little sediment	Sediment as resource
Obstruction of channels Rivers fill and flood Reefs get smothered Turbidity	Beaches erode Riverbanks erode Wetlands are lost River profile degradation	Construction material Sand for beaches Wetland nourishment Soil enrichment Habitat and food for life



Sediment = “no waste” =
essential & integral element of river-sea systems

Source scheme: Martin (2002)

Sediment management

1. Requires a holistic approach taking into account*:

- system understanding both in terms of quality and quantity
- the integrated management of soil, water and sediment
- upstream-downstream relationships
- supra-regional and trans-boundary collaboration

2. Should be an essential element in River Basin Management planning **

* *SedNet (2014) Moving Sediment Management Forward – The Four SedNet Messages*

** *SedNet (2006 & 2009) Round Table Discussion reports*

Outline:

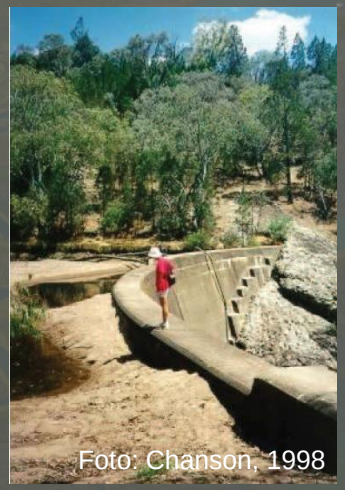
- Sediment and its management
- Sediment continuum as a key-management issue example
- Key-messages

Surplus

Deficit

Problem example 1

Sediment continuum – surplus



Problem example 2

Sediment continuum – deficit

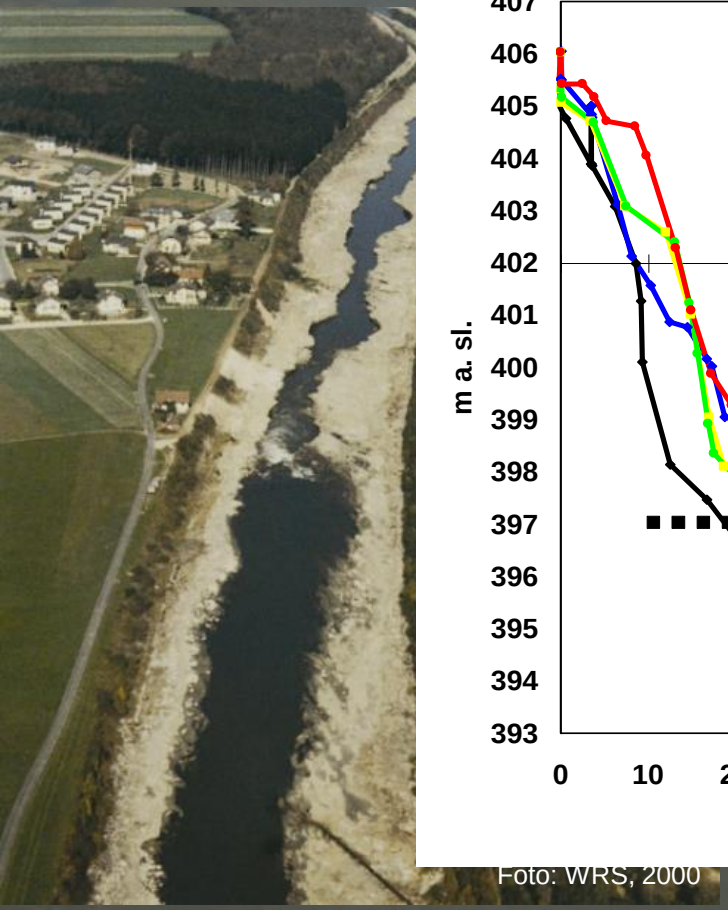
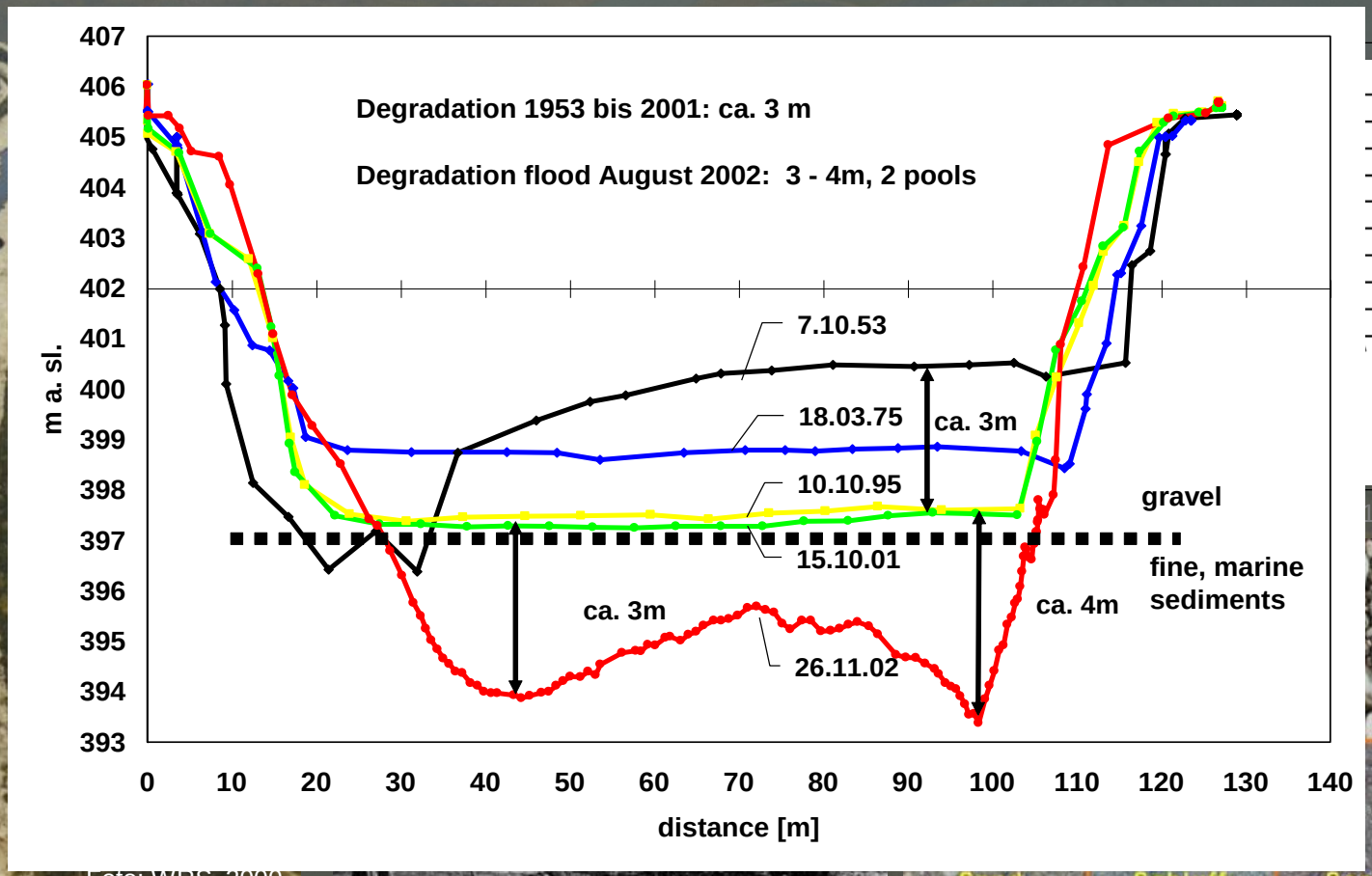


