Sustainable Flood Protection on the Drava River in Carinthia

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- Aims of the project
- Integrated flood risk management
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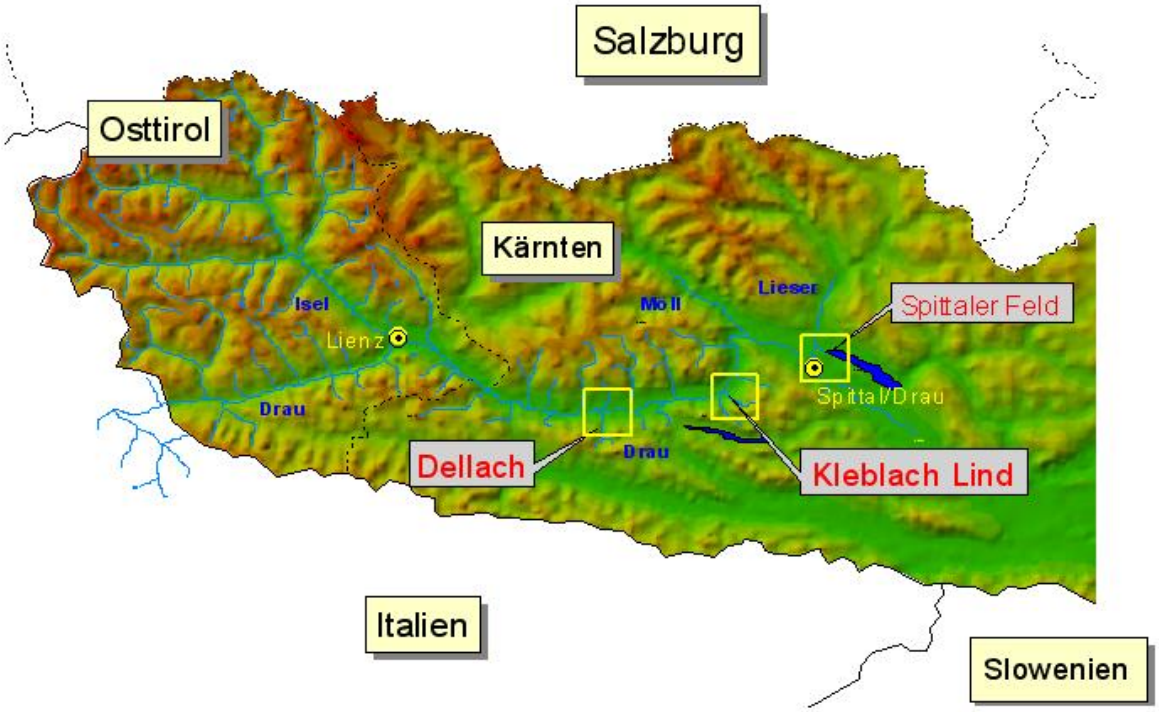
Planning area



Gauging station Drauhofen

- catchment: 3674,4 km²
- 7. Order
- mean slope 1,5 ‰
- mean discharge 102,3 m³ s⁻¹
- HQ_{100} ca. 1600 m³ s⁻¹
- river bed width ca. 55-80 m
- grain size d_m ca. 36 mm

