Content

Traits and features of large river systems (LRS)
The multi-dimensional nature of riverine landscapes
Anthropogenic pressures and impacts
River/ floodplain landscapes along the Danube
The need for protection and restoration
Reference conditions / “Leitbild-approach”
Catchments & riverine landscapes:

- erosion
- input of nutrients & organic material
- longitudinal transport of bed-load, nutrients, POM...

high complexity / individuality / uniqueness
Constrained rivers

Traits and features of LRS
Braiding rivers

Traits and features of LRS
Meandering rivers

Traits and features of LRS
Delta landscapes

Traits and features of LRS
Important factors in the longitudinal zonation of running waters

Connectivity conditions:

River morphology:

multi-dimensional nature
Current Concepts of RW Ecology

- River Continuum Concept – Vannote et al. 1980
- Shifting mosaic - steady state – Bormann & Likens 1979
- Intermediate Disturbance Theory – Huston 1979
- Serial Discontinuity Concept – Ward & Stanford 1983
- Ecological Connectivity – Amoros & Roux 1988
- Flood Pulse Concept – Junk et al. 1989
- Ecotone Concept – Naiman & Decamps 1990
- Extended Serial Discontinuity Concept – Ward & Stanford 1995
- Ecotones of riverine systems – Ward & Wiens 2001

multi-dimensional nature
Current Concepts of RW Ecology

- multidimensional river/landscape - systems
- highly dynamic nature
- disturbances key element
- complex connectivity conditions
- heterogeneous habitat complex
- shifting mosaic, steady state
- outstanding high biodiversity

multi-dimensional nature
Biodiversity: White Tailed Eagle

multi-dimensional nature

(Photograph: WWF)
Connectivity / dynamics

multi-dimensional nature
Consequences of channelization

naturally: > 90 % eupotamal water bodies (main channel, lotic side arms)

channelization: area share of backwaters/lentic water bodies significantly increased

after channelization: strong reduction of main channel and floodplain water bodies
Natural dynamic equilibrium

Danube River in the eastern Machland 1812

- natural equilibrium: aggradation – erosion
  - high degree of morphological diversity
  - intensive hydrological connectivity

multi-dimensional nature
Pollution

Anthropogenic pressures and impacts
Hydro-electric power plants

residual flow at Jettenbach

reservoir Waagspeicher

run off river power station at Altenwörth

Anthropogenic pressures and impacts
Hydro-electric power plants: spatially far reaching effects

- Hydro-peaking
- Water diversion / Residual flow
- Flushing of reservoirs & impoundments (run off river power stations)
- Bed-load retention
- Fragmentation of the longitudinal river corridor
Fragmentation of the river continuum: Effects on fish migration

- Hausen
great sturgeon (*Huso huso*)

- Waxdick
Russian sturgeon (*Acipenser güldenstädti*)

- Sternhausen
stellate sturgeon (*Acipenser stellatus*)

Danube catchment
Vienna
Iron Gate
delta
former spawning sites around Vienna

Anthropogenic pressures
and impacts
The worldwide situation of large river systems - River channel fragmentation & flow regulation

Dynesius & Nilsson, Science 1994
Flood protection measures

Anthropogenic pressures and impacts
Comparison of the river-system in Liechtenstein 1820 and 1999 (Haidvogl & Kindle 2001)
River channelization


Anthropogenic pressures and impacts
Problems created by flood control, navigation & hydroelectric power plants

Anthropogenic pressures and impacts
Problems created by flood control, navigation & hydroelectric power plants

- Deep going alteration of the riverine landscape
- Impairment of the multidimensional nature / natural processes
- River bed degradation
- Decoupling of alluvial floodplains from the river
- Reduction of exchange processes & lateral connectivity
- Suppression of hydro-morphological dynamics
- Reduced habitat variability
- Decreased biodiversity
- Loss of functions for recreation ......
The decoupling process: river bed degradation and floodplain aggradation

Anthropogenic pressures and impacts
Intact tributary-systems

River/ floodplain systems along the Danube
Middle reach of the Danube at Gemenc, Danube-Drava-National Park

(photos U. Schwarz, FLUVIUS)
National park Kopacki Rit

River/ floodplain systems along the Danube
„Island Danube“ along the border between Romania and Bulgaria downstream of the Iron Gate

(photos U. Schwarz, FLUVIUS)
Lower Danube II (Small Braila Island)
(photos U. Schwarz, FLUVIUS)

River/ floodplain systems along the Danube
Danube – Delta

River/ floodplain systems along the Danube

WWF
The need for protection and restoration

- Challenge to protect and restore sustainable river floodplain systems
- Protection of biodiversity commonly accepted goal
- Focus: Multi-usable systems instead of one-sided uses
- EU- Water Framework Directive:
  - sustainable systems
  - integrative river basin management
  - good ecological status
  - „Leitbild“ approach
New planning philosophy / “Leitbild-approach”

Goal: good ecological status
Intact reference: undisturbed status of the respective river-type („vision“)
Deficit analysis: comparing current status vs. undisturbed reference
Interdisziplinary development of an operational „Leitbild“
Detailed planning process
Monitoring / evaluation
Reference conditions

Reference site

Historical fish data

Historical morphological data

High ecological status

Reference models

Number of species

Stream order

1230 sites
134 segments
156 main

n=21
n=38
n=43
n=28

n=4
n=9
Best references: intact systems

Thank You!

(photos U. Schwarz, FLUVIUS)