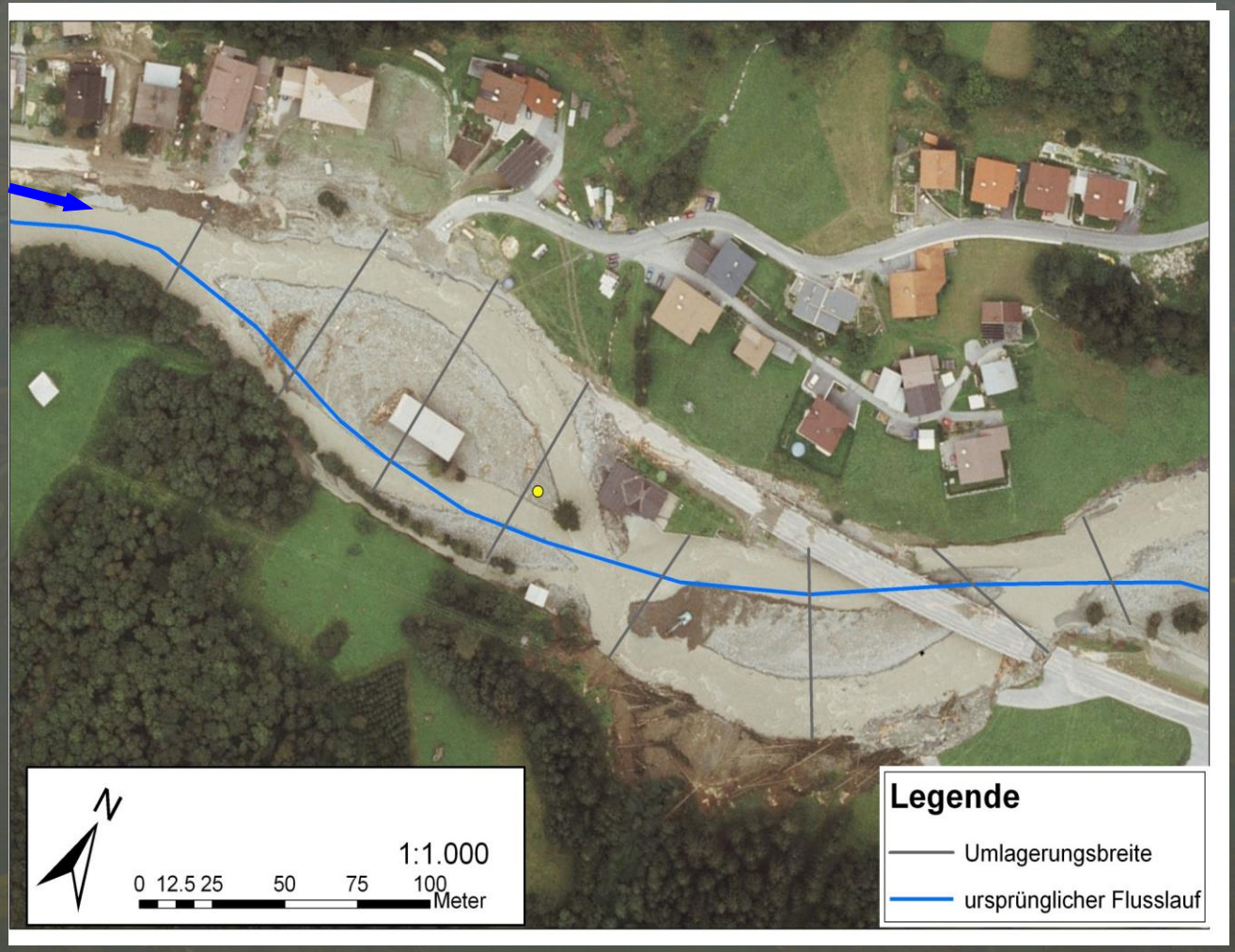
Foto: WRS, 2000



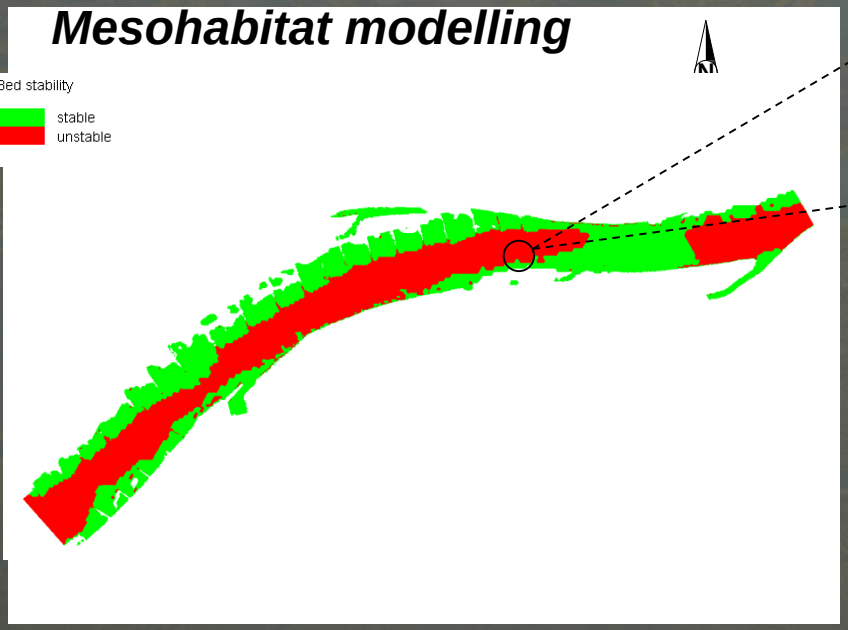
(Hengl, 2004)

Morphological Processes and Floods

Bank erosion, channel migration, morphodynamics

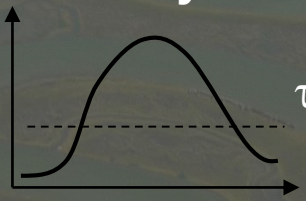


Sediments and fish

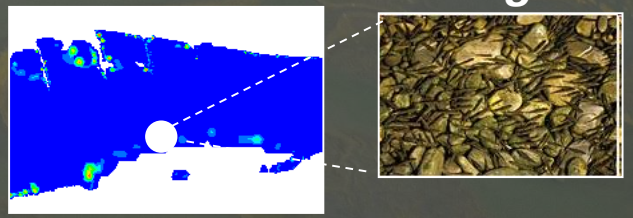


Spawning

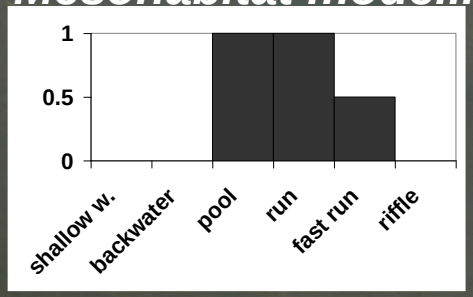
Stability



Microhabitat modelling



Mesohabitat modelling



Hauer, Schober, Habersack 2011: *World Large Rivers*

Consequences of System Changes

Landuse change	→ Change of sediment regime
Climate change	→ Change of sediment regime, - transport
Development of cross sectional structures	→ Change of sediment continuum and transport capacity
Dredging	→ Bedload deficit (by excavation)
Increase of transport capacity (width reduction, increase of bed slope length reduction …)	→ River bed degradation
Reduction of transport capacitiy	→ River bed aggradation
Stop of side erosion and morphodynamics	→ Sediment deficit, depth erosion
Disconnection of floodplains by dams	→ Increase of transport capacity and thus shear stress on river bed