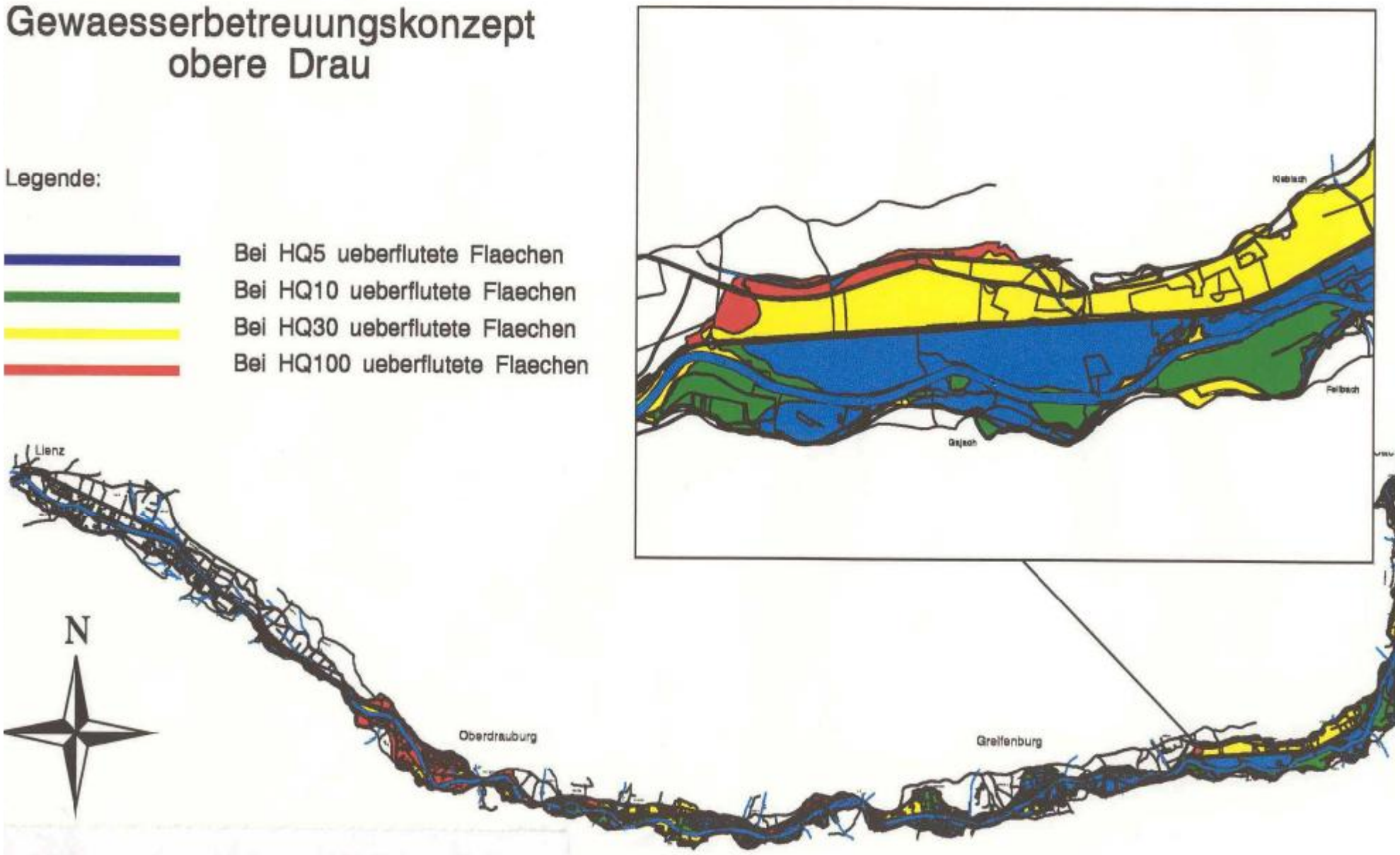
Carinthia / Helmu

LEBENSADER OBERE DRAU

Problems at the Drau River

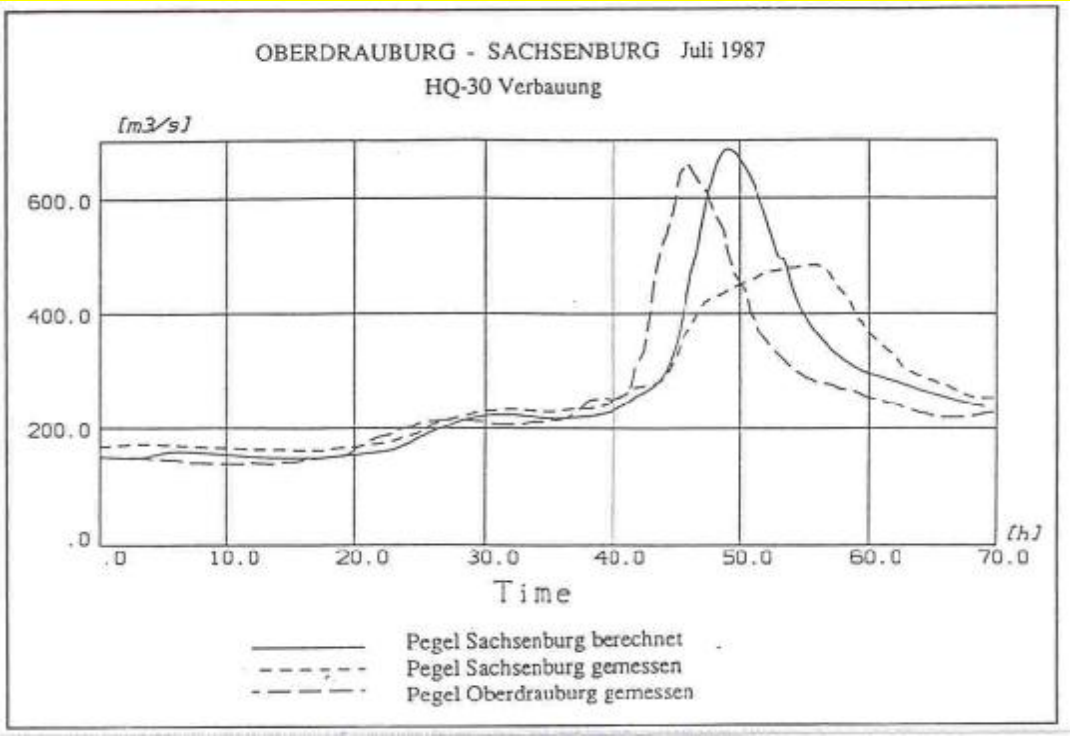
- Flood protection
- Bed degradation
- Ecological status

