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Morphodynamic Design for River Restoration

Session 12 “Lowland Rivers in Central Europe”

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Objectives for River Restoration

Main incentive for river restoration:

- Improving the ***ecological state*** of a river (European Water Framework Directive)
- Improvement of the ***spatial quality*** of the river basin (integrated planning including landscaping, recreation, cultural heritage, urban planning)
- Storm water ***retention*** (National Flood Directives)




Hypothesis:

- Feasibility of ecological objectives is determined by the degree of improvement of the **physical** and **chemical** conditions in the river basin.

- Physical conditions: the ability of the river to rejuvenate:
  - cut-off banks (erosion)
  - form new point bars (sedimentation)
  - -> change of plan view ((re-)meandering)

- Chemical conditions: reduce input of nutrient rich water (source restoration)
  - Change of land use upstream (diminish use of pesticides and fertilizer)
  - Removal of nutrient rich top layer of floodplains

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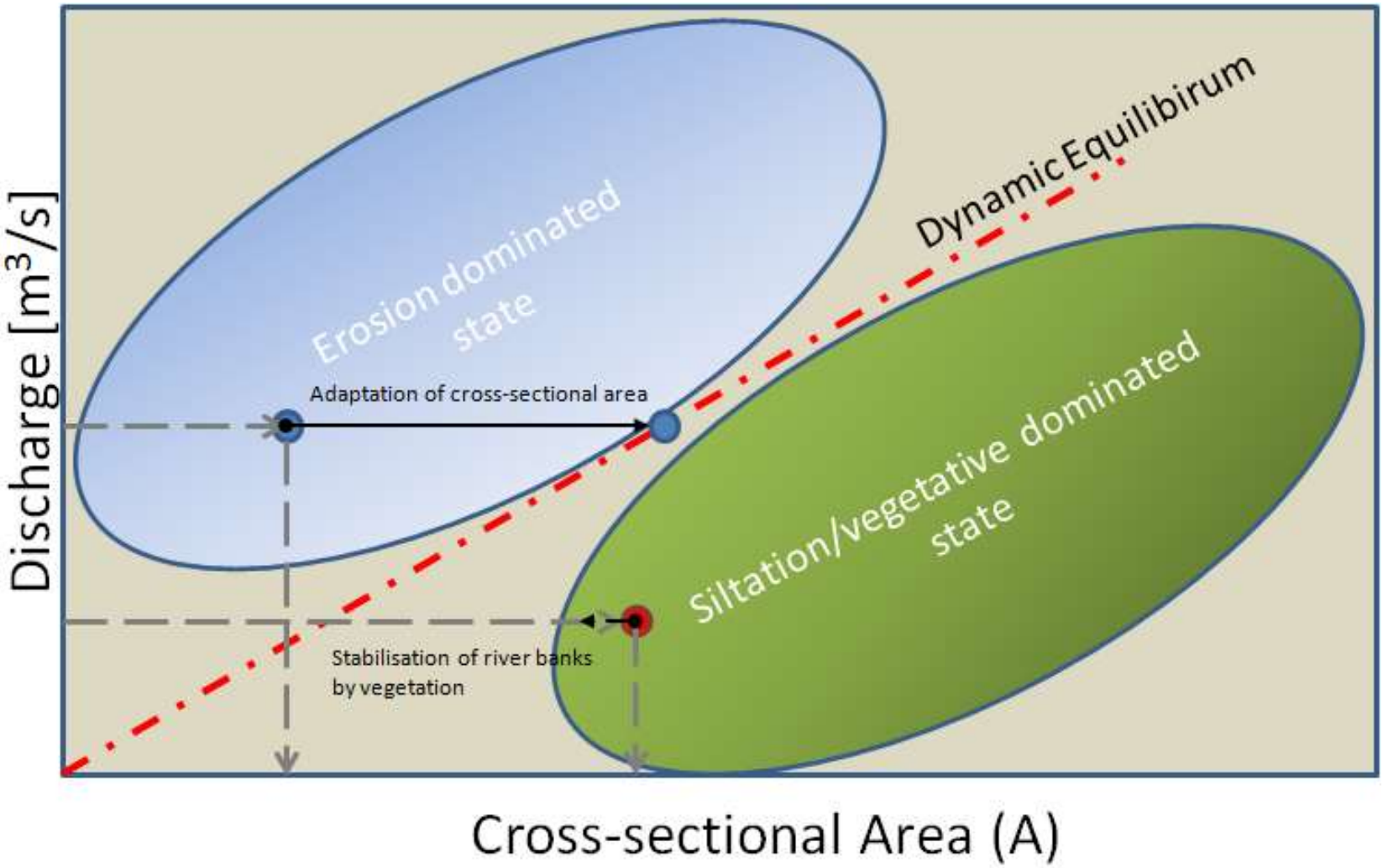
Morphodynamic Approach