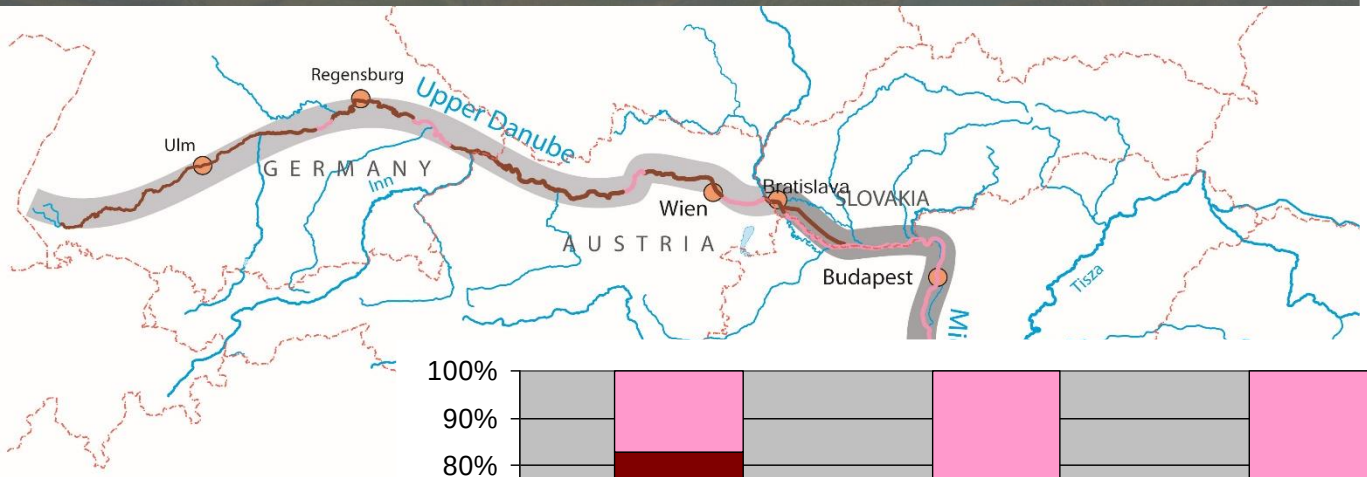
EU Water Framework Directive 2000

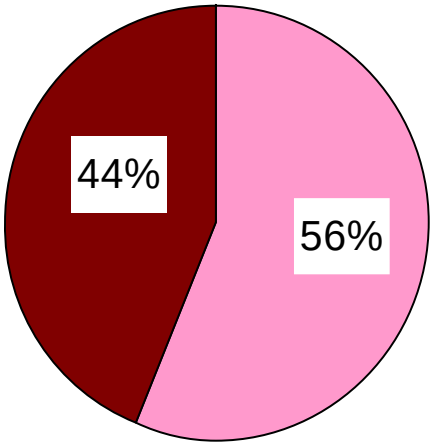
Hydromorphological Quality Components

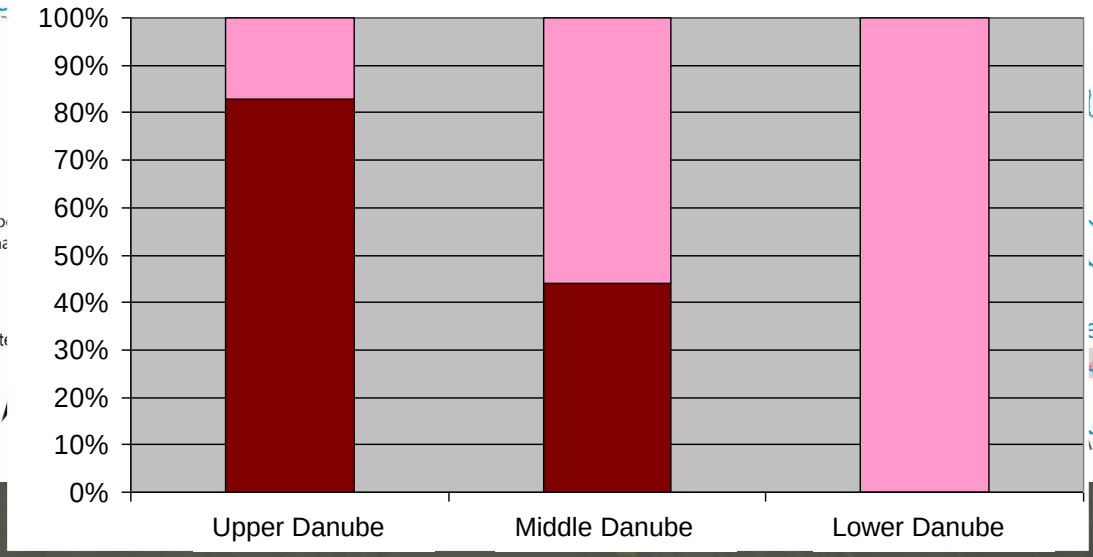
Element	High Status
Hydrological regime	The quantity and dynamics of flow, and the resultant connection to groundwaters, reflect totally, or nearly totally, undisturbed conditions.
River continuity	The continuity of the river is not disturbed by anthropogenic activities and allows undisturbed migration of aquatic organisms and ***sediment transport***.
Morphological conditions	Channel patterns, width and depth variations, flow velocities, substrate conditions and both the structure and condition of the riparian zones correspond totally or nearly totally to undisturbed conditions.

