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Sediment Transport:
A Key Issue for Transboundary Water
Management in the Danube Basin

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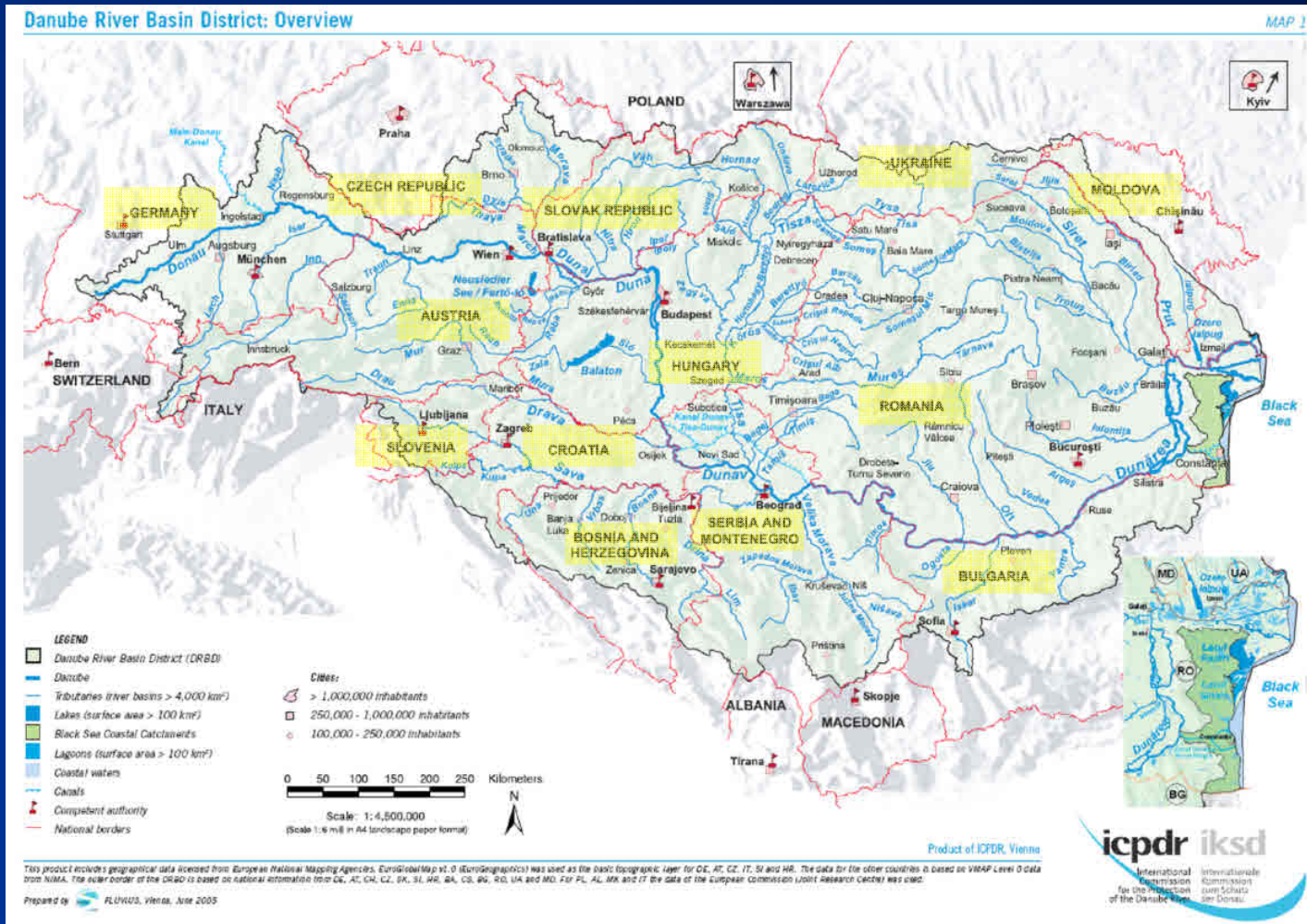
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Organisation of the Presentation

- Introduction and Background
- Objectives
- Methodology
- Some Results
- Summary and Conclusions

Introduction and Background



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- Danube catchment area 810 100 km²
- Population in the basin 81 Mio
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 - national
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 - basin wide
- Sediment: Numerous interventions in the basin have impacts on the sediment regime

