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DIAnet international school proceedings 2013

Interdisciplinary Methods
for the Sustainable Development
of the Danube Region

Gorizia 13th-22nd April 2013

edited by
Stefano Brumat and Diana Frausin

EUT

The objective of the School is to offer a unique opportunity for young researchers from different countries and different fields of study to engage with the sustainability challenges of the Danube River Basin through an interdisciplinary perspective. The outcome of their practical work in the 2013 edition is represented by six project proposals, which form the core of these proceedings, accompanied by the presentations of Prof. Verena Winiwarter of the Alpen-Adria Universität Klagenfurt at the opening ceremony, and of Giorgio Perini (Member of the Italian Permanent Representation to the European Union) and Prof. Claudio Zaccaria of the University of Trieste at the closing ceremony. With foreword by Prof. Sergio Paoletti, the then Acting Rector of the University of Trieste, and Prof. Loredana Panariti, the current Minister of the Regional Executive of Friuli Venezia Giulia. The DIAnet International School is an activity of Danube:Future – *A sustainable future for the Danube river basin as a challenge for interdisciplinary humanities*, a Flagship project of EUSDR PA7 – Knowledge Society.

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Flagship project of the Priority Area 7 of the EU Strategy for the Danube region

DANUBE REGION strategy
Knowledge Society

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Foreword

The innovative and future-oriented perspective of the DIAnet International School and the positive results achieved by the participants during the first edition certainly deserved to be collected in the form of proceedings. Hopefully, they will be a useful tool for anyone interested not only in the topics of the school, *i.e.* the Sustainable Development of the Danube River Basin, but also in the interdisciplinary methods applied, or in the process of drawing up project proposals in relation to the funding system of the European Union.

The context in which the DIAnet International School was conceived is that of close cooperation between two large international university organisations: the Alps-Adriatic Rectors' Conference (AARC) and the Danube Rectors' Conference (DRC). The AARC is certainly among the oldest transnational organisation between universities in Europe, and it worked very efficiently even and in particular at the stage before the fall of the Berlin Wall. Its recent endorsement of joint projects in cooperation with the DRC, shows the firm intention of European institutions and organisations to continue along the same line, overcoming the socio-economic borders that still divide instead of unite, and putting culture and research at the service of society and integration. The active involvement of the European Union through its funding system and its macroregional strategies is giving stimulus and direction to this desire for cooperation and cross-border activity shown by the European university system at large, and its organisational structures such as AARC and DRC in particular.

The Danube:Future project is one of those joint AARC-DRC projects that have been recently endorsed and it operates in the framework of the EU Danube Strategy. Its aim is to provide "A sustainable future for the Danube river basin as a challenge for interdisciplinary humanities", which will be achieved through three successive phases. The DIAnet International School

aims at implementing one of the actions of the Capacity-building module of the Danube:Future Project, through capacity building, network creation and the analysis of national precursor studies. The context in which the DIAnet International School and the Danube:Future Project operate is one of ambitious goals set in a cradle of deep-rooted problems and difficulties which need to be overcome in order to allow the harmonious development of the region both in socio-economic and environmental terms. The aim of a sustainable future for the Danube region in fact, cannot be achieved without an interdisciplinary perspective which takes into account the various aspects and developments at different levels which have affected and still affect the area and the peoples who share its territory and natural resources.

The Danube River Basin (DRB) is a large geographic area in the heart of Europe, shared by many countries, and consequently divided by many borders. The Danube itself as long been seen as a natural border between different countries, peoples, languages and histories, in a region that has been very dynamic all through history and not only in the recent past. The legacies of this rich and eventful history are still to be seen and felt along this remarkable European river basin, not only in socio-economic terms, but also from an environmental perspective. In order to overcome the intricate and multifaceted problems created and left by these longstanding legacies, an interdisciplinary approach is essential to understand the natural and environmental developments through a socio-economic and historical perspective. The DIAnet International School wants to offer and develop the interdisciplinary methods which are necessary to analyse the DRB situation and come to feasible solutions and proposals.

The almost twenty different countries that share the territory and natural resources of the DRB have different social, linguistic, economic and historical backgrounds, still strongly and intensely felt, also considering that the Iron Curtain ran through the DRB until as recently as 1990, dividing the Danube region and the European continent for over four decades not merely in political, but also economic, social and environmental terms. Yet we believe that the same diversity that has so long affected its potentialities can become a resource to overcome the problems and shape a sustainable future. The coordinators, teachers and participants of the DIAnet International School come in fact from different universities, regions and countries . Such a diversity is a precious asset of the School and is a key factor for the development of project proposals which are meant to be implemented in different countries of the DRB, and must therefore meet their specific needs and release their unique potentialities.

The universities have a central role to play in the process of European integration and in shaping a sustainable future for the territory of the many countries and peoples who share its resources and fate. The DRB poses to our society many questions and challenges, at various levels: social, economic, political, legal, environmental, etc. The intricacy of the situation of the region, the legacies of the past, the environmental problems and the need for an harmonious economic and social development call for an attentive and coordinated approach, which the university system can best offer, thanks to the first-rate expertise which it can provide, and the long-term and all-comprehensive perspective with which it can tackle the difficult situation with a clear vision of wellbeing and sustainability for the future generations in mind.

In particular, universities can prove to be an excellent driving force for positive change because they can provide skills and expertise from the most diverse fields of knowledge and research, which together can come up with ideas and solutions that otherwise would simply be unthinkable, and provide connectivity to such diversity. Interdisciplinarity is in fact a key factor in today's world because society at large - and sensible policy makers in particular – rightly demand that all aspects of life and wellbeing be considered when tackling single problems, and that future sustainability be seen as a priority in public management and socio-economic development. The most innovative aspect of the DIAnet International School is its interdisciplinary approach which goes as far as bringing together expertise from fields that would usually never meet – from natural sciences to the humanities, giving the latter a leading role which interdisciplinary research usually reserves to natural, applied or formal sciences.

Yet interdisciplinarity is not the only benefit that the university system can offer. Longstanding cooperation between universities of different countries can now find a favourable ground in the social and political integration that the evolution and enlargement of the European Union and the fall of the Berlin Wall have brought and are still bringing to our continent. The drive to cross-border and cross-culture exchanges, which is an innate aspect of higher education, can prove to be a major factor of positive change. However, political support and adequate financial tools are to be provided to the high learning community, in order to bring together the best expertise from various countries with their baggage of unique experiences and distinctive perspectives, allowing them to work together in innovative and creative ways to find new and better solutions to long-standing and complex problems.

The University of Trieste, thanks to its position at the North-East border of Italy, has always looked at the neighbouring countries and their universities

as its natural partners in projects and activities of study and research, and good and far-looking leaderships have managed to turn this intrinsic characteristic into a driving force towards even greater cooperation in ambitious and innovative projects. The DIAnet International School is one of those projects and since its very first edition it has proven to be a promising activity and a fruitful meeting ground for the talented young expertise coming from many motivated universities that share with us the same willingness and energy towards cross-border and macro-regional cooperation and innovative research methodologies and undertakings.

In the years I served as the vice-Rector at the University of Trieste I was deeply and personally involved in the process of approach between the AARC and the DRC, and at the same time I could follow the process of approval of the DIAnet International School with the subsequent launch of the first edition. This personal viewpoint allowed me to see and appreciate the work and contribution of many people involved at different levels. But all practical work and tangible achievements could not be reached if the ideas that first conceived the DIAnet International School had not been allowed to develop and become actions. The DIAnet International School in fact owes its very existence to the farsighted leadership of the then Rector of the University of Trieste, Professor Francesco Peroni, who with his vision and guidance shaped the preconditions which were necessary for all following events to take place.

The University of Trieste could not have implemented any such ambitious project without the substantial support of the Autonomous Region Friuli Venezia Giulia (FVG). The significant financial funding awarded by the FVG Region through the European Social Fund (ESF) has been essential to the DIAnet project and its many actions, of which the DIAnet International School is only one example. The practical and political support we have enjoyed has been just as essential: it allowed us to launch this ambitious project in a very short time, thanks to the active and personal involvement of the many people who work for the FVG Regional authority, and make it an open and encouraging institution, willing to take a pro-active role in the socio-economic and research/higher-education realities of the FVG territory and a leading role in cross-border and interregional cooperation.

It was my pleasure and honour to work along many different people and institutions to conceive the DIAnet International School and bring it to life, as it was my pleasure and honour to personally see this project take shape and to support its actual development and first implementation in the first edition of 2013. The results and implications of the DIAnet International School will be actualised and can therefore be appreciated only in the years to come, yet the

project proposals developed by the participants in this first edition and collected in these proceedings, can offer a fascinating glimpse on the potential that interdisciplinary methods can release by bringing together young and promising expertise from different countries and different fields and giving them the tools to work together for a shared and sustainable future.

Trieste, 20th July 2013

Prof. Sergio Paoletti
Acting Rector of the University of Trieste

Foreword

As Minister of the Regional Executive of the Autonomous Region Friuli Venezia Giulia (FVG) in charge of Education and Research, it is a pleasure to support novel and significant initiatives in the field of university post-graduate education. I believe it is a good practice for local and regional authorities to support such projects both financially and politically.

The FVG Region has long been active in promoting knowledge and research through direct and close cooperation with the three regional universities (University of Trieste, University of Udine and SISSA – International School for Advanced Studies) and the research centres of FVG, a networked system of knowledge-sharing and model of cooperation, already successfully tested.

The European Social Fund (ESF) is an essential and strategic tool to foster productivity and competitiveness, and Education and Research are pivotal for the whole socio-economic structure and development of the territory. In this context the DIAnet International School is an interesting initiative because it promotes scientific and educational cooperation, for and among young people coming from different European regions, overcoming any usual regional geographic limit.

The transnational scope of the DIAnet International School, and in particular its connection with the EU Strategy for the Danube Region, is important for the FVG Region, because this innovative project is consistent with the Region's geo-political perspectives projected towards the Danube macro-region, where Friuli Venezia Giulia plays an important role thanks to its geographical position and cultural heritage.

We therefore welcome these initiatives, and particularly this first edition of the DIAnet International School, a project supported by the FVG Region with the European Social Fund, and we wish the next editions to be equally successful, so that the results achieved by this project can be of strategic relevance and offer a vision beyond the limits of the university and research system and beyond the same geographic borders of the FVG region.

Trieste, 8th October 2013

Prof. Loredana Panariti
FVG Regional Minister
for Employment, Training, Education,
Equal Opportunities, Youth and Research

Introduction

The objective of this publication is to collect and disseminate the proceedings of the first edition of the DIAnet International School which was held in Gorizia, Italy, between 13th and 22nd April 2013. The core is made up by the works produced by the participants in the School that are basically project proposals along the lines of the Danube:Future project, which is closely related to the DIAnet International School as the following paragraphs will try to explain. Before and around the School participants' efforts and results, are the contribution and involvement of many people and institutions, on which this introduction wants to shed a light, thus defining the perspective and context within which the DIAnet International School has been conceived and shaped, and the scope and objectives that drive and direct its development.

The University of Trieste is a member institution of the Alps-Adriatic Rectors' Conference (AARC) and of the Danube Rectors' Conference (DRC). In the academic year 2010/11, when the Chair was held by the University of Trieste, the AARC brought on a strong synergic action towards the EU Commission thanks to the close collaboration with the DRC. A joint letter by the then Chairperson of the AARC, Professor Francesco Peroni of the University of Trieste, and by the then President of the DRC, Professor Vladimir Vesković of the University of Novi Sad, was addressed to Mr Johannes Hahn, EU Commissioner for Regional Policy, and endorsed a joint activity of the two Rectors' Conferences which led to the possibility of having a trans-national cooperation between the universities of the Conferences within the European Danube Strategy. The Agreement between AARC and DRC to develop joint projects was formalised and approved by the EU Commission in the "Action Plan" document of the EU Strategy for the Danube Region (EUSDR), specifically in the Priority Area 7 – *Knowledge Society.*

Although Italy is not included in the EUSDR, the Autonomous Region Friuli Venezia Giulia (FVG) – because of its geographical inclusion in the Danube River

Basin through the presence of the affluent Slizza, and its strategic position on the border with Slovenia and Austria – has *de facto* entered the EUSDR through the Regional University System. A thorough cooperation activity between the universities and the FVG Region, has resulted in the project DIAnet – *Danube Initiative and Alps-Adriatic Network*. DIAnet aims at promoting and developing interregional and transnational agreements to activate cooperation paths and networks within the environment of the Alps Adriatic Rectors' Conference and Danube Rector's Conference – a clear example of territorial cooperation between neighbouring regions. The DIAnet project and all its actions, among which is the DIAnet International School, would have not been possible without the valuable leadership and significant financial support provided by the regional government of the FVG Autonomous Region through the European Social Fund (ESF).

The leaders of the DIAnet project are four institutions of the FVG Region: the University of Trieste, the University of Udine, SISSA (International School for Advanced Studies of Trieste), and Area Science Park of Trieste. The first three institutions promote the mobility of young researchers to and from the FVG Region, whereas the latter organises a series of seminars devoted not to scientists and researchers, but to universities' administrations and staff, to help them establish joint projects and to teach them how to manage the available EU Funds. The DIAnet International School is instead a capacity-building School targeted at PhD Students and Post-Doc research fellows, and is only one of the DIAnet actions promoted and implemented by the University of Trieste.

The DIAnet International School is part of the DIAnet project but at the same time implements one of the actions of the Capacity-building module of the project Danube:Future – *A Sustainable Future for the Danube River Basin as a Challenge for Interdisciplinary Humanities*, led by Professor Verena Winiwarter of the Alpen-Adria-Universität (AAU) Klagenfurt, with the collaboration of Dr Gertrud Haidvogl of the University of Natural Resources and Life Sciences (BOKU) Vienna, both also actively involved in the organisation of the DIAnet International School. Danube:Future is the first of the AARC-DRC joint projects to have been launched, and was unanimously elected for the "Label Priority Area 7 Flagship Project" at the last meeting of the EUSDR PA7 Steering Group on 24th September 2013. Consequently the DIAnet International School too has become an integral part of the EUSDR. The School participants are young researchers coming from the AARC-DRC Network universities, these two Conferences having a territorial extension that goes from the upper part of the Adriatic, across the Alps, and encompassing the whole of the Danube Basin. The DIAnet International School is scheduled to have three editions. The 2013 edition was the first one, organised by Professor Claudio Zaccaria of the University of Trieste as the School Director, and two other editions will take place in 2014 and 2015.

The town of Gorizia is the ideal setting for the DIAnet International School. It has an outstanding modern facility (the Gorizia Conference Centre) capable of hosting major international events like this, and it lies at the heart of Europe where Romance, Germanic and Slavic languages meet, split by a border that runs through it and through its history, a border that has long separated but is now becoming the emblem of European cross-border unity and integration. The DIAnet International School is financed mainly through the ESF but has also received a financial contribution by the Carigo Bank Foundation of Gorizia, because of the School's relation to the territorial, cultural and economic scope of the town of Gorizia. Gorizia is therefore the perfect venue for the DIAnet International School for its practical and symbolic relevance to the School's organisation, methods and topics.

The project proposals made by the School participants are the actual and tangible results of the 2013 edition and the most objective proof of how the tools and funds provided by the EU, through the leadership and coordination of local institutions, and the passionate work and involvement of many people at different levels, can be used to achieve substantial improvements for the society at large. The commitment of the EU to the development and implementation of macroregional strategies, such as the Danube Initiative, shows how the major challenges for the future of our continent can only be met by a joint effort between countries, institutions and peoples, a vision that will be better expressed in the words of Mr Giorgio Perini, currently member of the Italian Permanent Representation to the European Union, who actively monitored the EUSDR approval procedure from the very beginning, and was present at the closing ceremony of the 2013 DIAnet International School.

The ambitions that drive this project rest on the capable shoulders and inspiring vision of many people and institutions, which this introduction hopefully introduced and clarified even if only briefly and sketchily. The following pages will provide more detailed and comprehensive information about the DIAnet International School, the innovative perspective that this project wants to offer and its relevance in the context of European development and integration. Yet the core of these proceedings is made up by the project proposals developed by the School participants, young researchers coming from different fields, different universities and different countries, and working together to turn the insights and methods offered to them by the School teachers and coordinators, into feasible project solutions for a sustainable future of the Danube River Basin.

Stefano Brumat and Diana Frausin
The DIAnet Staff

The 2013 DIAnet International School, its aims and principles against the background of the sustainability challenges of the Danube River Basin

This overview is a slightly amended transcript of the presentation delivered at the opening of the DIAnet School[1]. It addresses sustainability challenges with particular reference to the Danube River Basin and links them to the school's aims and outcomes.

1. THE DIANET SCHOOL – AIMS, PROCESSES, OUTCOMES

We have identified three aims for your work over the coming days. Before I go into details, let me briefly remark that the hours on the schedule are the minimum deemed necessary for completing the assignments; this is an advanced course, we count on your initiative, interest and active involvement. After completing your assignments, you should have gained basic knowledge of several methods useful for research on the Sustainable Development (SD) of

1 I would like to thank Diana Frausin for the meticulous work of transcribing the tape of my presentation.

the Danube River Basin (DRB); you should have gained insights into the work of an interdisciplinary (ID) group and learned to tackle the pitfalls of ID communication (there are quite a few such pitfalls); and your group should have co-developed and presented a paper on one particular challenge for the SD of the DRB, analysing its links to other such challenges. This paper should be conceived as part of a potential application to a granting agency. Working at these tasks, you will gain experience and skills useful and necessary in sustainability research.

You have already been assigned to a working group according to your area of disciplinary training. The groups were put together to ensure the utmost level of interdisciplinary. You will soon find out to which group you have been assigned and with your working group you will identify the subjects and appropriate methods that you as a group most want to pursue together. Next Monday you will present a 15-minute version of your paper. Your papers are, as I said, to be written as research proposals. If any one of them is really good there is no reason why you should not take it to one of the governments, funding agencies or other potential sources of funding after the school – you as a group will jointly hold the intellectual property right on your idea.

Now let me explain how you will work. Your working group will identify the themes you most want to work on together after this introduction. You will receive an outline for the paper to be produced. Each day, you will add information from excursions, lectures and discussions to the outline and do extra reading to fill it in. On Monday, April 22nd, you will present a 15 minute version of your paper (as a group).

Altogether, you will deliver a 5-10- page paper consisting of four parts:

1. Present your theme (How and Why is your theme a sustainability challenge for the DRB?)
2. Which research/ which scholars are needed to tackle it and for what are they needed (data, processes, approaches…)?
3. Which methods do you envisage necessary for solving the problem and why?
4. Give a concrete example of how your theme connects to another sustainability issue of the DRB.

2. SUSTAINABLE DEVELOPMENT (SD) IN THE DANUBE RIVER BASIN (DRB)

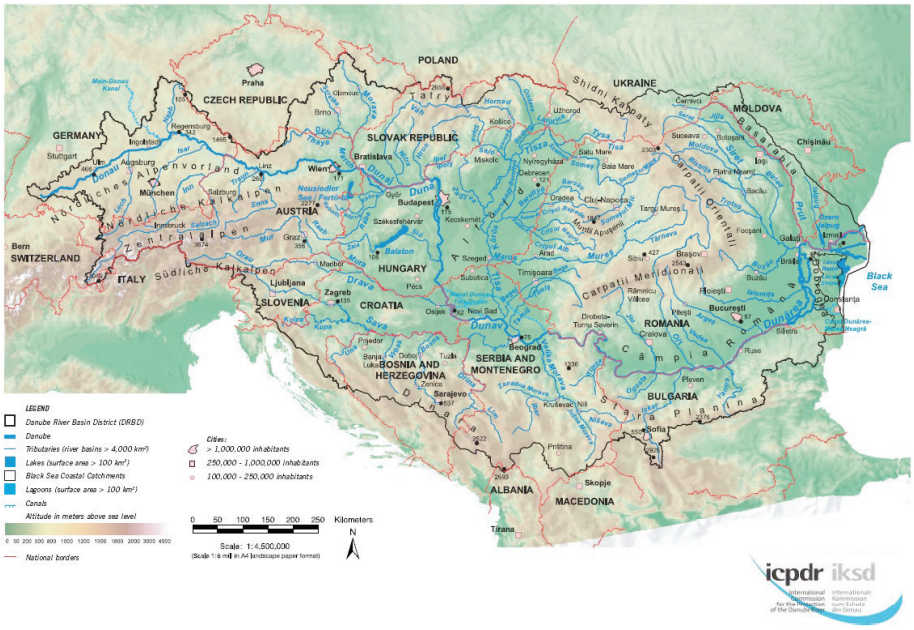

Figure 1:
Map of Danube Basin by ICPDR all maps © ICPDR, see http://www.icpdr.org/main/Special features of the Danube Region

The Danube River Basin (DRB) is a very complex geographical area, shared by 19 countries and 81 million people, with an extension of ca. 800.000 km^2. The length of the Danube River cannot be known with precision, it is about 2,780 km long, up to 1.5 km wide, and up to 8 meters deep (see Fig. 1). The countries that share the territory of the Danube River Basin can have a large portion of the DRB within their borders, or just a very small percentage. Hungary lies entirely inside the DRB, and countries such as Romania, Austria and Slovakia also lie largely, over 95% of their territory, inside the DRB. On the contrary, Poland and Albania have only 0.1% and 0.01% of their territory belonging to the DRB respectively. The graph of Figure 2 shows the different percentages for each country of the DRB.

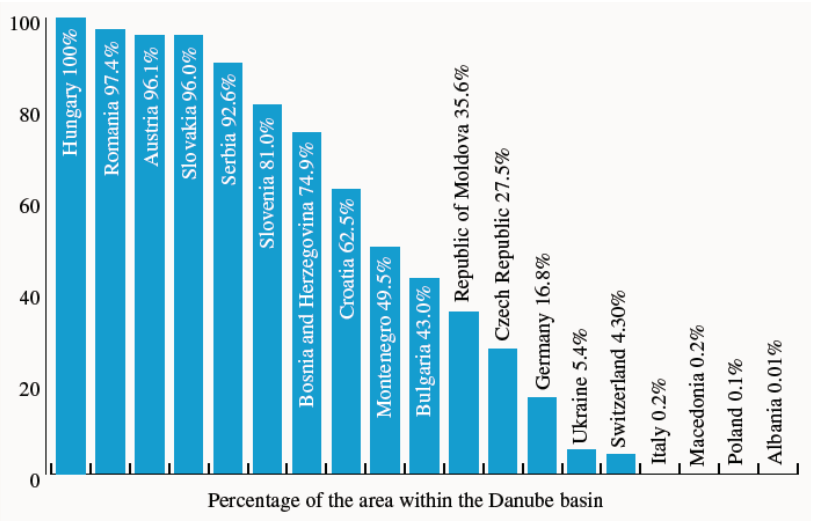

Figure 2:
Percentage of territory within the DRB for all ICPDR member countries[2]

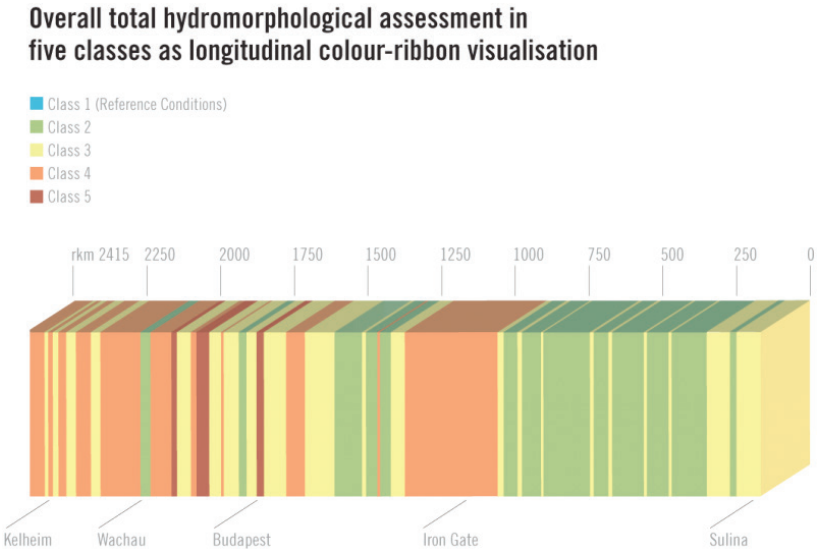

Figure 3:
The Joint Danube Survey 2 results of 2007/8: Nowhere does the Danube exhibit reference conditions[3]

2 http://www.icpdr.org/main/danube-basin/countries-danube-river-basin
3 http://www.icpdr.org/jds/final_results/hydromorphology

The legendary "Blue Danube" is anything but blue. As can be seen in the graph below (Fig. 3)[4], which shows a colour-ribbon visualisation of the river from its source to the delta, the blue colour is missing. This is a clear sign of the unsustainable development which is characterising the DRB at the moment, and indicates that action towards sustainable development in the region is necessary and no longer deferrable.