Danube

Erosion and Deposition reaches





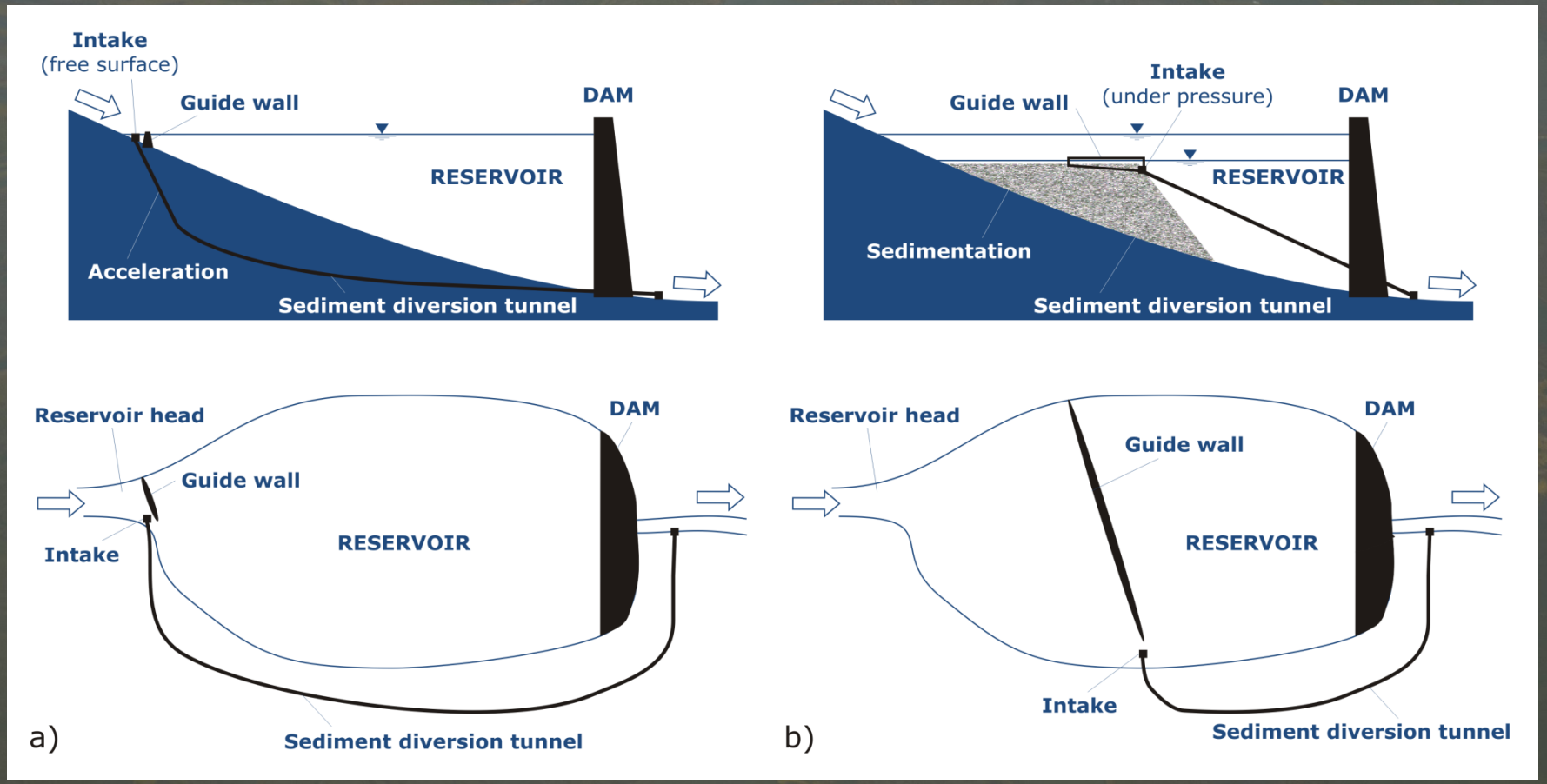


Habersack, Jäger, Hauer, Schwarz, 2010

Measures against reservoir sedimentation

Measures against reservoir sedimentation

