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The Ecological Situation of the Danube Region and its Relevance for Life Sciences



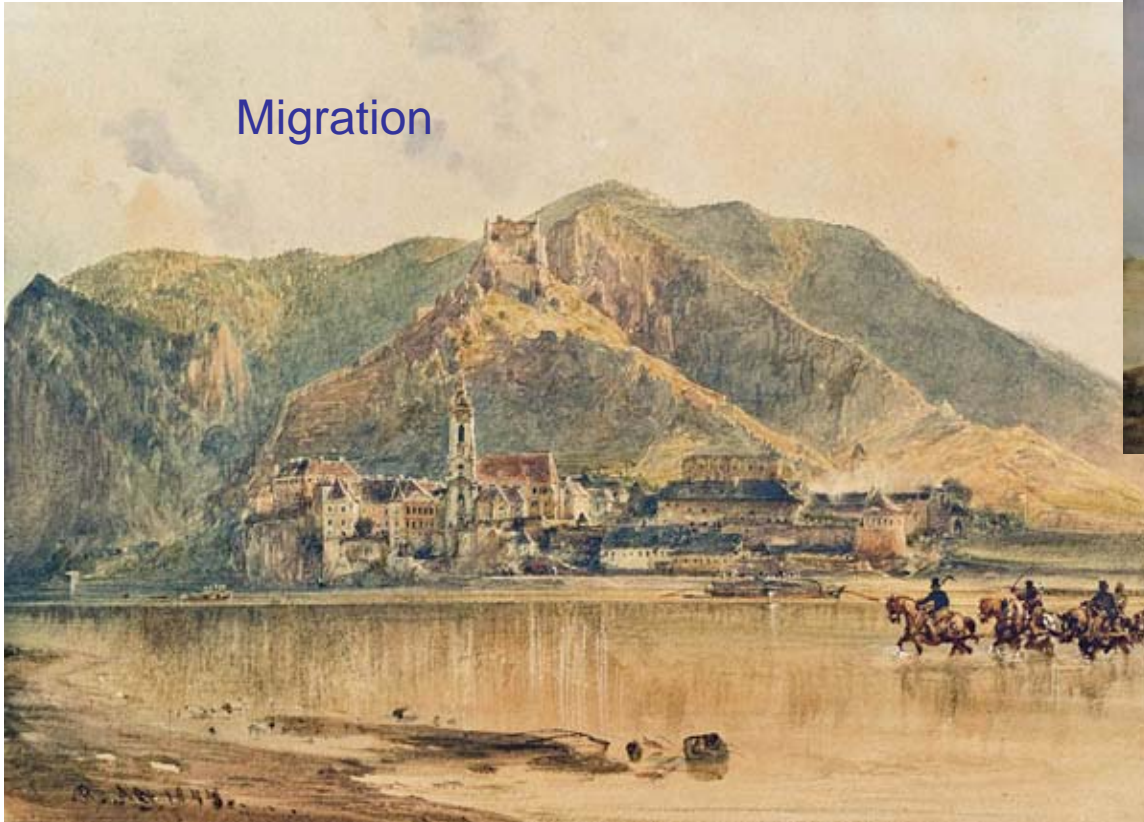
Herwig Waidbacher, University of Natural Resources and Life Sciences, Vienna



11.05.2011

April 28-29, 2011, Szent Istvan University Gödöllő, Hungary

1



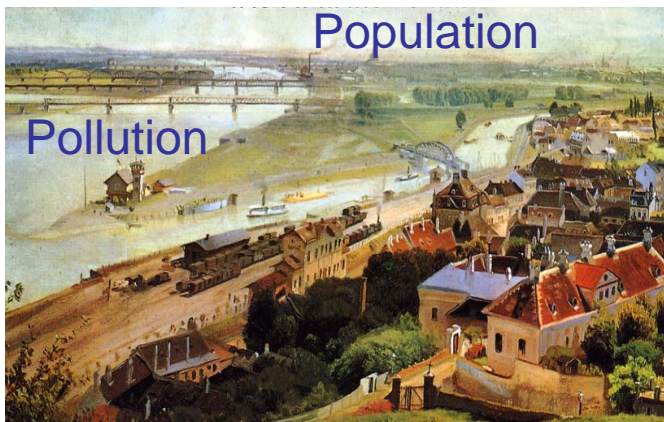
Migration



Transport

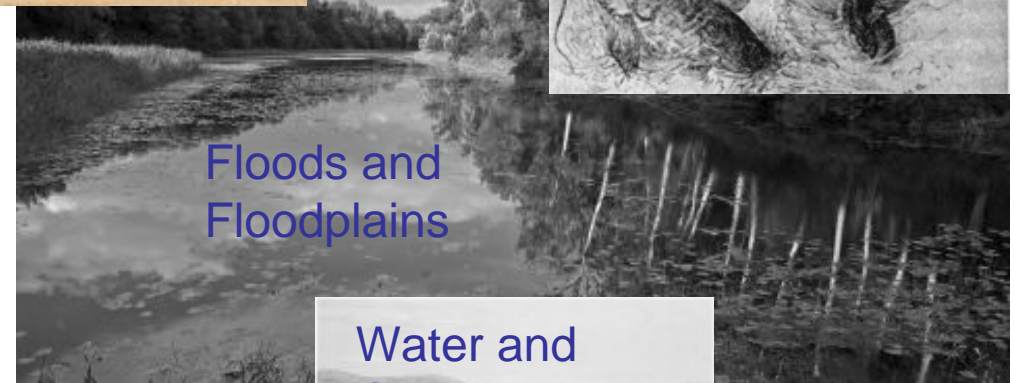


Biodiversity



Population

Pollution



Floods and Floodplains



Water and Groundwater

Some Basics:



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Some Basics:

Danube countries with catchment areas >2.000 km²: Austria, Bosnia & Herzegovina, Bulgaria, Croatia, Czech Republic, Germany, Hungary, Moldova, Montenegro, Romania, Serbia, Slovak Republic, Slovenia, Ukraine (14)

Danube countries with catchment areas <2.000 km²: Albania, Italy, Macedonia, Poland, Switzerland (5)

11 transboundary groundwater bodies of basin-wide importance are identified in the Danube River Basin District

Approx. 80,5 million inhabitants are settling in the Danube River Basin District



Some Basics:

The Danube River Basin District covers **9 ECOREGIONS** or parts of them

Danube River Basin District: Ecoregions

MAP 2



This ICPRD product is based on national information provided by the Contracting Parties to the ICPRD (AT, BA, BG, CZ, DE, HR, HU, MD, RO, RS, SI, SK, UA) and CH, except for the following: EuroGlobalMap v1.1 from EuroGeographics was used for national borders of AT, CZ, DE, HR, HU, MD, RO, SI, SK and UA; ESRI data was used for national borders of AL, BE, BG, Shuttle Radar Topography Mission (SRTM) from USGS Seamless Data Distribution System was used as topographic layer; data from the European Commission (Joint Research Center) was used for the outer border of the DRBD of AL, IT, ME and PL.