Objectives

- From local actions to a catchment perspective
- From single events to long term changes
- Elaboration of a sound basis for national and transboundary sediment management strategies
- Emphasis is on quantitative aspects

The Framework for Basin Wide Approach

- SEDIBAL:
Sediment balance of the Danube basin
- An Initiative of the Danube Countries
together with UNESCO-ISI and ICPDR
from 2007-2009 with inputs from SedNet

Overall Goal of SEDIBAL

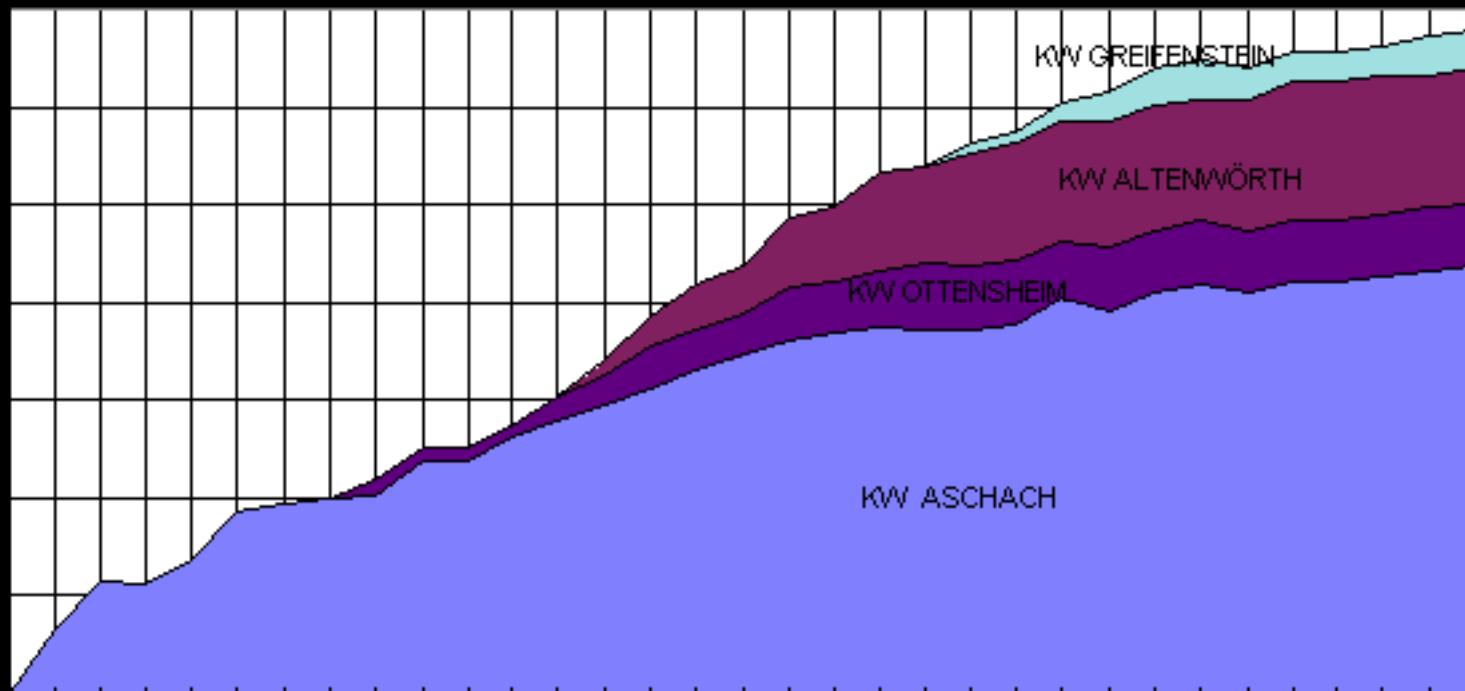
- Provide a sound basis for transboundary water and sediment management and environmental protection by establishing a sediment balance for the whole Danube under consideration of the main tributaries considering different spatial and temporal scales.