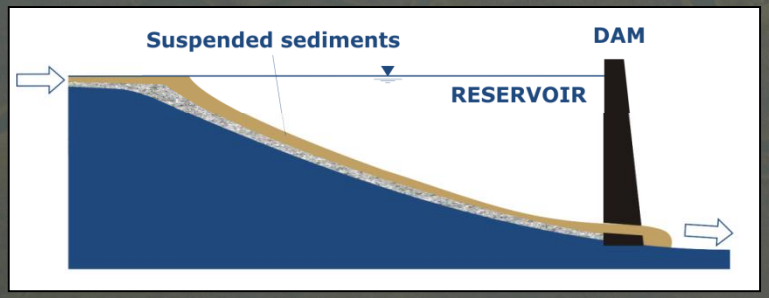
Sediment diversion tunnel

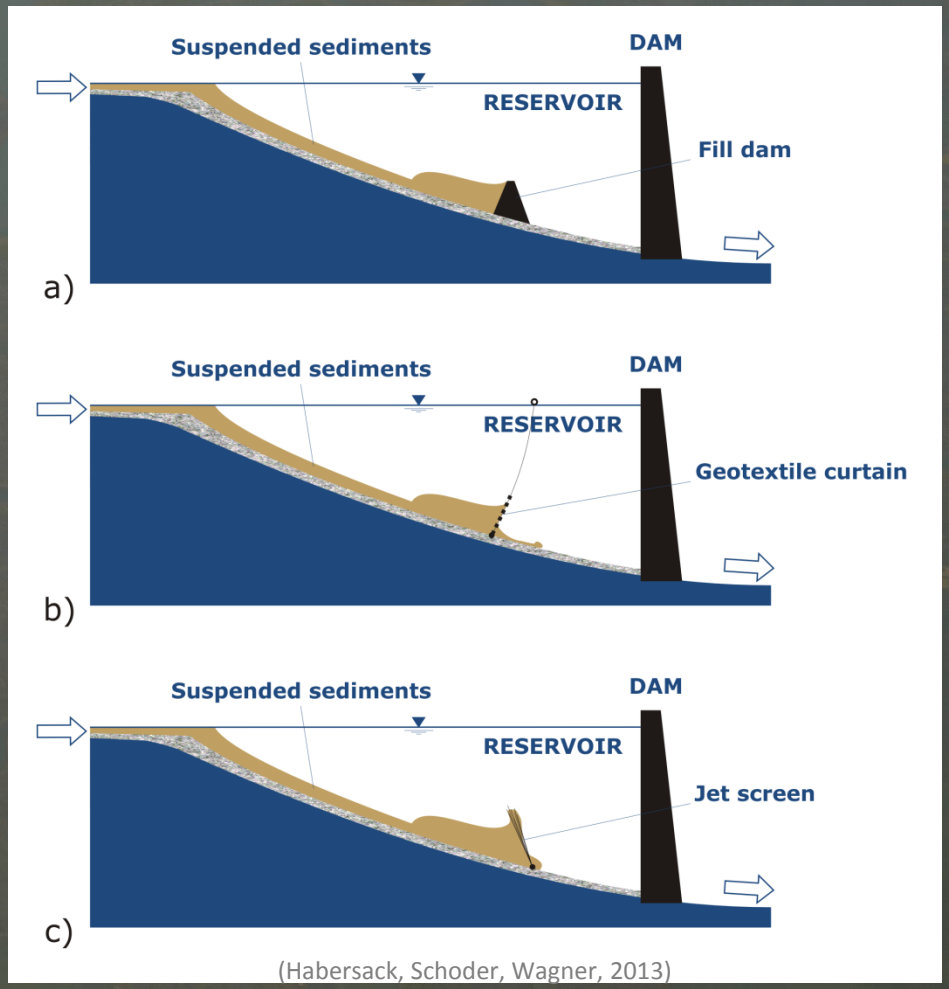


(Habersack, Schoder, Wagner, 2013

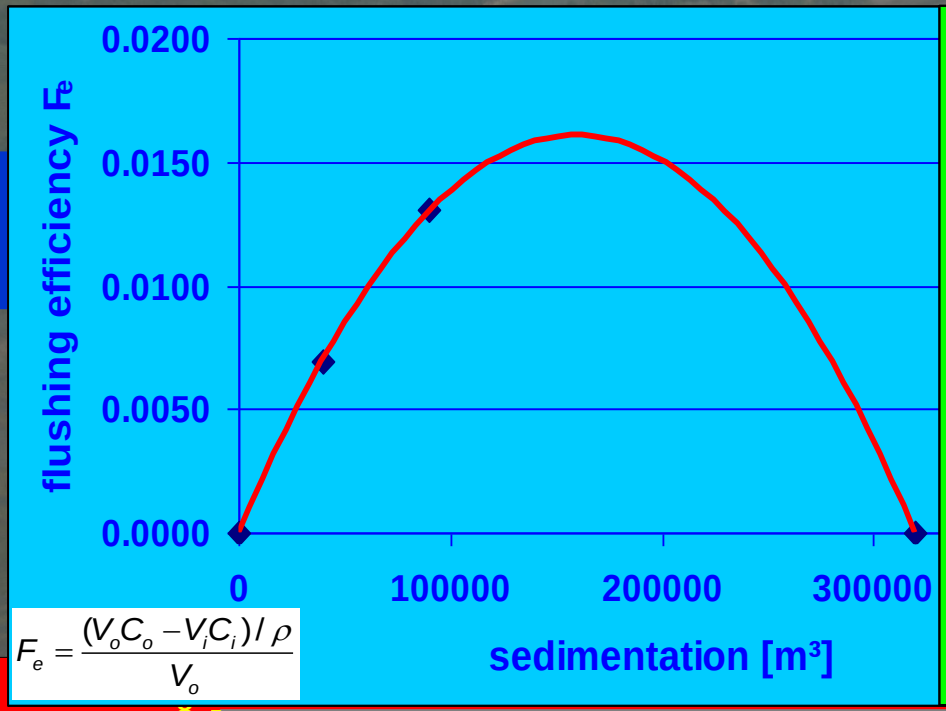