The River is called differently by the people who live along its course. In Hungarian it is called Duna, in Romanian Dunăre, in German Donau, in Slovakian Dunajin, in Serbian Dunav (Дунав), and so forth. In the DRB, 81 million people communicate through 20 different languages, at least 17 of which are official national languages. Parts of these populations speak other languages of the Danube basin as their mother tongue. This is due to the eventful history of the Danube basin and is an important common feature of all countries of the Danube basin. It is important to realize that a communication challenge in the DRB exists, which needs to be met and overcome in order to allow shared decisions and policies which are essential if we really want the DRB to enjoy a sustainable development.

The European Community in 1994 came up with the idea of joint action and created the Danube River Protection Convention. The body entrusted with taking care of the execution of the Convention, ICPDR (International Commission for the Protection of the Danube River) was founded in 1998 with the following goals: safeguard the Danube's Water resources for future generations; achieve naturally balanced waters free from excess nutrients; eliminate risk from toxic chemicals; enable healthy and sustainable river systems; and seek ways to make floods damage-free. The latter is very important because many people live in flood plains. For the DIAnet School we suggest your groups take up these goals as the core of your project works.

Figure 4 shows the area of the DRB with a dot for each river and habitat interruption by a dam, or any kind of construction in the river. Every red dot in this map is a construction that interrupts the natural flow of water and fish passage, every red dot signifies an obstacle to species movement. Many such obstacles are present in the upper basin. Let me mention e.g. two power plants which provide sustainable energy from hydropower but which also interrupt the natural flow of the river and the free movement of species. There are no easy solutions to these problems.

4 http://www.icpdr.org/jds/files/page/graph_p16_hymo_large.png

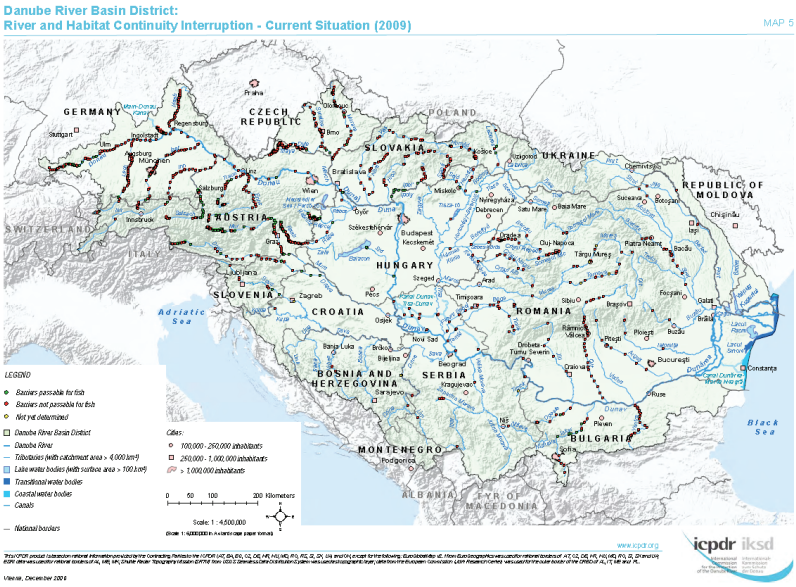

Figure 4:
Obstacles in the Danube and its tributaries, depicted is the situation in 2009 [5]

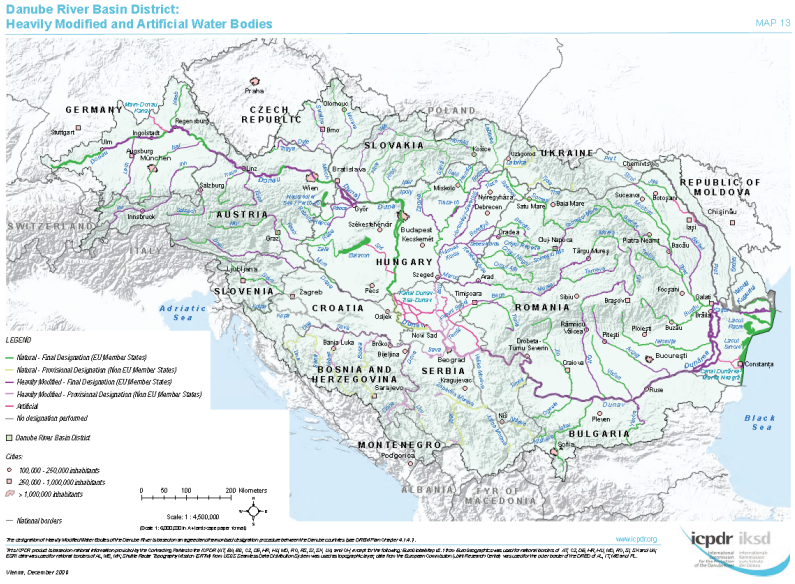

Figure 5:
Artificial water bodies (mainly canals) in the DRB as of 2009[6]

5 http://www.icpdr.org/main/sites/default/files/DRBMPmap05_ContInterr2009.pdf
6 http://www.icpdr.org/main/sites/default/files/DRBMPmap13_HMWB.pdf

Figure 5 shows the presence of heavily modified and artificial water bodies in the Danube River. One of these is the Rhein-Main-Donau-Kanal which links two different river systems and consequently two ecological systems, a situation potentially creating havoc among species. Some of these modified or artificial river bodies have been modified in the distant past. Such artificial water bodies are not necessarily a problem, but we have to realise that if we want to work for the sustainable development of the DRB, we must take into account that the course of the Danube River has been heavily modified.

Many things with a bearing on sustainable development have happened in the basin. Let me start with the more recent past, the year 2000. You might remember the cyanide spill in Baia Mare, and later in Baia Borsa, in January and March 2000. On the evening of January 30th, 2000, a tailings pond burst at a facility near the city of Baia Mare, Romania, which was reprocessing old mining tailings and re-depositing the waste sludge into a new tailings pond. This led to approximately 100,000 m^3 of waste water containing up to 120 tonnes of cyanide and heavy metals being released into the Lapus River, then travelling downstream into the Somes and Tisza rivers into Hungary before entering the Danube. On March 10th, 2000, another tailings dam burst in Baia Borsa in the same region close to the Ukrainian border. While some of this material was retained within the dam complex, 20,000 tonnes of sediments were released into the Novat River, a tributary of the Viseu and Tisza rivers.[7]

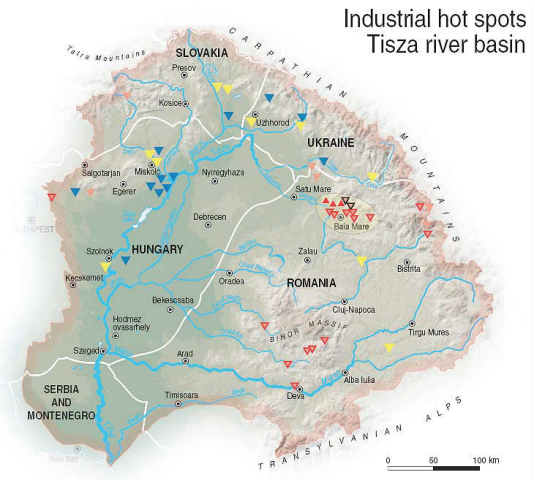

Figure 6:
Hotspots of industry in the River Basin of the Danube's largest tributary [8]

7 http://reliefweb.int/report/hungary/report-international-task-force-assessing-baia-mare-accident
8 http://www.grida.no/publications/et/ep3/page/2589.aspx

As Figure 6 shows, there are many industrial hot spots in the Tisza river basin. Baia Mare is a region of particularly intensive industrial development and this led to a lot of incidents. Scientists have therefore studied the environmental legacies in the area.

The graphs of Figure 7 come from such a publication. The upper series of maps shows the heavy metal concentrations in surface river water, the lower shows the same concentration in river sediment:

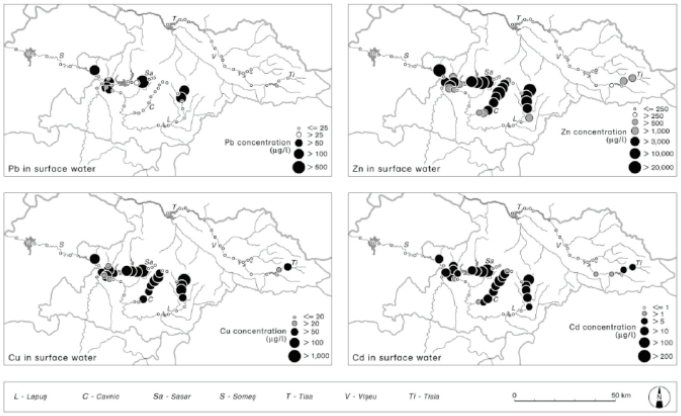

Fig. 2. Surface river water concentrations of Pb, Zn, Cu and Cd in Maramureş County. Shaded proportional circles show where concentrations fall either below (white) or above (grey) EC target values, or where they exceed (black) EC imperative values for drinking water abstraction.

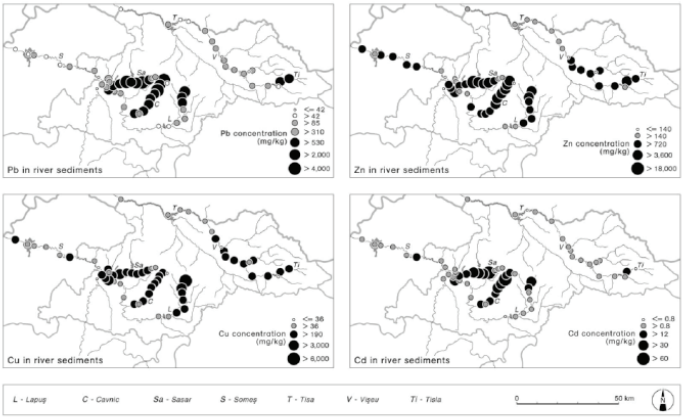

Fig. 4. River sediment concentrations of Pb, Zn, Cu and Cd in Maramureş County. Shaded proportional circles show where concentrations fall either below (white) or above (grey) Dutch target values, or where they exceed (black) Dutch intervention values for soil remediation.

Figure 7:
Heavy metal pollution in river water and sediment in the Tisza basin (from Macklin et al, 2003)[9]

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9 Macklin MG, Brewer PA, Balteanu D, Coulthard TJ, Driga B, Howard AJ, Zaharia S. The long term fate and environmental significance of contaminant metals released by the January and March 2000 mining tailings dam failures in Maramures County, upper Tisa Basin, Romania. Applied Geochemistry, 2003, 18/2, 241-257.

The occurrence of pollutants in sediment is strange and unexpected; it means that the concentrations of heavy metals are long-standing. As dangerous as spills might be, the environmental problems of the area have not arisen in recent years. The authors sum up their findings: "Indeed, more widespread contamination is clearly arising from ongoing mining activity in the Cavnic, upper Lapus¸ Sasar and Tisla catchments. While not downplaying the short term ecological effects of the spills, they should be seen more as compounding much longer term problems associated with many decades of poorly regulated, and largely untreated, industrial, mining and urban discharges into local rivers." (p 256).

What can be learned from the Baia Mare spill and the astounding results of this study? Legacies of past practices determine the river development today. You have to think about such legacies when you talk about SD. The contamination is stuck in the sediment. If you move it, you release the pollutants into the environment. It is easy to stipulate that pollution should be stopped. But the victims should not be blamed as villains. People do not pollute for fun, they pollute because economic considerations make this a viable option. Sustainable development has to take this into consideration.

CONFLICT AS A SUSTAINABILITY PROBLEM

Peace or war make a difference in terms of sustainable development. People in the Danube region fought for centuries and have left all kinds of legacies, but the sustainability problems created by the most recent conflicts are the most dangerous. The UNEP has a database for post-conflict environmental reports[10]. In the report on the Kosovo war, the infamous depleted uranium penetrators are depicted. The uranium is not used because it is radioactive, but because it is a heavy metal, and because it is so heavy, penetrates very well. But this issue, which received widespread media coverage is not the major problem of the legacy of the Kosovo war.

The legacies of the recent war in the Balkans are varied. A bombed oil storage facility in Bor, a destroyed oil tank at Novi Sad point to the pollution legacies of the war, one of the sustainability challenges that we face is to overcome the legacy of war. This is a task for the humanities, a task for the social sciences, it cannot be solved by natural sciences. As long as nations fight

10 The UNEP report on the Kosovo war (UNEP/UNCHS. The Kosovo Conflict Consequences for the Environment & Human Settlements, 1999.) can be found at: http://postconflict.unep.ch/publications.php?prog=kosovo.

against each other, sustainable development will be compromised. Each war creates new legacies not just of pollutants and destruction, but also of conflict and trauma which have to be overcome.

But back to the pollution issues. Pančevo has become famous for 250 tonnes of liquid ammonia spilled into the Danube during the war. UNEP reports about this incident: "As a preventive measure, about 250 tonnes of liquid ammonia were released into the open canal from the fertiliser plant by site managers fearful that a direct air strike on stored ammonia could kill large numbers of people. This release was probably responsible for fish kills reported in the Danube, up to 30 km downstream. Fertiliser production prior to the air strikes had been accelerated in order to minimise the quantity of ammonia in storage." So, site managers had done every possible thing to keep the damage small – but had to decide between risk for people or damage to the environment. In the water of the Danube, due to the Balkan war, a lot of extra pollution was found, again in the wording of the report: "Serious leakages of 1,2-dichlorethane (EDC) and mercury; burning of vinyl chloride monomer (VCM) to form dioxins; burning of 80,000 tonnes of oil & oil products releasing sulphur dioxide and other noxious gases; high concentrations of EDC found in water of canal running into the Danube; high concentrations of mercury and petroleum products in the canal sediments." Even more important are the social insights that UNEP formulates in conclusion. "Social, economic and administrative disruption are likely to cause an increase of pressure on natural resources, both within and outside protected areas (e.g. increased use of wood for cooking and heating, due to loss of electricity supplies). Tourism, and the income it generates will also be reduced, though, it should be recalled that development of skiing infrastructure in Kopaonik had been reported as a conservation problem. Experience from reconstruction activities in other Balkan countries shows that future reconstruction in Yugoslavia will place heavy demands on raw materials (e.g. gravel, rock, wood products, water). The Federal authorities responsible for telecommunications facilities within protected areas formerly paid rent to the protected area concerned (though reportedly not for facilities located in Montenegro). The future of these financial contributions is unclear." (UNEP Kosovo Final report, p 68)

I would in conclusion quote one sentence from the UN report which points to the political ramifications of the Kosovo [and any other] war: "**An unhealthy and dangerously polluted environment does not provide a sound basis for the well-being of human populations or for business and trade**. However, the implementation of the recommendations will not only depend on the availability of funds; political concerns related to the international embargo of Serbia will also have to be taken into account." (UNEP, 1999: 72)

War and the havoc it wreaks are not a pleasant subject to talk about, but there is an important point to learn: if you don't confront the past, it will haunt you. But, on the other hand, if you confront the past, it turns into a unique learning opportunity. With this knowledge, we can try to prevent wars and their environmental legacies from happening again.

The larger point that I am making here is that democracy itself needs sustainable development. But we can also turn this sentence around: sustainable development needs democracy. In an ecologically degraded world, long-term economic development is impossible and social unrest will increase.

The politicians and administrators of Europe – in reaction to future challenges, but also in reaction to the legacies of war, have developed the frameworks within which the further, sustainable development of the Union is to be fostered. In the following passage, we will quickly review the most important ones.

THE EU STRATEGY FOR THE DANUBE REGION

One of the reasons why the European Union designed the Danube Strategy might have been that the Danube River Basin history poses a very unique challenge of the Danube River Basin, a history of turbulence, violence and nationalism. This is very much in line with Horizon 2020, the new framework program for research and innovation, because its aim is to build a better society.

The Horizon 2020 website starts with the following text:

> **Tackling Societal Challenges**
> Horizon 2020 reflects the policy priorities of the Europe 2020 strategy and addresses major concerns shared by citizens in Europe and elsewhere. A challenge-based approach will bring together resources and knowledge across different fields, technologies and disciplines, including social sciences and the humanities. This will cover activities from research to market with a new focus on innovation-related activities, such as piloting, demonstration, test-beds, and support for public procurement and market uptake. It will include establishing links with the activities of the European Innovation Partnerships (EIP).[11]
> Horizon 2020 is operationalizing this aim by focussing on several challenges, these challenges are:
> • Health, demographic change and wellbeing;
> • Food security, sustainable agriculture, marine and maritime research, and the bio-economy;
> • Secure, clean and efficient energy;
> • Smart, green and integrated transport;
> • Inclusive, innovative and secure societies;
> • Climate action, resource efficiency and raw materials.

11 Horizon 2020: http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=better-society (last accessed on 24/10/2013); EUROPE 2020: http://ec.europa.eu/europe2020/index_en.htm.

Horizon 2020, it can be inferred, is about sustainable development of the EU without using the word. But what about the regional aspect of this development? In 2009 the European Council formally asked the European Commission to prepare a EU Strategy for the Danube Region. Commissioner Danuta Hübner on the open day in October 2008 made the importance of this macro-regional strategy abundantly clear: "The importance of the Danube Basin for the EU cannot be underestimated. Our policies and the investments we are making in the Basin through the EU's cohesion policy in particular have an impact on the livelihoods of 20 million citizens. The Danube needs a specific strategy comparable to the strategy we are developing for the Baltic Sea Region. A one-size-fits all approach doesn't work in an EU of 27 Member States and 271 regions. We need a targeted policy for the Danube that meets its ecological, transport and socio-economic needs[12],"The Danube Strategy 2010 was developed in the months following this proclamation.

EUSDR – DANUBE STRATEGY 2010

"The EU Strategy for the Danube Region (EUSDR) is a macro-regional strategy adopted by the European Commission in December 2010 and endorsed by the European Council in 2011. The Strategy was jointly developed by the Commission, together with the Danube Region countries and stakeholders, in order to address common challenges together. So it is based on a bottom-up approach, not a top-down approach. The Strategy seeks to create synergies and coordination between existing policies and initiatives taking place across the Danube Region. The Danube Region Strategy will serve the goal of increasing prosperity, security and peace for the peoples living there, especially through enhancing cross-border, trans-regional and trans-national cooperation and coordination" (Danube Strategy, 2010). The Strategy is about people, and this is why you are here. It is also about the future; the future is for you and the future is also your responsibility. The DIAnet School invites you to take the Danube Strategy seriously: think and work in cross-border, in trans-regional and in trans-national cooperation and coordination. Therefore the groups that have been put together are not just as interdisciplinary as possible but also as international as possible.

How is the Danube Strategy designed? Like other macro-regional strategies, EUSDR is not about new money or new institutions, the aim is to create synergies by fostering co-operation, bundled into certain priority areas. The

12 http://europa.eu/rapid/press-release_IP-08-1461_en.htm

strategy consists of 4 pillars divided into 11 priority areas. The 4 pillars are depicted in Figure 8: connecting the region, protecting the environment, building prosperity and strengthening the region.

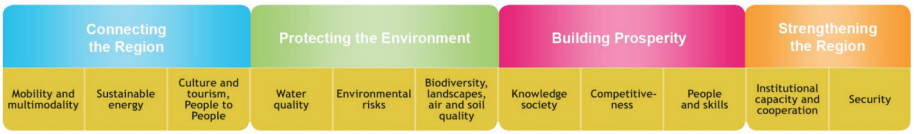

Figure 8:
The organization of the Danube Strategy (http://files.groupspaces.com/EUStrategyfortheDanubeRegion/files/163255/Presentation+EUSDR.ppsx)

Let us now explicitly pursue the connections between sustainable development, the Horizon 2020 goals and the Danube Strategy. Figure 9 depicts the magic triangle as it is known in the sustainability literature, Figure 10 maps the Horizon 2020 challenges onto it, and Figure 11 depicts the EUSDR Pillars in connection with the triangle, while Figure 12 links the Horizon 2020 challenges directly to the Danube Basin.

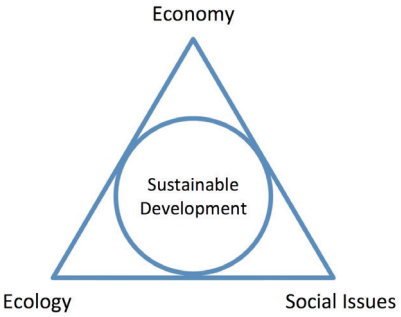

Figure 9:
"The magic triangle" of sustainability [publishes in numerous publications, e.g. Wilkens, 2007][13]

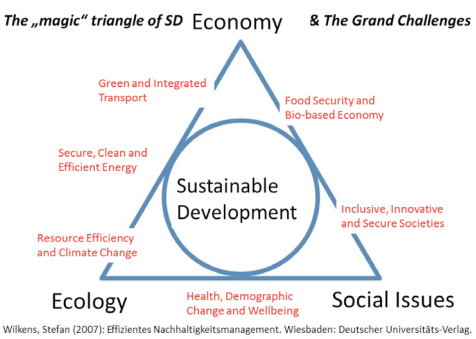

Figure 10:
Horizon 2020 and the magic triangle of sustainable development (Source: V.Winiwarter, 2013)

13 Wilkens S. Effizientes Nachhaltigkeitsmanagement, 2007. Wiesbaden: Deutscher Universitäts-Verlag.

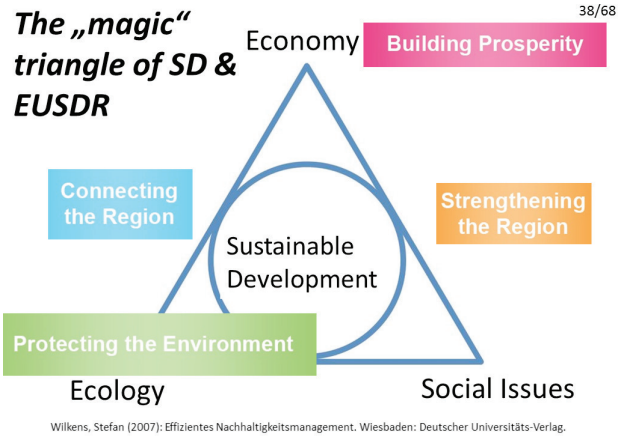

Figure 11:
EUSDR's pillars and the sustainability triangle (Source: V.Winiwarter, 2013)

The mapping exercise should not be seen as a mere intellectual play. It is important to identify where funding opportunities for research can be generated, but above all it is important to link one's own interests with those of a wider public as represented by the EU politicians.

The Horizon 2020 challenges can be further mapped onto the challenges identified by ICPDR for the Danube River Basin. These are:

- Safeguarding the Danube's Water resources for future generation
- Naturally balanced waters free from excess nutrients, which means agricultural reform
- No more risk from toxic chemicals, which means industrial reform and sustainability in the industrial sector
- Healthy and sustainable river systems, which means nature conservation
- Damage-free floods, which I don't think is a goal that can be achieved, but we can do a lot of things to protect ourselves against floods. One of the things is to let the river move in a retention space large enough to absorb a flood. But this means not to build near the river – contrary to what currently happens.