Floodplains at the Upper Drau river

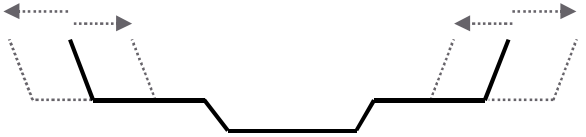


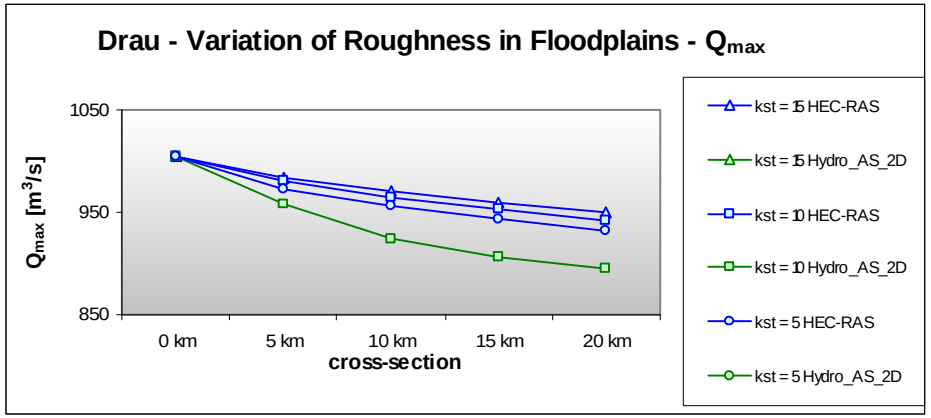
Flood Retention Upper Drau

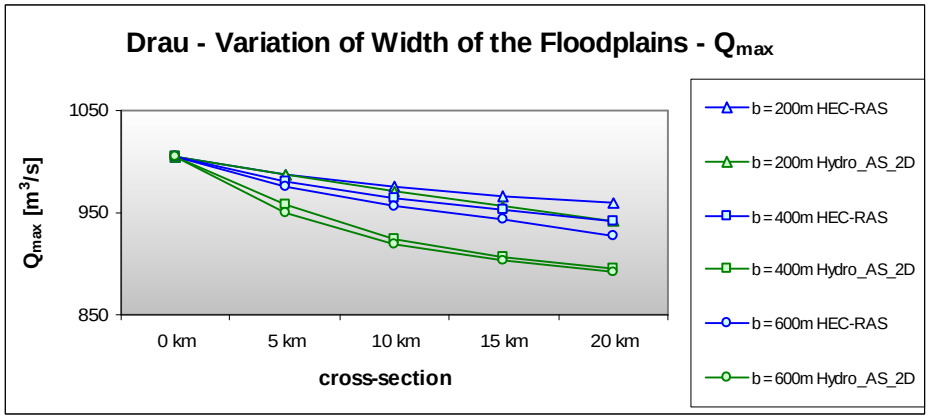
For the 15-year event of ***Juli 1987*** a channalisation (levee) would give an increase of the flood peak from ***483 m³/s to 685 m³/s***. In Sachsenburg ***instead*** of a ***3-4 years flood a 10-11 years flood would occur***, (Nachtnebel & Habersack, 1998). Flow time would be significantly reduced by missing retention effect of 10 to 3,5 hours

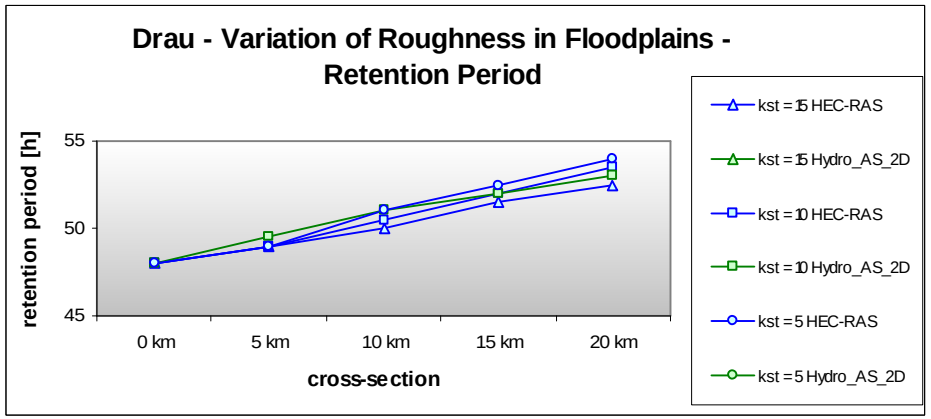


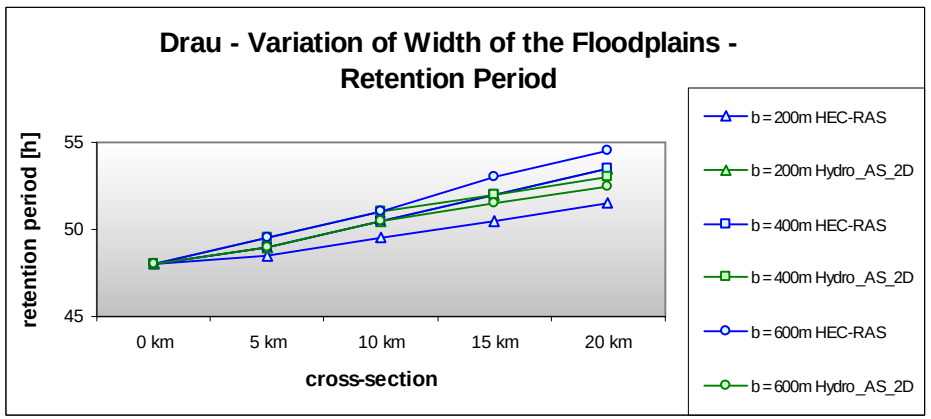
Floodplain evaluation







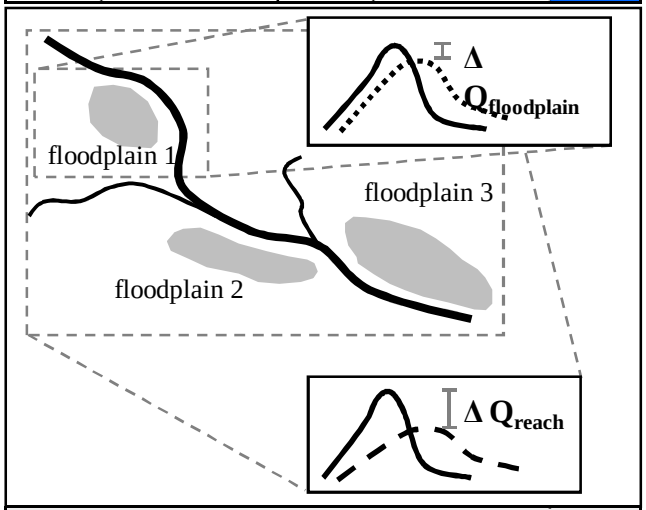




Habersack, Hauer, Schober, Dister, Quick, Harms, Wintz, Piquette, Schwarz, 2008

Floodplain evaluation matrix FEM+

peak reduction	peak increase	priority ranking
$\Delta Q/km_{floodplain} > 0$	$\Delta Q/km_{floodplain} > \Delta Q/km_{reach}$	low
$\Delta Q/km_{reach} > \Delta Q/km_{floodplain} > 0$	$0 > \Delta Q/km_{floodplain} > \Delta Q/km_{reach}$	medium
$\Delta Q/km_{floodplain} < \Delta Q/km_{reach}$	$\Delta Q/km_{floodplain} < 0$	top



Wave translation: prolongation	Wave translation: reduction	priority ranking
$\Delta t/km_{floodplain} > \Delta t/km_{reach}$	$\Delta t/km_{floodplain} > 0$	top
$0 > \Delta t/km_{floodplain} > \Delta t/km_{reach}$	$\Delta t/km_{reach} > \Delta t/km_{floodplain} > 0$	medium
$\Delta t/km_{floodplain} < 0$	$\Delta t/km_{floodplain} < \Delta t/km_{reach}$	low