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Sources: http://www.icpdr.org/participate/sites/icpdr.org/participate/files/DRBM_Plan_2009_Maps.pdf and icpdr "Danube Basin Analysis (WFD Roof Report 2004)"

Ecoregion Countries with territories in the DRB

4 – Alps Germany, Austria, Slovenia, Italy, Switzerland

5 – Dinaric Western Balkan

Austria, Slovenia, Croatia, Bosnia and Herzegovina, Serbia and Montenegro, Albania

6 – Hellenic Western Balkan Serbia and Montenegro, Albania, Macedonia

7 – Eastern Balkan Serbia and Montenegro, Bulgaria, Macedonia

9 – Central Highlands Germany, Austria, Czech Republic

10 – The Carpathians Austria, Czech Republic, Slovak Republic, Poland, Serbia and Montenegro, Romania

11 – Hungarian Lowlands Austria, Czech Republic, Slovak Republic, Slovenia, Hungary, Croatia, Serbia and Montenegro, Romania

12 – Pontic Province Romania, Bulgaria, Moldova, Ukraine

16 – Eastern Plains Romania, Moldova, Ukraine

In several countries (Germany, Austria, Croatia, Hungary and Romania) the ecoregions have been divided into smaller geographical regions to address differences in river types based on different landscape features or differences in the aquatic communities.

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Some Basics: major tributaries



River	Mouth at Danube [rkm]	Length [km]	Size of catchment [km ²]	Average Discharge [m ³ /s]	Time series for discharge values
Danube	0	2,780	801,463	6,460	(1914-2003)
Lech	2,497	254	4,125	115	(1982-2000)
Naab	2,385	191	5,530	49	(1921-1998)
Isar	2,282	283	8,964	174	(1926-1998)
Inn	2,225	515	26,130	735	(1921-1998)
Traun	2,125	153	4,257	150	(1961-1999)
Enns	2,112	254	6,185	200	(1961-1999)
Morava/March	1,880	329	26,658	119	(1961-1999)
Raab/Rába	-2	311	10,113	88	(1901-2000)
Vah	1,766	398	18,296	161	(1931-1980)
Hron	1,716	278	5,463	55	(1931-1980)
Ipel/Ipoly	1,708	197	5,108	22	(1931-1980)
Sió	1,498	121	9,216	39	(1931-1970)
Drau/Drava	1,382	893	41,238	577	(1946-1991)
Tysa/Tisza/Tisa	1,214	966	157,186	794	(1946-1991)
Sava	1,170	861	95,719	1,564	(1946-1991)
Tamis/Timis	1,154	359	10,147	47	(1946-1991)
Morava (CS)	1,103	430	37,444	232	(1946-1991)
Timok	846	180	4,630	31	(1946-1991)
Jiu	694	339	10,080	86	(1921-2003)
Iskar	636	368	8,684	54	(1936-1998)
Olt	604	615	24,050	174	(1921-1995)
Yantra	537	285	7,879	47	(1936-1998)
Arges	432	350	12,550	71	(1914-2003)
Ialomita	244	417	10,350	45	(1915-2003)
Siret	155	559	47,610	240	(1921-2003)
Prut	132	950	27,540	110	(1928-2003)

Sources: icpdr: "Danube Basin Analysis (WFD Roof Report 2004)"



Basics for The Ecological Situation of the Danube Region

- Water Framework Directive 2000: goals for whole Danube River basin
- Danube River Basin Analyses 2004 (ICPDR)
 - to find out which common problems exist in DRB
- Danube River Basin Management Plan 2009 (ICPDR)
 - to point out strategies and planned actions

Sources: icpdr (International Commission for the Protection of the Danube River)

Examples for The Ecological Situation of the Danube Region



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Danube River Basin District:
Hydrological Alterations/Impoundments - Current Situation (2009)

MAP 7a



impoundments

This map illustrates full water bodies which are affected by impoundments. The exact location of individual impoundments is not visualised. Annex 20 of the DRBM Plan indicates respective details per country.
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Vienna, December 2009

Sources: http://www.icpdr.org/participate/sites/icpdr.org/participate/files/DRBM_Plan_2009_Maps.pdf

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Examples for The Ecological Situation of the Danube Region



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Danube River Basin District:
River and Habitat Continuity Interruption - Current Situation (2009)

MAP 5

continuity interruption



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Examples for The Ecological Situation of the Danube Region



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Danube River Basin District:
Future Infrastructure Projects Planned by 2015

MAP 8



Infrastructure, flood protection,
navigation and hydropower

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Sources: http://www.icpdr.org/participate/sites/icpdr.org/participate/files/DRBM_Plan_2009_Maps.pdf

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Examples for The Ecological Situation of the Danube Region

Danube River Basin District:
Chemical Status of Surface Water Bodies

MAP 12



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chemical status

* Details on the risk assessment regarding the risk for failure of the WFD environmental objectives performed by the Non EU Member States are part of the Danube River Basin Management Plan Annex 14.

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Examples for The Ecological Situation of the Danube Region

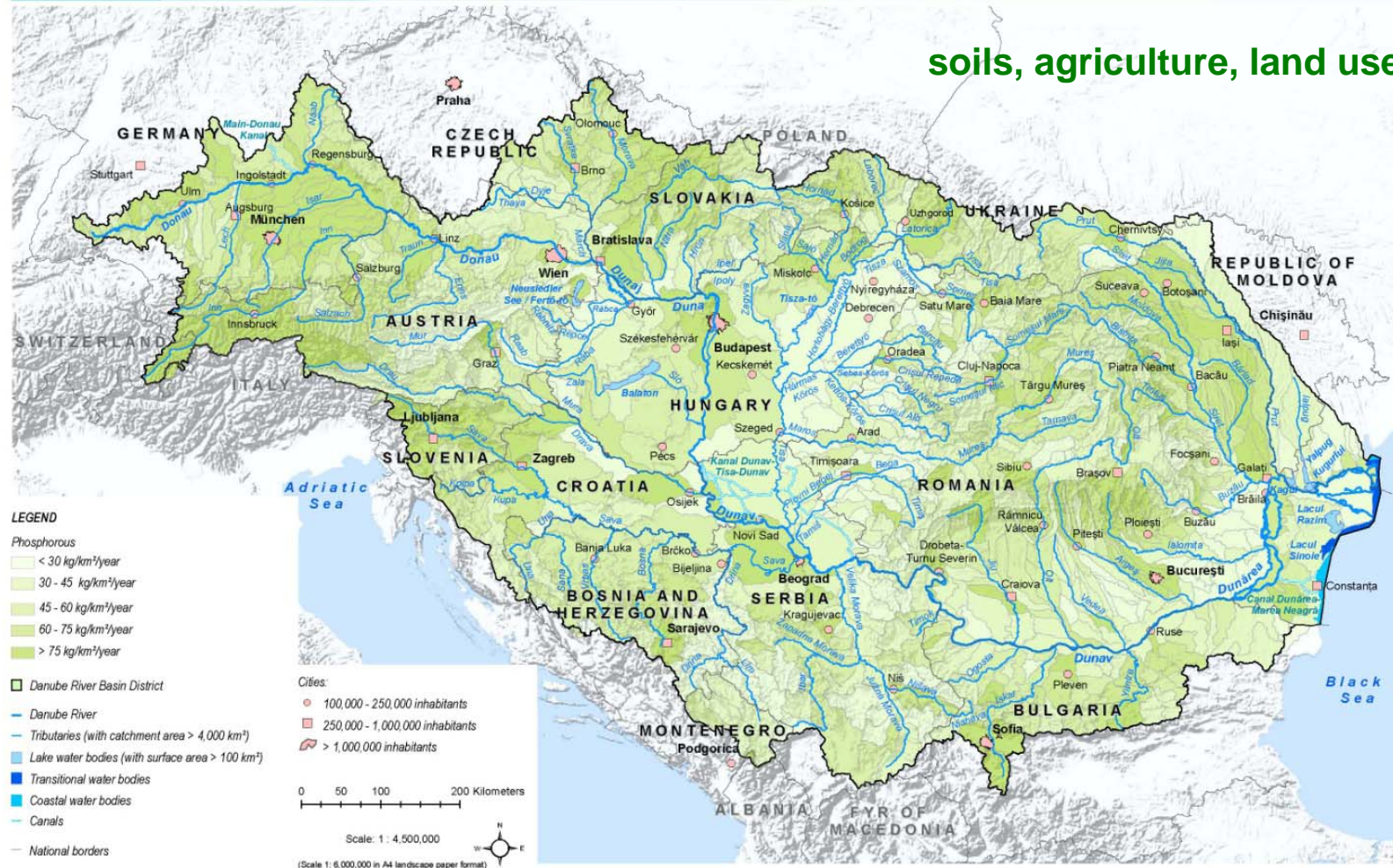


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Danube River Basin District:
Nutrient Pollution from Point and Diffuse Sources - Baseline Scenario 2015 for Phosphorous

MAP 25

soils, agriculture, land use



Significant efforts have been undertaken so far in the DRBD regarding diffuse source pollution and its illustration using the MONERIS Model System (Behrendt et al., 2007). However, further research and monitoring is needed.