Measures against reservoir sedimentation

Management of turbidity currents

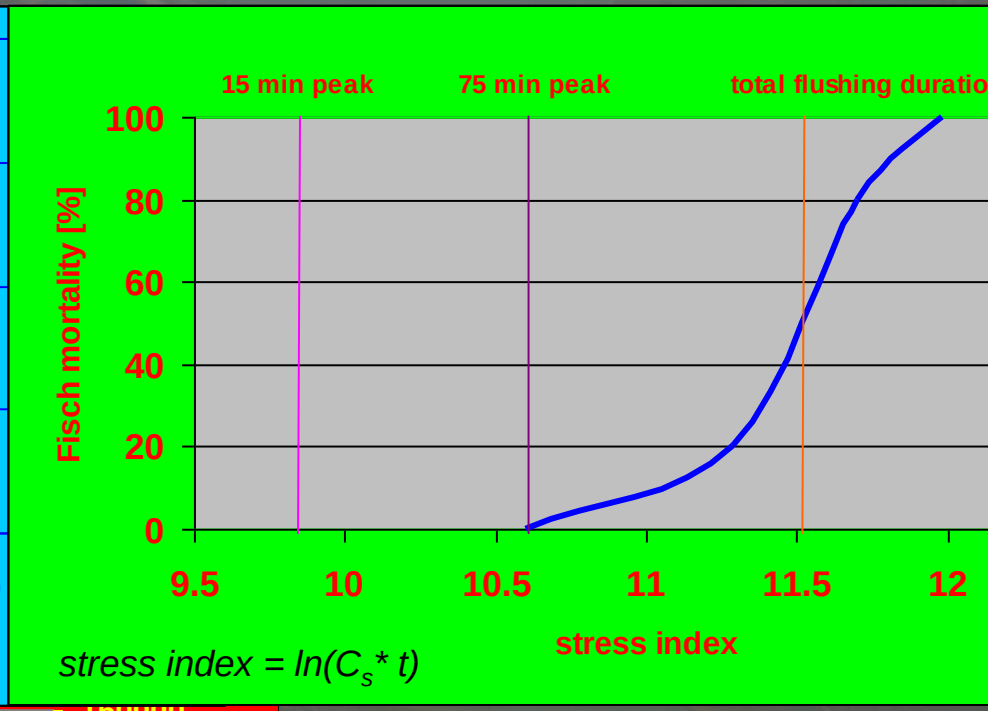




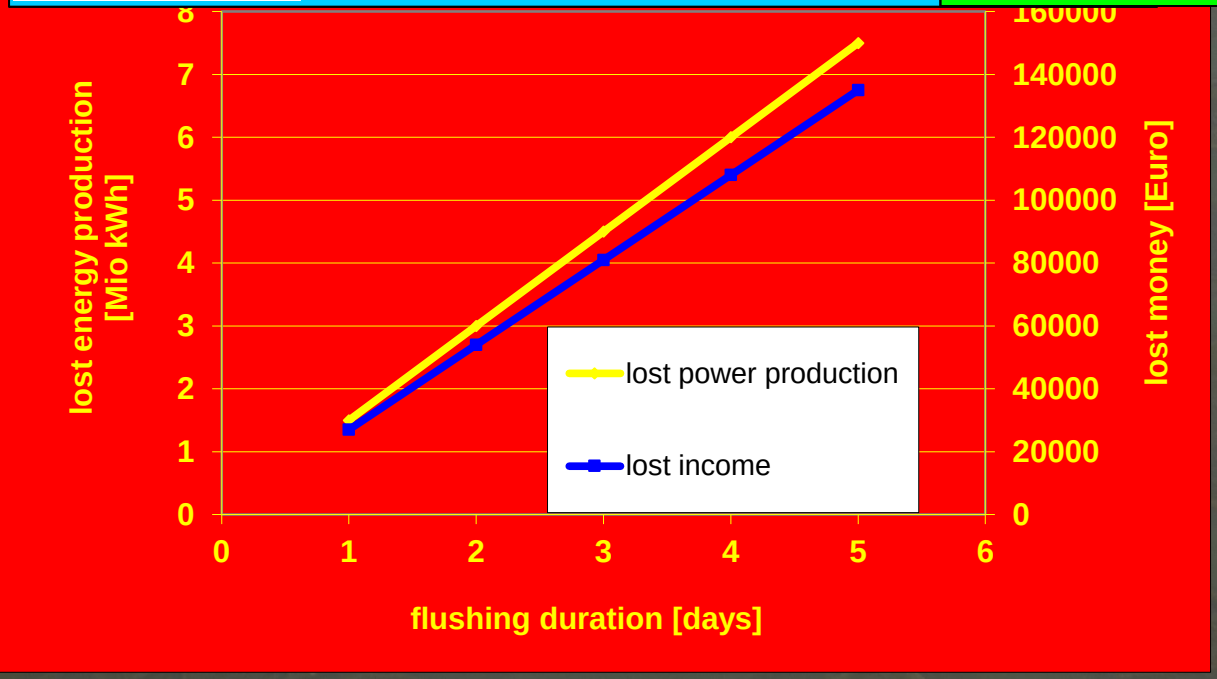
(Habersack, Schoder, Wagner, 2013)