Hydromorphology	floodplain 1	floodplain 2	floodplain 3
peak reduction	1	1	5
flood wave translation	1	3	5
kilometer-related parameters	1	3	5
higher risk	3	1	5
other processes	3	3	3
Hydromorphology total	**1**	**3**	**5**
Hydraulics			
water level	5	3	5
flow velocity	5	3	5
bottom shear stress	5	3	5
specific discharge	3	1	3
Hydraulics total	**5**	**3**	**5**

Ecology	floodplain 1	floodplain 2	floodplain 3
adapted land use	3	1	3
dynamics of the water level	1	3	3
flow velocities	5	5	5
surface relief	5	3	3
connectivity of water bodies	3	3	1
potential for development	5	3	3
endangering of habitats	5	5	3
Ecology total	**5**	**3**	**3**

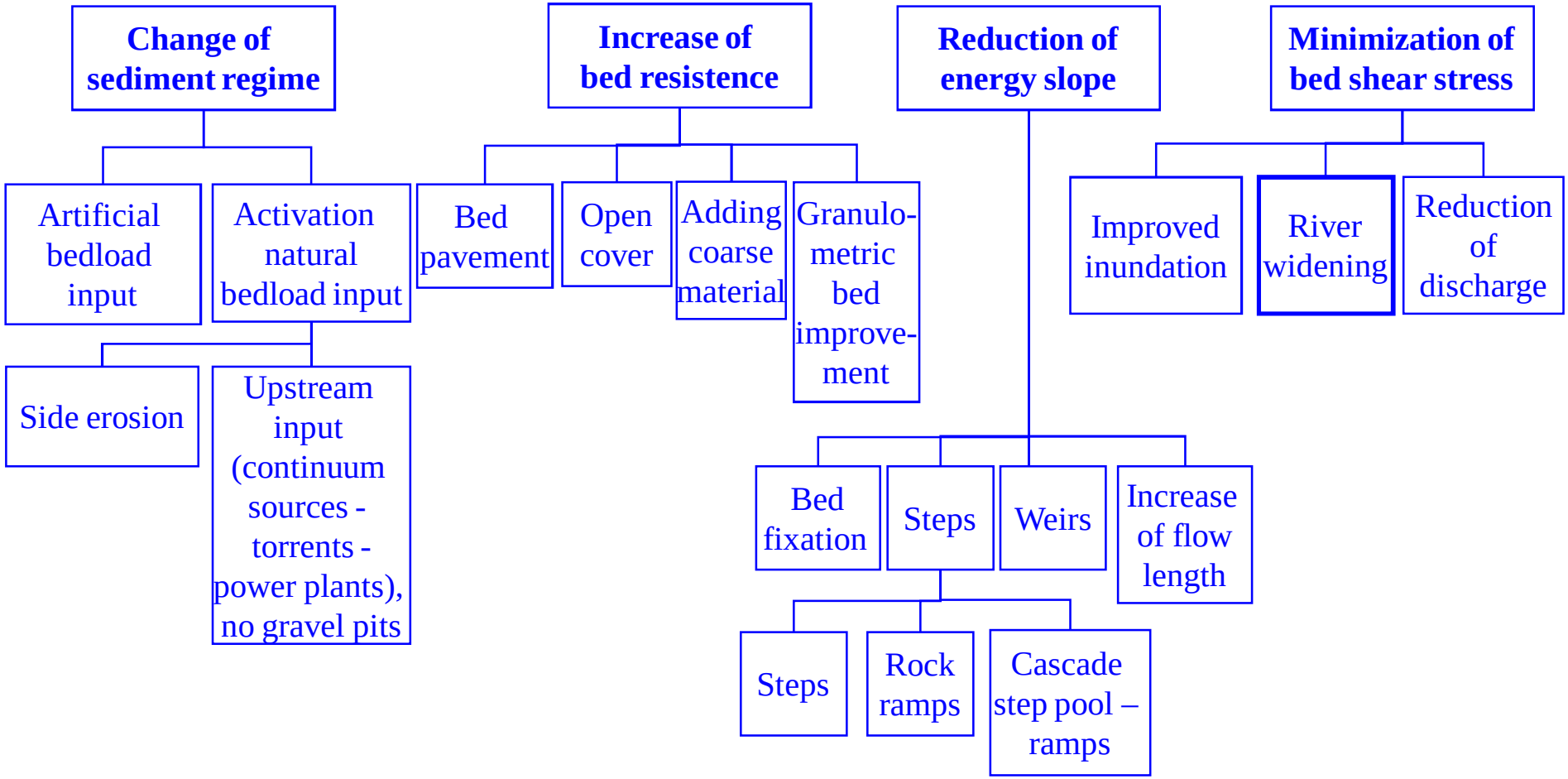
Sociology	floodplain 1	floodplain 2	floodplain 3
type of usage	3	1	1
channel of communication	5	3	5
Sociology total	**5**	**1**	**3**

	Hydromorphology / Hydraulics total		Ecology total	Sociology total
floodplain 1	1	5	5	5
floodplain 2	3	3	3	1
floodplain 3	5	5	3	3