Problems at the Point Scale

- River flow is always connected with sediment flows
- The sediments at barrages and ha
- Removal is cost downstream, is
- Human interven sediment regim

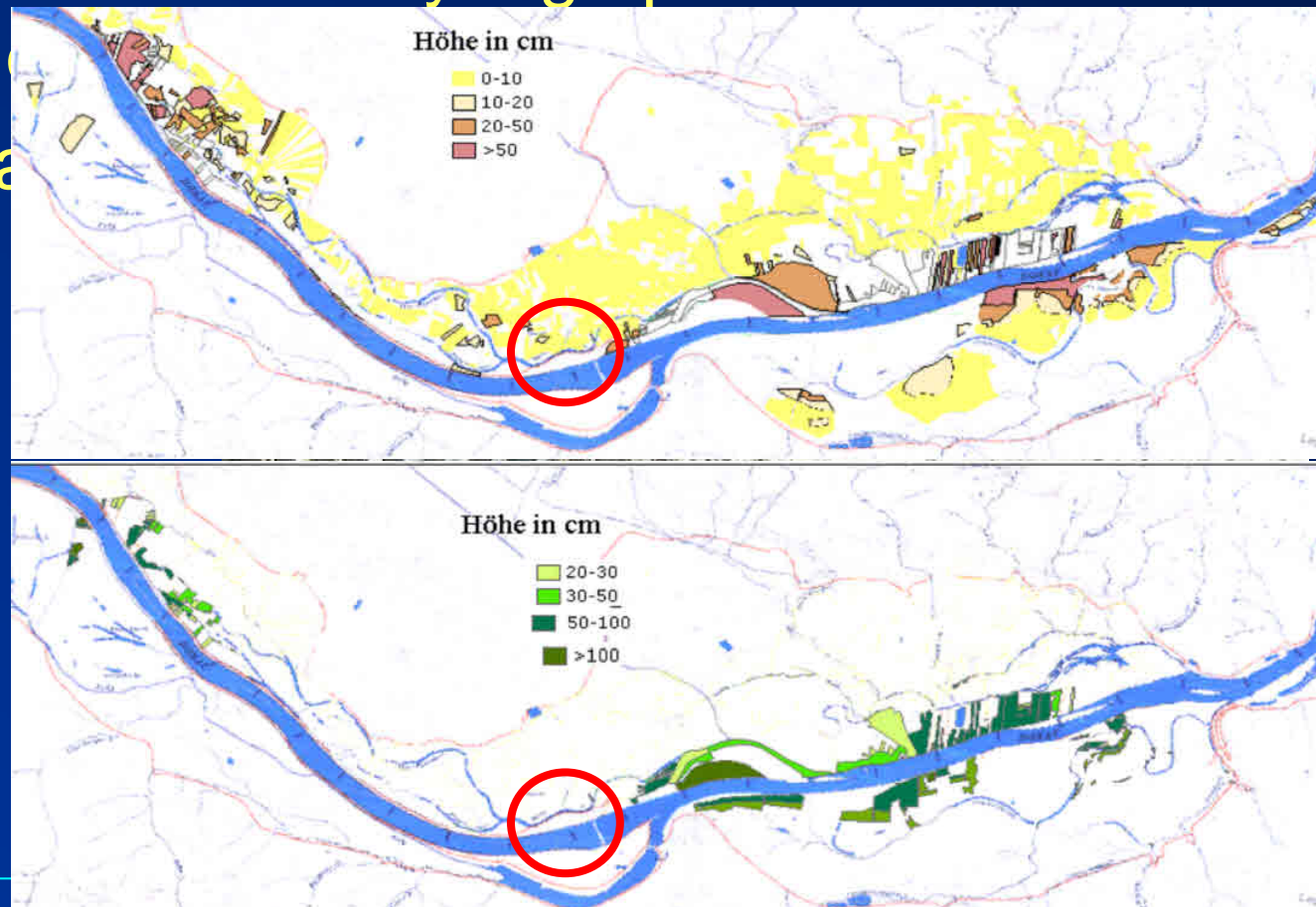


The National Scale:



The National Scale

- During floods extremely high peaks in sediment loads are observed
- Sedimentation is a major problem in the Danube basin