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Examples for The Ecological Situation of the Danube Region

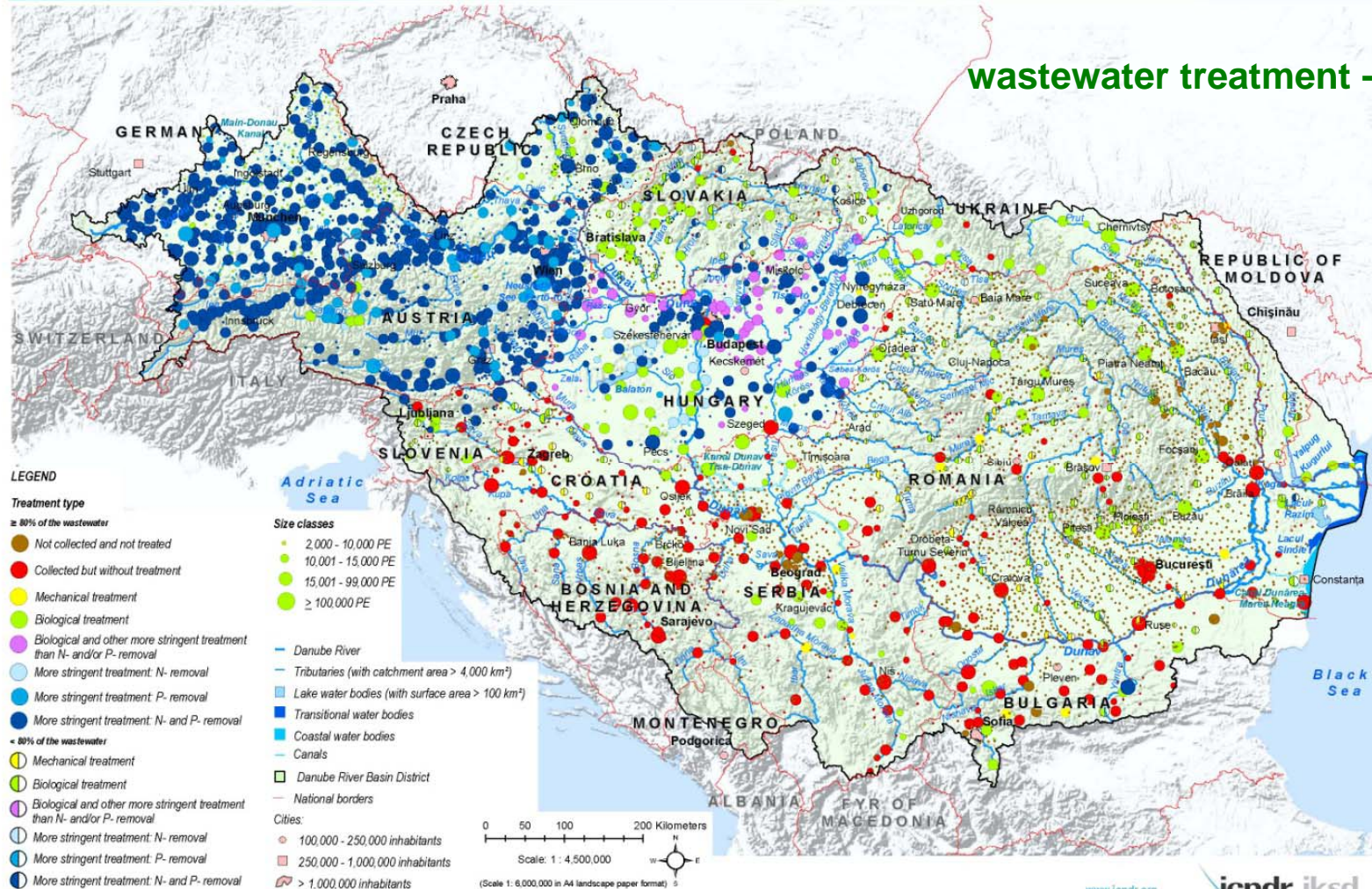


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Danube River Basin District:
Urban Wastewater Discharges – Reference Situation - UWWT 2005/2006

MAP 18

wastewater treatment - reference



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Examples for The Ecological Situation of the Danube Region