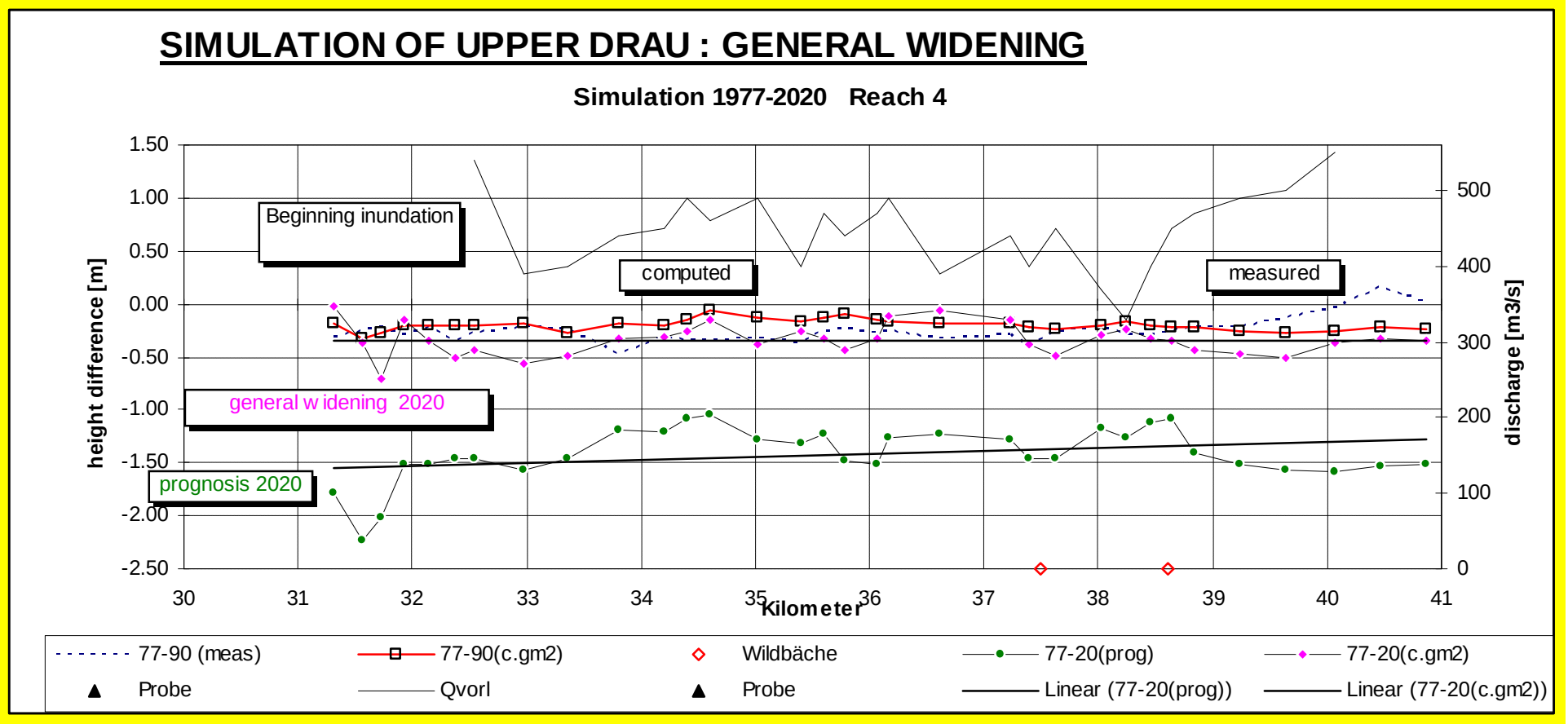
www.pro-floodplain.eu

Habersack, Hauer, Schober, Dister, Quick, Harms, Wintz, Piquette, Schwarz, 2008

Measures against bed degradation



River bed widening



Spanzel und Habersack, 1997

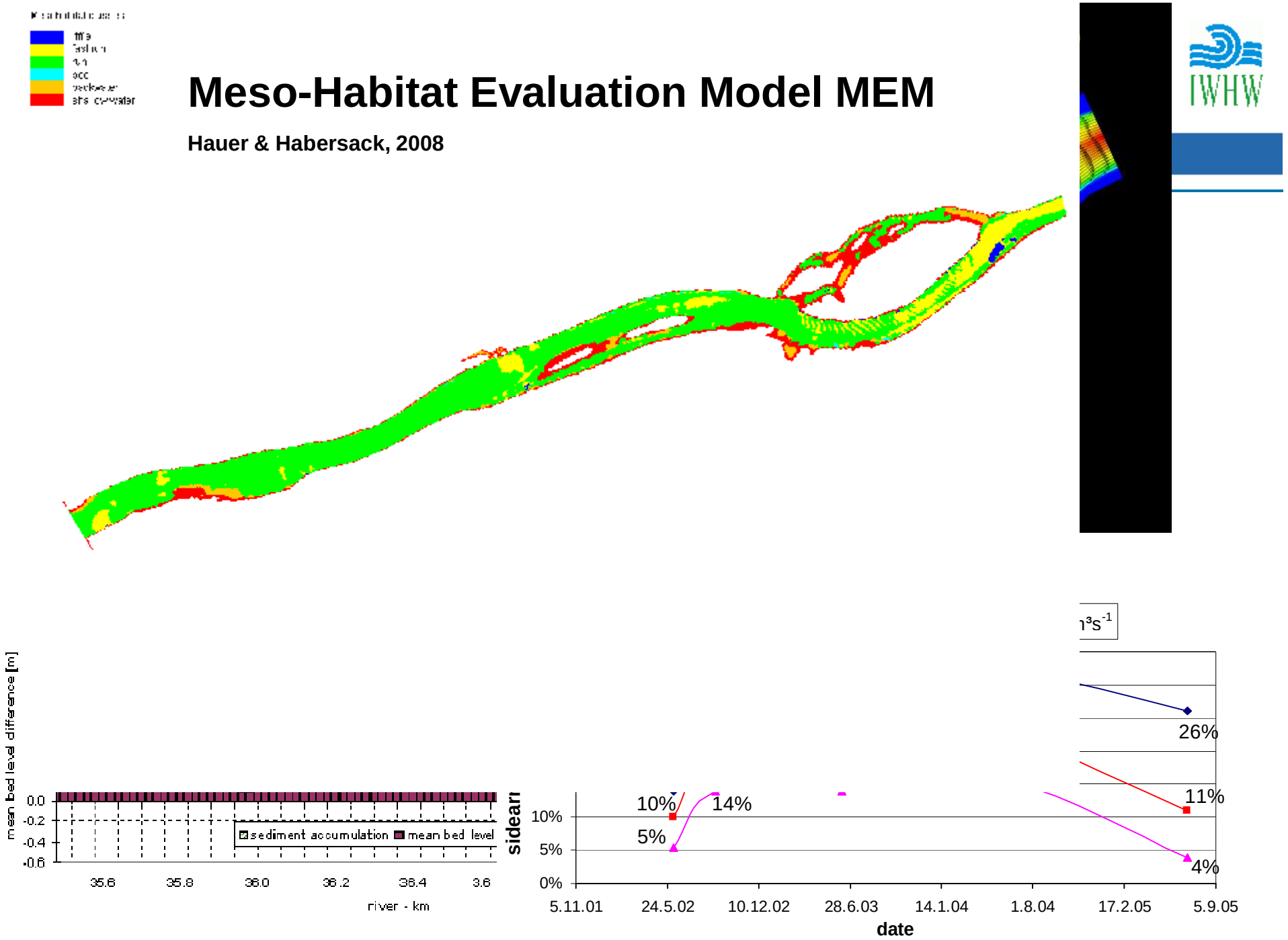
River restoration – Drau Kleblach-Lind