If one cross-links the EU challenges to those of the Danube River Basin, the size of the challenge to move the Danube River Basin socio-ecological system towards a more sustainable future becomes immediately visible:

Figure 12:
The Horizon 2020 challenges (vertical) liked to the challenges identified for the Danube Basin by ICPDR

Challenge/ICPDR priority	Long-Term Water Resource protection	Stopping eutrophication	Stopping toxic chemical releases	Healthy and sustainable River systems	Flood risk mitigation
Green and Integrated Transport	x			x	x
Secure, Clean and Efficient Energy				x	x
Food Security and Bio-based Economy	x	x	x	x	
Health, Demographic Change and Wellbeing		x	x		x
Inclusive, Innovative and Secure Societies	x	x	x	x	x
Resource Efficiency and Climate Change	x	x	x	x	x

3. LONG-TERM-SOCIO-ECOLOGICAL-APPROACHES TO SUSTAINABLE DEVELOPMENT

While sustainability studies offer a wide range of approaches, I would like to particularly emphasize the importance of long-term socio-ecological approaches to sustainable development. Why do I suggest this? Because we are dealing with an integrating approach to the management of a river basin, and what has been called "Integrated River Basin Management" at the moment does not work very well. IRBM has been defined as a process „which promotes the coordinated development and management of water, land and

related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" [14] But there is a gap between theory and practice. Authors such as Varis, Ramahan and Stucki bemoan the hiatus between international recommendations and reality in large international river basins, and are concerned about the evolution of the quality of recommendations, which does not seem substantial[15]. McDonnell concludes that new approaches are needed which take on board important research findings emanating from fields such as social theory and geographical information science (GIS science). This is encouraging news for those who believe in the study of coupled socio-natural systems, but a historical perspective does not rank high on the agenda of the author. For McDonnell, historical data are solely used to characterize the baseline conditions of the area[16]. Braga mentions the historical context in which the planning process is situated, but does not go into any historical depth in describing the antecedents influencing the planning process[17]. Varis et al. give a very brief sketch of climate history in their case study on the Senegal River Basin, but, more interestingly, they hold that "River basins are the cradles of mankind, and each basin has its own age-old and recent history. The former is a mix of cultural, ethnic, political and other factors and the latter includes institutional arrangements and governance characteristics, locally, nationally and internationally. They all influence the implementation of IWRM [Integrated Water Resource Management, V.W.][18]."

This situation can be improved if long-term socio-ecological research (LTSER) is used. My argument is also that you need to study the historical legacies because they influence the current situation. But what are and to what benefit does one undertake "Long-Term Socio-Ecological Studies"?[19] The authors of a conceptual paper concluded that sustainability-oriented long-term

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14 Braga BPF , Lotufo JG. Integrated River Basin Plan in Practice: The São Francisco River Basin. International Journal of Water Resources Development, 2008, 24(1), 37-60. Here 37.

15 Varis O, Rahaman MM, Stucki V. The Rocky Road from Integrated Plans to Implementation: Lessons Learned from the Mekong and Senegal River Basins. International Journal of Water Resources Development, 2008, 24(1), 103-121.

16 McDonnell RA. Challenges for Integrated Water Resources Management: How Do We Provide the Knowledge to Support Truly Integrated Thinking?. International Journal of Water Resources Development, 2008, 24(1), 131-143.

17 Braga & Lotufo, 2008:40.

18 Varis et al, 2008: 117.

19 Haberl H, Winiwarter V, Andersson K, Ayres RU, Boone C, Castillo A, Cunfer G, Fischer-Kowalski M, Freudenburg WR, Furman E, Kaufmann R, Krausmann F, Langthaler E, Lotze-Campen H, Mirtl M, Redman CL, Reenberg A, Wardell A, Warr B, Zechmeister H. From LTER to LTSER: conceptualizing the socioeconomic dimension of long-term socioecological research. Ecology and Society, 2006, 11(2), 13. [online] URL: http://www.ecologyandsociety.org/vol11/iss2/art13/.

research made it necessary to link biophysical processes to governance and communication and to consider patterns and processes across several spatial and temporal scales. The authors were aware of the "difficulties of combining data from in-situ measurements with statistical data, cadastral surveys, and soft knowledge from the humanities". This group, like McDonnell, stresses the importance of including pre-fossil fuel system baseline data but they also discuss a methodical challenge they perceived as the „often delicate balance between monitoring and predictive or explanatory modeling." As an interdisciplinary group, they found it „challenging to organize a continuous process of cross-fertilization between rich descriptive and causal-analytic local case studies and theory/modeling-oriented generalizations." Their conceptual framework comprises research into socio-ecological metabolism, studies of land use and landscapes, governance and decision making, as well as studies of communication and knowledge in a transdisciplinary framework. Ideally, all these themes would be studied in an integrated fashion. Haberl et al make clear that "the ecological and social legacies of institutional and jurisprudential models introduced in the past" have to be studied, because „the current situation is dependent on our material and immaterial inheritance".

If one searches the internet for 'toxic legacies', signs warning trespassers to stay out of a polluted area or water can be found in large numbers.[20] Legacies abound and influence the choices we have, so it is necessary to know them before developing ideas for the future of an area. And I suggest that you look at two things: at the system of the river and at the "human factor" in it and understand them as an intertwined whole. This whole is called a "socio-natural site".

Socio-natural Sites consist of material arrangements, which are guided by cultural programs and, though material, are not "natural". They are constantly re-constructed by means of practices, actions of humans, which require, though guided by ideas, practical, physical interaction with the material of the arrangements. Arrangements can only be kept in working condition if labour is applied. Socio-natural Sites result from PRACTICES. Their material precipitates are ARRANGEMENTS. Socio-natural sites are composites (nexuses) of arrangements and practices[21].

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20 Look, e.g. at: http://indiancountrytodaymedianetwork.com/2013/09/02/americas-chernobyl-results-uranium-mining-great-plains-151091 ; http://plpnemweb.ucdavis.edu/nemaplex/images/Pollution%20warning.JPG ; http://poopy.org/water-pollution/polluted-beaches-california/; http://friendsofcortemaderacreek.org/new_site/creek-care-2/pollution-in-our-creeks/.

21 Winiwarter V, Schmid M, Hohensinner S, Haidvogl G. The Environmental History of the Danube River Basin as an Issue of Long-Term Socio-ecological Research. In: Singh SJ, Haberl H, Chertow M, Mirtl M, Schmid M (Eds.), Long Term Socio-Ecological Research. Studies in

If we look at a river for the material side of the socio-natural site, typical arrangements on the river are fortified river banks, weirs, harbours, but also power plants in the river, bridges and bathing beaches. The realm of possible human practices is determined by those arrangements already there (socio-ecological inheritance). This inheritance has a bearing on the practices: if you already have a power plant there, it is impossible to build a bathing beach or a harbour at the same site.

If we look at the Danube watershed, we can look at changes in arrangements and at changes in practices and then we can study what the driving forces of change are, in particular, we can explore history-policy links. A well-known concept trying to link driving forces with the state of the environment is the DPSIR Framework: DPSIR is an acronym built from: Driver, Pressure, State, Impact and Response. The framework was first developed by OECD and has been adopted by EEA, the European Environmental Agency. It is an interesting sustainability question what the driving forces of change are, how they impact nature and what a societal response to this impact could be[22].

But one should not equate chance with deliberate action. Socio-natural sites change all the time. Life is thermodynamically highly improbable. To continue living, living beings need exergy. Human beings create via their practices arrangements from the material world to harvest exergy. These arrangements deteriorate due to wear and tear. All arrangements are part of the evolutionary setting of humankind, either because of (evolving) humans taking part in them, or because of other living beings which evolve being part of them. The higher the extent of exergy which needs to be controlled in an arrangement, the more likely is its deterioration, and therefore, the more likely is the production of potentially harmful legacies and their long-lasting effects[23].

When we conduct research in the Danube River Basin, we work in a world of hybrids. Older ARRANGEMENTS (such as rectification works) influence younger ones. This changes the realm of possible actions for humans. This means that older arrangements influence the practices of humans today. We call these influences **socio-ecological legacies**. It is particularly important to take note of the irreversibility of interventions.

We are doing research in a world of hybrids, not nature, not culture. Older arrangements influence younger ones, and this changes the realm of possible actions for humans. You cannot simply turn the power plant off after you have

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Society-Nature: Interactions Across Spatial and Temporal Scales (Series: Human-Environment Interactions, Vol. 2), Dordrecht (u.a.) 2013, 103-122.

22 http://root-devel.ew.eea.europa.eu/ia2dec/knowledge_base/Frameworks/doc101182 has a graphic representation and short explanation.

23 See Winiwarter et al, 2013 (see Footnote 20)

built it and pretend nothing has happened. There have been changes which cannot be undone.

How can this conceptual framework be translated into research questions? We can ask how certain practices via material arrangements shape fish population distributions, change sediment characteristics, influence access to clean water for rural communities, lead to social conflict between actors and create long-lasting legacies (e.g. power plants).

Figure 13:
Arrangements and their Legacies (© Winiwarter and Schmid, 2013)

Characteristics	Arrangements with short-lived legacies	Arrangements with stable, long-lived legacies	Arrangements with transformative legacies
Type of Legacy	Benign	Problematic	Wicked
Longevity of Legacy	Short	Middle	Long (indefinitely)
Maintenance requirements	Low	Middle	High
Energy expenditure centred on	Production	Production and Maintenance	Maintenance
Exergy harvest density	Low	Middle	High
Transformative Potential (Impact on practices)	Local, Sectorial	Local, Regional, Sectorial (1 or several)	Societal, global

Arrangements can be sorted into categories according to the more or less dangerous legacies they create. My colleague Martin Schmid and I have developed the following tripartite scheme shown in Figure 13. We suggest that Legacies can be benign, problematic, and wicked. Wicked arrangements have a very long lasting legacy, basically indefinitely long. What does indefinitely long mean? The half-life of plutonium is 24,000 years. So, after 24,000 years there is still half of the plutonium there. Plutonium is a dangerous heavy metal, not just radioactive, but very poisonous. It therefore creates very wicked lega-

cies. The longer the legacy, the more wicked it potentially is. And the more energy society needs to invest not for building an arrangement, but for maintaining it and for dealing with its legacies, the more wicked it should be considered. More effort goes into coping with this legacy than into the original cause, because it is so long-lasting and so difficult to deal with. Viewed from such a perspective, we gain fresh insight into what sustainability is all about: sustainability, it can be postulated, is about avoiding to produce too many wicked legacies, because taking care of them all the time limits the options and choices you have to a very high degree, and if you have created too many, you have no freedom of action left. Figure 13 gives an overview of the types of legacies and their power to transform society. Wicked legacies, because they bind society to deal with them over very long periods, transform society. A society having created an atomic legacy has to protect it from proliferating, and one can clearly see how this transforms society, e.g. when looking at the international politics towards Iran or Pakistan.

For sustainability studies, it is important to understand that transformations, both those occurring thermodynamically or by biological evolution and those we bring about, not stability, characterises the present situation. In such a situation no single discipline has the key to success. We have to work together.

4. THE ROLE OF INTERDISCIPLINARY AND TRANSDISCIPLINARY METHODS FOR SUSTAINABILITY RESEARCH IN THE DRB

We also have to bring actors from outside the academic system into our teams. We should never assume that as academics, we are by virtue smarter than the people out there. In fact, the "people out there", actors in the life-world, know a lot of their problems, not a lot "more" than we do, but they know different aspects of the problem. Scholarly expertise is needed, but cannot substitute local knowledge. The basis of such interaction on the field of sustainability is an interdisciplinary approach as detailed in Figure 14.

Only against the backdrop of history can the present be understood and a sustainable future planned. It is important to value traditional ecological knowledge (TEK) and not dismiss it on the unfounded hyppthesis that people in the past were dumb. One has to see that they were confronted with different rationales and different possibilities and hence, reacted differently. In the post-fossil world, many of their insights will gain new relevance as they were produced in the pre-fossil age.

Figure 14:
Scholarly knowledge needed for planning sustainable futures:

- Reconstruction of the state of arrangements over time
- using natural science methods
- using the methods of the humanities
- extract status data from historical sources

AND

- reconstruct the practices of humans, their perceptions, value systems and decision making rationales at a given time and place

The notion of sustainable development itself has a history, which is closely intertwined with the new notion that people should not be researched upon, but with. In a report prepared for the first ever UN conference on the environment (5th-6th June 1972, Stockholm: United Nations Conference on the Human Environment), which stands at the beginning of the sustainability sciences, Barbara Ward and Rene Dubos described the rationale for giving a new role to lay people. "Since policies concerning the human environment require both social judgment and specialized scientific knowledge, perceptive and informed laymen can often contribute as much as technical experts to their formulation. In certain cases, indeed, laymen may be wiser judges than experts because their overall view of the complexity of human and environmental problems is not distorted by the parochialism which commonly results from technical specialization."[24] Ward, Dubos, 1972, xvii.

That is the rationale for working in a transdisciplinary way. Interdisciplinary work, which is about crossing the communicative boundaries between disciplines, is in many ways not only necessary when working on sustainability issues, but also a good preparation for the communicative challenges of transdisciplinary work. Working on a specific place and on a specific problem is not enough to secure integration of a team. It is very helpful to devise tools of integration consciously when setting up a project. Figure 15 shows the main requirements of integrative concepts.

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24 Ward B, Dubos R. Only one Earth: The Care and Maintenance of a Small Planet, 1972. An unofficial report commissioned by the Secretary-General of the United Nations Conference on the Human Environment, prepared with the assistance of a 152-member committee of corresponding consultants in 58 countries.

Figure 15:
Requirements for an integrative concept

- The concept should …
- … be open for quantitative and qualitative information
- … allow the representation of entities, ideas, and events, along with their properties and relations, according to a system of interdisciplinary categories
- … be independent of scale, if you work on the micro- or on the macro-level
- … NOT be based on key concept of ONE discipline, possibly a fair intellectual work, otherwise we end up fighting against each other
- … have the ability to connect with stakeholders, a requirement of particular relevance and a big challenge

Integration of a project is one of the greatest challenges in interdisciplinary research. Partners need to agree on the desirable levels of integration, there is no premium on a maximum of integration. Each discipline has a wonderful reservoir of very important things to bring in and it is not the best way to try to become an 'interdiscipline'. It is necessary to work with defined (rather than assumed) connections, otherwise integration will remain loose. It is of great importance to devote attention to the interfaces, to the communication process and a good idea to have an experienced communicator in a project with the sole role to develop meeting designs and oversee the communication process. Integration cannot be achieved by technical tools, but it can be greatly aided this way. There are many tools for technical integration out there, One of them are GIS (Geographic Information Systems). They are of particular importance in sustainability research, because they allow to integrate a diversity of spatially explicit data into a common research framework. Some of the basic functions of a GIS are listed in Figure 16.

Figure 16:
Basic GIS functions

- data acquisition and pre-processing
- data base management and retrieval
- spatial measurement and analysis
- graphic output and visualization

The last function is important for effective communication with stakeholders. A 250-page report with footnote 670 containing the most important result will not suffice. Spatially explicit data on maps are often a good way to reach people and GIS is very powerful to create such maps.

This presentation has hopefully given you an overview of the issues at hand and the challenges of interdisciplinary and transdisciplinary work needed to address them. Interdisciplinary co-operation cannot be learned from lectures or books, one has to experience it, but it can be prepared by anticipating the challenges, for which the material presented should be a basis.

Gorizia, 13rd April 2013
2013 DIAnet International School – Opening Ceremony

Prof. Verena Winiwarter
Leader of 2013 DIAnet International School

Project Proposals

The participants in the 2013 DIAnet International School were divided into 6 Workgroups.
Each Workgroup conceived and drew up a Project Proposal on the basis of the Interdisciplinary Methods learned and drawing from the field-specific knowledge of each participant.

Workgroup A
BioBricks
The Fate and Effects of Sewage Sludge-Based Bricks on Human Health and Water Resource Quality

ABSTRACT

The overall project goal is to prevent water pollution in the River Basin of the Danube's stretch crossing Croatia, Serbia and Hungary, coming from the use of sewage sludge-based bricks in house construction, which despite representing a solution to the ever increasing problem of waste management and determining a reduction of the clay needed for construction, may pose environmental and health dangers if not properly used, due to leaching of toxic substances and heavy metals into the waters. The project aims at creating a comprehensive database on SSBB environmental and health effects; developing a guideline for SSBB manufacturers on standardised SSBB production, and increasing the awareness and knowledge of manufacturers and consumers on possible negative effects and the proper handling/use of SSBBs.

KEYWORDS

sewage sludge-based bricks
waste management
toxic leaching
database

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GLOBAL CHALLENGE CONSIDERED

Inclusive, Innovative and Secure Societies

DANUBE RIVER BASIN CHALLENGE CONSIDERED

No more risk from toxic chemicals
Healthy and sustainable river systems

BACKGROUND INFORMATION

PROBLEM DEFINITION

The production of sewage sludge-based bricks (SSBB) represents a solution to the ever increasing problem of waste management, but if treated improperly this innovative technology may pose harmful environmental and health effects.

On the one hand, the use of sewage sludge for brick manufacturing will reduce the amount of waste and will reduce the amount of clay needed for brick production.

On another hand, the use of sewage sludge-based bricks (further on – SSBB) may pose negative externalities on the environment and the people. The presence of heavy metals in the sludge may be a problem in case a construction is made without a facade that serves as a protective shield against the rain and prevents heavy metals from leaching. In that case the leaching of toxic substances into the waters of the Danube River Basin can cause negative effects on the aquatic flora, fauna, and the human health.

The application of dewatered sewage sludge for production of bricks started on a commercial scale in mid 80s, with the sludge content in manufactured bricks ranging from 10 % to 80 %. According to manufacturers these bricks satisfy all technical requirements but there are still contradictory data regarding the safety of SSBB, especially if they are not properly protected.

The supply side – production of sewage sludge-based bricks should comply with the technical requirements and environmental and health safety norms; on the demand side, the people using SSBB for private or commercial construction, should be aware of the rules of proper handling of these bricks and be stimulated to apply them.

PROJECT LINK TO THE DANUBE RIVER BASIN SUSTAINABILITY CHALLENGE

The Danube river basin represents the foundation of the Black Sea Ecological Network, and as such its sustainable development is of the outmost importance for the social-economic wellbeing and environmentally sound development of the countries forming part of this river basin.

This project will be implemented in the Danube River region of the three selected countries – Croatia/Serbia/Hungary. The project area of the three chosen countries enjoys a protection status, e.g. Special Nature reservation "Gornje Podunavlje" in Serbia; Nature Park "Kopacki Rit" in Croatia; and National Park "Danube-Drava" in Hungary.

The project results and findings, however, can be extended onto the entire Danube region since waste management and water pollution issues are of high relevance for the entire Danube river basin. Specifically, apart from the formal project objectives an extra value-added of this international collaboration will be the dissemination of the project findings onto the Danube river basin, specifically the guidelines on the improved SSBB production technologies, and the creation of an international ecological network that will share data from biomonitoring studies conducted in the Danube River Basin area.

The project will significantly increase the awareness of SSBB producers and consumers on the issues involved in the proper use of these bricks, and it will promote the ecological and sustainable development of the selected parts of the Danube river basin, with a follow-up replication onto the entire Danube region.

The areas of expertise required for the project implementation will be geography, chemistry, biology, toxicology, public health, civil engineering, architecture, ecology, policy, economics and public relations.

PROJECT GOAL AND OBJECTIVES

GOAL

The overall project goal is to prevent water pollution in the Danube River Basin, particularly on the Danube stretch in Croatia/Serbia/Hungary, coming from the use of sewage sludge-based bricks in the house construction.

OBJECTIVES

1. Create a comprehensive database on environmental and health effects of the sewage sludge-based bricks used in the construction of houses in the Danube River Basin on the territory of Croatia/Serbia/Hungary.
2. Develop a guideline for sewage sludge-based brick manufacturers of Croatia/Serbia/Hungary on the standardized sewage sludge-based brick production.
3. Increase by 50% the awareness of the sewage sludge-based brick manufacturers and the residents of Croatia/Serbia/Hungary of the Danube River Basin on the possible negative effects of the sewage sludge-based bricks and their knowledge on the proper handling/use of the sewage sludge-based bricks.

Below are the maps displaying the geographical coverage of the project (taken from the internet):

Figure 1. Maps of the Danube River basin with a focus on the project areas – Croatia (Slavonia area), Serbia (Vojvodina area) and Hungary (Southern area) highlighted by the circle

PROJECT OBJECTIVES IN DETAIL

Objective 1: Create a comprehensive database on environmental and health effects of the sewage sludge-based bricks used in the construction of houses in the Danube River Basin on the territory of Croatia/Serbia/Hungary.

As a result of the project work a database on the temporal and special distribution of SSBB in the area of Croatia, Serbia, and Hungary in the Danube River basin will be developed and regularly updated by the participating project partner institutions. A detailed distribution of the already existing SSBB houses in the area of Croatia (Slavonia area), Serbia (Vojvodina area) and Hungary (Southern area) will be identified and mapped in order to obtain detail information on the usage of this type of bricks for house construction in the villages and cities of the selected area.

The following types of scientific analyses will form part of this database:

1) *A chemical analysis of the SSBB and surrounding surface water, ground water and soil*
   The aim of this type of an analysis is a detailed chemical characterization of the sewage sludge used for brick manufacturing to determine the chemical composition and the bulk elemental concentration of heavy metals present in the sludge.
   In order to determine possible leaching of heavy metals from the bricks they will be exposed to precipitation in control laboratory conditions to determine the amount of heavy metals after the precipitation. To examine a possible contamination of the surrounding surface water, ground water and soil with heavy metals we will collect samples around the houses already built with this type of a material and we will also conduct a biomonitoring study of the watercourses with transplants of the aquatic moss (*Rhynchostegium riparioides* Hedw.). Mosses are excellent bioaccumulators of trace elements and can solve problems like detection limits of instruments as the concentrations of trace elements in water are often below the instrumental limit of detection (LOD) or they rapidly change in space and time, as for example, in case of intermittent pollution sources.

2) *In vivo cyto/genotoxicity study on plant and animal model*
   The aim of this analysis is a detailed cytotoxicity and genotoxicity study on plant and animal model that would be done in vivo on duck weed (*Lemna minor* L.) and fresh mussel (*Unio pictorum*). Fresh mussel is commonly liv-

ing in the Danube River as a bioindicator of exposure since the mussels are filtering harmful substances. Additionally study will be done on zebra fish (*Danio rerio*) model that is widely used as a model in toxicity studies. Zebra fish study will be done on two generation to see the impact on the offspring on blood, liver, gill and gonad cells, and in embryos, larvae, juvenile and adult stage to have the results on developmental toxicology.

3) *In vitro cyto/genotoxicity study on human model*
   Studies will be conducted in vitro on primary human blood cells (human peripheral blood lymphocytes, HPBLs) since those cells are sensitive biomarkers of exposure to toxins.

OBJECTIVE 2: Develop a guideline for sewage sludge-based brick manufacturers of Croatia/Serbia/Hungary on the standardized sewage sludge-based brick production.

The following will feed this objective:

1) *Development of new technologies in SSBB production to reduce the toxic effect of the final product*
   This part aims to develop new purification methods of sewage sludge in order to have a more purified material for brick production. New technologies will be introduced to minimize the leaching of potentially toxic elements. Standards on the raw materials that can be used in the production will be set to be applied on the entire project territory. Specifically, the production of bricks will be optimized taking into account the optimum ratio of sewage sludge and clay material, preparation of raw material, proper brick molding and drying procedures and sintering in order to obtain sustainable bricks with a minimal toxic content.

2) *Legal framework amendment*
   A regulation on the sewage sludge-based brick production for SSBB manufacturers, and a policy on compliance of the SSBB manufacturers and users with the environmental and health safety norms will be developed and proposed to decision-makers.

OBJECTIVE 3: Increase by 50% the awareness of the sewage sludge-based brick manufacturers and the residents of Croatia/Serbia/Hungary of the Danube River Basin on the possible negative effects of the sewage sludge-based bricks and their knowledge on the proper handling/use of the sewage sludge-based bricks.

To achieve this objective the following activities will be carried out:

1) *A baseline awareness survey*
   This study will be carried out to assess the current level of awareness of the sewage sludge-based brick manufacturers and the residents of Croatia/Serbia/Hungary of the Danube River Basin on the possible negative effects of the sewage sludge-based bricks and their knowledge on the proper handling/use of the sewage sludge-based bricks. It will be carried out via structured questionnaires and meetings with stakeholder groups. The survey findings will serve as reference data to evaluate the awareness increase of the project target population at a later stage.

2) *Media coverage*
   Mass media will be involved to ensure the project publicity and visibility among the project target population (SSBB manufacturers, SSBB house owners and potential owners, scientific community) via creation of a project website, regular publications and press-conferences, media field trips).

