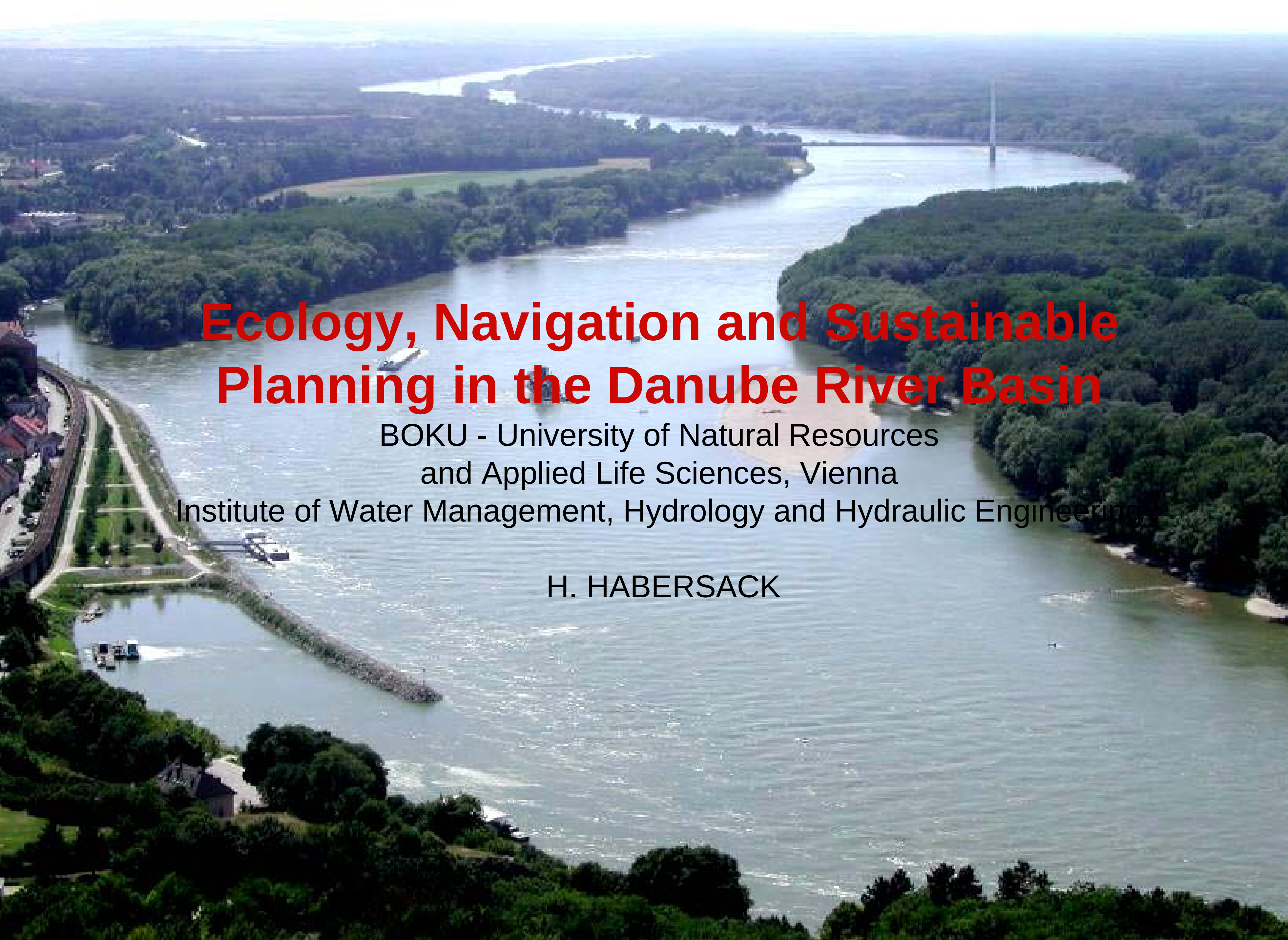

Ecology, Navigation and Sustainable Planning in the Danube River Basin

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Outline

1. General introduction
2. Possible approach
3. Examples of measures

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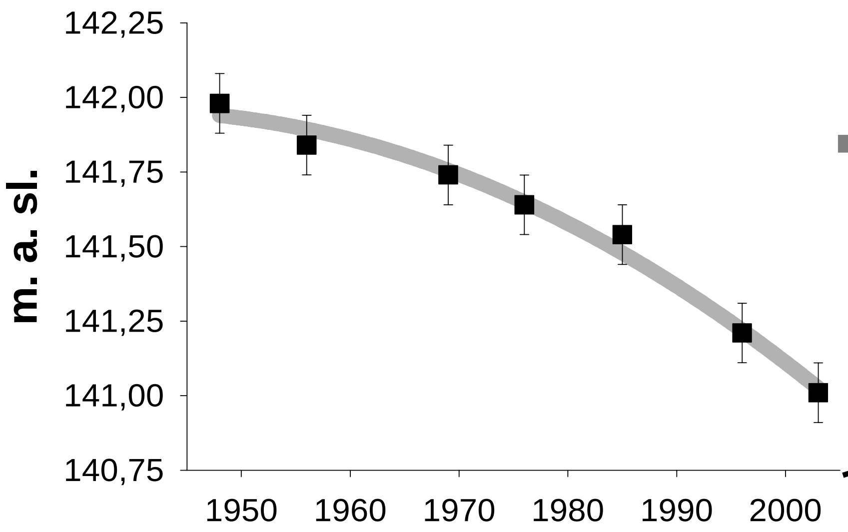
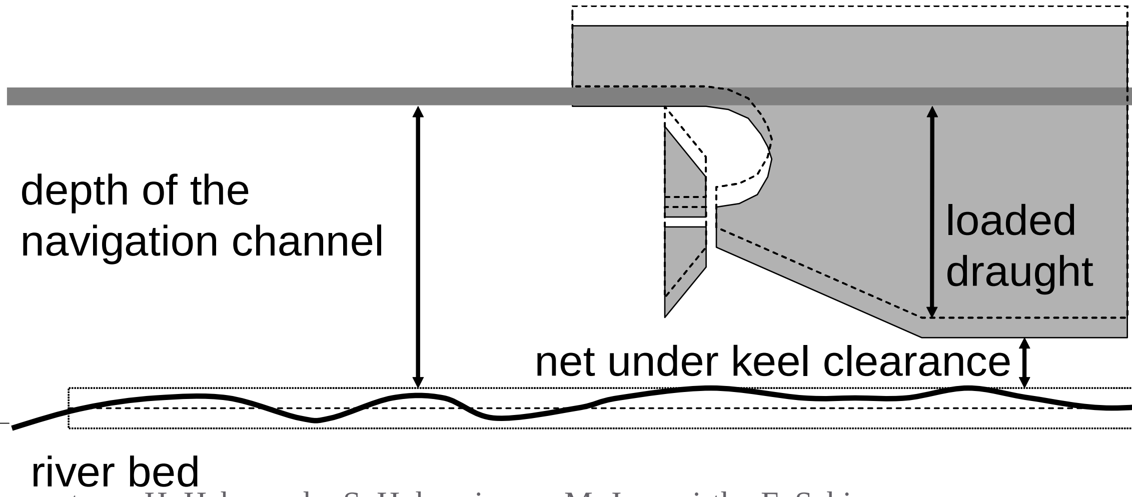
Problems

- Ecological degradation
- Navigation limitations





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Problems/Measures

River bed degradation/aggr., Habitat structure

Problems

Minimum water depth, River bed degradation/aggr.

Ecology

River Engineering

Navigation

Measures

Sidearm reconnection
Riverbank restoration

Low flow river regulation
Gravel redeposition

Bed stabilisation, e.g. granulometric bed improvement

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Ecological framework conditions

- **Large river systems** (LRS) are **complex ecological unities**, with exchange processes with the adjoining ecosystems
- **LRS are multidimensional ecosystems**, where natural disturbances (floods, droughts) are key elements → highly dynamic nature of riverine landscapes
- This results in **frequently changing connectivity conditions** and **heterogeneous habitat composition**
- The **EU Water Framework Directive** aims to reach a **good ecological** status of running water **until 2015**

Jungwirth, 2007

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Effects of navigation on the riverine environment