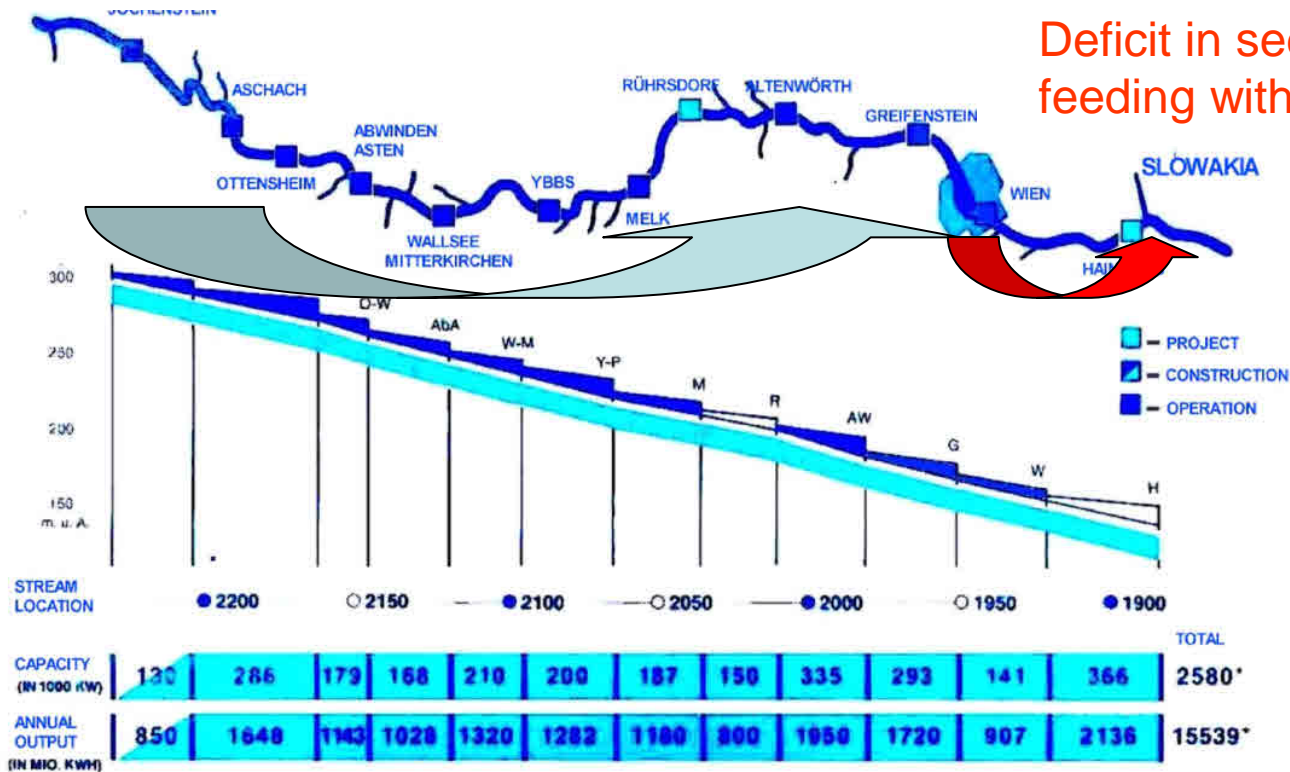


The National Scale

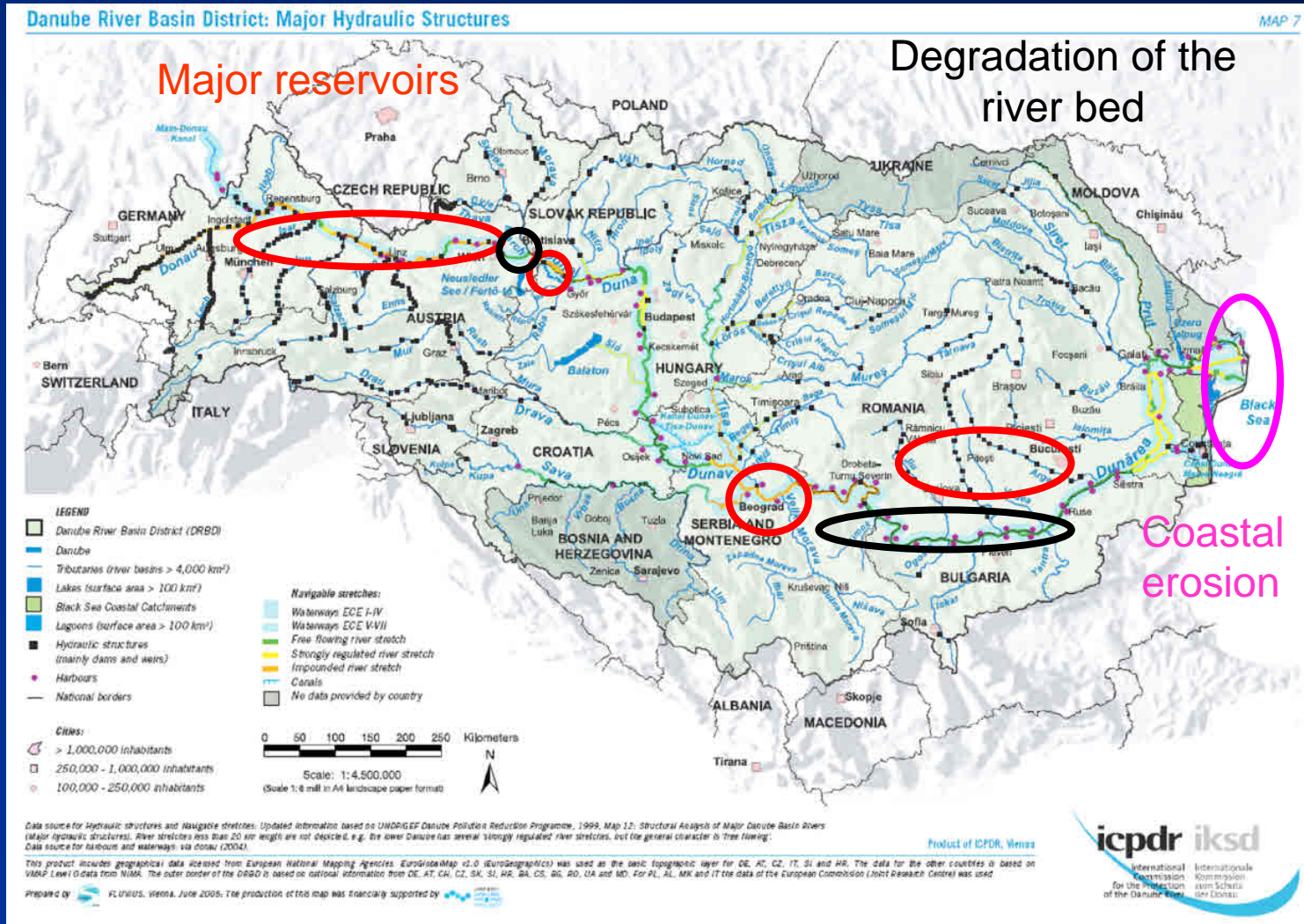
Accumulation of sediments and temporary dredging activities

R OESTERR. DONAUKRAFTWERKE AG

Deficit in sediments and feeding with gravel



The Basin Scale



Methodological Approach

- Sediment regime is dependent on
 - land use pattern
 - hydraulic structures
 - river training works
 - water management strategies