3) *Scientific community exchange*
   Participation at scientific conferences, organization of scientific workshops and publications in the targeted research papers in environmental, toxicology and civil engineering journals (PubMed, Scopus, Google Scholar)

4) *Educational campaigns*
   Educational events (seminars, workshops, field trips) will be carried out for SSBB manufacturers, constructors and people living in the identified SSBB house areas. Information events will also be carried out at the schools of the project area.

PROJECT MANAGEMENT

The project management will be carried out by a subcontracted agency, that will be responsible for the overall administration and financial transactions of the project; coordination of work among the project partners and implementing institutions-organizations. This agency will carry out an overall supervision and monitoring of the project progress, and will serve as a link among the project partners/ implementing organizations and the funding agency.

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Workgroup B
Green and Integrated Transport on the Danube River
Extending and Enhancing the Existing Motorail (Car Trains) System in the Danube River Basin (Drb)

ABSTRACT

The aim of the project is the enhancement of a greener, innovative and sustainable mobility through the extension of the existing railway system with as little changes as possible and the development of new modes of transport, providing a fast and seamless combination of rail and water transport, followed by short distance travel to the final destination by motorized vehicles or bicycles. This would be achieved through the extension in the Danube River Basin of the motorail system which allows the transport of cars, motorbikes and small trailers, creating an efficient, seamless and low-carbon transport network, thus contributing to the sustainable development of economic competitiveness and growth, of an integrated European single market and of an open and inclusive society, of tourist accessibility to new countries.

KEYWORDS

sustainable mobility
modes of transport
seamless combination
rail and water transport
motorail

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INTRODUCTION

The Danube Region is a functional area defined by its river basin. Geographically it concerns primarily but not exclusively: Germany (Baden-Württemberg and Bavaria), Austria, the Slovak Republic, the Czech Republic, Hungary, Slovenia, Romania and Bulgaria within the EU, and Croatia, Serbia, Bosnia and Herzegovina, Montenegro, the Republic of Moldova and Ukraine (the regions along the Danube) outside. Since the Danube flows into the Black Sea, it should be coherent with Black Sea perspectives. With over 100 million people, and a fifth of EU surface, the area is vital for Europe.

Sustainable mobility can only be achieved through a radical change in the transport system, inspired by breakthroughs in transport research, far-reaching innovation, and a coherent, Europe-wide implementation of greener, safer and smarter transport solutions. This can be achieved by extending the existing railway system with as little changes as possible and developing new modes for seamless transportation. Transport is a major driver of Europe's economic competitiveness and growth. It ensures the mobility of people and goods necessary for an integrated European single market and an open and inclusive society. The existing railway and water system have little contribution for the access of citizens from Eastern Europe to the common labour market. The currently preferred air transport can be challenged only by providing a fast (TGV) and seamless (well-coordinated) combination of rail and water transport, followed by short distance travel to the final destination by motorized vehicles or bicycles.

Transport industry and transport equipment manufacturing together represent 6.3 % of the Union's GDP. Transport is 96 % dependent on fossil fuels. The urban context poses specific challenges to the sustainability of transport.

Accelerating the development and deployment of new technologies and innovative solutions for vehicles, infrastructures and transport management are proposed in the map of the extended network and in the work packages in this project proposal. Union level funding of transport research and innovation will help to focus on activities with a clear European added-value which include lower emissions, ease of connecting remote areas, providing employment opportunities, improving revenues from tourism. Europe-wide, interoperable transport solutions need to be pursued which is why extending and enhancing the existing motorail system is an important matter.

In order to achieve sustainable mobility within the Danube river basin, the upgraded motorail system should fulfil the following:

- Resource efficient transport that respects the environment which could be achieved by switching from fossil fuels to bio fuels, and in general, renewable sources of energy and in that way decrease the amount of CO_2 emissions by using electrically powered rail system which provide a greener way of transport. Also, improving the efficiency of transport by providing more work for the Railway System and Danube River Navigation companies while in the same time relieving the car and motorcycle traffic should be included. This kind of action also lowers the risk of congestions and accidents on the roads. Optimization of the use of infrastructures, by means of intelligent transport systems and smart equipment and increasing the use of demand management and public and non-motorized transport, particularly in urban areas could be achieved by online coordination of a coherent railway-river transport system.

- Better mobility, less congestion, more safety and security which should include innovative solutions for seamless, inclusive, safe, secure and robust transport systems through investments in research, involving new materials and new sources of energy. Also, providing input from research centres, universities and sector-specific organizations could be very useful. Enhancement of inter-modality and the deployment of smart planning and management solutions requires development and implementation of a smart planning systems similar to the ones used for coordination of flights.

- Socio-economic research and forward looking activities for policy making – the main task would be to raise awareness of people through education and marketing (advertisement, series of actions involving lower cost of transportation – government actions). The aim is to support improved policy making which is necessary to promote innovation and meet the challenges raised by transport and the societal needs related to it. The focus of activities shall be to improve the understanding of transport related socioeconomic trends and prospects (which includes training of interested parties and target groups and providing employment opportunities to underdeveloped economic regions) and provide policy makers with evidence-based data and analyses (assured by inclusion of policy (and decision) makers as partners in the project and creating the sense of ownership for the process implementation, thus assuring better chances for success).

The new alternative way of transportation in the Danube river basin shall be a competitor to the currently existing railway and waterway systems, thus fostering a continual strive for improvement.

The experts needed for project realization include civil engineers, ecologists, architects and designers, economists, software developers and marketing managers from all countries participating in the Danube river basin motorail system.

PROBLEM BACKGROUND

Several proposed Commission funding resources will be used to support a new transport system in Europe:

- Horizon 2020, the next framework programme for research and innovation, has a proposed budget of €6.8 billion euros for research and innovation on "smart, green and integrated transport".
- The Connecting Europe Facility (CEF) has a proposed budget of €31.7 billion to modernise Europe's transport infrastructure, build missing links and remove bottlenecks. This includes €10 billion ring-fenced in the Cohesion Fund for transport projects in cohesion countries, with the remaining €21.7 billion available for all Member States.
- The programme for the Competitiveness of Enterprises and Small and Medium-sized Enterprises (COSME) will, among others, help small and medium-sized enterprises to access finance and new markets. Its proposed budget is €2.5 billion.

The initiative launched the European Commission, in the form of a Communication, lists ten different fields of interest for which roadmaps towards deployment will be developed:

1) Clean, efficient, safe, quiet and smart road vehicles
2) Clean, efficient, safe, quiet and smart aircraft
3) Clean, efficient, safe, quiet and smart vessels
4) Clean, efficient, safe, quiet and smart rail vehicles
5) Smart, green, low-maintenance and climate-resilient infrastructure
6) Europe-wide alternative fuel distribution infrastructures
7) **Efficient modal traffic management systems (including capacity and demand management)**
8) **Integrated cross-modal information and management services**
9) Seamless logistics
10) Integrated and innovative urban mobility and transport

As outlined (in bold text font) this project aims to improve the current state of fields of interest 7 and 8. Industry, the public sector and other stakeholders involved in bringing innovative transport technologies and services to the market are invited to participate in further developing and implementing this strategy, for example by agreeing common targets, coordinating development and deployment agenda's, considering the needs for standards and identifying funding implications.

METHODOLOGY

The methodology will include identification of availability of existing railway system, opinion poll among the drivers, and comparison of energy used by trains, impact of activities in environment, biodiversity, measurement and comparison of efficiencies with other transport system.

Organizing of pilot projects to test the speed of trains, improve the train efficiency, finding of alternate routes, solving problems of bottle neck section as part of a railway.

IDEA FORMULATION

Motorails (car trains) are used successfully in the USA between Washington D.C. and Florida, and also in Europe. One can take a ferry or Eurotunnel shuttle across the Channel, as motorail trains cannot use the Channel Tunnel, they start at either Düsseldorf (Germany) or Hertogenbosch (Netherlands) or Paris, but no longer (as of 2010) from Calais.

The specific objective is to achieve a European transport system that is resource efficient, environmentally-friendly, safe and seamless for the benefit of citizens, the economy and society.

WHAT IS MOTORAIL?

Normal passenger trains don't carry cars or motorbikes, just passengers and sometimes bicycles. However, there are special Motorail trains which carry

cars & motorbikes using car transporters attached to the train. They are usually summer-only and usually only once or twice a week. They are run by several operators. Motorail trains carry cars, motorbikes, small trailers & roof boxes, and on many routes you can now take some over-height 4x4 vehicles & people carriers. However, they can't carry big 4X4s, vans, caravans or campers, as these are too high. There are no motorail trains within the UK, these ceased in 1995. Also there are no motorail in the DRB.

WHY USE MOTORAIL?

First, there's the relaxed holiday atmosphere of the motorail experience, avoiding the stress & hassle of airports & flights. Second, it offers door-to-door convenience, taking your own car to the given destination carrying as much luggage as you like. No baggage fees or weight limits, no crowded airports, no expensive airport parking, etc. The journey is part of the holiday. It needn't take much longer than flying, because motorail trains run overnight, it may save a hotel bill or two as well.

The Motorail model is very simple. Ride a train to a given destination is very general and operates well for a long time. Those passengers who want to use the motorail services just simply purchase a motorail ticket, drive their car onto the car carrier and then go to their seat on the train. At the end of the journey they simply drive right off just like it is usual on a river ferry.

The environmental costs of inefficient transportation are growing permanently all around the world. In the United States the transportation sector accounts for approximately one-third of total CO_2 emissions. Transportation is the fastest-growing source of greenhouse gases, accounting for nearly half of the net increase in total U.S. emissions since 1990. To maintain the current transportation structure is simply not sustainable. We need to find innovative ways to make auto travel more efficient, and at the same time, find ways to encourage other means of getting around besides the car[3]. Rail travel is a relatively green mode of transportation. Traveling by train produces three to 10 times less CO_2 compared to road or air transport, according to the UIC, an international railroad organization. The other point is the technology development: beside sustainability the modern railway systems could be much cheaper, more effective and more green than the 'traditional' modes of transportation. The advantages of rail travel are the next:

- Energy consumption
- Carbon emissions
- Efficiency (compared with the single cars)

- Cost (even lower external costs)
- Safety
- Community benefits

EXTENDING THE EXISTING NETWORK TO A CIRCULAR RAILWAY SYSTEM

Thus improving tourist services and accessibility to new countries.

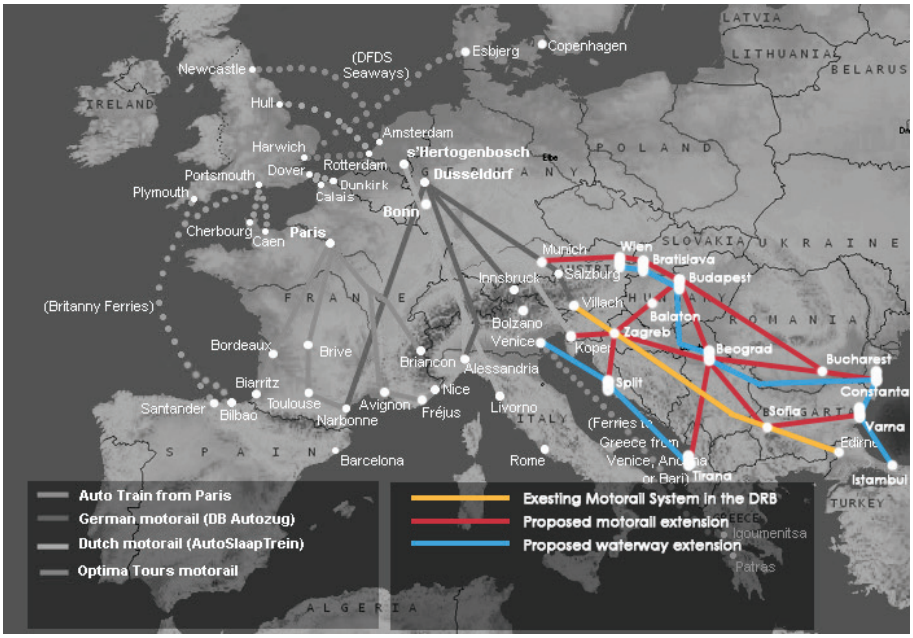

Fig.1 Existing network of railways

TOURIST SERVICES

- Hop on/off
- Mixed service: bike between cities and pick up car in a different railway station (hub)

Enhancing commuting between economic centres and rural areas

Temporary employment: unemployed people will be trained to help people with disabilities to reach their destination, and tourists with organising custom tours and interpreting.

LINKS TO HORIZON2020

The specific objective (4.1) in the 4. chapter of Horizon 2020 (SMART, GREEN AND INTEGRATED TRANSPORT) is to achieve an European transport system that is resource efficient, environmentally-friendly, safe and seamless for the benefit of citizens, the economy and society, parallel with satisfying the growing mobility needs of its citizens with and the and climate resilient economy. *'Despite its growth, the transport sector must achieve a substantial reduction in greenhouse gases and other adverse environmental impacts, and must break its dependency on oil, while maintaining high levels of efficiency and mobility. Sustainable mobility can only be achieved through a radical change in the transport system inspired by breakthroughs in transport research, far-reaching innovation, and a coherent, Europe-wide implementation of greener, safer and smarter transport solutions.'* Extending the existing railway system with as little changes as possible and developing new modes for seamless transportation help to reach these aims. There are great differences within the European Union, but according to the Impact assessment support study on the revision of the institutional framework of the EU railway system[5], in the next years the development of old rail infrastructure in certain parts of the EU is an important priority and policy supported from different funds of the European Union. It is clear that failing to improve the sustainability of transport will result in unacceptably high societal, ecological, and economic costs in the long term.

'The transport sector is a major contributor to greenhouse gases and generates up to a quarter of all emissions. The other important problem of the sector that transport is 96 % dependent on fossil fuels. The existing systems are not yet sufficiently smart; the alternatives for shifting between different modes of transport are not always attractive; road fatalities remain dramatically high at 34 000 per year in the Union; citizens and businesses expect a transport system that is safe and secure.'

'Within a few decades the expected growth rates of transport would drive European traffic into a gridlock and make its economic costs and societal impact unbearable. Passenger-kilometres are predicted to double over the next 40 years and grow twice as fast for air travel. CO2 emissions would grow 35 % by 2050. Congestion costs would increase by about 50 %, to nearly EUR 200 billion annually. The external costs of accidents would increase by about EUR 60 billion compared to 2005'.

'Research and innovation, driven by policy objectives and focused on the key challenges, shall contribute substantially to achieve the Union's targets of limiting global temperature increase to 2ºC, cutting 60 % of CO2 emissions from transport, drastically reduce congestion and accident costs, and virtually eradicating road deaths by 2050'.

'The problems of pollution, congestion, safety and security are common throughout the Union and call for collaborative Europe-wide responses. Accelerating the development and deployment of new technologies and innovative solutions for vehicles infrastructures and transport management will be key to achieve a cleaner and more efficient transport system in the Union; to deliver the results necessary to mitigate climate change and improve resource efficiency; to maintain European leadership on the world markets for transport related products and services.'

'Additionally, the Union level funding of transport research and innovation will complement Member States' activities by focussing on activities with a clear European added-value Lower emissions; ease of connecting remote areas; providing employment opportunities; improving revenues from tourism.'

Project proposal of enhancing and expanding the existing motorail system in the Danube River Basin match European policy objectives and priority areas although this aim covers just a part of the sustainable transportation system challenges of the European Union. This initiative could create a smarter and more integrated transport system will make an important contribution to the Europe 2020 goals of smart, sustainable and inclusive growth and the objectives of the Innovation Union flagship initiative, with connecting the countries, regions and people in Central-Eastern Europe and in the Danube River Basin.

The next SWOT analysis of the project proposal shows the identified internal strengths and weaknesses, and the external opportunities and threats.

STRENGTHS

- Improving the efficiency of transport;
- Lowers the risk of congestions and accidents on the roads;
- Lower greenhouse gas emissions;
- Providing employment opportunities to underdeveloped economic regions;
- Lower highway traffic, improve accessibility;
- Easier mobility for elder generation;
- Easier accessibility of popular tourist destinations;
- More safety, comfort and security;
- Strong links to the different objectives of European development strategies.

WEAKNESSES
- Low level of available resources, low level of available resources of funds;
- Low level of profit, negative effects of market competition;
- Low level of mobility of the target groups in the Danube River Basin;
- Not sufficient cooperation between stakeholders;
- Seasonality of needs;
- Great differences between the state of the railroads and infrastructure.

OPPORTUNITIES
- Resource efficient motorail system that respects more the environment: reduce resource consumption and improve vehicle efficiency;
- Explore and exploit the potential of alternative fuels and innovative and more efficient propulsion systems, including fuel infrastructure;
- Develop smart online coordination of a coherent railway-river transport system.

THREATS
- Lack of interest (stakeholders and potential target groups);
- Market competition of substitute products and services (higher prices, less effective marketing and PR activity, etc.);
- Unchanging costumer behaviours and attitudes;
- Lack of European and local funds.

ADDITIONAL LINKS TO THE DANUBE STRATEGY

According to the Danube Strategy the links between the project proposal and the Strategy are the next:
- There is a need to connect people, their ideas and needs;
- Transport interconnections must be modernised, and informatics access improved;
- Mobility challenges: There is particular need for greater multimodality, better interconnection with other river basins modernising and extending infrastructure in transport nodes such as inland ports;
- Environmental challenges: the environmental impact of transport links, tourist developments, or new energy-producing facilities must also be considered;
- Existing transport and trade links must be developed (Opportunities, 2.2.);
- Better connections among people are also needed, especially through culture and tourism. (Connecting the Danube Region, 3.1.).

In the first stage of implementation the project is focusing on expanding the existing Western-European motorail system seasonally (concentrating to the summer period) to connect the Romanian, Bulgarian and Adriatic Coast with the railway centres of Europe have play already important role in this type of combined transportation. Also, the implementation of vignette system (Danube vignette) into this motorail system would bring the connectivity among countries of the region onto an even higher level.

We have defined the challenges and objectives of our project in the following logic framework matrix:

OVERALL OBJECTIVE
Efficient modal traffic management systems (including capacity and demand management)

PROJECT OBJECTIVE
Extending and enhancing the existing motorail (car trains) system in the Danube river basin (DRB)

INTERMEDIATE RESULTS
WP1 Organization and coordination of partner consortium
WP2 Establishing the current state
WP3 Product design
WP4 Product simulation and testing on a small scale
WP5 Full scale implementation of the product
WP6 Dissemination of the project results

OBJECTIVELY VERIFIABLE INDICATORS SOURCES OF VERIFICATION ASSUMPTIONS & RISKS

Extended Motorail (Car Trains) System in the South-Eastern Sector of the Danube River Basin (Drb) – Statistical Data from Railway and Ships Operators

- On-Site Visits
- Feedback From Customers – Continuing Economic Crisis
- Insufficient Demand of Motivated Customers

WP1 budget; worksheets
WP2 analysis of the current state, permits for operation
WP3 map of planned extension of the existing network

WP4 Analysis of feedback (from customers, operators, operation)
WP5 Report on the implementation of the product
WP6 Publications

- Individual budgets of partners, justification documents; worksheets;
- Analysis/reports;
- Map;
- Publications.
- Exchange rate fluctuation;
- Acts of god.

ACTIVITIES

WP1 Organization and coordination of partner consortium

1.1 Establishing a Technical Committee and Work Groups
1.2 Organize a kick-off meeting
1.3 Define and administrate project monitoring and reporting
1.4 Define communicational and promotional activities
1.5 Define a corporate image of the partnership

WP2 Establishing the current state

2.1 Surveying of stakeholders' and potential customers' opinions/motivation
2.2 Exchanging experience and good practices with Italian and German Motorail operators
2.3 Analysing the state of existing railway stations, trains and infrastructure
2.4 Financial analysis of necessary expenses and potential income and possibilities for fund raising

WP3 Product design

3.1 Analysis of existing motorail systems
3.2 Design of trains for transportation of people, cars, motorbikes and bicycles
3.3 Adaptation of the existing railway infrastructure, including railway tracks, stations, parking facilities, supporting software
3.4 Preliminary pricing and promotion
3.5 Developing training materials
3.6 Translation on the training and promotional activities in the languages of the target countries
3.7 Defining the scope for simulation and testing of the system

WP4 Product simulation and testing on a small scale

- 4.1 Operational planning of simulation and testing activities(S&T)
- 4.2 Implementation of S&T
- 4.3 Analysis of effectiveness and efficiency and providing feedback
- 4.4 Follow-up activities and cost analysis

WP5 Full scale implementation of the product

- 5.1 Final design of trains for transportation of people, cars, motorbikes and bicycles
- 5.2 Maintenance of the railway infrastructure, including railway tracks, stations, parking facilities, supporting software
- 5.3 Pricing and promotion
- 5.4 Training the staff involved

WP6 Dissemination of the project results

- 6.1 Organizing promotional activities (PA)
- 6.2 Carrying out PA
- 6.3 Feedback and dissemination to similar projects

According to the discussions with the other three working groups, we can we make a direct, primary contact with the group E. The possible cooperation is based on the common target of developing a certain types of touristic attractions. Our project can be determined as a mobile intermodal transporting system, which makes connections and shifts from train to car, motorcycle or bicycle. The group E proposed a touristic development of rural areas, but it has to be supported by other tools to make it more sustainable. Our project could help with the accessibility of these rural areas. Both projects can be successful only with well-functioning informational systems. This high-level information system could satisfy the needs of the tourists and could support the comfortable using of the offered services. In this way we can increase the number of available and accessible destinations of the existing motorail system. The other common point could be to install new intermodal stations at the borders of rural areas where cars could be changed for bicycles so rural areas could be reached without using cars: in this case there is no need for motorways.

With the other planned DIANET project proposals can we set up just secondary connections because it is likely that they are geographically wide from the train stations where the planned services offered. In case of realization it could be possible to link these projects with an information system but it would be necessary to know more details which are basically missing in this state of the projects.

STRATEGY FOR PROJECT REALIZATION

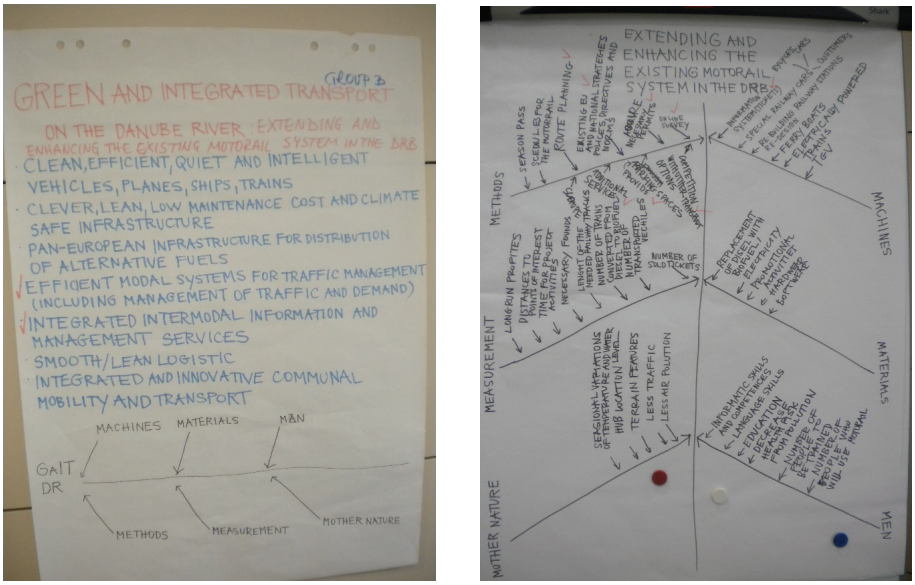

Fig. 2 General idea (left) and a detailed cause and effect diagram for extending and enhancing the existing motorail system in the Danube River Basin

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http://europa.eu/rapid/press-release_IP-12-975_en.htm

Mooney, G. (2010): Making Transportation More Sustainable. http://www.environmentalleader.com/2010/11/10/making-transportation-more-sustainable/

http://www.seat61.com/Motorail.htm

Impact assessment support study on the revision of the institutional framework of the EU railway system with a special consideration to the role of the European Railway Agency25/03/2013 http://ec.europa.eu/transport/modes/rail/index_en.htm

European Union Strategy for Danube Region. http://ec.europa.eu/regional_policy/cooperate/danube/index_en.cfm

ADDITIONAL WEB RESOURCES

http://ec.europa.eu/transport/modes/rail/index_en.htm

http://www.uic.org/spip.php?rubrique1638

http://www.era.europa.eu/Pages/Home.aspx http://www.eurail.com/

http://www.danube-navigation.eu/)and national railway and water transport organizations.

http://ec.europa.eu/commission_2010-2014/kallas/headlines/news/2013/01/doc/com(2013)-25-communication_en.pdf

Workgroup C
Implementing organic food production in the DRB

Organic farming is an agricultural system that seeks to provide you, the consumer, with fresh, tasty and authentic food while respecting natural life-cycle systems
(EU commission – Agriculture and rural development)

ABSTRACT

The aim of the project is a more sustainable agriculture and the re-ruralisation of remote mountainous regions in the Danube River Basin through the strengthening and establishment of organic farms in selected less developed mountainous regions, and through educating the demographically young population of the Danube area to organic farming methods and practices and to the ecological relevance of quality farming. Organic food production implements traditional and indigenous knowledge, fosters a more eco-friendly use of soil and water resources, and allows farmers in market-marginalized areas to rely on local resources and food distribution systems, therefore addressing the challenges of demographic change in mountainous regions by creating local networks and strengthening marketing activities in the selected regions.