- **river straightening** for flood control and/or **navigation**
- **river engineering measures** that **impair** the original **hydro-morphology** (e.g. bedload transport, connectivity)
- and/or **impair natural composition of ecological communities** (e.g. by devastation of habitats)
- navigation needs lead to a **stabilized, single thread river** channel, **monotonous aquatic environment** that lacks instream structures with smooth gradients and connectivity conditions towards adjacent floodplains
- river **bed stabilization and dredging** due to **elimination** of **ecologically important instream structures** result in a monotonous aquatic environment

Jungwirth, 2007

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A new planning approach

- As intended by the **EU-WFD catchment wide planning** and **cross border cooperation** are necessary and call for **multi-disciplinary planning and decision processes**
- The **same is given** by the **new EU-Flood Directive**
- A so called **„Leitbild“ (vision, target view)** uses **natural reference conditions** as an environmental orientation
- Also **navigation development needs a long reach approach**, including integrated measures to improve the existing situation

Jungwirth, 2007

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Philosophy for a joint Danube approach

- Development of a **common planning philosophy** for improving Navigation AND Ecology
- A prerequisite for planning of an environmentally sound navigation is a **common language across disciplines**
- **From the beginning all parties** (ministries to NGOs) have to be **involved in the planning**
- **First, problems** and **needs** for **navigation** and **ecology** as well as **navigation pressures** have to be clearly identified
- Both, issues **on pressures** and **measures** should become a **common understanding**

Planning principles (examples)

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- implementation of **measures according** to given **river morphological processes**
- **integrated design of regulation structures**, equally regarding hydraulic, morphological and ecological criteria
- realisation of measures in an **adaptive form**
- definition of **width and depth specifically** for the central part of the **navigation channel**
- **optimal use** of the **potential** for **river bank restoration** and **side channel reconnection**

The planning principles should be commonly agreed creating a winning situation for ecology and navigation

Navigation pressures on ecology and integrated measures to improve navigation and environmental sustainability

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- **Identification** of **navigation pressures** and **design** of corresponding **integrated measures** to simultaneously improve navigation and eocology
- **Needs** for **ecology** and **navigation** have to be specified for the **basin-wide** and **sectional scale**
- **Integrated measures** should clearly reflect, that the **aims** of **navigation** and **ecology** are **weighted equally**
- Thus, **simultaneously** with **engineering measures to improve navigation**, the **full potential for river restoration** to improve the ecology should be used

Navigation, ecological needs and respective examples of measures

Navigation Needs	Navigation Measures	General Effects	Pressures/ Effects on Ecology	Ecological Needs	Environmental Measures
Minimum water depth	Transformation of the shipping way towards outer bank and deep water sections, low water regulation, dredging and refilling of material	Increase of water level at low flows	River channelization due to low water regulation, reduction of morpho-dynamics	Minimization of river engineering measures	River restoration (esp. river banks and floodplains)
Minimization of lateral flow velocity	Improvements of the flow field at confluences with tributaries and reconnected side channels by river engineering	Low cross sectional flow velocities	Reduced morpho-dynamics of confluences, less cross sectional flow velocity	No restriction to river bank and side channel dynamics	Side channel reconnection and restoration of tributary confluences

Navigation, ecological needs and respective examples of measures

Navigation Needs	Navigation Measures	General Effects	Pressures/ Effects on Ecology	Ecological Needs	Environ-mental Measures
No sudden changes in flow field, flow velocity	Limitation of flow velocity changes	Low spatial variability of boundary conditions for navigation	Modified flow field compared to more natural conditions	Development of flow field and flow velocities towards Leitbild conditions	Development of river eng. measures to improve flow field variability
Predictable position and geometry of navigation channel	Minimization of sudden sedimentation by use of groins, dredging and refilling	Less interruption / disturbance for navigation	Modified sediment transport / river morphology, habitat alteration	Variable water depths, flow widths, grain sizes, low lateral river bed gradients	Restoration measures leading to high var. of water depth, channel widths etc.
No extreme trend towards river bed aggradation / degr. of the main channel	E.g. groins (aggr.), dredging and refilling of material, / river bed widening, (degr.)	Dynamic river bed stability	Also a need for ecology as the pressure is not resulting from the driver navigation	No extreme trend towards river bed aggr. / degradation of the main channel	Specific groins, dredging and refilling of material, / river bed widening