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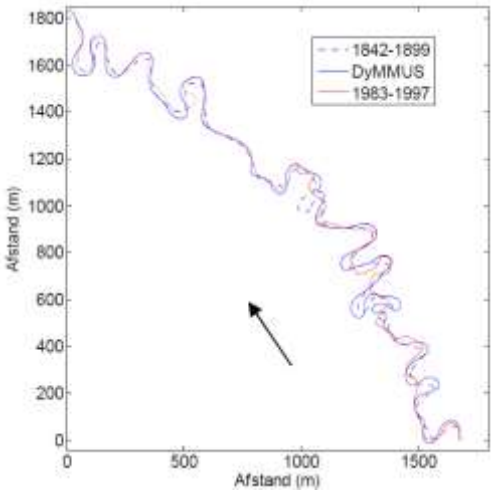
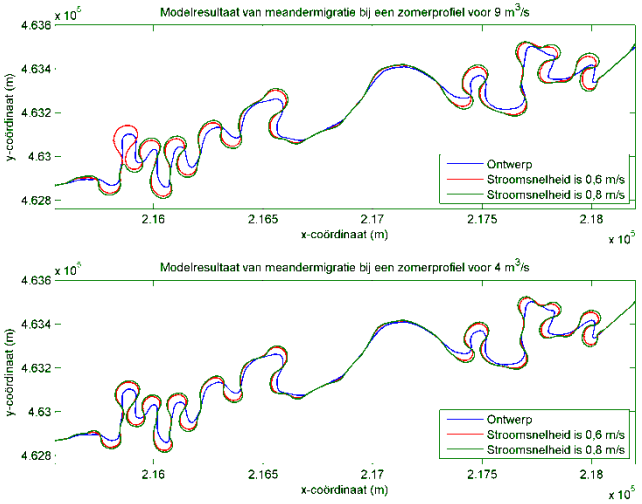
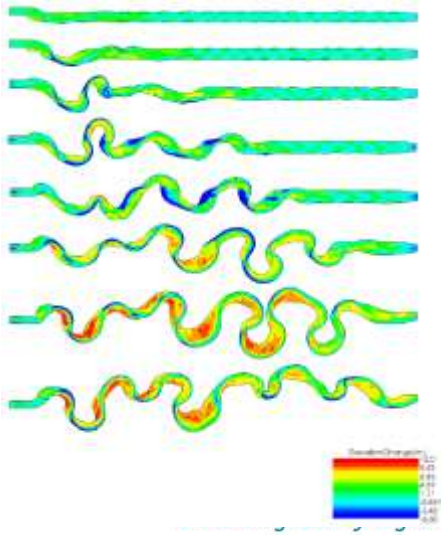
Morphodynamic Approach

- The natural character of the river is estimated using empirical relations to derive cross-sectional parameters (e.g. depth, width) and plan view parameters (e.g. meander radius, sharpness of the meander bend).
  1. 1**D hydraulic modeling:** results in indicative values for flow velocity; a measure for river dynamics.
  2. Assessment of results using general **standards** for river restoration;
  3. In-depth morphodynamic assessment using 1D/2D **Meander Migration Modeling**







Lessons learned

- Many recently restored rivers in Holland show a lack of morphodynamic behavior due to:
  - Relaxation of restoration ambitions due to stakeholder involvement or cooperation of land owners;
  - Restoration of short transects, often leaving existing weirs in place;
  - Application of a simplified approach to derive parameters for cross-sectional area and plan view;
  - Assumptions on hydrological parameters are wrong (design based on stationary simulations representing a dynamic behavior)



What experience can be gained from other projects?