KEYWORDS

re-ruralisation
mountainous regions
organic farming
market-marginalized
demographic change
ancient crops

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1. INTRODUCTION

Our overall objective is a more sustainable agriculture in the Danube River Basin. In order to achieve this goal we are proposing to strengthen and establish organic farms in selected less developed mountainous regions in the Danube River Basin. In doing so we will address the Horizon 2020 challenge of food security. Furthermore this project will address the challenge of demographic change in mountainous regions by creating local networks and strengthening marketing activities in the selected regions. Intermediate results of our project will be less polluted soil and water and re-ruralisation of remote mountainous regions.

2. MODERN AGRICULTURE AND ITS DISCONTENTS

A SHORT OVERVIEW OF THE ORIGINS AND SOCIO-ENVIRONMENTAL PROBLEMS OF MODERN FARMING

An overview of the origin of modern agriculture and its problems must begin with the Fertile Crescent and the phenomenon that Gordon Childe named the Neolithic revolution. At the same time, the solution of a contemporary "uneasiness in agriculture" lies in the explanation of the agricultural socio-genesis and the understanding of natural, ecological and social logic of ancient agricultural practices.

First of all, it is important to understand that the emergence of agriculture was not a sudden "revelation", but a time-consuming process that occurred independently in several areas of the world. It is also crucial not to think that hunting and gathering, the subsistence practice that human animals used for hundreds of thousands of years, were inefficient and ineffective. It is wrong to suppose that the hunter-gatherers life was short and hard, and that the emergence of agriculture was the solution for existence of an ancient man. Farmers spend several hours a day at work, and until a few centuries ago (or even a century), their life expectancy was longer than the life span of hunter-gatherers.

Therefore, agriculture in certain regions of the world appeared gradually, from a combination of necessity and favourable conditions for its development. The earliest evidence of domesticated plants is found in certain areas of today's Palestine, Iraq, and Iran, during the period between 9,000 and 7,000 BC. The main

crops that were domesticated were the ancient varieties of wheat, barley and rye. Crops such as emmer and einkorn wheat do not appear to have become domesticated until well into the Neolithic and ancient rice took 3000 years to become domesticated. In other words, it was not until after 9500 BC that the eight so-called founder crops of agriculture appear: first emmer and einkorn wheat, then hulled barley, peas, lentils, bitter vetch, chick peas and flax. The title "inventors of agriculture" usually goes to the Sumerians, starting c. 5500 BC.

The first explanation of an agriculture socio-genesis concerned the assumptions about food production at the oases stimulated by draughts and lack of food reserves. Later ideas add demographic factors into the picture, such as the factors appearing due to the transition towards a productive economy, along with many other socio-ecological factors. Today, most theorists interpret the origins of agriculture as an inevitable response to the crisis in traditional hunter-gatherer economy and the necessity of providing a system of survival in the new ecological situation. It is a situation that is primarily characterized by imbalance between natural resources and human needs. These are the socio-historical messages that are relevant for the challenges in a modern ecological context.

An interesting example concerning these issues comes from the classical antiquity. Roman agriculture built from techniques pioneered by the Sumerians, transmitted to them by subsequent cultures, with a specific emphasis on the cultivation of crops for trade and export. Romans laid the groundwork for the manorial economic system, involving serfdom, which flourished in the Middle Ages. The farm sizes in Rome can be divided into three categories: small farms were from 18-88 iugera (one iugerum is equal to about 0.65 acre), medium-sized farms from 80-500 iugera (singular iugerum), and large estates (called latifundia) that were over 500 iugera.

The Romans had four systems of farm management: direct work by owner and his family; slaves doing work under supervision of slave managers; tenant farming or sharecropping in which the owner and a tenant divide up a farm's produce; and situations in which a farm was leased to a tenant. There was a great deal of commerce between the provinces of the empire, all the regions of the empire became interdependent with one another, some provinces specialized in the production of grain, others in wine and others in olive oil, depending on the soil type.

In the Middle Ages, European agriculture underwent numerous significant changes, such as the improvement of tools (scythe, plough), a new system of crop rotation, an increased usage of advanced ploughs, usage of horses and oxen etc. In this period, much of Europe had low population densities, which suited extensive farming techniques. These were crucial steps towards

agricultural modernization, although the socio-cultural structure around it remained traditional.

Between the 16th and the 19th century, mechanization gradually became more sophisticated. This resulted in unprecedented population growths and ultimately led to Industrial Revolution. Also, the socio-genesis of agriculture was closely tied to the processes of European exploration and colonization in an ever-more globalized world. The agricultural patterns of the world underwent dramatic changes in a process labelled as the Columbian Exchange (exchange of plants and animals between the Old World and the New World).

What were the socio-environmental problems concerning these massive historical events? The agricultural revolution(s) proved to be major turning points in history. First of all, the world experienced its first stable settlements or sedentary communities made by humans. Then, there was a dramatic increase in human populations, which led to a rising demand for different goods and services. In other words, this wide-scale transition of many human cultures from a lifestyle of hunting and gathering to one of agriculture and settlement transformed the small and mobile groups (that had hitherto dominated human history) into sedentary societies living in built-up villages and towns. The food surpluses provided the basis for complex labour diversification, trading economy, administrations and political structures, as well as art, architecture and culture. And, above all, these changes radically modified natural and social environments of humans.

It is often argued and/or thought that agriculture gave humans more control over their food supply, but this was disputed by the findings that nutritional standards of Neolithic populations were generally inferior to hunter-gatherers. Furthermore, the life expectancy of agricultural populations might have been shorter than the hunter-gatherers, probably due to the diseases generated from living in close encounter with domesticated animals. For example, not until the 20th century did the average human height come back to the pre-agricultural levels. Also, it shouldn't be forgotten that food production led to the emergence of powerful social elites that were not engaged in agriculture, but nevertheless dominated their respective societies.

Societies collapse due to the environmental component, which is a too-often and usually neglected scenario in history. In other words, environmental fragility is a crucial input element of societies' (in)stability, while the outputs could be survival or collapse. The main problem concerning this is the failure to adapt to the pressing environmental issues, such as deforestation, soil problems, water management problems, overhunting, overfishing, and effects of introduced species on native species, overpopulation and increased per-capita impact of people.

3. AN OVERVIEW OF POTENTIAL SOLUTION(S)

WITH REFERENCE TO THE SOCIO-POLITICAL POINT OF VIEW

Increasing agricultural production and decreasing agricultural workers, how it happened and how not allow this situation repeat more: an educational approach.

After the Industrial revolution and with the use of more and more sophisticated and improved mechanical and chemical technology and the use of new forms of energy people of Europe solved the problem of feed but modified completely the way of agricultural production, agricultural products, landscapes and above all the philosophy on which the relationship between humans and the environment was based. Agriculture has been transformed from the principal opportunity of livelihood into a business. But soil and agriculture are living things and so they are not able to sustain in extreme business and exploitation logic.

A problem observed is the increase of agricultural production but the systematic and so far irreversible process of decrease in the number of people employed in agriculture, and this is connected to rapid urbanization, ghost villages and the cause of a lot of former farmers unemployed. Mechanical devices and tools replaced the workers. Agricultural politics were just attracted by profit forgetting the ancient smart attention to manage agricultural resources.

Since some years we can observe a sort of reversibility of this phenomena. It is very important to educate new generations and in particular new generations of agricultural workers to have a new relationship with the environment and with the managing of crops. In this way, we will create, with the fundamental help of institutions, a new ecological sensibility. Agricultural workers will produce with a "quality" and not "quantity" mentality. To do this we first have to change mentality suggesting a modern, but in the same time traditional mentality; not only in the agriculture professional schools but just in schools we have to reinstate two fundamental concepts: sustainable production in connection with sustainable consumption. Education is as important as politics because every agricultural worker has to feel the agricultural soil as a living entity to protect and manage. We want to create awareness of a sustainable agriculture and try to do all what is possible to reduce wastes and pollution. In the future agriculture will be a resource compatible with the environmental needs. Emerging countries in the Danube region will serve as a new European think tank.

The Danube River Basin is connecting important European Union new entry counties with others outside the economic community. A lot of them hold

developing economies with huge and not still quantified growing possibilities. We have to plan, promote, boost with economic incentives the integration and collaborations among countries, planning permanent connections and joining the international platform. This pilot project pattern institution could have the possibility to offer an incentive for the stakeholder countries.

New entered countries in the Balkans and in Eastern Europe have a lot of very interesting demographic and economic parameters very important in agriculture. Co-operation is a possibility and above all an opportunity. The economics in these countries are in a new initial phase but the very important consideration is that their economics parameters are often growing unlike the worn out economics of west European countries.

On average they have a young population, so they are rich of people to educate in an ecologic way. The objective could be not just educate new generations but also become the integration an economic benefit changing the situation a lot of them are still taking out of the European decisions maker circuit; that would also increase the sustainable consumption. Danube community countries are open minded and ready to experiment new sustainable politics and international projects, and also to incentive know how interchange. A great "green" container of resources not still developed at top must became in Europe an example of green economy and ecological progress.

4. ORGANIC FOOD PRODUCTION

KEY CONCEPTS AND METHODS

Production of organic food is an approach that involves the production of food in a natural and traditional way, which is in harmony with nature, without using pesticides and chemical means. Organic food is food produced in a way that complies with organic standards set by national governments and international organizations.[1]

Organic agriculture defines a farm as an integrated system of soil, plants, animals and humans and is responsible for the balance of all these elements.[2]

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1 http://www.epa.gov/agriculture/torg.html#Organic Production and Handling Standards (17/04/2013)

2 http://www.zps.si/hrana-in-pijaca/oznacevanje-zivil/ekoloska-zivila-4.html#O ekološkem kmetijstvu in pridelkih (18/04/2013)

Organic farming takes the best of farming methods used in the past and combines them with modern scientific knowledge. It provides long-term benefits to people and the environment.

The goals of organic farming are the maintenance of soil fertility, closed nutrient cycling, protection of natural living resources, minimal environmental impact, the active protection of the environment and biodiversity. Sustainable use of energy and raw materials and also to ensure employment in agriculture.[3]

There are several methods which can be used to improve the quality of the soil and achieve higher productivity, even on less suitable areas for agricultural use. These methods are permaculture, which includes crop rotation and mulching, biodynamic methods and use of organic fertilizers, like green manures and compost.

Permaculture is a holistic approach to landscape design and human culture. It is an attempt to integrate several disciplines, including biology, ecology, geography, agriculture, architecture, appropriate technology, gardening and community building.[4]

Soil fertility is maintained with the use of organic fertilizers (manure, compost and green manures). Compost is organic matter (plant and animal residues) which has been rotted down by the action of bacteria and other organisms, over a period of time. Materials such as leaves, fruit skins and animal manures can be used to make compost. Compost is cheap, easy to make and is a very effective material that can be added to the soil, to improve soil and crop quality.[5]

Green manures, often known as cover crops, are plants which are grown to improve the structure, organic matter content and nutrient content of the soil. They are a cheap alternative to artificial fertilisers and can be used to complement animal manures. They increase and recycle plant nutrients and organic matter, improve soil fertility, soil structure, the ability of the soil to hold water, control soil erosion, prevent weed growth and stop the process of nutrients being washed out of the soil, for example, when the ground is not used between main crops.

Soil fertility is also maintained with the right soil cultivation at the right time, crop rotation and mulching on the soil surface. Mulching means covering the ground with a layer of loose material such as compost, manure, straw, dry grass, leaves or crop residues. Mulches have several effects on the soil which help to improve plant growth. These effects are decreasing water loss due to

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3 http://www.zps.si/hrana-in-pijaca/oznacevanje-zivil/ekoloska-zivila-4.html#O ekološkem kmetijstvu in pridelkih (18/04/2013)

4 http://www.permaculture.net/about/definitions.html (17/04/2013)

5 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

evaporation, reducing weed growth by reducing the amount of light reaching the soil, preventing soil erosion, increasing the number of micro-organisms in the top soil, adding nutrients to the soil and improving soil structure and adding organic matter to the soil.[6]

The organic farmer must cultivate the soil at the right time and in the right ways to provide the best living conditions for the soil life and plant roots. Growing the same crops in the same site year after year reduces soil fertility and can encourage pests, diseases and weeds in the soil. Crops should be moved to a different area of land each year, and not returned to the original site for several years. For vegetables a 3 to 4 year rotation is usually recommended as a minimum.[7] Crop rotation also helps a variety of natural predators to survive on the farm by providing diverse habitats and sources of food for them.

The quality of the stock of meat, milk and eggs they are trying to achieve by high-quality animal feed and compulsory free-range outside the barn. Horses and cattle used to be a basic farm feature that provided labour for hauling and ploughing, and also fertility, which is important for the self-regeneration function of farms. Recycling of manure and fuel in the form of food for farmers and other animals is important for self-sufficiency and also for sale of surpluses. Organic crops contain much less components, which reduce the amount of food (pesticides, nitrates), products have better taste and contain several ingredients that are good for human health. To control pests, diseases and weeds we have to make a careful planning and crop choice, implement the use of resistant crops and encourage useful predators that eat pests. Each crop and crop variety has its own specific needs. In some places it will grow well and others it will not. Crops are affected by soil type, rainfall, altitude, temperature, the type and amount of nutrients required and the amount of water needed. These factors affect how a crop grows and yields. If a crop is grown in a climate to which it is not suited, it is likely to produce low yields and be more susceptible to pest and diseases. Varieties should be selected to suit local climatic conditions. There is also very important companion planting with other crops that pests will avoid, such as onion or garlic.[8]

Genetic diversity is important when we are talking about the selection of appropriate crops and seeds. Ancient crops grown by farmers contain greater genetic diversity than modern bred crops. Ancient varieties have been selected over many centuries to meet the requirements of farmers in a specific region. Although many are being replaced by modern varieties, seeds are often still saved locally.

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6 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136
7 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136
8 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

Although some modern varieties may be very resistant to specific pests and diseases they are often less suited to local conditions than ancient varieties which have higher natural resistance.[9] By implementing organic agriculture we try to minimise all forms of pollution that may result from agricultural practices.

Methods. In order to explore the area on which the project will be applied different steps need to be conducted (Table 1). Geological, geomorphological, pedological, meteorological, hydrological, biological (biodiversity) research needs to be done, as those are the natural foundations for farming. That includes literature data (maps and papers) and direct field observation. Remote sensing is very useful for that purpose as well as for estimations of soil parameters with different remote sensing sensors and techniques for finer scale analysis (Zribi, Baghdadi & Nolin 2011).

Biological, chemical and physical properties of soil and ground water will be analysed to determine its present condition in the sense of nutrient contents as well as possible existing pollutants (C, N, P, K, Mg, Ca, pH, EC, faeces, heavy metals, pesticides and herbicides). According to soil and water condition (nutrient depleted or not, polluted or not) different approaches should be applied, e.g. nitrogen fixating bacteria and bioremediation to remove pollutants. Experts that should be consulted are stated in Table1.

Another important aspect of organic farming is the implementation of traditional and indigenous knowledge. For that purpose different approaches will be applied: ethnological, historical and archaeobotanical literature and sources will be investigated. If those data do not exist or are scarce, this will be analysed by coring or/and excavating of test pits. This could provide us precious data about ancient plants that were once planted in this area and are most adapted to specific soil types and region/climate, and because of that have resistance to pests and give good yields on poor soils. Such are einkorn (*Triticum monococcum*) and emmer (*Triticum dicoccon*) that were the predominant cereals during the Neolithic and today are relict crops in mountainous areas in Europe (Hajnalova & Dreslerova 2010). In the Carpathian (Slovakia, Ukraine, Romania) and Dinaric region (Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Kosovo region) einkorn was grown until 2.WW (Hajnalova & Dreslerova 2010), so this areas could be suitable for reintroduction of this ancient crop.[10]

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9 RHS A-Z encyclopedia of garden plants. United Kingdom: Dorling Kindersley. 2008. p. 1136

10 http://www.gospodarski.hr/Publication/2005/21/pirevi-pogodni-za-ekoloku-proizvodnju/6876#.UXJh-hzIgU8 (19.4.2013)

TABLE 1		
OBJECT	EXPERTS	METHODS
Landscape: geology precipitation insolation temperature land processes (erosion) biodiversity nature conservation	geologist geomorphologist biologist	literature research geological maps meteorological data remote sensing
Soil: nutrients pollutants biodiversity	agronomist biotechnologist chemist biologist toxicologist	biological, toxicological, chemical and physical properties remote sensing bioremediation
Water: nutrients pollutants biodiversity	hydrologist chemist biologist toxicologist	biological, toxicological, chemical and physical properties remote sensing bioremediation
Ethnology	ethnologist architect	literature research interviews with local people
Archaeobotany	archaeobotanist (+ radiocarbon lab and ancient DNA lab)	literature research excavation of test pits and/ or coring radiocarbon dating ancient DNA
Monitoring: pollutants and nutrients in soil and water agricultural yield biodiversity	GIS expert	GIS program

5. SOCIO-ECOLOGICAL ANALYSES

THE METABOLISM ISSUE

In this task a social-ecological analysis of the selected organic farms will be done. Social Ecology deals with questions of human-nature interaction. Colo-

nization of natural processes is one of the major concepts of social ecology. This concept refers to socio-economic intervention into natural processes in order to transform and utilize them for their purposes (Fischer-Kowalski & Weisz 1999). For this purpose humans have to invest time and energy. Agricultural practices are the prime colonizing intervention into natural processes. Humans intervene into nutrient and water cycles in order to produce food, fibre and other biomass based materials.

Another concept of social ecology, social metabolism, refers to the related resource flows of societies. Societies extract and use natural resources in order to build up and maintain their biophysical compartments (humans, infrastructure, and livestock) on the one hand side and on the other hand in using these materials they produce waste and emissions (Fischer-Kowalski & Weisz 1999). The material and energy flow accounting framework (Haberl et al. 2004) can be applied as a tool for analysing these social-metabolic flows. Socio-metabolic flows can be analysed on different scales: for the totality of humankind, on a national wide level, for a city, a region or even on the scale of a farm.

This part of the project will analyse energy and nutrient flows and time use on the selected farms using the material and energy flow accounting framework (Haberl et al. 2004, for the application on the local level see: Singh et al. 2010). Respective data will be collected and analysed on a yearly basis. We will calculate the energy return on energy investment (EROI) (Cleveland 2008) for each farm, we will establish nutrient balances (Krausmann 2004) for each farm and gather information on time use (see Singh et al. 2010) on each selected farm. Data will be compared among the selected farms and with farms using conventional production methods based on a literature review. The following two hypotheses will be tested: organic farms have a higher EROI, than conventional farms. Organic farming needs more investment of production time of the farmers. The nutrient balance will be a tool for monitoring potential nutrient shortages.

The comparison of farms will allow detecting factors contributing to an efficient use of energy, nutrients and time.

Results of this part of the project will contribute to the understanding of metabolic flows on a very local level. It will provide empirical data from several case sites which will be further useful in the analyses of socio-ecological farming systems. On the sites the socio-ecological analyses will serve as a monitoring tool.

6. REGIONAL ORGANIC FOOD PRODUCTION

THE ECONOMICAL ASPECTS

In market-marginalized areas, organic farmers can increase food production by managing local resources without having to rely on external inputs or food distribution systems over which they have little control or access. Organic farms grow a variety of crops and livestock in order to optimize competition for nutrients and space between species: this results in less chance of low production or yield failure in all of these simultaneously. In rain-fed systems, organic agriculture has demonstrated to outperform conventional agricultural systems under environmental stress conditions (FAO, 2013).

Investment and yields. The performance of organic agriculture on production depends on the previous agricultural management system. In *industrial countries*, organic systems decrease yields; the range depends on the intensity of external input use before conversion, while in *traditional rain-fed agriculture* (with low-input external inputs), organic agriculture has the potential to increase yields. In fact, many multiple cropping systems, such as those developed by small holders and subsistence farmers, show higher yields in terms of total harvest per unit area (RodaleInstitute.org). These yield advantages have been attributed to more efficient use of nutrients, water and light and a combination of other factors such as the introduction of new regenerative elements into the farm and fewer losses to pests and diseases. Farmers are finding that they can cut their inputs of costly pesticides and fertilisers substantially, varying from 20-80%, and be financially better off. Yields do fall to begin with (by 10-15% typically), but there is compelling evidence that they soon rise and go on increasing (Pretty, 1998). Cornell University conducted a 22 year-long Rodale Field Study (RodaleInstitute.org) where it was found that organic farming: (1) improved soil allowed the organic land to generate yields equal to or greater than the conventional crops after 5 years; (2) conventional crops collapsed during drought years; (3) organic crops fluctuated only slightly during drought years, due to greater water holding capacity in the enriched soil; (4) organic crops used 30% less fossil energy inputs than the conventional crops (Pimentel et al., 2005). Studies which compared the income of organic farms with conventional farms have found that the net incomes are similar, with best practice organic systems having higher net incomes by increasing yields, total on-farm productivity is higher and higher on-farm yields (UNEP-UNCTAD, 2008;

Cacek, 1986; Wynen, 2006). It can be concluded that increased yields on organic farms are more likely to be achieved if the departure point is a traditional system, even if it is degraded (FAO, 2013).

Returns. Organic systems produce more corn than the conventional system in drought years. The average corn yields during the drought years range from 28% to 34% higher in organic systems (Pimentel, 2005). The researchers attributed the higher yields in the dry years to the ability of the soils on organic farms to better absorb rainfall. This is due to the higher levels of organic carbon in those soils, which makes them more friable and better able to store and capture rain water which can then be used for crops (La Salle and Hepperly, 2008).

Quality – implementation of ISO 22000. When it comes about organic products, the ISO you need to find more about is 22000. This new standard is common in the food supply chain, in crop production, in processing and delivery, actually in everything related to food. All those that adopt the ISO 22000 standard benefit of a unique global standard, identical procedure required worldwide, better communication with business partners and clients, the possibility of continuous improvement and a clearly auditable standard.

Marketing. Organic foods are promoted as being: safer, better-tasting, environmentally friendly, farmer friendly. Marketing strategy will be focused on the following areas: (1) publicity through word of mouth, (2) interpersonal contacts for feedback about products, (3) work with grassroots (associations, community clubs, schools) for farm visits, (4) use interest of mass media to publish on new and trendy issues, (5) develop a strong brand (logo) for communicating the products and the company, (6) focus will be put on both local and export market (export market as money generator for local market development).

Networking aspects. Local organic farm producers will have to connect with other players in the region such as input producers (seed, animal food, etc.) and distribution channels/points of sale (markets, restaurants, local government and educational institutions). For achieving collaboration among local organic food stakeholders the following actions will need to be conducted: (1) implementation of supply chain management, (2) direct business relations, (3) sales plans in line with production, (3) develop advance purchasing scheme, (4) provide training to producers, (5) technological development important to improve efficiency (lower cost of production).