Navigation, ecological needs and respective examples of measures

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Ecological Needs	Environmental Measures
Channel morphodynamics	Preservation or improvement of river morphology: no river bed pavement, keeping of morphodynamics, specific groin forms to improve morphodynamics, avoiding of groin fields
River bank morphodynamics	Initiation of more nature-like river banks: river bank restoration, removal of bank protection, side erosion, declinant groins to enhance side erosion
Lateral connectivity	Floodplain / wetland / sidearm reconnection, more water in the floodplain/alluvial area, improvement of habitats

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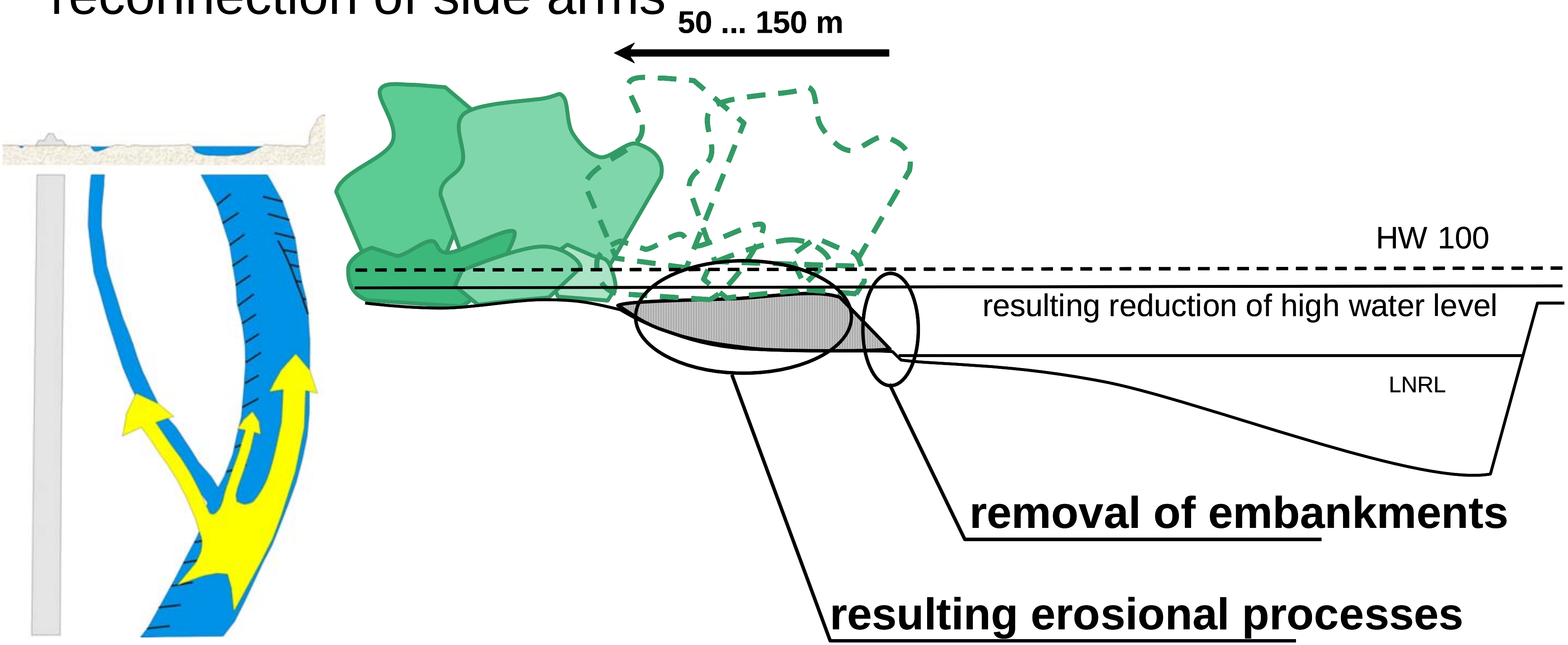
Achieve improved ecological conditions by riparian restoration measures and the reconnection of side arms



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Nationalpark Donauauen