

EUSDR Priority area 7:

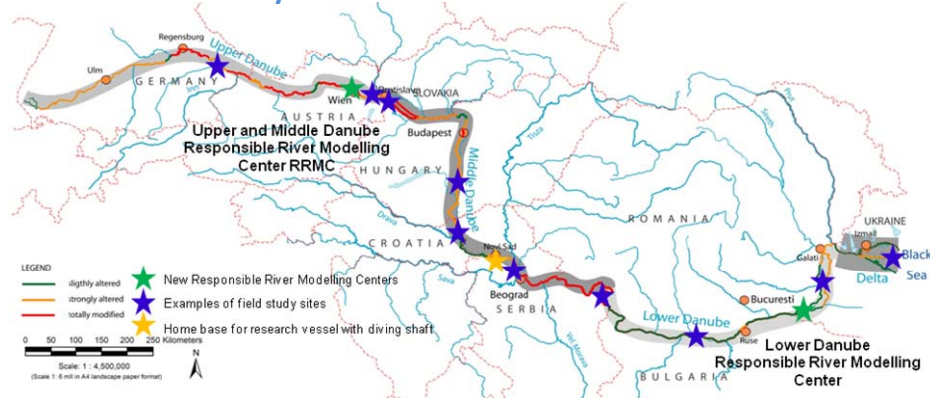
To develop the Knowledge Society through research, education and information technologies

Project Concept:

Danube River REsearch And Management *DREAM*

...from Basic Research to Knowledge Society

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Danube River REsearch and Management *DREAM*

Background

The Danube River provides people of the Region with key benefits, such as water supply, food, hydropower, navigation, irrigation, ecosystem services and recreation. The Danube is fundamental to life and frequently possesses major cultural significance. However, the Danube is currently threatened by unsustainable overexploitation, increasing human pressure on its catchment and problems of increased floods and droughts - at least partly induced by climate change.

This led to changes in floodplain morphology, pollution, degradation of aquatic habitats, changes in fish communities, changes in whole agricultural production systems and population movements.

All these changes impact dramatically on many features of the Danube region.

There is an urgent need to integrate use and protection of the Danube River in a sustainable way. Research is of fundamental importance to derive monitoring strategies, modelling and engineering solutions to improve measures suited to reach a win-win situation between economic use and environmental protection of the Danube River. This will be strongly related to the Danube River Basin Management Plan.

Legal boundary conditions are (examples): EU - Water Framework Directive 2000 (WFD), EU - Floods Directive 2007, EU NAIADES / Navigation, Korridor 7, 2008, EU - Renewable Energy Directive 2009 (Climate Change).

The Integrated Danube River Basin Management (based on the WFD) has to maintain or restore/rehabilitate (in a dynamic, spatial and temporal context) the Danube River basic functions, including biodiversity and ecosystem services, to avoid single-aim infrastructure development projects and strategies, to integrate ecological functionality (based on EIA) and economic use. Here the ICPDR is responsible and should play an *important role* in *DREAM*.

Research in river processes, preservation and restoration and improved river related knowledge are a prerequisite to reach a sustainable implementation of the Danube River Basin Management.

To reach an Integrated Flood Risk Management, fulfilling the EU Floods Directive, which regulates the Danube River Basin wide activities and aims to reduce the flood borne negative impacts on human health, environment, cultural heritage and economic activities, research

is necessary to harmonize data, improve calculation procedures, derive inundation maps and design flood protection measures.

The Renewable Energy Directive and Climate Change discussion give rise to a future [hydropower development](#) in the Danube River Basin, whereby scientific investigations are essential to lead to new types of hydropower plants, that e.g. can allow a sediment and biota continuum.

The Development of [Inland Navigation](#) is another area of economic interest, being also an environmentally friendly transport mode. Research is required e.g. to develop new types of river engineering measures that increase water depth, at the same time stop river bed degradation and improve the ecological status.

Especially for optimizing river engineering measures there are [infrastructural needs](#) for performing [research](#) on [large scale hydraulic models](#), computer simulation tools, field study sites and for interaction between Danube River research institutions.