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Workgroup D
Artificial Green Floating Islands

ABSTRACT

The project aims at reducing the gap between the Eastern and Western part of the Danube River, regarding economic disparities and environmental problems. This gap can be reduced by introducing Artificial Green Floating Islands in the Danube region, with the following objectives: improvement of water quality using specific plants that purify the water to be used in agriculture, attraction of tourists to the less developed countries to make a profit, opening of new jobs for young and inexperienced people, creation for the local people of public places where they can get together and socialize. The introduction of the Artificial Green Floating Islands would also change how people and countries of the area perceive the Danube River turning it from a natural border into a centre for social interaction between different coastal states.

KEYWORDS

Artificial Green Floating Islands
economic disparities
environmental problems
natural border
social interaction

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INTRODUCTION

Danube Region has one of the most diverse population structures in Europe. It comprises 19 countries and approximately 81 million people. The Danube River passes through different countries that have different levels of economic development. From its western to the eastern side, countries in the Danube River basin have different economic and wealth standard. For a half century, countries in the Danube region were divided into Eastern and Western blocs adopting different ways of economic, social and political development. These differences had also some consequences mostly related with the pollution of Danube River. During the Cold War period environmental problems did not attract much attention due to the lack of communication between coastal states in the Danube River.

However, with the fall of communism in 1990's Eastern European countries embarked on a process of European integration. The European Integration made it necessary the invention of a new strategy for the Danube Region in order to bridge the gap between countries in the East and West. Nevertheless, after twenty years of transition social, political and economic disparities are still existent in the daily life of people in the region. The level of wealth in the Western part of the Danube River basin is relatively higher than the Eastern part, which is also the reason of social disparities. Considering current economic conditions in Europe and the financial/economic crisis, it is possible to evaluate this economic difference as an opportunity for the countries in the Danube Region. Giving priority to the less developed countries would increase the attractiveness of the markets as well and contribute into the economic development in the region.

Probably the best interdisciplinary approach to analyzing the relationships between humans and their environment is human ecology. Through the concepts of human ecology we could analyze human adaptations to environment and environmental change, the role of social, cultural and other factors which play the role in maintenance or disruption of ecosystems, relations between technological and environmental changes etc. The analysis of Danube region cannot be complete without taking into consideration the concepts of bioregions and ecoregions. Bioregion is political, cultural end ecological system and they are defined through physical and environmental features, including water, soil and terrain characteristics. So, bioregionalism wants to accent the bioregion as a cultural phenomenon, and emphasizes local populations, knowledge, and solutions. All those aspects must be taken into consideration when we consider the Danube river basin, because it goes well beyond

national boundaries. Ecoregions are smaller than a bioregion and larger than ecosystem, so they cover the areas of land and water and contain characteristic, geographically distinct natural communities and species.

Challenges in the Region

Sustainable development encompasses four domains of economic, ecological, political and cultural sustainability. That means that for humans sustainability represents the potential for long-term maintenance of well being and needs to take into consideration all four dimensions which require interdisciplinary approach.

According to some surveys that try to measure the quality of life European cities have high quality of living as a result of a combination of increased stability, rising living standards and advanced city infrastructures. Of course, in some parts of Europe there are constant economic turmoil, political tensions and high unemployment, but among the top ten cities which have the highest quality of living index seven are from Europe. And it is also interesting that Vienna, the Danube city, is on top of the list for four years in a row.

Apart from the economic disparities, the main challenge in the region is the level of the pollution in the Eastern part of the Danube River. Due to the Communist style of industrialization, environmental problems have been mostly ignored for long period. With the fall of the East's communist regimes that scientists and government officials began to realize the seriousness of the environmental havoc which the destructive industrial policies of the former communist regimes had wrought on the Danube watershed. Industrial pollution is especially high on the Danube because the former communist masters in Eastern and Central Europe sought lucrative short-term production goals, often at the price of environmental degradation.

The international nature of the Danube river basin does not allow purely national context of bilateral relations. The implementation of the project might be hampered due to the problems stemming from the priorities set by different countries. Therefore, central communication headquarter has to be created in order to ensure the sustainability of the implementation.

Danube River has long been perceived as a natural border dividing countries like in the case of Bulgaria and Romania. This project aims to change the perception of the division line by turning the Danube River into a centre for social interaction between different coastal states.

The ongoing perspective for the European integration in the region has to be ensured by supporting the political and moral bids for EU membership. The EU is playing a crucial role for the standardization of the bureaucratic and political system, which is the basis for the initiation and the implementation of the project in the region. Therefore, political stability in the Danube Region has

to be fully ensured in a way to address the commitment of all coastal states in the project.

PROJECT DESCRIPTION

In order to build inclusive, innovative and secure societies, Europe requires a response which demands developing of new knowledge, technologies and capabilities as well as the identification of policy options (Horizon 2020: 22). Supporting that idea and contributing to the development of the region, a project of constructing artificial green floating island could decrease the gap between more developed and less developed countries in the Danube region.

During the last years, floating islands became common natural phenomena that can be found in many parts of the world – mainly on marshlands, lakes, and similar wetland locations and can be many hectares in size [Wikipedia, http://en.wikipedia.org/wiki/Floating_island]. With added aeration they are very effective at removing pollutants such as nitrates and ammonia, and increasing the dissolved oxygen in the water.

The surface area of the floating island naturally attracts microbes which cleanse the water and turn unwanted nutrients into fish food. This makes them a natural choice for cleaning not only lakes and streams, but also for wastewater lagoons, farm effluent ponds, and any other waterway impacted by sewage or landfill effluent: winery ponds, fish hatcheries, public parks or mines [http://www.floatingislandinternational.com/applications/water-quality/].

These are the four main objectives that our project tries to complete:

1. Improve water quality in the Danube region using specific plants that purify the water and enable usage of the clean water for the agriculture.

2. Attract tourists to the less developed countries and make profit from the tourism. One of the ideas how to attract tourists to the floating islands that will be located in the poorer countries on the Danube region is organizing cultural events, e.g. modern art exhibitions from (young) Romanian, Croatian, Slovenian etc. artists. These exhibitions could travel to other countries that are connected with the Danube and can be held on the floating island located in each country. Supporting similar exhibitions and young artists money resources from the different budget sources (e.g. funds for young artists) can be used.

3. Open the new jobs and give young and inexperienced people opportunity for employment. Educated and less educated people without working experience will have opportunity and advantage to work on the floating island, e.g. event planners, travel guides, maintenance workers, various technicians etc. Having in mind that maintaining the floating island will not be an intensive labor (as the construction), people could work until the end of their working period instead of going in early retirement.

4. Give the local people public places where they could get together and socialize. Idea is to create safe(r) society giving children the public place where they can do sports, learn about culture and also give them the opportunity for better education. Generally, moving the children from wandering the streets will be the main motto.

FUNCTIONAL DEMANDS

Constructed floating islands differ from their natural counterparts through their initial substrate formation and include an initial man-made raft (Vogel, The Effects of Artificial Floating Wetland Island – Construction Materials on Plant Biomass, 2011). The materials for the constructed floating island raft might be wide ranging, but should be durable, functional, environmentally sensitive, buoyant, easily anchored, and must not be too heavy (Kerr-Upal et al., 2000; Vogel, 2011). If materials are anything but durable, functional, environmentally friendly etc., the constructed floating island might not reach the intended goals of the project and might fail.

Generally, artificial floating islands can be classified into two groups (Vogel, 2011):

a) 'wet' floating islands, which have vegetation permeating into the water column
b) 'dry', with vegetation enclosed within the artificial island mass.

Many materials were used for artificial island frames (Vogel, 2011) and island substrate including wood, PVC, Bamboo, Styrofoam, burlap, coconut fibers, chicken-wire, and jute. All islands were initially planted with *Panicum hemitomon* (maidencane), but it was found (Vogel, 2011) that the PVC and Bamboo frames were the most buoyant and as a result led to greater species diversity than islands with less buoyant frames. Except for the materials, it is important

to explain the shape and the usage of the floating islands in order to achieve the project objectives.

Artificial green floating islands would be static and of various sizes, depending on the width of the riverbed as well as on the level of pollution. They will be adding up to landscape values and their shape could vary from flat platforms containing grass and shrubs to light undulating green surfaces to add up some hills where flatlands dominate. The size of these floating structures in the upper Danube region would be of size suitable for a small picnic place or surface that will contain vegetation that will serve as habitat for birds or for increasing the biodiversity in general in those areas. On the other hand, in the upper region of Danube the water is quite clean, artificial islands would be more of symbolic elements, that would help reinforce a regional identity.

ECOLOGICAL BENEFITS

The green component will play a fundamental role in the present project. Plants won't provide only beauty and shade, but several ecological and social benefits. Plants with rhizospheric microorganisms and bacteria are natural biological cleaners and can significantly improve the quality of air and of river's water. Indeed pollution is one of the major environmental problems of the Danube River and it can significantly affect also human health. Plants' leaves filter air, absorb chemicals from the atmosphere (nitrous oxides, sulfur dioxides, carbon dioxide etc.) and synthesize organic molecules essential for plant tissue and metabolism. This process leads to pollution abetment and carbon sequestration. All plants have also the ability to absorb with the root system organic molecules (phosphates, nitrates etc.) as well as heavy metals from soil and water. Some of these metals are essential for plants' growth and development for example; Iron, Copper, Zink, Manganese and also Nickel. Certain plants also have the ability to accumulate dangerous toxic heavy metals including Cadmium, Chrome, Lead and Mercury. So the greening of the floating island should include metal accumulating plants and plants which have been demonstrated by recent research works are the most effective in removing pollutants from the environment. Some example could be English ivy, water hyacinth, duckweed etc.

The floating island will also help biodiversity conservation providing habitats for plants, birds, insects and other animals. The artificial habitat will have a fundamental role as wildlife corridor. A wildlife or green corridor is a natural or

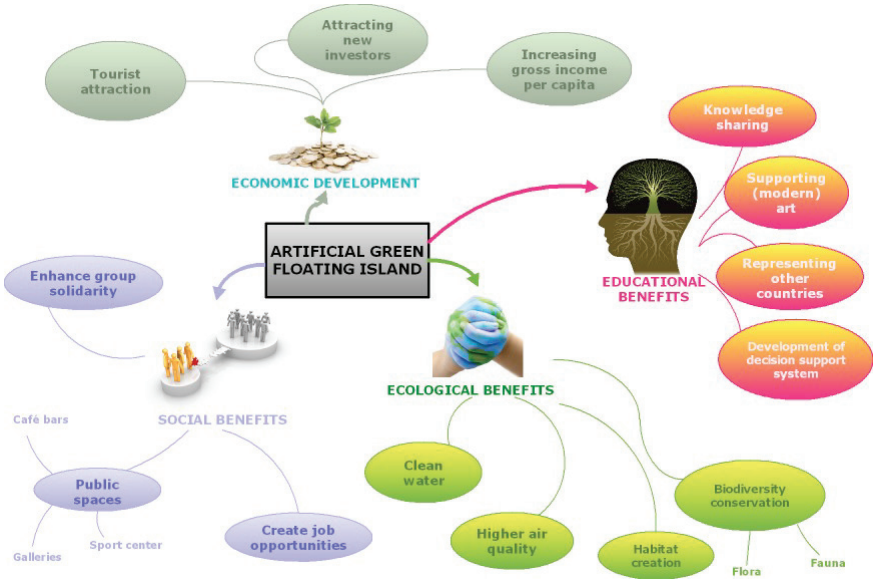
semi-natural surface connecting wildlife population speared by human activities. Creating floating islands will allow the exchange of individuals between populations with consequent moderation of some of worst effects of habitat fragmentation, like decreasing in the area of habitats, isolation of habitats and populations, diffusion of allochthonous (not native) species etc. The use of autochthonous (native) plants is needed to protect the biodiversity of the Danube River Basin. Native plants are well adapted to local environmental and climate conditions and more resistant to pest problems. Planting native forbs, shrubs and trees provide the foliage, nectar, pollen, berries, seeds and nuts that many species of wild animals require to survive and thrive.

SUSTAINABILITY OF THE PROJECT

Artificial green floating island project will provide the opportunity for the regional development of economically disadvantaged countries by turning riversides into an attraction point.

Through this project the transfer of technology from relatively prosperous countries towards Eastern part of the Danube River Basin will be ensured.

The pollution of the river that has long continued to be an obstacle for the regeneration of the ecological system will be reduced and that might encourage countries for further cooperation.



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Workgroup E
Argonauts – Restoration of Ancient Inland Waterways to Promote Sustainable Tourism in Borderlands

ABSTRACT

The main objective of the project is to restore some of the ancient inland waterways in the Danube River Basin and Adriatic River Basin to help implement a sustainable boat tourism in order to connect societies in borderlands, improve their socio-economic future and consequently help improve water management and the environment of the river basins, reduce cross border water pollution, promote natural heritage and support local organic farming. The project takes into consideration the needs of the incoming tourist, that will come to these areas for boat adventures and fulfil expectations of local communities in borderlands, and the low water table and the ecological perspective, which call for the use of smaller boats with basic facilities. The final outcome of the project will be a spatial plan proposal for local and/or national authorities in study areas.

KEYWORDS

inland waterways
boat tourism
natural heritage
organic farming
water table
spatial plan proposal
environmental history

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1. INTRODUCTION

The Greek mythological hero Jason, who is said to be a founder of the city Ljubljana in Slovenia, has travelled along with his fellow Argonautus on the ship called Argo, across the Black Sea and up the Danube, Sava and Ljubljanica rivers all the way to the spring of latter. There the Argonauts disassembled their ship to be able to carry it to the Adriatic Sea, put it together again, and return to Greece. This interesting legend inspired our project that is focusing on restoration of ancient inland waterways on Danube River Basin and Adriatic River Basin. It was also a reason why we chose for the project acronym »Argonautus«.

Like Jason and the Argonauts our interdisciplinary and international DIANET group of experts explored the regions between North Adriatic and Black Sea to find the possibilities to restore ancient inland waterways in order to ensure the socio-economically viable future and environmentally feasible development of the societies in borderlands that are divided by rivers and political borders.

Project explores the possibilities of developing sustainable boat tourism in borderlands in order to connect societies in borderlands, improve their socio-economic future and consequently help improve water management in the regions in North Adriatic River Basin and Danube River Basin.

In *Section 2*, we summarize the research problem and objectives of the proposed project and emphasize the relevance of the project in the frame of the Strategy of Danube River Basin and Horizon 2020. In *Section 3* basic background information to the selected case studies is given and problems in the areas are summarized. S.W.O.T. analysis will be presented for each case study that will help us identify possibilities for future sustainable development. *Section 4* details some of the methodological approaches that our international and interdisciplinary group can offer in order to help societies in borderlands. Case studies are based around ancient waterways that we intend to use as a drive to promote ecologically, socially and economically balanced development in the regions. We will present and discus selected problems and challenges within areas of selected case studies. Last but not least, *Section 5* gives some final remarks.

2. RESEARCH PROBLEM AND OBJECTIVES

Neolithic and later settlements were mainly along the rivers. The vicinity of the Danube influenced the development of settlements and the relationship between them. The Danube River was essential; serving as a landmark, border, source of food, but also endangering the sites by a shifting water course (Penezic et al., 2013). Nowadays, 19 countries in the Danube River Basin share many common issues; the Danube Region is a major international hydrological basin and ecological corridor. This requires a regional approach to spatial planning, nature conservation and water management. Pollution does not respect national borders. Water resources are one of the most important issues in the region and need cross-border cooperation. More than 81 million people are interconnected with the water system of Danube River. Danube is one of the most polluted rivers in the world. It absorbs raw sewage from cities, pesticides and fertilizers from agricultural fields, waste from factories and bilge oil from ships. Countries in the region also share the issues of insufficient resources for socio-economic development, ranging from funds to human resources. The river basin approach is the best way to manage water in Danube and North Adriatic River Basins (Water Framework Directive, 2000) where proposed project is implemented.

The main objective of this project is to restore some of the ancient waterways to help implement a sustainable tourism in borderlands. We intend to achieve this objective by implementing sustainable boat adventures named "Argonauts: sustainable river adventures". The chosen case studies are borderlands along the Tisa River (Hungary-Romania) and Mura River (Slovenia-Croatia-Hungary) from Danube River Basin and Soča/Isonzo River (Italia-Slovenia) from Adriatic River Basin. These rivers are separating countries, regions, people and cultures, particularly severely in the times of Iron Curtain.

For the successful implementation of the project is important to have in mind needs of incoming tourist, that will come to these areas for boat adventures and fulfil expectations of local communities in borderlands. As we intend to show later the rivers have low water table for that reason big boats are not feasible, also from the ecological point of view smaller boats with basic facilities would be more sustainable. The local communities will provide the facilities and services for the tourists travelling by boats (e.g. accommodation, food) (see Figure 1).

Figure 1. The scheme represents the needs of tourists travelling by boats, services that local communities must provide to these tourists and expected short/long-term benefits in the borderlands from sustainable point of view.

This project is aligned with the Strategy of Danube River Basin and Horizon 2020 for several reasons. One of the priority areas in Strategy is to connect the Danube Region throw implementing new inland waterways and building prosperity in the Danube Region. Project contributes to research and innovation for greener, smarter and more integrated transport system that will make an important contribution to the Europe 2020 goals of smart, sustainable and inclusive growth and the objectives of the Innovation Union flagship initiative (Horizon 2020). It supports the competitiveness of enterprises and invests in people and skills (e.g. new job opportunities: interpreters, craftsmen, organic farmers…). Project also contributes to the protection of the environment in the Danube Region by promoting natural heritage and supporting local organic farming. Regional approach to nature conservation, spatial planning and water management is applied in the project. From the social and cultural point of view proposed project will assist societies in borderlands to improve cross border cooperation. It will help them to build social, economic, cultural and ecological connections and unite them in common vision of sustainable tourism based on the sustainable tourist activities around rivers.

Project also contributes to the goals of other relevant transnational programmes and directives. Particularly important is the Water Framework Directive where one of the imperative EU actions is environmental improvement of river basins and reducing cross border water pollution. Long-term goal of the project is to achieve good ecological and chemical status, to protect human health, water supply, natural ecosystems and biodiversity which is in line with the Directive. Project is also important for promotion and preservation of Natura 2000 network of protected areas, consisting of Special Areas of Con-

servation established under the EU Habitats Directive and Special Protection Areas established under the EU Birds Directive. There are several Natura 2000 sites within the three case studies. Project also contributes to the efforts of the International Commission for the Protection of the Danube River (ICPDR) in the fields of sustainable water management and facilitates cooperation between the Danube countries, particularly borderlands surrounding rivers in the case studies.

The final outcome of the project will be a spatial plan proposal for local and/or national authorities in study areas. The plan will include detailed description how to implement sustainable boat tourism on inland waterways in the studied areas. A detailed plan of the tourist development in the borderlands will be developed; considering promotion of important natural and cultural heritage, local food production, revival of local crafts, development of tourist facilities, recreational roads for cycling and trekking etc.. The hidden, long term goal of the project is to change unsustainable land use practices in the studied areas and improve water resource management.

3. CASE STUDIES

These rivers selected for the case studies are floating throw borderlands; separating countries, regions, people and cultures. In the past these rivers represented both a natural and political division between countries and regions, but since these countries joint European Union new possibilities for cross border cooperation occurred. Three case studies were selected (Figure 2):

- the Tisa River (Romania-Hungary) – Danube River Basin
- the Mura River (Slovenia-Croatia-Hungary) – Danube River Basin
- Soča/Isonzo River (Italia-Slovenia) – Adriatic River Basin.

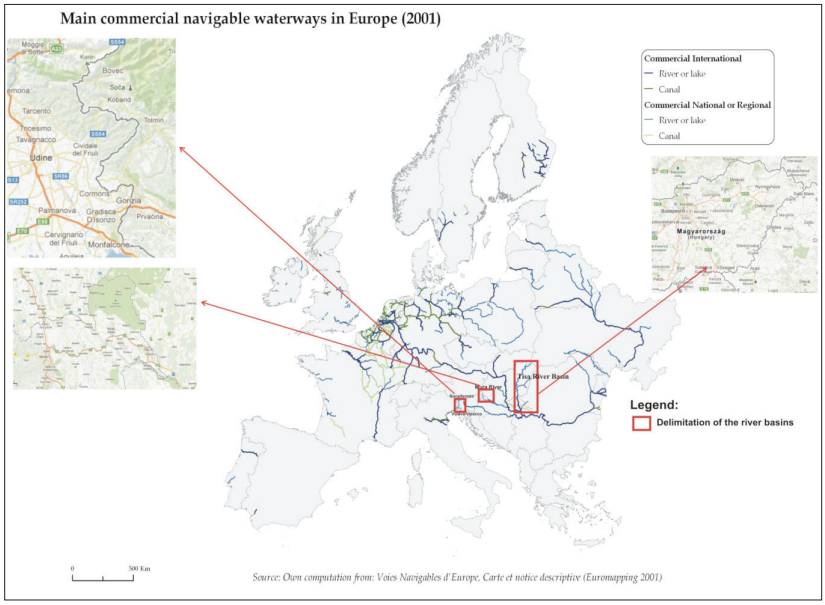

Figure 2. Map of the case studies in Danube River Basin and Adriatic River Basin

Table 1: SWOT analysis of the project proposal for case studies (Tisa River, Mura River, Isonzo/ Soča River). Black for all the case studies, orange only for the Tisa

Strengths	Weaknesses
- travelling energetically sufficiently, - low price of travel, - navigability, - rich cultural heritage, - many nature protected areas.	- transport upstream, - low speed, - time consuming transport, - dams, - negative local attitudes, - industrial plants.
Opportunities	**Threats**
- cross border cooperation, - improving tourist accommodation & other tourist infrastructure, - new jobs in tourism, - revitalization of riparian habitats, - local development of ecological prevention, - promotion of cultural heritage, - immigration to the region.	- climate change, - floods, - overdeveloped boat tourism & tourist infrastructure, - artificial changes in river bed and banks, - new power plants, - degradation of landscape, - water pollution, - tourists not respecting environment/nature, - weak participatory culture, - weak compliance, - exploitation of gravel.

4. INTERDISCIPLINARY METHODOLOGICAL APPROACH

Within the project an interdisciplinary approach will be adopted that will help to cultivate healthy and sustainable future development of the regions around the studied rivers. A special attention will be paid to the role of local communities and stakeholder groups in preparing the plan that will fit to their expectations and promote future sustainable development of the borderlands. Project is important for regional development, to improve overall prosperity of the communities in these areas. It will increase employment opportunities, preserve natural and cultural heritage and improve cooperation between societies in borderlands.