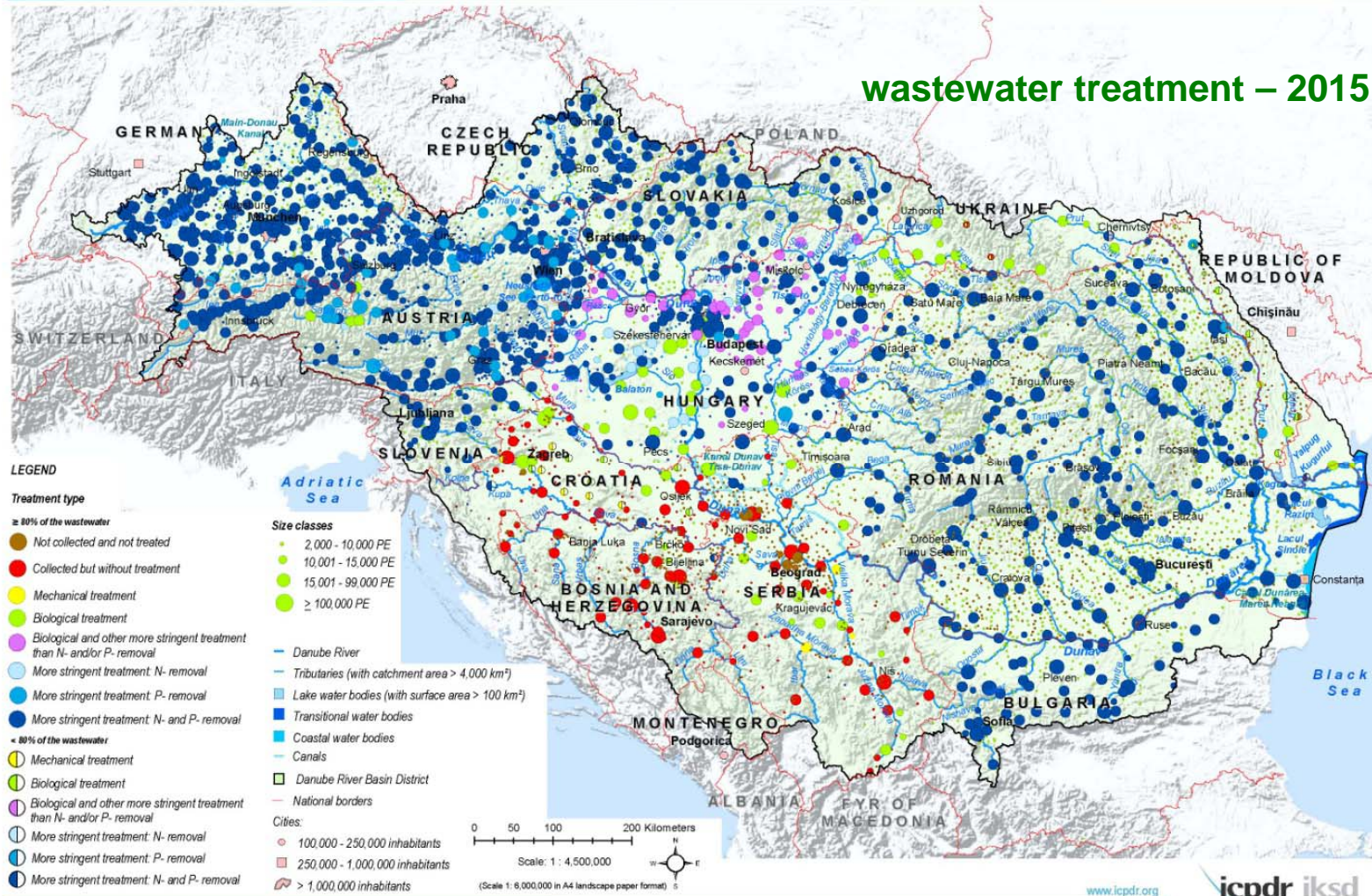


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Danube River Basin District:
Urban Wastewater Discharges – Baseline Scenario - UWWT 2015

MAP 19

wastewater treatment – 2015 expected



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Examples for The Ecological Situation of the Danube Region

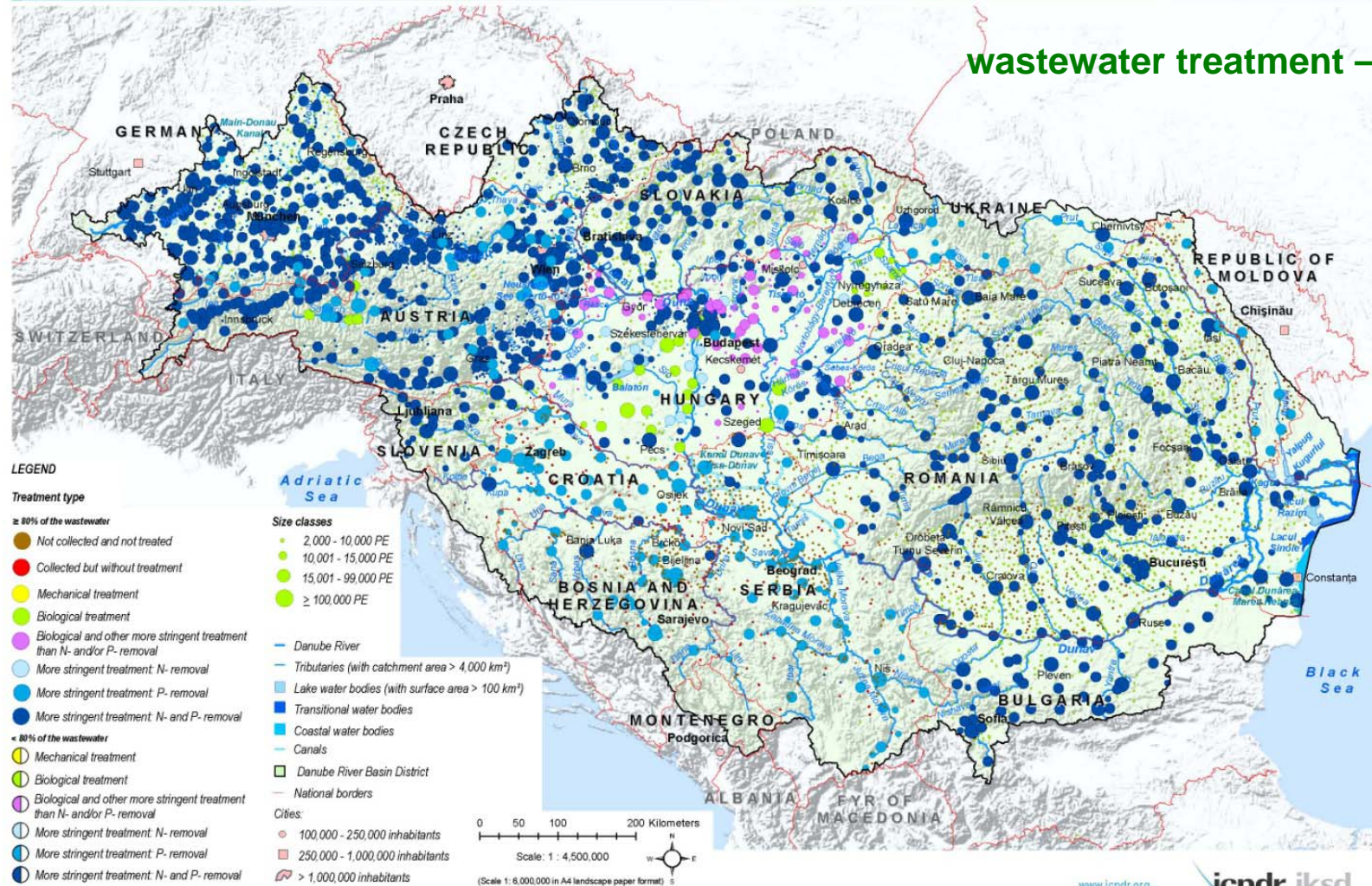


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Danube River Basin District:
Urban Wastewater Discharges – Midterm Scenario - UWWT

MAP 20

wastewater treatment – ??



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Examples for The Ecological Situation of the Danube Region

Danube River Basin District:
Ecological Status and Ecological Potential of Surface Water Bodies

MAP 11



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good ecological status
good ecological potential

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Examples for The Ecological Situation of the Danube Region



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Danube River Basin District:
Wetlands/Floodplains (>500 ha) with Reconnection Potential (2009) and Expected Improvement by 2015

MAP 6



wetlands, ecology, forestry

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Sources: http://www.icpdr.org/participate/sites/icpdr.org/participate/files/DRBM_Plan_2009_Maps.pdf

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Examples for The Ecological Situation of the Danube Region



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Danube River Basin District:
Protected Areas (Natura 2000 and Others)

MAP 9



habitat protection

Vienna, December 2009 Sources: http://www.icpdr.org/participate/sites/icpdr.org/participate/files/DRBM_Plan_2009_Maps.pdf

Examples for The Ecological Situation of the Danube Region



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Danube River Basin District:
Ecological Prioritisation Regarding Restoration Measures for River and Habitat Continuity

MAP 28

Restoration for river- and habitat continuity



The ecological prioritisation approach (Part A) is not meant to substitute similar national approaches but to outline the basin-wide perspective. Low restoration priority indicated on the basin-wide level does not imply that no measures should be undertaken on the national level as all fish species need open river continuity. On the other hand, ecological prioritisation is only one of many aspects in deciding which measures to adopt and implement. Final decisions will be taken at the national level.