Aims

- a) An important aim is to enable research of hydrodynamic, sediment transport, morphodynamic and ecological processes in the various reaches of the Danube River by means of [adequate hydraulic laboratories](#), that provide a significant discharge (about 5 m³/s without pumping) and space (large scale models).
- b) On the basis of an improved process understanding, derived by the large scale physical models in the labs, [computer based simulations](#) should be improved, leading to hybrid models. A further aim is to establish commonly agreed [field study sites](#) and stations along the Danube River to calibrate and validate physical and computer based models as well as to develop and test advanced river engineering measures under 1:1 conditions.
- c) The [cooperation of research institutions along the Danube River](#) is intended to improve scientific progress and to stimulate the [transfer from Basic Research to the Knowledge Society](#).



Description and Activities

Within the Danube Strategy the following Danube River Research and Management activities should be supported:

- Act. 1:** *Construction* of *two large Responsible River Modelling Centers/hydraulic and environmental engineering laboratories (5000 l/s flow capacity)*: one in the upper/middle part of the Danube and one in the lower part (see Figure 1); the reason for two labs (upstream section/downstream section): gravel bed vs sand bed river, up to ten times slope difference and different problem areas.
- Act. 2:** *Formation* of a *cluster/network of river engineering simulation tools* to be used by Danube countries (common software development and implementation), being applied both on computer clusters and individual servers.
- Act. 3:** *Establishment* of a *network of field study sites along the Danube River and tributaries* (each country should nominate a certain river stretch, specific problem area, work program etc.) for process analysis, model calibration and validation AND test of advanced river engineering solutions (examples, to be discussed and commonly agreed on: Germany: stretch Straubing-Vilshofen, Austria: National Park Donauauen, Slovakia: Reservoir Gabčíkovo, Hungary: Mosoni Danube, Serbia, Croatia: reach along Kopacki Rit, Romania, Bulgaria, Moldova, Ukraine: border section / islands / bifurcations, Danube Delta etc., further field study sites ev. in: Czech Republic, Slovenia, Bosnia).
- Act. 4:** *Construction* and *operation* of a *research vessel with diving shaft* for the whole Danube area (e.g. operated from Serbian base) to enable river bed research at various parts of the Danube river.
- Act. 5:** *Establishment* of a *network* of existing and extended *Danube River Research Institutions* throughout all riparian countries, including a strong link to management and society (...from Basic Research to Knowledge Society).



Outcomes and Results

- Out. 1:** Two large *Responsible River Modelling Centers/hydraulic and environmental engineering laboratories*, being able to undertake basic and applied, interdisciplinary Danube River Research, including the development and test of innovative river engineering measures to improve the situation (in the context of hydropower, navigation, ecology, flood risk management, drinking water supply, recreation, remobilisation of sediments etc.).
- Out. 2:** *Cluster/network of river engineering simulation tools* allowing to perform longterm and large scale analyses of the development of the Danube River (e.g. river bed aggradation or degradation) and to predict effects of river engineering works.
- Out. 3:** *Network of field study sites along the Danube River* being suited for carrying out benchmarking studies related to basic abiotic and biotic processes and interrelations with river engineering measures.
- Out. 4:** *Research vessel with diving shaft* for the whole Danube (e.g. operated from Serbian base) to perform in situ investigations of river bed dynamics/morphodynamics, sediment transport, effects of river engineering measures and biological processes, thus forming a strong link to management.
- Out. 5:** *Network of Danube River Research Institutions* that strenthens and improves the scientific knowledge on the Danube River, helping to develop a Knowledge Society.