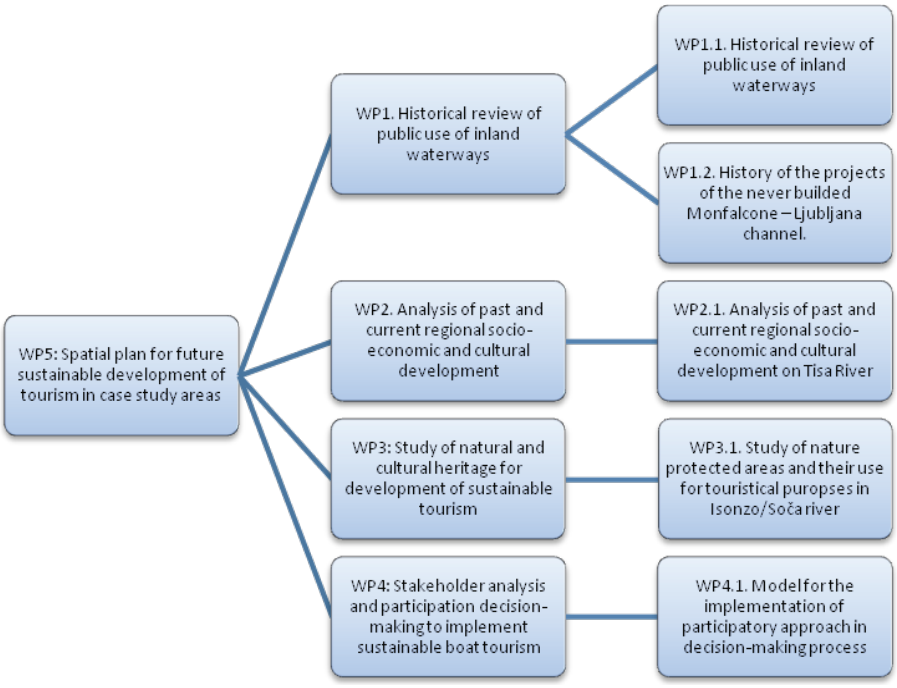

Figure 3. The scheme of the proposed work packages and some activities in order to produce spatial plan (WP5)

In order to support the design of the plan for the case studies the project foresees activities as:

- to undertake a historical review of public use of inland waterways; economic, social, cultural and ecological aspects of waterways (Work package 1)
- to undertake an analysis of past and current regional socio-economic and cultural development in case study areas with particular interest to water resource management and tourism (Work package 2)
- to undertake the study of natural and cultural heritage in case study areas in order to provide the input for development of sustainable tourism (Work package 3)
- to develop and implement new approaches in stakeholder analysis and participation aimed to bridge across environmental and human socio-economic needs in case study areas and implement sustainable boat tourism (Work package 4)
- to develop a spatial plan for future sustainable development of tourism in case study areas (Work package 5)

Taking into account the sustainable development of the Danube and Adriatic River Basin, by focusing on three case studies regarding the use of the ancient waterways, the most appropriate is interdisciplinary methodological approach that we synthesized into spatial plan (Work package 5). This tool emphasizes all methods used in spatial planning, where dynamic of the territory is included. The main steps of the methodology used, indicators and data, are:

a) **Identification of the target area**: Danube and North Adriatic River Basin, Tisa River, Mura River, Soča River (Monfalcone-Ljubljana). For each river catchment area, we will overlay administrative units (according to the NUTS system, used by EUROSTAT), different land use categories (according to CORINE LAND COVER), and different delimitation of the river from hydrological point of view.

b) **Establishing temporal scale**, which will include all political units in order to emphasize administrative aspects, the obstacles imposed by administrative borders, use of waterways, different distribution of settlements or natural and cultural resources.

c) **Collection and interpretation of internal drivers**. This step will be an **interdisciplinary issue**, including collection and interpretation of all indicators compulsory for an overall view of the river basins. All important aspects, gathered with the help of different disciplines, will be integrated with GIS

methods in order to realise a clear assessment of waterways and their impacts. We identified the following important aspects:

- Historical information: written sources and material remains, using old historical maps, old pictures, archives;
- Statistics and demographic data: population (number of inhabitants, population density, number of employees), settlements (number of settlements);
- Hydrographical indicators: water bodies, floods, excess water, reservoirs, and dams;
- Socio-economic indicators: SMEs, main economic activities, cultural resources, accommodation utilities, transportation connections, number of pollutants;
- Land use changes, according to CORINE LAND COVER;
- Natural environment data: natural protected areas (NATURA 2000, RAMSAR sites, national and natural reserves).

d) Collection and interpretation of external drivers. The project is especially focusing on the existing problems within the river catchment areas, all spatial plans or regulations will be integrated, such as land use restrictions, different proposals regarding infrastructure improvement, zoning maps, expected ecological networks, etc.

e) Realisation of possible scenarios regarding future territorial development and visualisation of an integrative interdisciplinary approach. This approach will take into account internal and external drivers, realised in GIS and integrated scenarios can be constructed. The scenarios will allow a comparison of past and current situation in order to have a coherent image of the problems resolved by our project.

WP1.1. HISTORICAL REVIEW OF PUBLIC USE OF INLAND WATERWAYS ON THE MURA RIVER (SLOVENIA)

Past use of waterways

Deep understanding of the landscape is inevitable for planning its future development. The numerous examples of extreme natural events forgotten after a couple of years and the fact that nature changes all the time send us a strong message that carefully studied present situation is just a part of the required knowledge. The study of historical sources based on the understanding of nat-

ural processes, their impact on human society and the influence of the society on nature, the field of research of environmental history (Hughes 2008, pp. 321, 323, 324) cannot be avoided.

In the uppermost parts of the rivers and on streams in mountainous and hilly landscape floating of wood was a common practice, causing damage to river bed and banks and reducing the fish population (Winiwarter, Knoll 2007, p. 223). Further down the stream wood used to be transported bound in rafts, often loaded with cargo (Braudel 1989, p. 435; Winiwarter, Knoll 2007, p. 222), accompanied by boats. At least since the 13th century many rivers in the Danube river basin like the Sava, the Ljubljanica, the Savinja, the Drava/Drau and the Mura/Mur to mention just the ones from the surrounding of one of the case studies were navigable (Kosi 1998, p. 151). In the 18th century the existing navigable waterways were extensively prolonged, causing major environmental damage. In order to build and maintain navigable waterways fish spawning places were destroyed, artificial channels used to be built, forest on river banks was cut while arranging and maintaining road for upstream drawing of the boats (Reith 2011, p. 29). According to the estimation for the 18th century the ratio of channel to carriage transport was 1 to 3, the data from the 19th century reveal that upstream transport cost five times as much as downstream navigation but still only half as much as the railway and a sixth as much as road transport. For this reason waterways were still important after the railway connections were built (Winiwarter, Knoll 2007, p. 220). Capacity was an advantage of river transport (Kosi 1998, p. 149); cargo which could be transported differed tremendously regarding the direction. Data referring to the Danube at Regensburg reveal that a ship navigating downstream could be loaded with 2000 cents, whereas the maximum weight of its upstream cargo could be 300-400 cents. From the point of view of sustainability the low energy consumption of river navigation has to be emphasized. According to the well accepted estimation referring to the 18th century 4 kg of cereals were needed to transport 1 ton heavy load 1 km long but not more than 1 kilogram of cereals in case of inland navigation (Winiwarter, Knoll 2007, pp. 217-220).

Downstream navigation was a quick way of transport. It was not exceptional to travel 100 km per day according to the data for rivers like the Salzach and the Inn at the turn from the Middle Ages to the Early Modern Period (Kosi 1998, p. 150). The velocity was severely influenced by river discharge, water table, wind directions, weather situations, forcing boat to stop, but also by human factors, especially toll stations, dams, gates (Braudel 1989, p. 432) and floating mills (Golec 2009, p. 325). Before regulations the majority of rivers used to be much wider than today with less powerful current and considerable shallow areas, where accumulation took place thus promoting freezing (Rohr

2007, p. 201). Especially in some periods of the Little Ice Age ice covering on rivers was common, preventing navigation and causing damage to harbours. The frequency of occurrence of sharp winters altered according to the climate change, the Maunder Minimum is one of the periods when data from the meridional Balkans and those from the Middle Europe show their more frequent occurrence (Dobrovolný et al. 2010, pp. 92-93; Xoplaki et al. 2001, pp. 589, 597). The floods in the other periods also caused damage in harbours and wracked the boats. Rocks near below the watertable and due to accumulation changeable locations of shallow water were the main hazards (Braudel 1989, p. 432). Unlike the downstream velocity the upstream navigation took extremely long, what limited its suitability. According to the sources from the 18th century it usually took 40 horses 29-48 days (depending on weather and watertable) to draw two ships on the Danube from Vienna back to Regensburg (Winiwarter, Knoll 2007, p. 218), where boats used to be oxendrawn the way took them even more than one and a half of that time (Kosi 1998, p. 150).

Beside the downstream and upstream transport navigation used to be a way of crossing the river, unless there was a bridge or a ford (cf. Hozjan 2007, p. 200).

Case study: The Mura River

The Mura used to play the most important role among rivers in Styria from the point of view of traffic, linking the northern and southern part of the province. Rock salt, iron and wood from upper Styria were transported downstream on boats and rafts. At least from the 1st half of the 13th century passenger traffic is reported. The river used to be navigable from Murau downstream. The upstream horsedrawn river navigation is already recorded in the 2nd half of the 14th century. The Radkersburg/Radgona city played central role in navigation on the lower Mura, river traffic is recognized to be one of the factors contributing to the development of the city to a more than regional trade centre in the late Middle Ages. The monopoly in trade from Radgona/Radkersburg downstream to Hungarian territory, existing already in the year 1383, was an important source of citizens' income. Beside the upstream and downstream transport navigation was also a very common way of river crossing. Seven ferries used to exist on the river section between Leibnitz/Lipnica and the Mura East from Ljutomer (at Ehrenhausen/Ernovž, Weitersfeld, Mureck/Cmurek, Podgorje, Petanjci, Veržej and Melinci) but only 2 bridges (at Leibnitz/Lipnica and Radkersburg/Radgona) around the year 1400. During the history river changed its direction several times, leading to great changes in landscape. East from Mureck/Cmurek in the 15th and the following centuries the

river channel moved to the North during the floods, causing the abandonment of half a dozen villages and destroying the whole medieval mainroad to Radkersburg/Radgona (Kosi 1998, pp. 157-158, 262 & map enclosed). Due to the accumulated sand and gravel the hazard of stranding was present, especially at low water table and after the flooding events, submerged trunks here and there caused capsizing (Hozjan 2007, p. 198; Petrić 2011, p. 60). The data referring to the near Drava river reveal that the maximal weight of cargo on one boat amounted to 150 to 160 cents, if the cargo might not get wet even less, 100 cents in terms of gunpowder. The boats used to be much bigger in the middle 19th century being possible to carry 300 cents of cargo and 200 cents on rafts (Kolar 2011, pp. 102-103). In the 18th century the extent of artificial interventions to the lower Mura was not considerable, only minor works in the 1770s are reported (Šorn 1984, p. 37).

Historical methods

The historical part of the work is going to be based on critical study of archival sources and their published editions. Historical research of the periods when navigable transport used to play an important role is inevitable to avoid the unnecessary mistakes while reintroducing navigable river transport. The retrogressive approach to the analysis of historical maps will be based on the Franciscan Cadastre map, georeferenced using the GIS. The result of a careful study of the archival collections of maps presenting the waterworks from the 1780s to the 1890s (Gesamtinventar 1959, pp. 207-208) will be the overlaying of the cadastre maps from the 1820s using GIS. The next step back in time will include an accurate georeferentiation of the maps, drawn for military purpose between the years 1763-1787 in the scale 1:28.800; by paying special attention to more stable landscape features their digitalisation will be possible despite the fact that the working methods were not entirely reliable. The result of the mentioned analysis of the maps will contribute to the understanding of historical characteristics of the river channel, influencing the size of historical vessels and assessment of past sustainability. Since the aim of the project is to reintroduce small boats and rafts the data from the Early Modern Period are more important than the ones introduced later. Thus the respective sources of the Inner Austrian Court Chamber and from the Archives of the States of Styria (Das landschaftliche Archiv) are going to be studied. While the selection of the sources of the States will be based on a modern register, the detailed registers on yearly level (archival sources themselves) will present the basis for the selection of the documents of the Inner Austrian Court Chamber. To collect the data for the other bank of the Mura river the edition Viri za zgodovino Prekmur-

ja/Források a Muravidék történetéhez 1, covering the period from 871 to 1849 will be investigated.

Additionally historical data on the Mura watertable from the years 1808-1836 (archival collection »Kleine Archivabteilungen« in the Provincial archives of Styria (cf. Gesamtinventar 1959, p. 210)) will be studied and connected with the information on floods and their impact on river traffic from the same period. This investigation of the circumstances during the early 19th century peak of the Little Ice Age will provide a better understanding of possible future impacts of the climate change on the reintroduced river navigation, improving the assessment of its sustainability.

WP1.2. HISTORY OF THE PROJECTS OF THE NEVER BUILT MONFALCONE-LJUBLJANA CHANNEL: ISONZO/SOČA CASE STUDY (ITALY-SLOVENIA)

This case study focuses on the connection between the Danube River Basin (DRB) and the Adriatic sea. In order to evaluate this challenge, we decided to study the long history of the projects of the never built Monfalcone-Ljubljana channel. In the times of the Habsburg Empire, the connection between the Northern Adriatic and the DRB was clearly of great importance as it very well completed the geographical personality of the Mitteleuropa and the South Eastern Europe. The idea was to strengthen economic, cultural and social communication for a future of peace and prosperity. Nowadays, it is again in the focus of the EU politics and programmes.

Nonetheless, the contacts between the Black Sea and the Adriatic, along the DRB, and the search for a passage which could interconnect the two seas, is rooted in the deep past of Europe, and of Western culture: for these reasons, we want to focus on this concept, which aims to link the people and the culture. We do not want to propose a digging of a real channel because it would not be sustainable from environmental as well as economical point of view.

According to some mythographers, the Argonauts, coming back from their adventure in the quest for the Golden Fleece[1], had to navigate along the Danube river. Having arrived to what is today Beograd, they chose to continue along the Sava. So, they navigated up to the Lake Bohinj in Northwestern Slovenia, where according to the myth they started to push the Argo ship on tree trunks for the 15 km separating the lake from the Soča river. In this way they were able to reach the Adriatic sea and to continue their adventures (Pozzetto, 1988, pp. 373-374). According to the presentation of Bratož quoting Plinius the

1 The Golden Fleece could probably symbolize the knowledge of iron.

Elder they turned from Sava to Ljubljanica and continued inland towards the Adriatic sea (Bratož 2003, pp. 246-247).

Figure 4. The Argonauts' trip for Plinius the Older (I c. a.d.) (Siempre ...)

The first complete project that tackled the problem to connect the Sava and the Soča was developed in XVII c. and was again topical under Maria Theresia's rule. The idea was popular till the first decade of XIX c. After that period the project was dismissed. At the end XIX c. the Habsburg Empire revitalized the idea of digging a channel, having in mind the limited capacity of the railroads to Trieste and the perspectives of its port development. An international competition to select the best project on the issue was held in 1904. But WWI made the creation of digging a channel impossible.

Max Fabiani, an important architect born in 1865 near Gorizia, and famous for his works in Vienna, Ljubljana, Trieste and some other parts of the Empire, also planned to carry out this important infrastructural project for his whole working period. Even after WWII, he tried to persuade Italian, Yugoslav and Austrian governments of the importance of the channel: he drew a serious plan before his death in 1962. It was based on 1904 competition results and on an original solution proposed by Leonardo da Vinci for the part of the Soča. Obviously, the division of the XX c. Europe, two WWs, the Cold war and the strained relations between Italy, Yugoslavia and the rest of the Eastern Eu-

rope, especially since 1915 till the 1960s, made the non-communication between the North Adriatic and the Black sea an important aspect of the Europe of borders (Pozzetto, 1988, p. 141; Pasquali, 1992).

East-West relations in Europe started to be more open and flexible, after the Helsinki agreement of 1975. Thus Italy and Yugoslavia finally formalized their frontiers and thanks the Osimo agreements started a new cooperation. The channel was officially decided to be built between the two countries, following the main two different Fabiani's projects (Supplemento ordinario…, 1977, p. 218). In 1984 in Grado, the Italian and Yugoslav ministers of foreign affairs officially ratified the building of the infrastructure (Baggi, 1985, p. 18).

Thus Italy and the former Yugoslav republics after three decades still officially have to carry out this project. But we, the people of Europe, now have a new concept of the relationship between nature and human beings, a new vision of multimodality and transport, we understand that the benefits of well-being of local communities must be integrated in the well-being of national and European population, at the same time not causing environmental damage.

This study aims to present the mentality of past generations feeling the urgency to open wider communications from North Adriatic to the Black sea along the DRB. This could give us new opportunities to plan the future in the new European political circumstances, e.g. open borders, one new common political frame, a shared legislation and a vision of peace and prosperity.

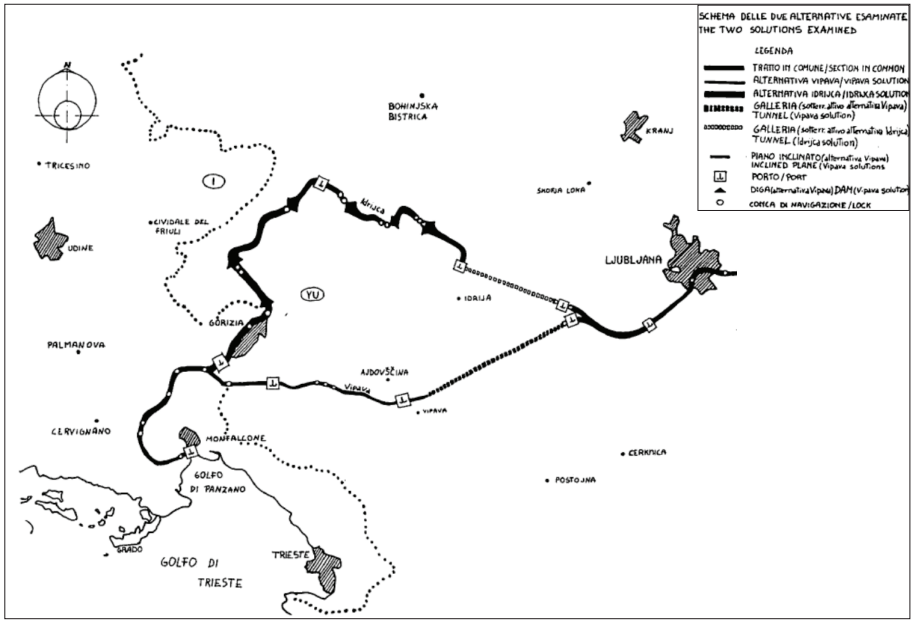

Figure 5.The two possible routes of the Monfalcone-Ljubljana channel as accepted by Italian and Yugoslav governments in 1984. (Baggi, 1985, p. 16).

WP2.1. ANALYSIS OF PAST AND CURRENT REGIONAL SOCIO-ECONOMIC AND CULTURAL DEVELOPMENT ON THE TISA RIVER (BETWEEN ROMANIA AND HUNGARY)

Description of the area

The Tisa River, one of the main tributaries of the Danube, rises in Ukraine, passes through Hungary and Serbia, until it flows into the Danube. It is extended over the territory of five countries: Romania, Ukraine, Serbia, Hungary, and Slovakia, covering a territory of approximately 158,000 km^2. One of the greatest challenges of this basin represents in the fact that the river is perceived as a border between three countries (Hungary and Ukraine, Hungary and Serbia, Serbia and Romania). It is not only an administrative border, but even a mental delimitation for the inhabitants within the basin. Taking a retrospective look into the history of the territory, the Tisa river for a long time belonged to a single state, as Burebista's Kingdom in Antiquity, the Principality of the medieval Transylvania, or Hungary. Behind the current administrative organization, the river can and should represent an open space for the local communities.

a) *Social aspects*
   The territory of the case study in the Tisa's river basin covers a surface of 8210,83 km^2 (7573,09 km^2 in Hungary, 637,74 km^2 in Romania) and is populated by 805078 inhabitants (737148 inhabitants in Hungary and 67930 inhabitants in Romania). The number of inhabitants within the basin is lower near the borders, meaning that population density is higher towards the core of the country, due to better national connections in all domains, while the cross-border cooperation needs to be strengthened in order to attract more inhabitants. Most of the settlements along the Tisa corridor are rural (155) and have low number of population, while the urban space has a small extension, only 16 cities/towns.

b) *Economic aspects*
   From economic perspective, except for the Hungarian river sectors, there is a low industrial activity in the Tisa basin, industry has only a slight impact upon the environmental quality, especially after the industrial restructuring and the introduction of more restrictive environmental practices. The Hungarian areas along the upper sections of the Tisa River are very poor in industrial activity (such as operations extracting construction materials, hydrocarbons production).

Regarding transport network, the main *roads* cross Tisa corridor and run along the river. There is a road and also a railway of national importance in Romania that run along the Tisa; apart from them, there are local roads that connect settlements along the river. The transportation network is considered to be insufficiently developed in order to assure good territorial connections inside the corridor and with the other territories. Territorial connections are planned to be improved through solutions requesting less time between departure and destination: high-speed roads and railways, better connections with airports. Public roads are mainly secondary roads. The density of railway network is low. Five of the nine Romanian settlements are connected with railway network, but there is no electrified wide gauge rail. With the exception of the one at Szolnok, all railway bridges across the Tisa River were built right next to public road bridges.

From the *perspective of navigability*, the flow of the Tisa River remains unregulated, which is unique in Europe in terms of its preserved natural state. For the Romanian part of the Tisa, navigation is not suitable as it is too close to the springs and the river passes through mountainous areas, while in Hungary the existing ports are available at Tisapalkonya, Tisabábolna, Tisafüred, Kisköre, Szolnok, Nagykörű, Tisaroff, Tisakécske, Szentes, Csanytelek, Mindszent, Algyő, and Szeged; marinas for small ships and boats are available at Tisabercel, Tokaj, Tisafüred, Tisaörvény, Tisaroff, Szolnok, and Tisaug on the River Tisa and at Poroszló, Újlőrincfalva, Sarud, and Abádszalók at Lake Tisa. No substantial changes have been carried out in freight shipping on the Tisa River over the past few years. The volume of internal freight shipping has remained at a level under the historical peak of 0.5 million tons per year.

The bicycle routes running parallel to the river are mostly bicycle paths constructed on the top of the river embankments.

c) *Environmental aspects*

Another particular issue of the basin represents the fact that a variety of natural protected areas can be found there (Natura 2000, national and natural reserves, Ramsar sites, ecological corridors). The frequent problems are linked to the absence of signs and warning panels, favouring the infringement of the regime of protection and conservation. The flooding of ecosystems in the low riverside floodplains leads to temporary disturbance of existing habitats and the emergence of counter effects regarding water pollution, affecting the existing species. The wild fauna has suffered a decrease in numbers in recent years due to unfavourable hydro-climatic conditions (harsh winters, great floods along the streams).

Taking into account the natural risks, floods are the common threat affecting the Tisa basin, having a high impact upon the livelihoods and implying large scale environmental changes. Floods have a very high frequency, causing important damages almost every year. In the Hungarian Tisa Valley, there are almost 200-250 thousand hectares of agricultural land, which is flooded by excess waters more frequently than every five years, so that these lands should not be managed in the current manner. Areas exposed to excess waters in the Great Plain are the surroundings of the Upper Tisa (Bereg, area between the Tisa and the Szamos, area between the Szamos and the Kraszna, Rétköz, Bodrogköz, Taktaköz), the area near Hortobágy, a large part of the Jászság and Nagykunság, the area of the Körös Rivers, the valley of the Lower Tisa. Since the middle of the 19th century, a series of excess water drainage systems was built. A large part of the extensive excess water drainage system (approximately 40.000 km) consists of artificial channels.

There are 23 SEVESO plants, related to oil and natural gas extraction and supply. Ten of them are hazardous plants with a lower limit value, while 13 are hazardous plants with a higher limit value. Three of them are located along the upper region of the Hungarian section of the Tisa River (in Tiszabezdéd and in Tuzsér), nine along the middle section (in Tiszaújváros, Törökszentmiklós, Szajol, and Szolnok), and 11 are located along the Lower Tisa (in Lakitelek, Szentes, Hódmezővásárhely, and Algyő).

Another challenge for the river management are waste systems, in Romania, there is only one landfill in Sighetu Marmatiei, while each of the 60 Hungarian settlements is covered by organized communal waste collection.

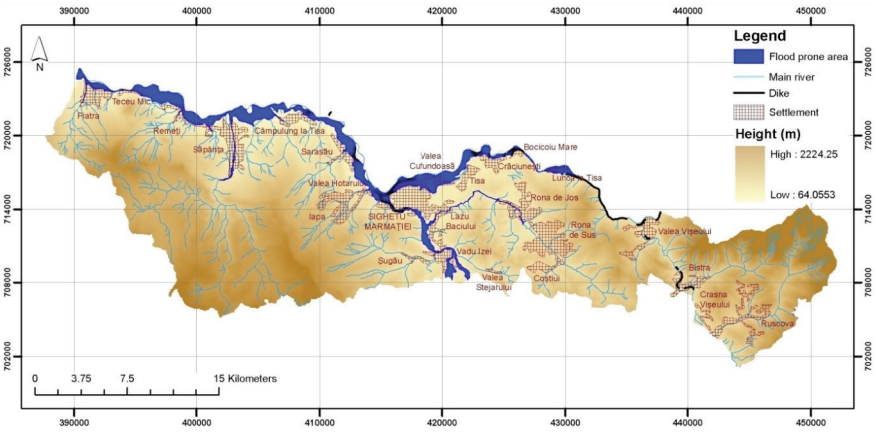

Figure 6. Flood protection hydrotechnical systems and floodable areas within Romanian Tisa ecological corridor (Development Strategy of the Tisa Catchment Area, 2012)

d) *Cultural aspects*

The Tisa River and its immediate environment, even in its present form, is among those European rivers preserved in their most natural state. Its unparalleled natural beauty, cultural landscapes, and ecological treasures grant its outstanding importance for the biosphere and biodiversity of the entire Carpathian Basin. On Romanian territory, the Tisa ecological corridor stands out due to a complex natural and anthropogenic tourism potential. In Hungary, the Tisa does not play an outstanding role in tourism. The attractiveness of the large and medium-sized cities based on their architectural heritage, their cultural events, and occasionally, on their thermal spas is emphasized while in some small settlements, water sports tourism has become a central theme of the tourist's experience.