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19



Central and South Eastern Europe



The Ecological Situation of the Danube Region:

Listing the topics:

- impoundments
- continuity interruption
- infrastructure
- flood protection
- navigation
- hydropower
- chemical status
- soils
- agriculture
- land use
- wastewater treatment
- good ecological status
- good ecological potential
- wetlands
- ecology
- forestry
- habitat protection
- restoration for river- and habitat continuity

**Emerging fields for life science universities
are highly visible !!**

The Ecological Situation of the Danube Region

One single detailed example from Austria

➤ The Hydropower Impoundment of Wien/Freudenau

The Life Science University **BOKU** as an entity
generated the complete
environmental impact assessment



hydrology
hydraulic engineering
sanitary engineering
water pollution control
limnology
water quality assessment
fish ecology and fisheries
spatial planning
transport
navigation
landscape planning
botany, forestry
zoology, biodiversity
climatology

The fish-ecological aspect



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Cool and flowing

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Cool
and
flowing

A

RHEOPHILIC

Acipenser ruthenus
Salmo trutta f.f.
Hucho hucho
Oncorhynchus mykiss
Thymallus thymallus
Chondrostoma nasus
Barbus barbus
Rutilus pigus virgo
Rutilus frisii meidingeri
Leuciscus leuciscus
Leuciscus cephalus
Leuciscus souffia
Vimba vimba
Phoxinus phoxinus
Gobio kessleri
Gobio albipinnatus
Gobio uranoscopus
Noemacheilus barbatulus
Alburnoides bipunctatus
Cottus gobio
Gymnocephalus baloni
Gymnocephalus schraetzer
Zingel zingel
Zingel stréber

B

Leuciscus idus
Abramis sapa
Abramis ballerus
Pelicis cultratus
Aspius aspius
Cobitis taenia
Gobio gobio
Lota lota

Fish species:
guilds

EURYTOPIC

Anguilla anguilla
Esox lucius
Rutilus rutilus
Alburnus alburnus
Blicca bjoerkna
Abramis brama
Carassius auratus gibelio
Perca fluviatilis
Stizostedion lucioperca
Proterorhinus marmoratus
Silurus glanis
Gymnocephalus cernua
Cyprinus carpio
Neogobius kessleri

STAGNOPHILIC

Leucaspis delineatus
Scardinius erythrophthalmus
Rhodeus sericeus amarus
Carassius carassius
Tinca tinca
Misgurnus fossilis
Stizostedion volgensis
Gasterosteus aculeatus
Umbra krameri



57 native fish species presently still found in the Austrian Danube (Haidvogel)



4 Acipenseridae missing

Fish "target group" for improvements

RHEOPHIL

INDIFFERENT

STAGNOPHIL

A

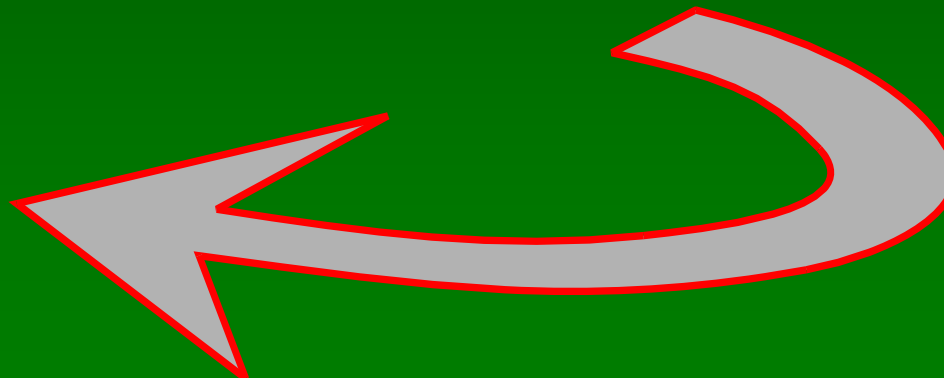
Acipenser ruthenus
Salmo trutta f.f.
Hucho hucho
Oncorhynchus mykiss
Thymallus thymallus
Chondrostoma nasus
Barbus barbus
Rutilus pigus virgo
Rutilus frisii meidingeri
Leuciscus leuciscus
Leuciscus cephalus
Leuciscus souffia
Vimba vimba
Phoxinus phoxinus
Gobio kessleri
Gobio albipinnatus
Gobio uranoscopus
Noemacheilus barbatulus
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Cottus gobio
Gymnocephalus baloni
Gymnocephalus schraetzer
Zingel zingel
Zingel streber

Anguilla anguilla
Esox lucius
Rutilus rutilus
Alburnus alburnus
Blicca bjoerkna
Abramis brama
Carassius auratus gibelio
Perca fluviatilis
Stizostedion lucioperca
Proterorhinus marmoratus
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Gymnocephalus cernua
Cyprinus carpio
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Carassius carassius
Tinca tinca
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Stizostedion volgensis
Gasterosteus aculeatus
Umbra krameri

B

Leuciscus idus
Abramis sapa
Abramis ballerus
Peliculus cultratus
Aspius aspius
Cobitis taenia
Gobio gobio
Lota lota