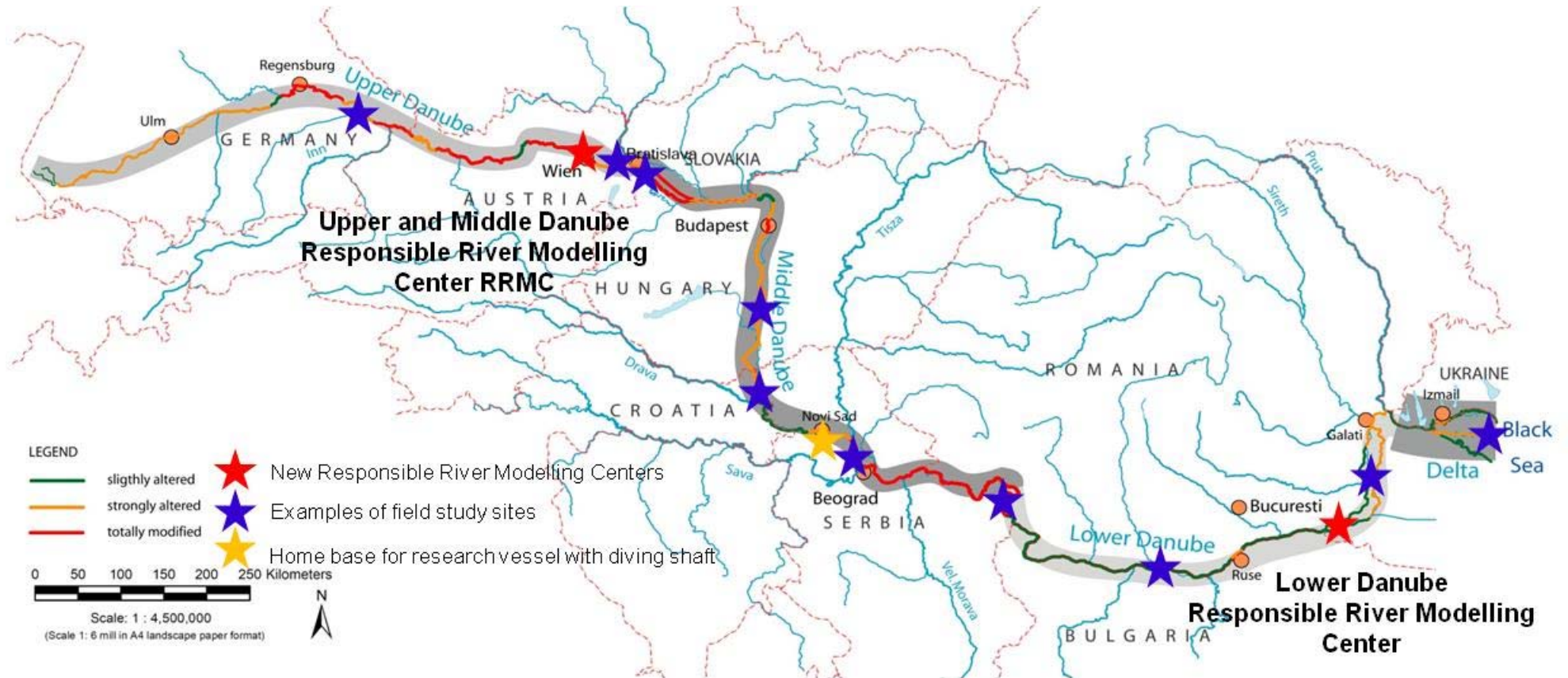


Figure 1: Ideas for the implementation of research infrastructure along the Danube River (base map: river morphology of the Danube River, Habersack et al., 2010)



Relevance for the Danube Strategy

This proposal contributes significantly to the following pillars and priority areas:

- (1) Connecting the Danube Region
 - To improve mobility and multimodality
 - Inland Waterways
 - To encourage more sustainable energy
 - To promote culture and tourism, people to people contacts
- (2) Protecting the Environment in the Danube Region
 - To restore and maintain the quality of waters
 - To manage environmental risks
 - To preserve biodiversity, landscapes and the quality of air and soils
- (3) Building Prosperity in the Danube Region
 - To develop the knowledge society through research, education and IT
 - To support the competitiveness of enterprises, including cluster development
 - To invest in people and skills
- (4) Strengthening the Danube Region
 - To step up institutional capacity and cooperation

Especially between PA 07 (Knowledge Society), PA 1A (Mobility – Waterways), PA 02 (Energy), PA 04 (To restore and maintain the quality of waters), PA 05 (Biodiversity, Landscapes, Quality of Air and Soils) and PA 06 (Environmental Risks) strong synergies are given and win-win effects could be gained.

Within PA 07 this project would contribute significantly to the Action - “To strengthen the capacities of research infrastructure” and Action - “To strengthen cooperation among universities and research facilities and to upgrade research and education outcomes by focusing on unique selling points”.



Potential Partners

All relevant universities and research institutions along the Danube River and tributaries in the Danube River Basin (e.g. Sava) are potential partners, in strong interrelation with public and private sectors (ministries, regions, hydroelectric companies, waterway administrations to NGOs). The Network of Danube River Research Institutions should be formed under the framework of the Danube Rectors Conference, CASEE network, ICPDR and include academies of sciences.