Nov.1999 Sept. 2002 June 2003 July 2004

LEBENSADER OBERE DRAU

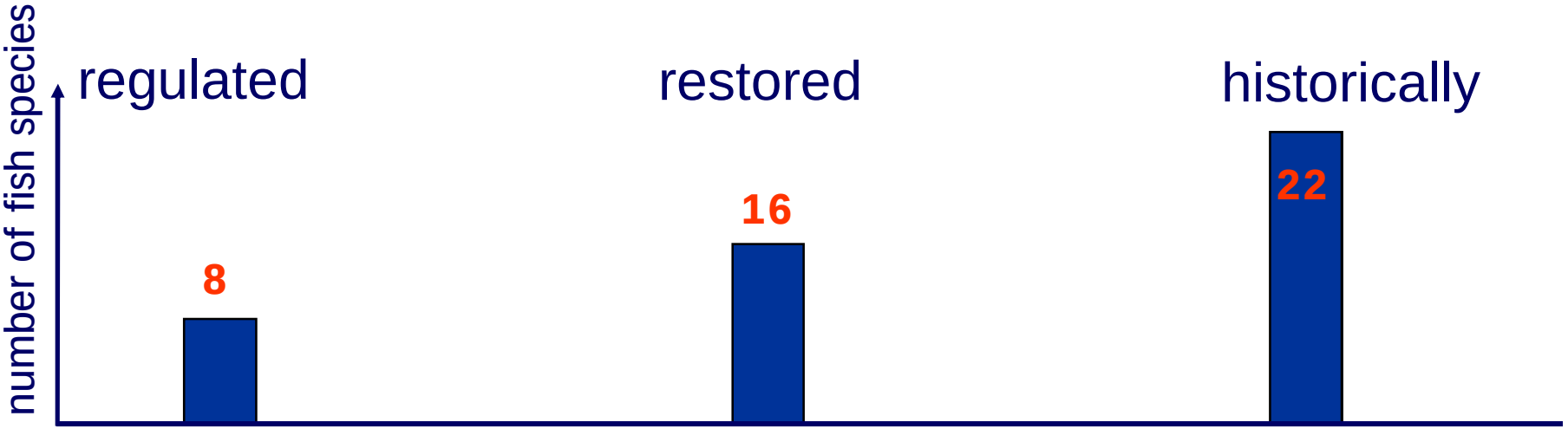
Meso-Habitat Evaluation Model MEM

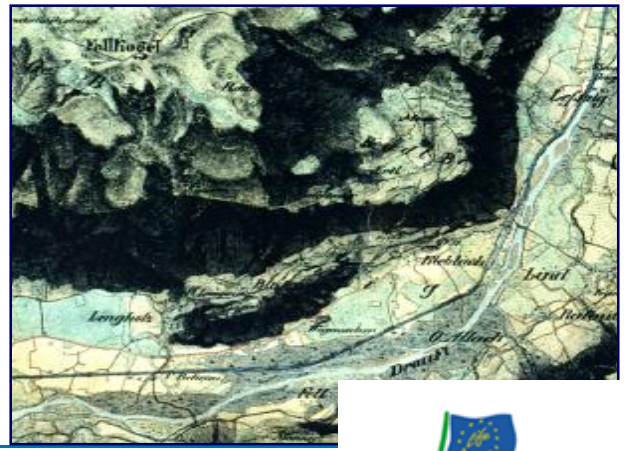
Hauer & Habersack, 2008



Formann, Egger, Schober, Habersack, *River Research Appl.*, 2008