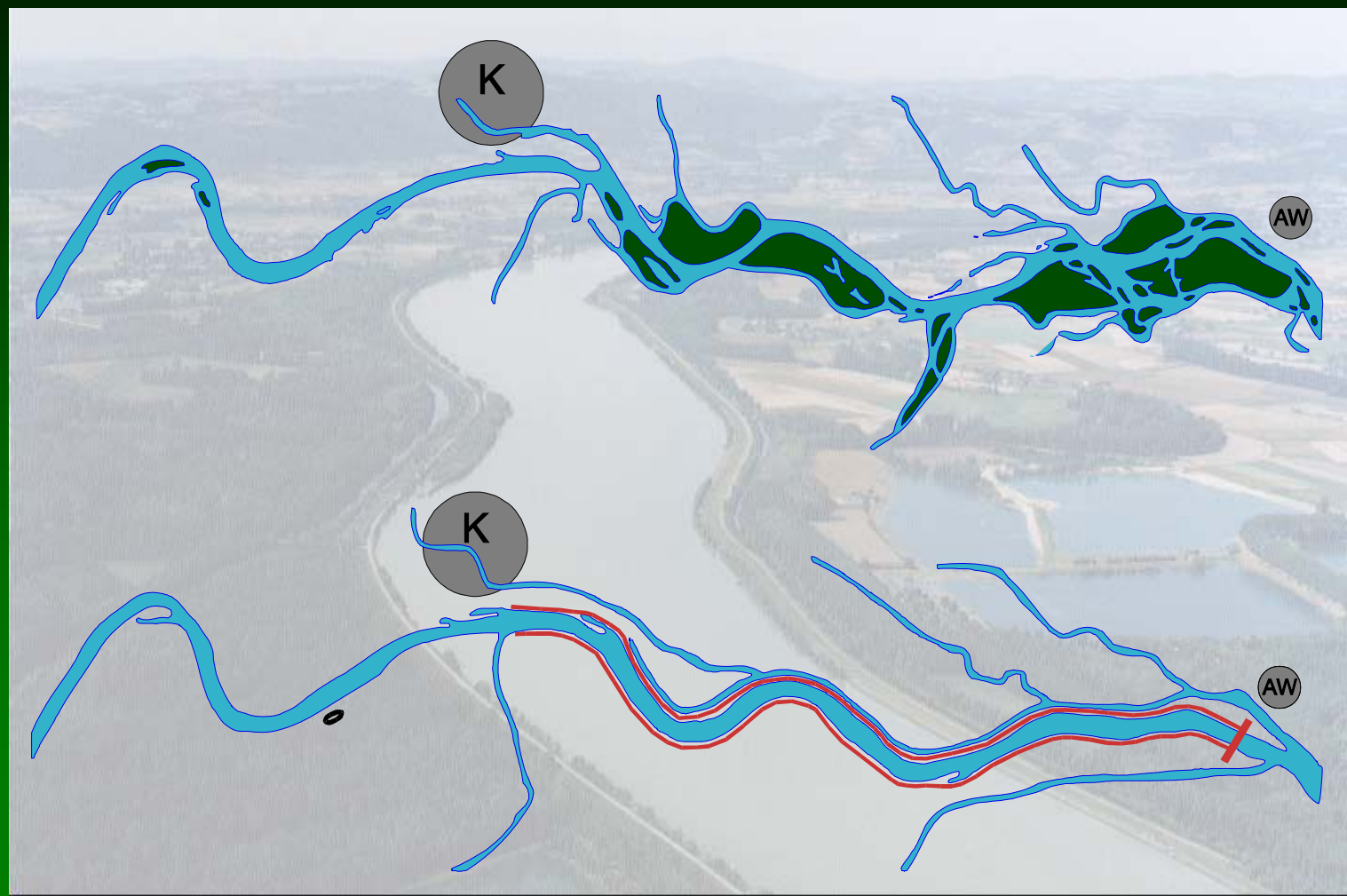


- straightening
- hydropower - impoundments





Hydropower – impoundments



Hydropower - impoundments

Stocks are confronted with:

- relatively low average temperature
- lack of shoreline structure (rip-rap)
- low plankton density
- ? spawning grounds for streaming water species
- ? spawning grounds for standing water species

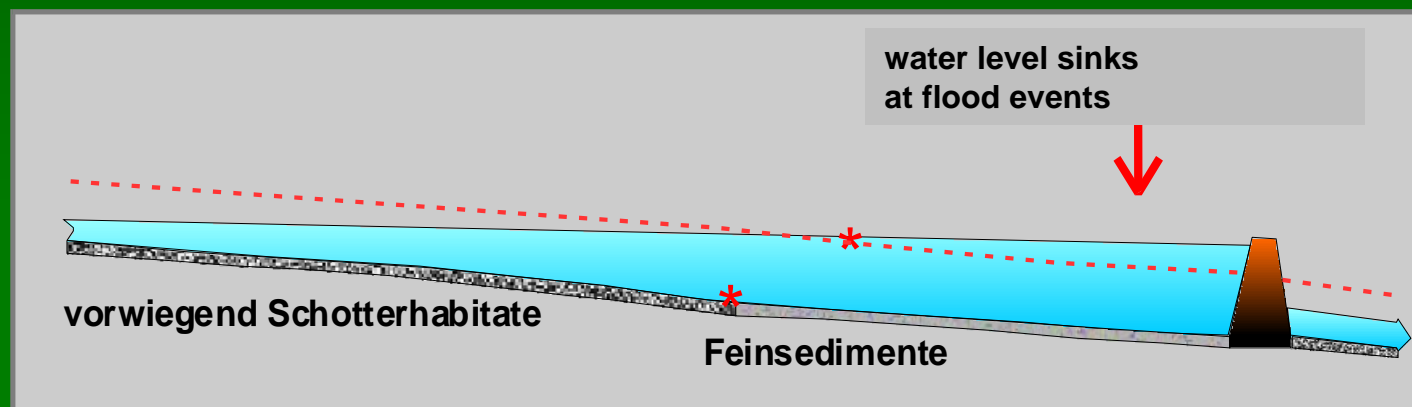
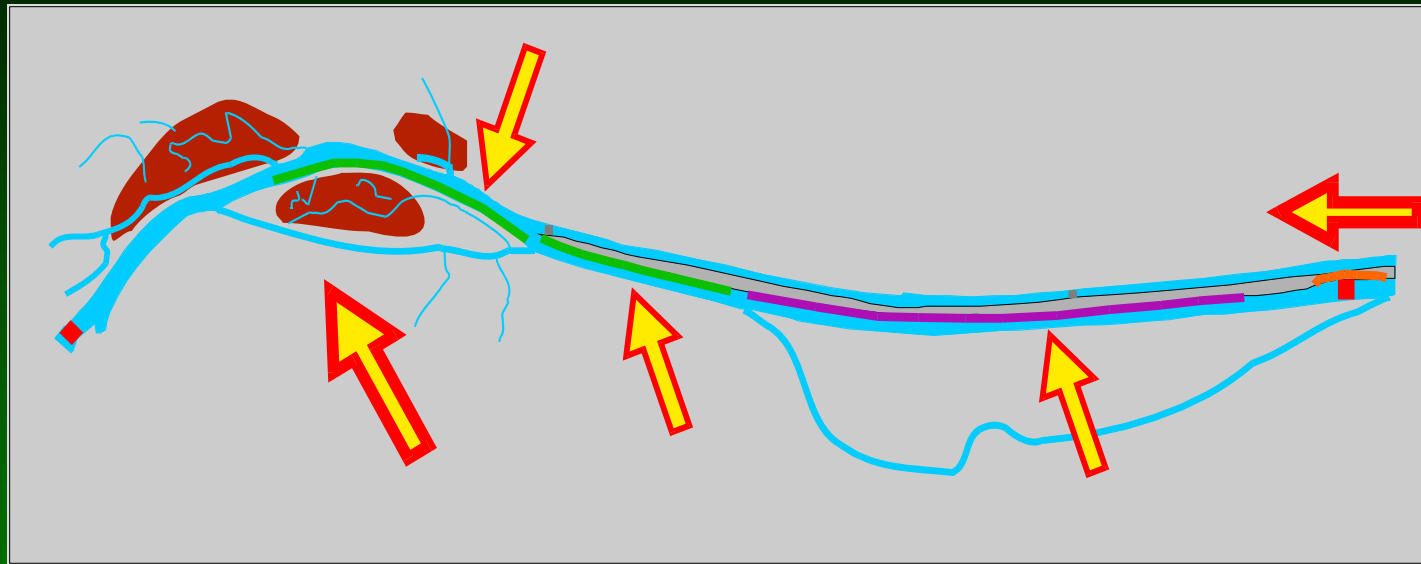
Hydropower - impoundments

Objectives for habitat improvements:

- dynamic gravel banks
- dynamic sand habitats
- shelters in case of flood events
- possibility for long distance migration
- lateral connections of waterbodies
- riparian bays and channel systems