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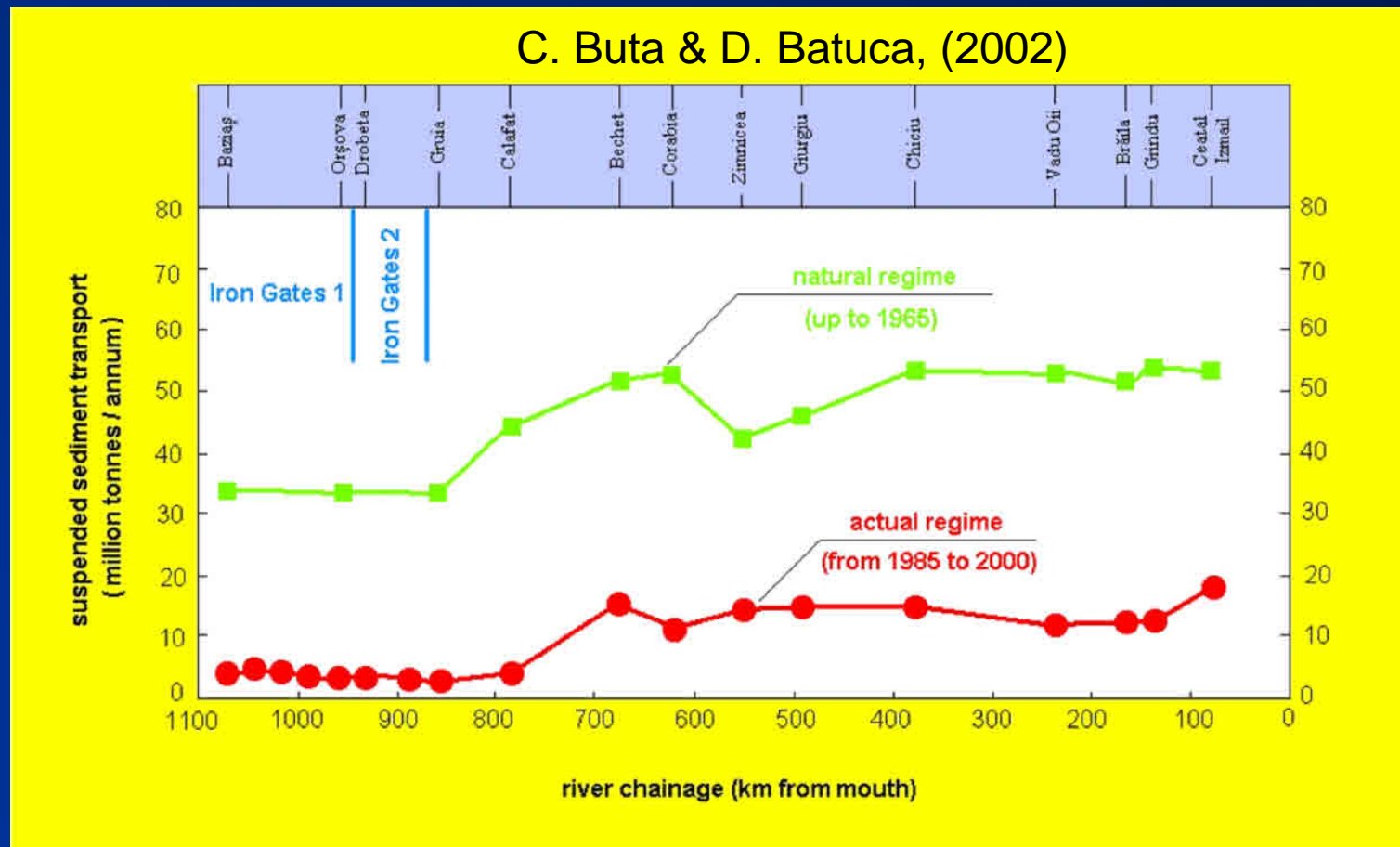
- Sediment regime is dependent on
 - land use pattern
 - hydraulic structures
 - river training works
 - water management strategies
- Sediment management is based on local actions but requires a basin wide perspective
- Management strategies should be based on different spatio-temporal scales

Temporal Characteristics: Long Term Changes in the Upper Danube

- Mean values in Austria
 - 1954-1968: 3,3 Mio. t/a (in Linz)
 - 1982-2002: 3,4 Mio. t/a
- Variability
 - 2002: 12.3 Mio. t (!!)
 - 1984: 0,9 Mio. t

Temporal Characteristics

Long Term Changes in the Lower Danube



Relationship Between Q and Load

- 70-80% of the annual suspended load occurs within 10 % of the time
- Single flood events yield more than in a regular year
- 90 % of the load when $Q > MQ$
- 63 % of the load when $MQ < Q < HSQ$
- 27 % of the load when $Q > HSQ$

Summary and Conclusions

- Critical changes in the river morphology of the Danube river (degradation as well as the accumulation of sediments in reservoirs)
- During floods high concentration of suspended sediments create implications for agriculture and forestry downstream
- Changes in the cross sections may increase the flood risk
- Flood damages are increased by sediment deposits.
- Degradation of the river bed changes groundwater regime and flood plain ecology.
- Implications for drinking water taken from wells in the flood plain

Summary and Conclusions

- Human interventions have substantially modified the sediment region
- In the long term no major changes of suspended sediments are found in the upstream part
- The peak values of sediment load are increasing
- Long term decrease in annual load downstream
- Combined approach for water and sediment management is required

Thank you for your attention