$$F_e = \frac{(V_o C_o - V_i C_i)/\rho}{V_o}$$

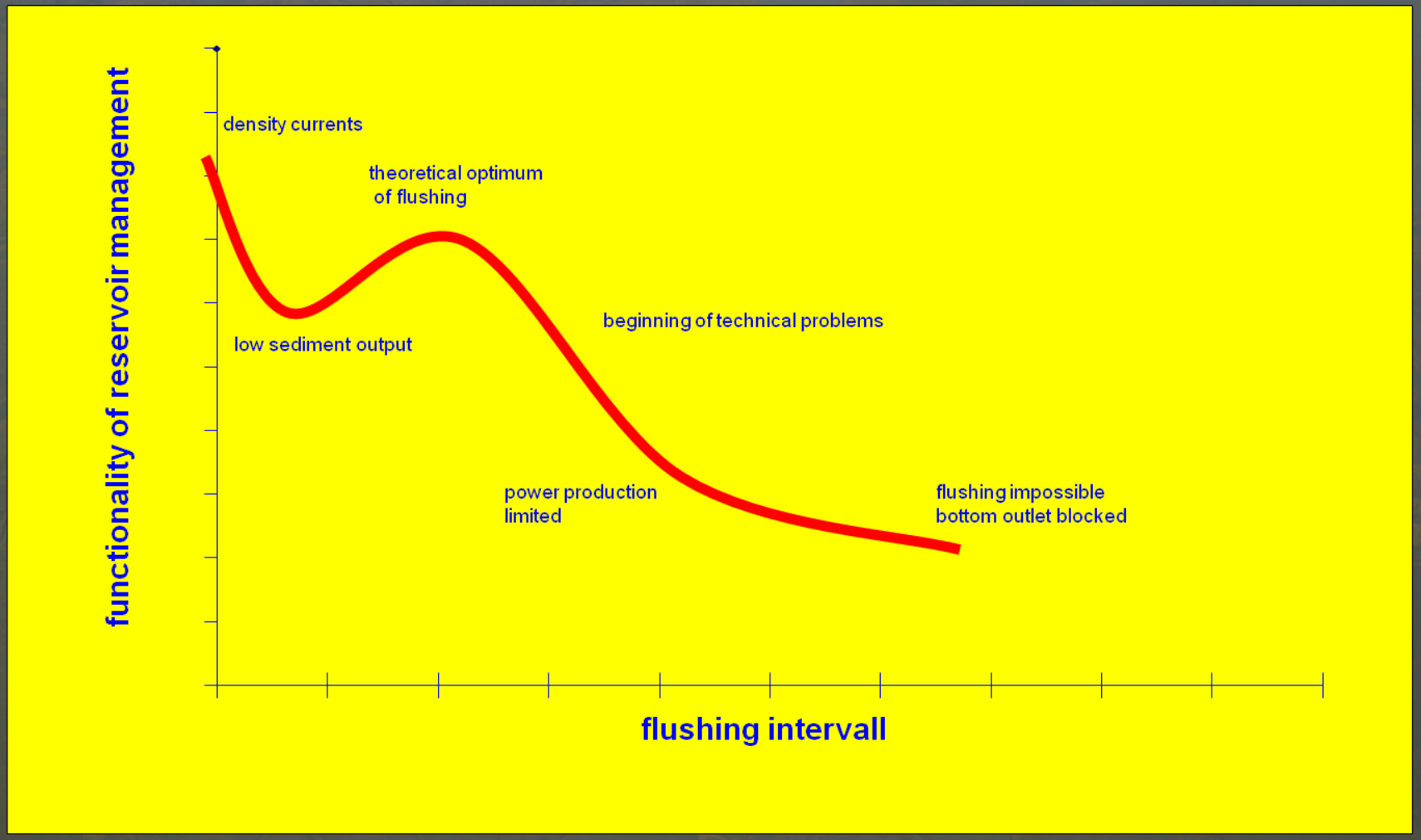


stress index = ln(C_s t)*



Habersack et al., EU project Warmice

Reservoir management



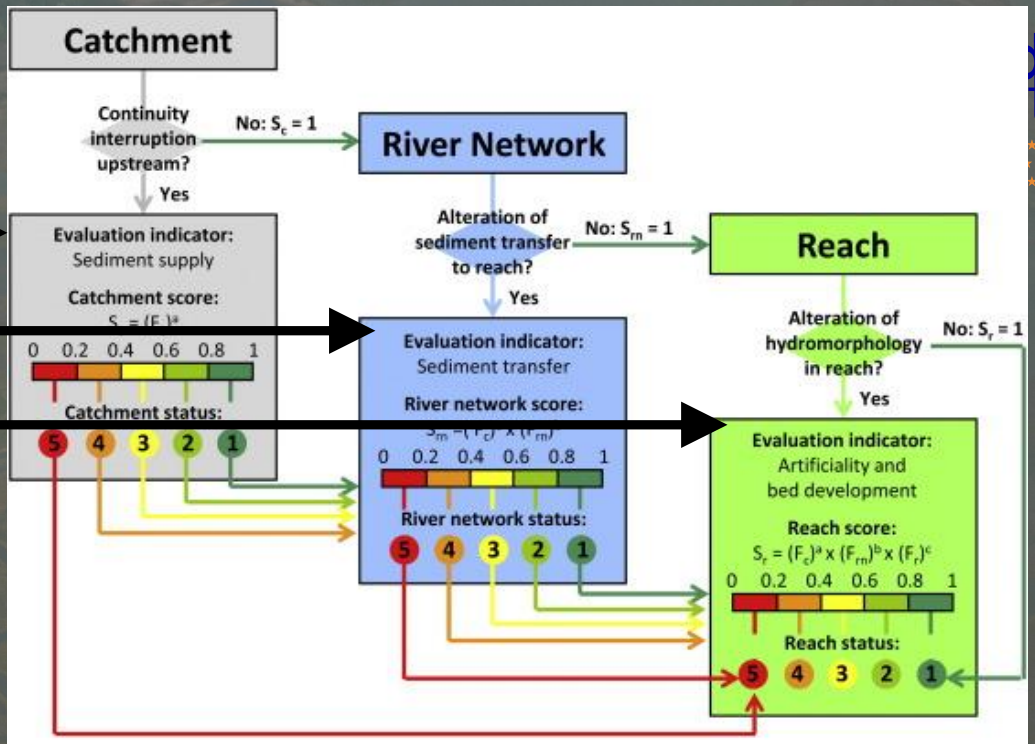
Habersack et al., EU project Warmice

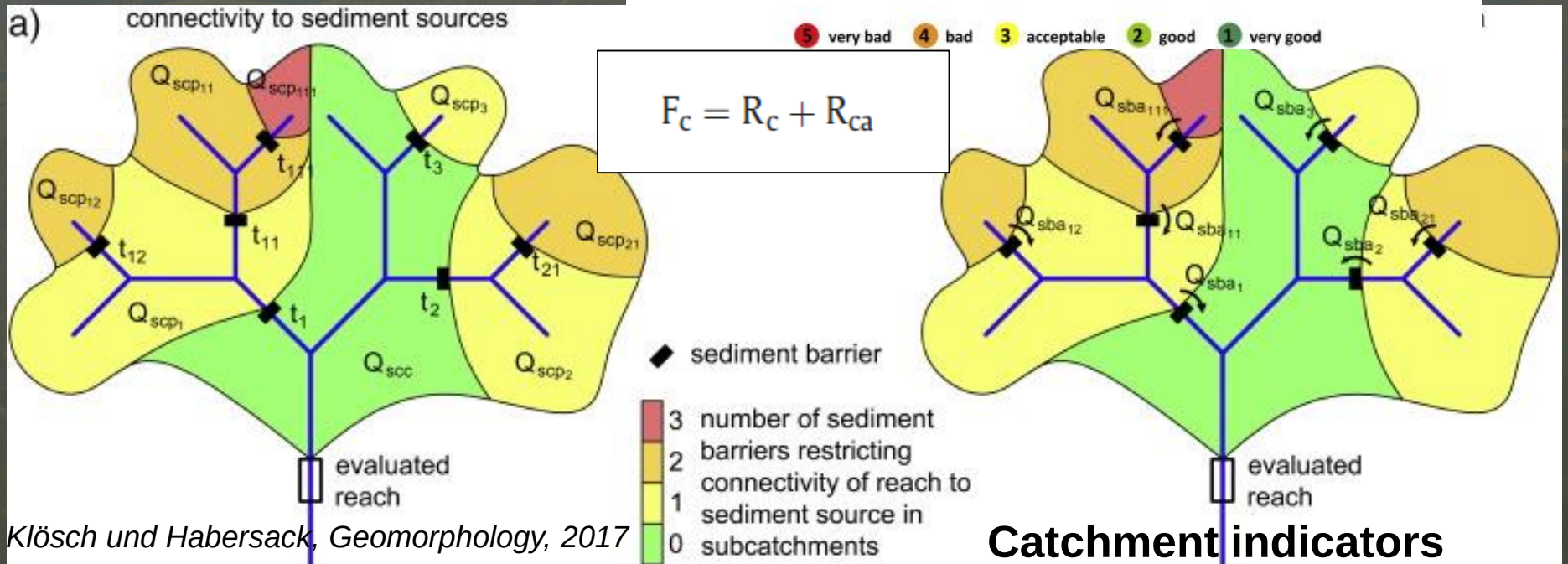
Catchment indicators

River network indicators

Reach indicators

Hydromorpho-logical Evaluation Tool (HYMET)





Klösch und Habersack, Geomorphology, 2017

Catchment indicators

Actual examples of Sediment related Projects

SedAlp (Sediment Management in Alpine Basins):

DanubeSediment (Danube Sediment Management - Restoration of the Sediment Balance in the Danube River)

Hymocares (HydroMorphological assessment and management at basin scale for the Conservation of Alpine Rivers and related Ecosystem Services)

Christian Doppler Laboratory on Sediment Research and Management

BUT SEDIMENTS ARE underrepresented specifically in H2020

Outline:

- Sediment and its management
- Sediment continuum as a key-management issue example
- Key-messages

Summary and outlook

- **Sediments form the backbone of natural river development**
- **The disbalance between surplus and deficit is increasing**
- **Reservoir Sedimentation** is of urgent global importance **for hydropower**
- **Innovation** is needed to develop **new types** of **hydropower plants to improve** the **sediment continuum**
- **Interrelation** between **catchment, river reaches and local structures** should be **improved**
- **Optimisation** between **technical, ecological and socioeconomic issues** essential
- Only a **cooperation** between **hydropower companies, industry, authorities, various stakeholders and research and innovation** leads to needed **advances** in **integrated sediment management**
- **New research facilities** with **large lab discharges** combined with field work, numerical modelling are needed to **close medium scale gaps** in doing basic and applied **sediment related research**

Key-messages

- Effective river basin management needs to include sediment
- SedNet offers to share sharing its experience in this field
- Dedicated attention needed for sediment continuum R&I in H2020

…. and ….

- Be very welcome to join

Thank you for your attention