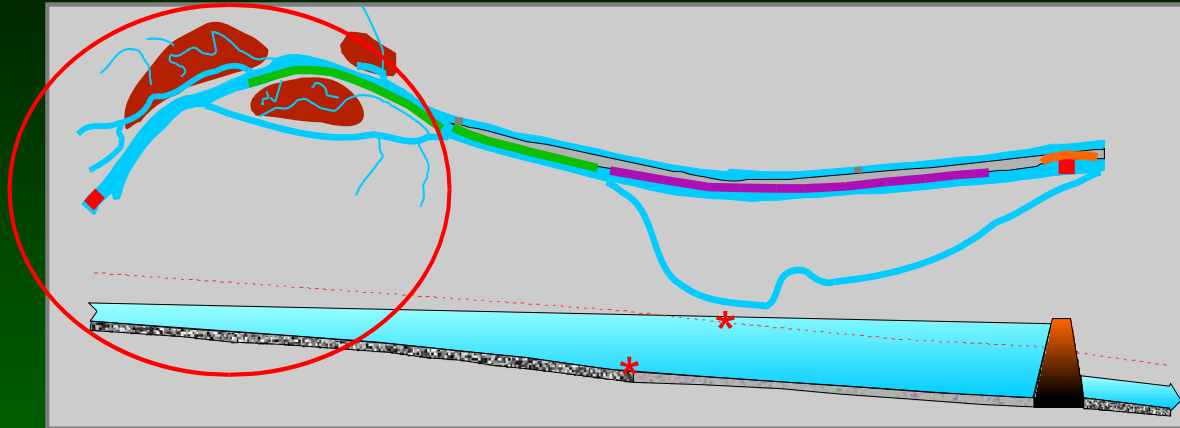
Improvements a whole concept

Impoundm. Wien/Freudenau



Improvements a whole concept

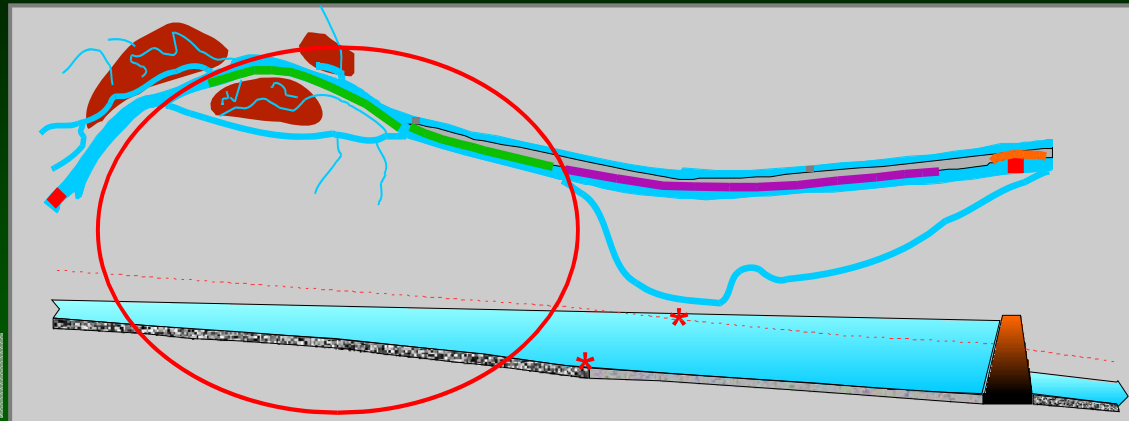
impoundment Wien/Freudenau



The intensive connection of lateral waterbodies to the main river channel favours the migration of lacustrine backwater fish associations and offers nursery and feeding grounds.

Improvements a whole concept

impoundment Wien/Freudenau



Double riprap



The original dominant rheophilic fish fauna is represented in Danube impoundments by mainly adult individuals only; gravelbank-spawning grounds have been constructed in extended areas in the uppermost part of the Vienna/Freudenau impoundment.

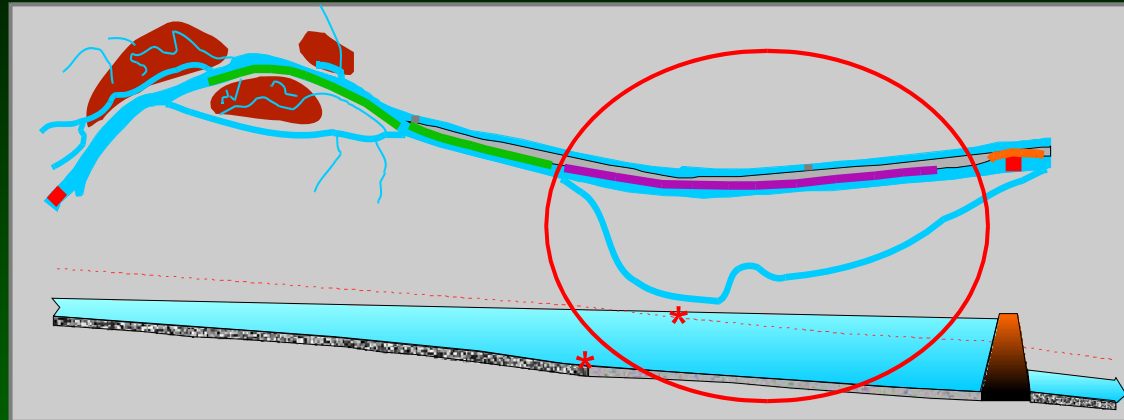


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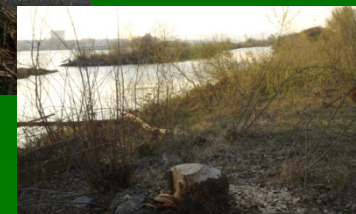
Improvements a whole concept

impoundment Wien/Freudenau



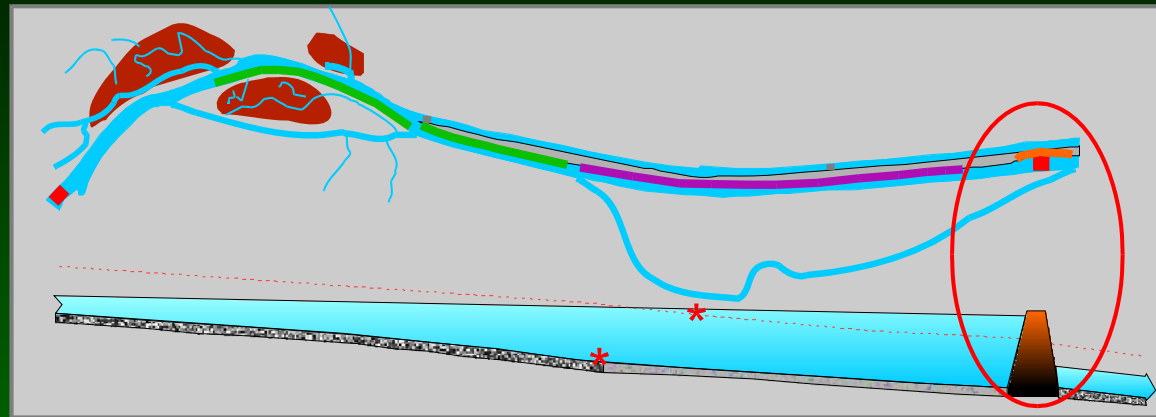
An extended riparian channel and bay system in the central impoundment serves as spawning ground, nursery and feeding area for fish associations. At flood events these zones have protective functions.