Ecological evaluation / Fish species

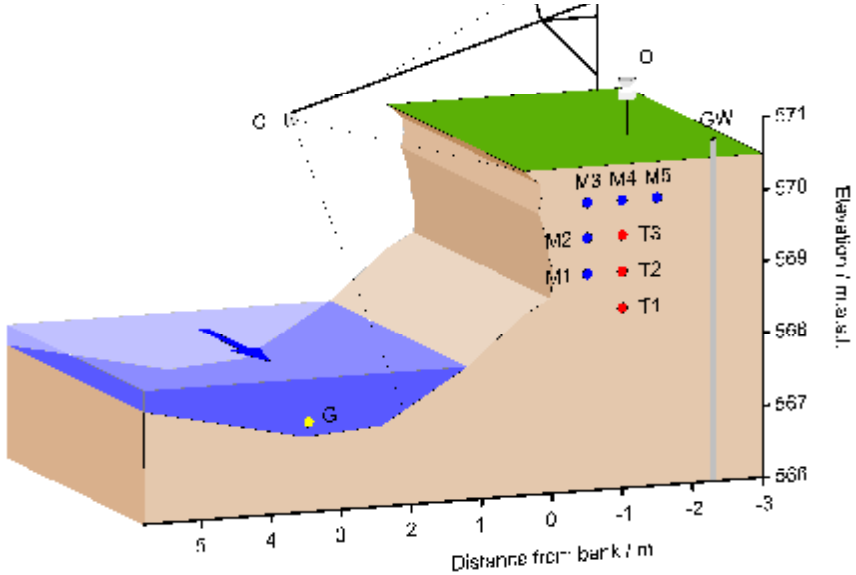




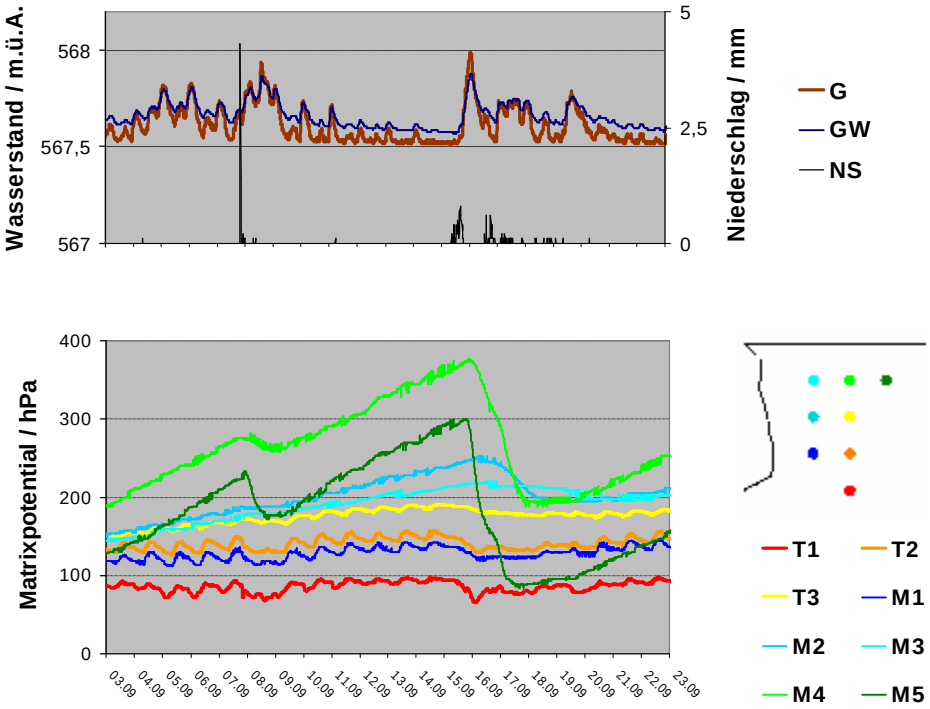
Muhar, Jungwirth, Unfer, Wiesner, Poppe, Schmutz, Hohensinner & Habersack , 2008

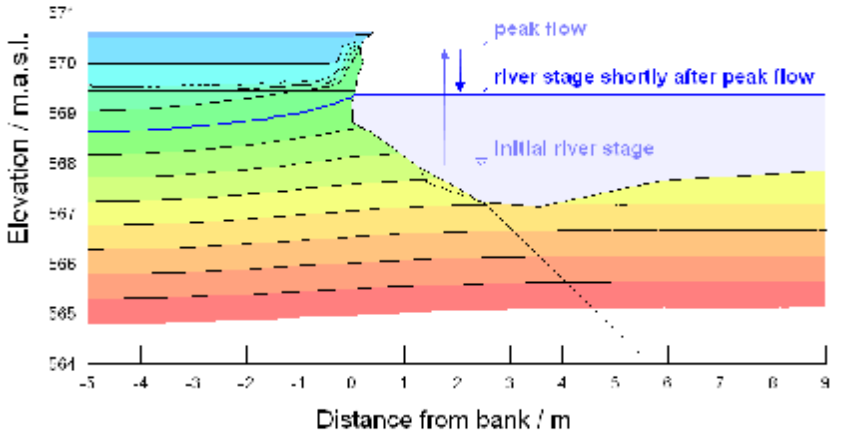
Monitoring and Modelling of Side Erosion Processes