Consortium leaders: Austria, Romania, Serbia

Idea and potential lead partner: BOKU, Austria

EXAMPLES OF POTENTIAL universities and research institutions participating in *DREAM* (could be e.g. two per country): to be decided by countries

Germany

- Technical University of Munich
- Federal Waterways Engineering and Research Institute (BAW)
- ...?

Austria

- BOKU-University of Natural Resources and Life Sciences Vienna
- Austrian Federal Agency for Water Management
- ...?

Slovakia

- Slovak Academy of Sciences
- Slovak University of Technology in Bratislava, Water Research Institute Bratislava
- ...?

Hungary

- VITUKI
- Budapest University of Technology and Economics
- ...?

Serbia

- University of Novi Sad
- Jaroslav Černi Institute
- ...?

Croatia

- University of Zagreb
- University of Osijek
- ...?

Romania

- Universitatea "Dunărea de Jos" din Galați



- Technical University of Bucharest
- ...?

Bulgaria

- University of Architecture, Civil Engineering and Geodesy (Sofia)
- ... ?

Moldova

- Technical University of Moldova
- ...?

Ukraine

- National University of Kyiv
- ...?

Czech Republic

- Brno University of Technology
- ... ?

Slovenia

- University of Ljubljana
- ...?

Bosnia

- University of Sarajevo
- ...?

Timeline

- 2012:** Submission of a proposal to Danube Strategy (Jan), structural funds etc. (Apr), general planning for infrastructure (May-Dec), formation of the network of Danube River Research Institutions (Sep-Nov)
- 2013:** Start of Danube River Research Institutions network (Jul), purchase of equipment for field work, simulation tools (Apr-Oct), detailed planning and legal permits for lab infrastructure (Jan-Dec) and research vessel / diving shaft (Jan-Dec)
- 2014-2015:** Implementation of lab infrastructure and research vessel / diving shaft (Jan-Dec), operation of cluster/network of river engineering simulation tools, network of field study sites along the Danube River, network of Danube River Research Institutions (Jan-Dec)
- 2015:** Begin of operation of infrastructure (Dec)

TOTAL COSTS (2012-2015)

Activities	Description	Costs	Outcome
Act. 1	Construction of two large hydraulic and environmental engineering laboratories		
	Upper and Middle Danube Responsible River Modelling Centers (perfect location could be in Vienna, regarding free flowing 5 m³ s ⁻¹)	19.8 Mio €	Two large hydraulic and environmental engineering laboratories: large discharge (5 m³s ⁻¹), free flowing water supply
	Personnel costs for planning coordination	0.5 Mio €	
	Lower Danube Responsible River Modelling Centers (perfect location could be in the middle stretch of the lower Danube in Romania regarding free flowing 5 m³ s ⁻¹)	19.8 Mio €	
	Personnel costs for planning coordination	0.5 Mio €	
Act. 2	Formation of a cluster/network of river engineering simulation tools		
	a) Hardware (Cluster of 10 Servers)	1.7 Mio €	Hardware implemented in various research institutions in each targeted country and organisation
	b) Software development and acquisition	1.1 Mio €	
	c) Personnel costs	1.9 Mio €	One staff per organisation for three years (PostDoc)*
Act. 3	Establishment of a network of field study sites		
	a) Measurement devices	2.3 Mio €	Measurement devices (ADCPs, sediment samplers, GPS...)** One person per organisation for three years (PhD level)*
	b) Personnel costs	1.5 Mio €	
Act. 4	Construction and operation of a research vessel with diving shaft and labs		
	a) Construction of a research vessel with diving shaft and labs	16.5 Mio €	Research vessel with diving shaft ** Operation of vessel and homebase in a first step
	b) Operation of research vessel with diving shaft and labs	2.1 Mio €	
Act. 5	Establishment of a network of Danube River Research Institutions (Personnel costs)	1.9 Mio €	One staff per organisation for three years (PostDoc level)
	Total Costs	69.6 Mio €	

* two organisations per riparian state (2*10) and one org. per tributary country (1*3)

** costs are based on the Carl Straat in Germany

*** for each organisation (2*10 riparian state, 1*3 tributary country)