Improvements a whole concept

impoundment Wien/Freudenau



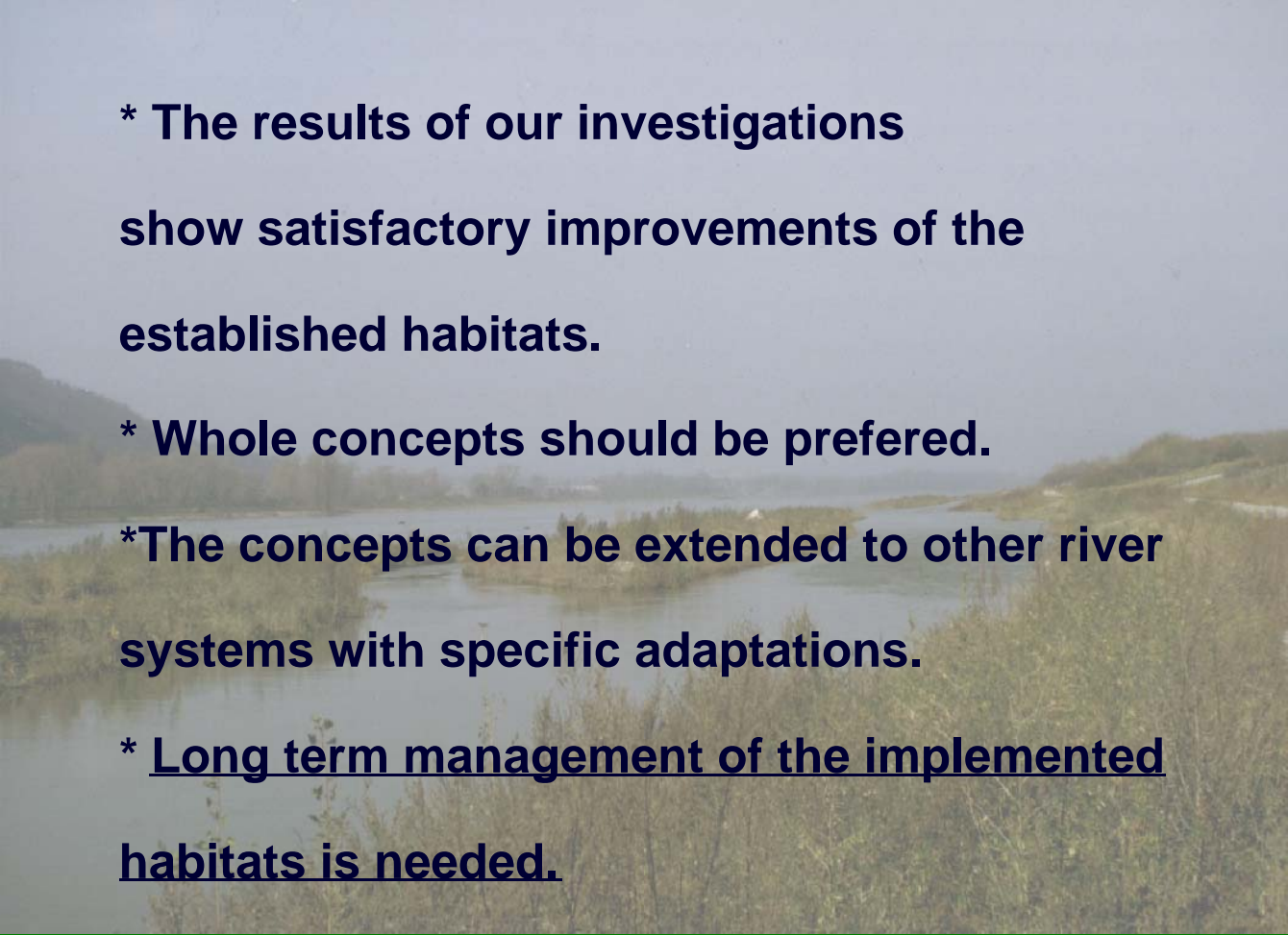
Fish migration in a bypass channel system supports transfer of genetic material.

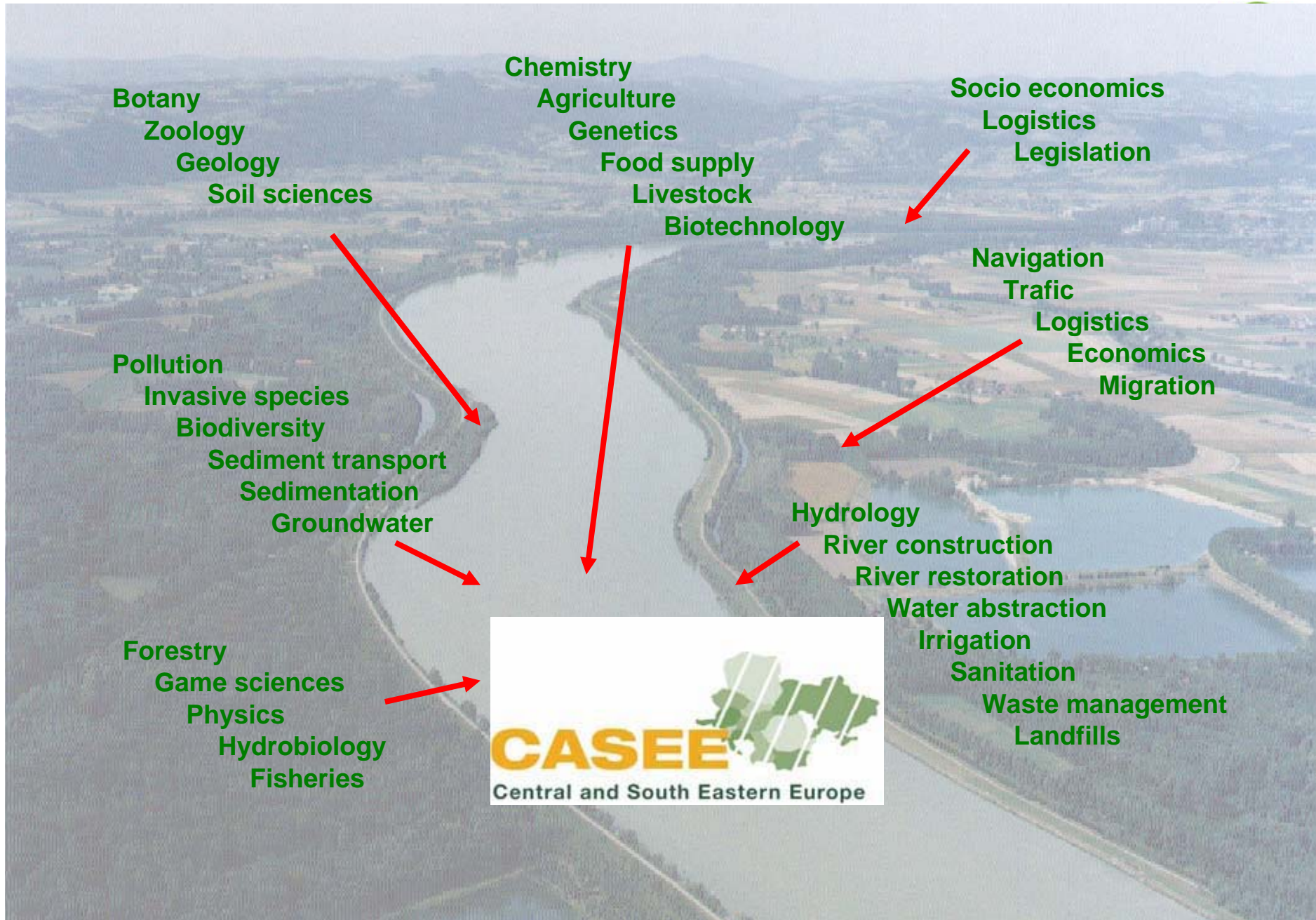


migration of 41 fish species in the bypass system is recorded



As an extension of the environmental impact assessment
BOKU institutions – as the hydrobiology – continued
scientific work and can nowadays formulate:

- 
- A background image showing a wide river flowing through a landscape with green hills and trees under a clear sky.
- * The results of our investigations
show satisfactory improvements of the
established habitats.
 - * Whole concepts should be preferred.
 - * The concepts can be extended to other river
systems with specific adaptations.
 - * Long term management of the implemented
habitats is needed.



CONCLUSIONS for CASEE



- 1st SCENARIO for CASEE
- cooperate
 - intradisciplinary
 - interdisciplinary
 - transdisciplinary (as seen with hydropower impoundment Freudneau)
- 2nd SCENARIO for CASEE
- Assistance for decision makers, stakeholders, and top politicians to generate “irrevocable advisory reports“ and expertises.



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Thank you for
your attention!

11.05.2011

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