Monitoring of Geometry



Monitoring of Hydrology





Modelling of Hydrology and Bank Stability

Klösch & Habersack, 2006

Integrated Automatic Bedload Transport Monitoring Dellach/Drau

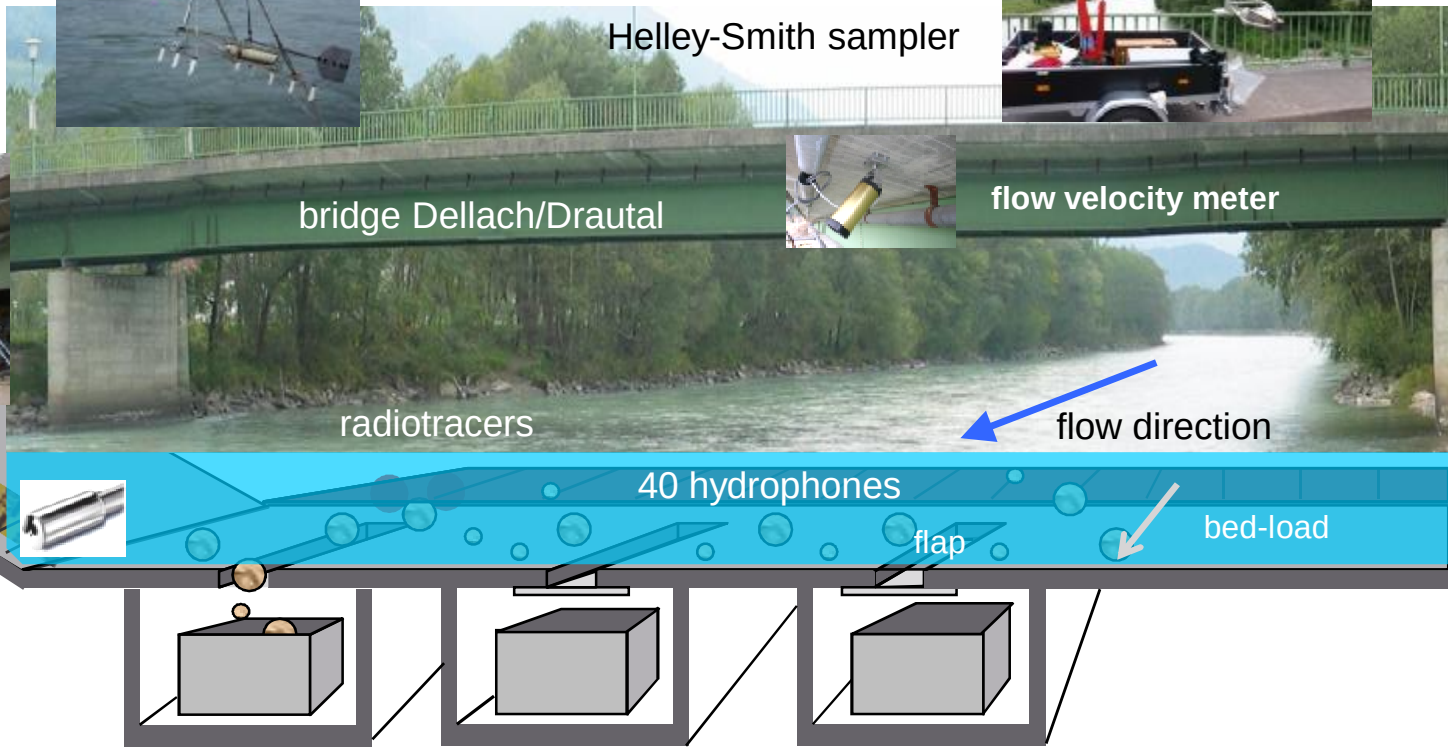
processing unit

river gauging

suspended load measurement

Admodus Sonar

Helley-Smith sampler



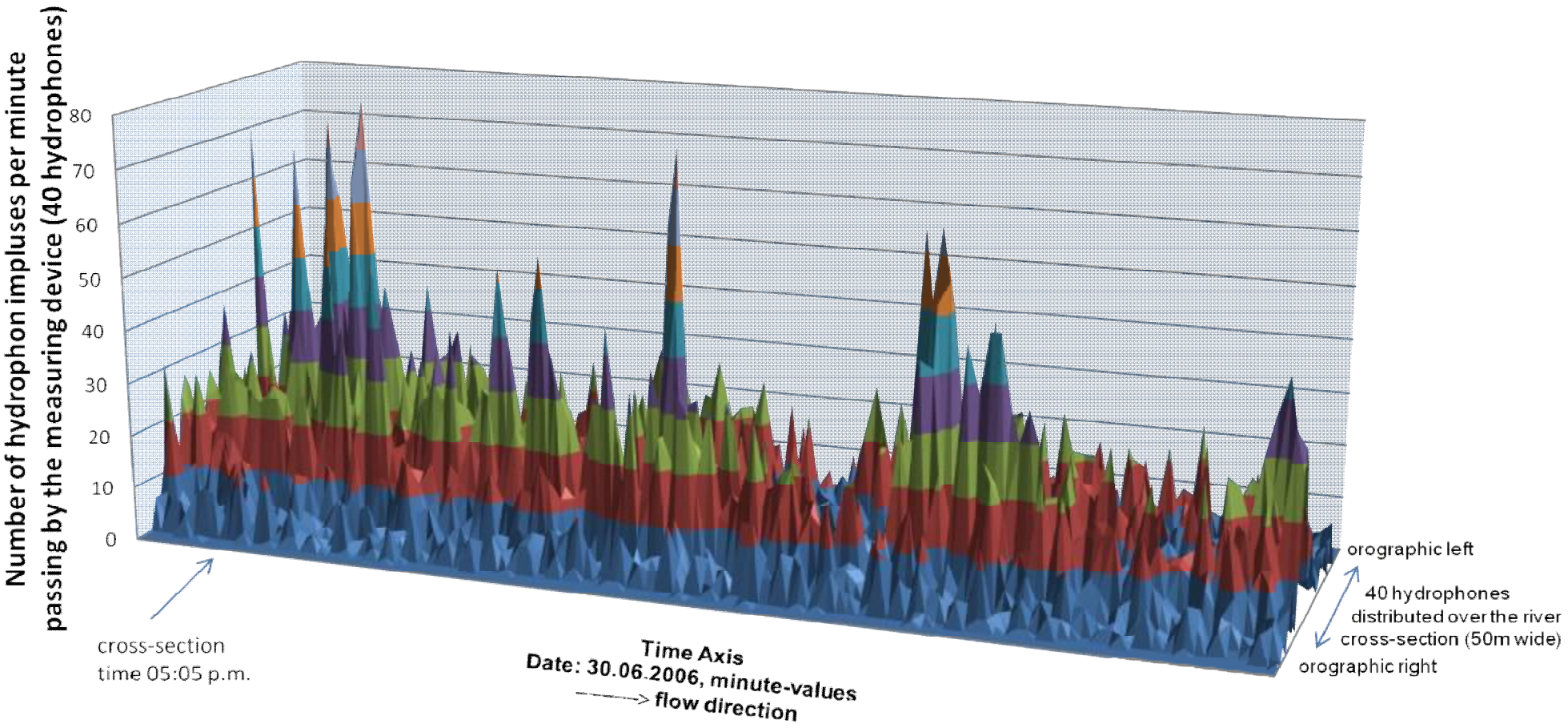
bed-load traps

Habersack, Seitz, Laronne, *Geod. Acta,* 2008

Number of Hydrophon Impluses per minute

date: 30.06.2006, time period: 04:00 - 07:00 p.m., discharge: Q = 140 m³/s

location: Dellach im Drautal - Austria



Conclusions

- Integrated floodrisk management has to cover total Drava river basin (see also WFD, FLOODS Directive)
- Sustainable flood protection on the Drava River has to be based on river basin management:
  - Floodplain management (preservation and restoration of floodplains) – non structural measures
  - Flood protection (ring dams, object protection…) - structural measures
  - River flow management (surge effects, residual flows…)
  - Morphodynamics and sediment management (river restoration, sediment input, transfer…)
- Scientific results:
  - Floodplain evaluation matrix FEM+
  - Self forming river restoration, monitoring and modelling
  - Automatic, integrated bedload and suspended sediment transport monitoring as basis for planning of sustainable measures