WP3.1. STUDY OF NATURE PROTECTED AREAS AND THEIR USE FOR TOURISTIC PURPOSES IN ISONZO/SOČA RIVER

As can be seen from the S.W.O.T. analysis Isonzo/Soča River has many nature protected areas which are often not valued as they should be, especially in comparison with the valorisation of many historical sites interested by PIC/PPS Interreg IIIA Italia-Slovenja 2000-2006. Enhance natural areas represents a unique opportunity for sustainable tourism, therefore we intend to implement boat tourist adventures into these area. The tourism in nature protected areas allows people to experience the natural heritage of a country without damaging it. It is extremely important aspect of the economic policy of any country. Throughout the world there are areas of great beauty and ecological importance yet to be discovered by tourists. Nature tourism is able to create local jobs based on a concept of sustainable and responsible tourism. It is therefore possible to implement sustainable development in some of these natural areas in order to promote and better protect them. Furthermore, with the creation of a range of sustainable accommodation facilities in the region we can avoid those countless examples of defacement of the natural landscape caused by an uncontrolled expansion of tourism in areas of high natural value. This work is intended as a support tool for tourists wishing to engage in exploring the nature and biodiversity in the Isonzo/Soča River.

A visit to a natural area can offer time for meditation and reflection out of the routine of daily life. This kind of tourism offers not just a passive but an integral experience through a number of activities such as hiking, horse riding, cycling, bird watching etc. The purpose of this study is to investigate how protected areas could be implemented into programs of sustainable tourism.

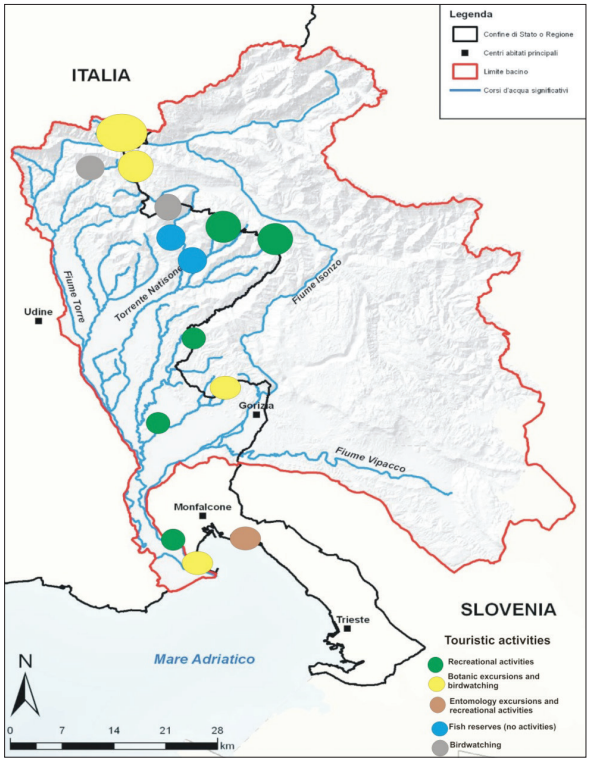

Figure 7. Map of protected areas in Italian part of the Isonzo/Soča River Basin and proposed touristic activities

Table 2. Nature protected areas and their possible use for touristic purposes in Isonzo/Soča River

	Nature protected areas	Important fauna and flora	Tourist activities
	Alpi Giulie, Rio Bianco, Marano, Grado	Natural semi natural vegetation, swamps	e.g. botanical excursions and bird watching
	Valle Cavanata e Banco Mula di Muggia	Amphibians, reptiles, birds, fishes, swamps	e.g. bird watching
	Tolmino, Aree Carsiche della venezia Giulia	Caves, sinkholes, amphibians, reptiles, birds, insects, swamps	e.g. entomological excursions and recreational activities
	Palude del Preval, Laguna di Marano e Grado	Fishponds, natural vegetation, swamps	e.g. recreational activities
	Natisone	Fish reserves	no activities allowed

Particularly which touristic activities would be appropriate in nature protected areas. This study is also relevant for raising awareness in local communities. By using natural heritage for tourism purposes the local communities will have direct economic benefits. These approach to the nature conservation will not be seen an obstacle in regional development but as an opportunity.

The method for producing guidelines is based on a comprehensive study of the natural areas of Isonzo/Soča River. We studied accessibility of nature parks, their vulnerability and interesting fauna and flora in order advice on the possibilities to use them for sustainable tourism. Each colour is matched to a different category of protected areas in order to respond to the demands of the most demanding tourist.

In order to biomonitor the impacts of tourism in protected areas we recommend implementation of biomonitoring that will focus on indicator group species (e.g. birds). Biomonitoring will occur periodically in order to evaluate the impacts. The changes in population numbers will be an indicator for future management of tourism impact. In areas of botanical interest we intend to implement tourist paths in order to prevent creating major damage to flora and fauna.

WP4.1. MODEL FOR THE IMPLEMENTATION OF PARTICIPATORY APPROACH IN DECISION-MAKING PROCESS IN STUDIED REGIONS

Fair and sustainable agreement in sharing the common water resources is one of the grates challenges for 19 countries in the Danube River Basin. Strategic alliances with different stakeholders are essential in successful implementation of any regional management strategy. Participatory and integrated management strategies should be built on environmental, social, cultural and economic objectives to promote coherent sustainable development in the studied areas.

Participatory decision making-model (Antunes et al., 2006) is a relevant method to advance the decision-making process and to analyse the opportunities for different stakeholders in the field of local tourism along the Danube and North Adriatic River Basin. Developing sustainable family farms, food production, accommodation etc. are necessary to provide tourists with local products and facilities. This is a multidimensional task. The participatory planning process works to find *solutions that are acceptable to all* stakeholders (citizens, local authorities, entrepreneurs etc.) and suitable from socio-economical, ecological and also cultural aspects. Bellow a model of stakeholder analysis and participatory decision making process is outlined (Figure 8).

Figure 8. Model of stakeholder analysis and participatory decision making process

5. BRIEF CONCLUSION

In conclusion, we would like to stress out that the integration of history, environmental issues, economy and culture is essential for achieving sustainable solutions in any field. Proposed project offers an idea for connecting peripheral areas of Danube River Basin to its "mainstream", connecting people and regions from North Adriatic to the Black sea. Proposed project would also contribute to cross-border cooperation and sustainable development of Danube River Basin, offering new sustainable tourism development strategy, built on natural and cultural diversity of the regions alongside the rivers.

Working on the project proposal, we experienced enormous potential of transnational and interdisciplinary cooperation. This opportunity gave us a great personal satisfaction, both from a human and professional side.

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Workgroup F
DeWOS
(**D**anub**e** **W**ellbeing **O**peration **S**ystem)
The Development of a Decision Support System for Wellbeing in the Danube River Basin

ABSTRACT

The aims of the project are to develop a decision-making support tool – DeWOS; and to establish a permanent users network using a spin-off company, which will enable international cooperation and implementation of the software. DeWOS will encompass all existing relevant data on factors affecting wellbeing: environmental (water, air, soil, food quality and quantity), social-demographic (education, prosperity, migration, tourism and mobility, health services, safety) and economic factors (employment, industry, agriculture). The tool will provide a reliable valuation of the degree of wellbeing in the Danube River Basin enabling policy makers (from the municipality to the national level) and other stakeholders to assess the current wellbeing situation and simulate possible scenarios along with the feasibility and impacts of possible interventions.

KEYWORDS

decision support tool
databases
wellbeing
policy makers

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1. INTRODUCTION

Wellbeing, as an extremely complex concept, reflects a wide set of factors including: objective physiological and medical criteria (Fujita and Diener 2005); age (Siedlecki et al. 2008); cognitive and emotional components (Diener et al. 1991; Diener et al. 1997; Diener et al. 2006); life-ability (the capacity of an individual to cope with life's problems – Veenhoven 2009); living conditions (*live-ability of the environment* – idem); education, income and employment status, gender, and marital status (Frey and Stutzer 2000, 2002; Di Tella et al. 2001; Kahnemann and Krueger 2006; Di Tella and MacCulloch 2006). The subjective assessment of wellbeing is also influenced by socio-economic factors, the state of human development, respect of human rights, political stability, economic freedom, distribution of income, and the structural and institutional aspects of labour market (Inglehart and Klingemann 2000; Saribas 2010).

Considering all these aspects, there is a need for a proper and consistent supporting tool for proper decision making. This tool should encompass all the existing relevant databases and provide a reliable valuation of the degree of wellbeing in the Danube River Basin (DRB). The indicators for Quality of Life (QL) could be a reflection of the wellbeing of millions of inhabitants of this region. On the long run, the consequences of the decision-makers and other stakeholders using such tool, can mean better prospects of education, employment, prosperity, food-security, healthcare system, safe and non-polluted natural surroundings.

Moreover, the sustainable development of DRB requires integrated solutions of the challenges identified in the Danube Region Strategy (DRS). The prosperity of the DRB is one of the pillars of territorial cohesion and an explicit objective of the European Union. In order to achieve prosperity, comparable living conditions are needed in DRB including good connections between urban and rural areas and access to infrastructure.

Therefore, the aim of this project is to contribute towards the improvement of QL among/within the countries of DRB through the following specific *project objectives*:

- to develop a decision making supporting tool entitled DeWOS (Danube Wellbeing Operation System);
- establishing a permanent users network using a spin-off company, which will enable international cooperation and implementation of the software.

DeWOS will enable policy makers (from the municipality to the national level) and other stakeholders to assess the current wellbeing situation and simulate

possible scenarios (in case of doing an intervention or not), while the spin-off company will represent the interface between science and market, being in charge for sustainability of the system.

2. THEORETICAL FRAMEWORK

This section summarizes the overall structure of the project with involving stakeholders, and shows main connections among addressed challenges, project purpose and refers to the expected result.

Moreover, due to the different meaning of the concept concerning the Quality of Life as well as to somehow specific needs of each category of stakeholder, DeWOS enables the users to target their area of interest and obtain pertinent and consistent data for reaching a sustainable decision.

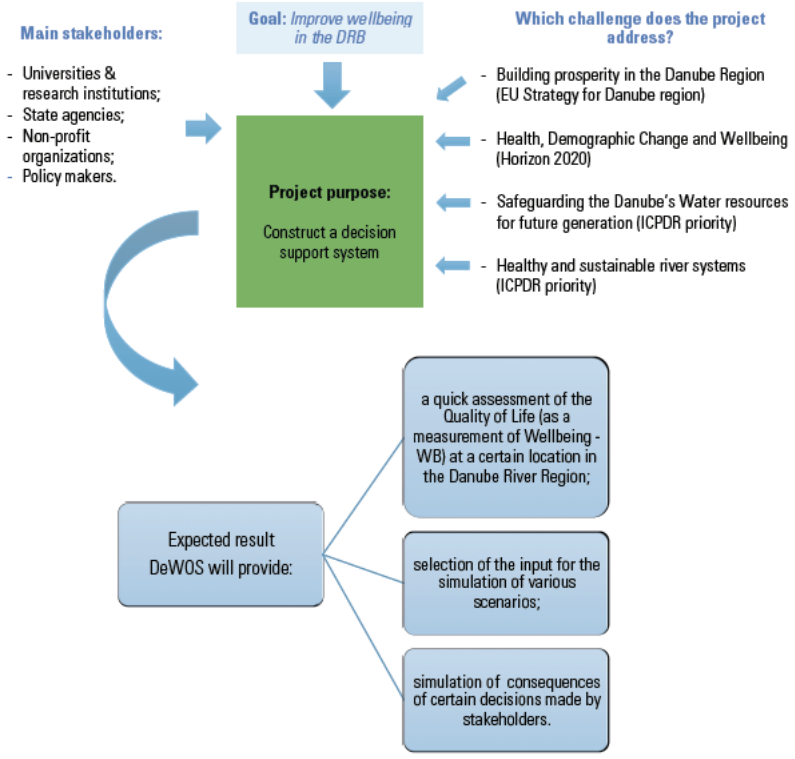

Figure 1: Project framework

3. PRE-ASSESSMENT ANALYSIS OF THE QUALITY OF LIFE

In this pre-assessment analysis we identified the ranks of DRB countries according to their QL through the following series of steps:

a) *Select relevant databases*: Word Bank; United Nations Development Programme (for HDI);

b) *Select the composition of an aggregate indicator regarding the Quality of Life in the DRB*:
The QL is a multidimensional aggregate, thus, we have constructed **intermediate indicators** of the Global Quality of Life Index in the form of the following dimensions:
   – The indicator of the quality of the environment;
   – The indicator of final consumption, tourism and tax;
   – Infrastructure indicator;
   – The indicator concerning age, health status and the labour.

   Moreover, we have added the already computed *Human Development Index (HDI)*, which is a composite statistic of life expectancy, education and income indices.

c) *Establish the econometric methodology of computing intermediate and global indices*:
   – in a preliminary stage, the data are rescaled accordingly with the next formula: (X-average values of X)/ standard deviation of X;
   – each dimension is computed based on a Principal Component Analysis (PCA) with the inclusion of the corresponding variable;
   – the global score is computed based on PCA with the inclusion of the mentioned dimensions;
   – these scores are translated in ranks.

d) *Build a global indicator and establish the ranking.*
   After computing the intermediate indices and by considering HDI, we have constructed a global index regarding the Quality of Life, which allowed us to rank, for the period 2007-2010, the sample countries in the Danube River Basin consisting of 17 jurisdictions for which data were available in the selected databases. The 4 year period allowed us to perceive if there were changes in the ranking due to effects of policies in all fields related to well-being in the Danube River Basin.

Table 1: The final ranking according to the Quality of Life Index

	2007	2008	2009	2010
Albania	16	16	16	16
Austria	3	3	3	3
Bosnia and Herzegovina	15	15	15	15
Bulgaria	13	13	13	13
Croatia	8	7	7	7
Czech Republic	6	6	6	6
Germany	1	1	1	1
Hungary	7	8	8	8
Italy	5	5	5	5
Moldova	17	17	17	17
Poland	11	11	11	10
Romania	12	12	12	12
Serbia	10	10	10	11
Slovakia	9	9	9	9
Slovenia	4	4	4	4
Switzerland	2	2	2	2
Ukraine	14	14	14	14

The pre-assessment analysis of the QL in the sample countries reveals that Germany has best QL index, while Moldova has the worst from the DRB countries. We observed that both positions were maintained during the four years of analysis. In addition, Croatia improved the quality of life of its inhabitants from 2007 to 2008 as well as Poland from 2009 and 2010. Hungary and Serbia dropped a place in the period of analysis. Thus, we consider that an extended and more detailed analysis should be carried out during the project, as well as the development of a methodology dealing with extensive data concerning the Danube River Basin.

4. WORK PLAN OF THE PROJECT

We have regrouped tasks into components according to the aforementioned specific project objectives. Activities are briefly explained and summarized in an activity sheet in the form of table describing specific objective, scope of work, outputs and key staff responsible.

- Component 1: Software Development
- Component 2: Establishing permanent users network

In addition to these 2 groups of activities we have considered a horizontal component, which is the Project Management.

4.1 HORIZONTAL COMPONENT – PROJECT MANAGEMENT

WP 1: Project Management

The establishment of a solid management foundation is a precondition for the successful implementation of any project. The essential goal of this component is the need to ensure the timely delivery and co-ordination of all inputs (human and technical) and outputs in order to ensure the achievement of the project objectives. The Activity Sheet for this horizontal component provides a clear overview of the principal tasks to be accomplished.

Activity sheet 1 HORIZONTAL COMPONENT: PROJECT MANAGEMENT	
Objective	To establish professional project management structures and processes
Activities	WP 1: Project Management • Leader Team establishment • Development of Team's Quality Assurance Systems • Backstopping and invoicing • Visibility measures • Preparation of project publicity materials • Kick-off meeting
Outputs	• Establish international standards of project management • Establish Advisory board • Good project co-ordination and reconciliation procedures in place • Inception Report • Draft and confirmed Final Assessment and Recommendation reports • Report on methodology for defining wellbeing assessment
Key staff responsible	• Leading Team • Project Director

Leading Team is responsible for the co-ordination of all activities regarding project management, and it is supposed to be located in Vienna where central office was planned to be established, due to all necessary administrative, technical and scientific support that city of Vienna provides.

Leading Team is also responsible for stakeholder analysis (Activity 2.1.), to insure workshops and implement their feedback in the project process. Project management will insure promptly engagement of all identified internal stakeholders, partners which will present research team responsible for certain activity sections.

Within DeWOS development project several calls will be set to engage different academic institutions in order to deliver assessment reports and about established indicators regarding quality of life, existing databases and operation systems, GIS systems.

4.2 COMPONENT 1: SOFTWARE DEVELOPMENT

The Implementation of the project will benefit from the Project management horizontal component set up in the above activity sheet.

WP 2: Planning

Planning is concerned as one crucial activity in this project, especially because it includes identification and definition of indicators, methodology and stakeholders.
Based on the synthesized data from database assessment (Activity 2.3), need assessment (Activity 2.1), and through literature review we will identify and select indicators regarding the QL.

Activity 2.1 – Needs assessment

Leader Team will do a comprehensive stakeholder analysis to define internal stakeholder who are going to be included in project itself and also external stakeholder including local communities representatives, NGOs, health institutions, media and the most important policy and decision makers who will be more involved.
We will hold active workshops where we will use focus group methods, consulting key stakeholders, and distribute the questionnaires to collect information about the problems related to the wellbeing in the DRB.

Wellbeing, except being a political goal (Borsdorf A. 1999), represents an integral and wide concept consisting of environmental factors (water, air, soil, food quality and quantity), social-demographic factors (education, prosperity, migration, tourism and mobility, health services, safety), economic factors (employment, industry, agriculture). It's obvious how much factor groups are intercepting with each other; hence a unique tool for connecting all of those to generate an overall assessment is needed.
Identified internal stakeholders are consulting companies, institutes and universities with their branches related to IT and communication systems, database management, new technologies, environmental and social-environmental studies, social-demographic, tourism management and social-economic studies are going to be involved as responsible partners obliged to deliver detailed reports about existing situations and improvement ideas. They are encouraged to include students at different levels of study, depending on final budget they will be allowed, but their internal structure is independent of main leading partners.
One of the key issues at this stage of the project is accomplishing the ownership attitude with policy and decision makers, as they will be final users of the product.

Activity 2.2 – Indicators identification and defining criteria

We identified indicative indicators which were used for rapid assessment of the quality of life in DRB, and also to identify case studies that are going to be used in Activity 4.
After detailed work with stakeholders, the list of indicators will be updated and also methodology for identifying them will be developed.

Activity 2.3 – Databases assessment

Whether it is remotely sensed, in-situ, ocean based, or surface-based, earth observation (EO) data is essential for making informed public policy decisions in many areas involving societal benefits like climate variability and change, energy management, agriculture, biodiversity, human health and epidemiology, weather forecasting and water management (Barbara J. Ryan: *The economic value of EO data is in its utility*) and those are all issues that impact general wellbeing. Data, in and of itself, is of little value unless it is used.
While many existing databases systems were primarily designed for a single purpose, it is both beneficial and cost effective if these systems can be multipurposed, therefore special reports will be done in order to deliver compre-

hensive assessment of existing databases and recommendation to connect them integrally. There are already initiatives and ongoing projects which are working on standardization of existing and adoption of new data on international level like GEOSS, EO, Balkan GEONet within FP7 scheme, hence this project intends to use them as a baseline and then systematically upgrade it to the required level.

WP 3: Programming

At this stage we will focus on the lab work and programming. First through different bids for contracts we will identify IT specialists and engineers who will develop the program. They will create a friendly Graphic User Interface (GUI) and they will consult the target user about GUI. Based on the identified indicators and database, we will integrate them in the software process.

Activity 3.1 – Creating port that can combine all databases

Teams of experts for IT, communication and databases management are going to be involved at this stage to recommend and develop solutions for building a collecting interface console that would gather necessary data from those existing databases.

Activity 3.2 – Integrate defined indicators and criteria in software process

Software developers will include previously defined process of indicators identification and methodology for criteria. Key issues in this activity concern computer resources limitations that programmers will have to solve, and an important collaboration between developers and stakeholders defined in Activity 2.1. need to be established. Leader team has the key role to establish that communication path.

Activity 3.3 – Creating simulation console

This activity will result with simulation console that can use the existing data, accept continuous data updates and calculate defined level of quality of life at certain location. Created software will enable user to change certain parameters to simulate some interventions that could be done in order to improve the quality of life. This activity is over when DeWOS software itself is ready to be used.

Friendly graphic user interface (GUI) is a key issue for the good implementation of the software and its utility to the final user – decision maker. Hence, an iterative process of communication between developers and sample of final users will be established.

WP 4: TESTING

This stage of the project is considered to be rather vulnerable as it will generate lot of issues that will have to be solved as soon as possible. Key issues will be

Activity sheet 2 COMPONENT 1: SOFTWARE DEVELOPMENT	
Objective	To create a joint interface software for decision support regarding wellbeing in Danube River Basin – DeWOS
Activities	**WP 2: Planning** 2.1. Needs assessment 2.2. Indicators identification and defining criteria 2.3. Databases assessment
	WP 3: Programming 3.1. Creating port that can combine all databases 3.2. Integrate defined indicators and criteria in software process 3.3. Creating simulation console 3.4. Creating friendly graphic user interface 3.5. Consultations with target user about the GUI
	WP 4 : Testing 4.1. Basic testing 4.2. Case studies (Germany and Moldova) 4.3. Calibration and verification
Outputs	• Indicators clearly defined and identified • Methodology for defining priority impact factors • Databases assessment reports • DeWOS blueprints • DeWOS software • Documentation (recorded errors, creating Help Menu) • Report on software efficiency • Draft Manual
Key staff responsible	• Leader Team • Research teams by areas of interest • Project Director

adoption of the model to each location databases and their integration in calculation process. Activities within the testing stage solve the following tasks:

– basic testing – basic numerical and conceptual operation check,
– rapid assessment of wellbeing at case studies location to check the software applicability and ability to adopt in extremely different conditions,
– calibration and verification – this processes will apply directly on case studies but using different set of data.

4.3 COMPONENT 2: ESTABLISHING A PERMANENT USERS NETWORK

After DeWOS has been developed and launched, there is a need to establish permanent users network, which will ensure the real implementation and global objective of increasing WB in DRB.

WP 5: Establishment of Spin-off Company (named Spin-WOS)

Leader Team in accordance with main stakeholders will define and establish spin-off company which will be in charge for:

1. Promoting and selling the final product – DeWOS
2. Organizing capacity building program, workshops
3. Public relations and technical support service
4. Establishing focal points in every country or sub-region of the DRB
5. Operation and maintenance of the system

Table 2: Key issues regarding Spin-WOS

How Spin-WOS contributes to increasing the WB of people in the DRB?	Why fund Spin-WOS?
• job creation; • better image of public sector research; • improved ability to attract young researchers.	• it helps to justify funding for a research project that has direct applications; • local governments support these companies because the dynamic image of the region; • there is a tendency to fund similar projects, when it exists a legal framework encouraging the creation of such companies and especially when one of the home countries of partner institutions has a long and productive cooperation with spin-off companies.

Spin-WOS is a research spin-off (also, entitled spin-out or start-up) representing a company licensing technology from a public research university (leading institution) and being directly established by such entity. The relationship between the company and the partner institutions refers to cooperation in research activity and exchange of personnel (lecturers, scientific consultants, PhDs, etc.).

WP 6: Capacity building program

This activity will include workshops and organized courses for teaching wide user audience how to use the program and implement it in their analysis or decision making process. Researches that have been included in software development together with their colleagues from other field of research are going to be key personnel in this phase.
After education system at this level has been established, final manual document will be produced together with detailed guidelines on DeWOS application and suggested analyses that it can enable.

WP 7: Implementation

Once critical mass of trained users is reached, next step is to start implementing this system at different level of decision making stages. Establishment of local focal points responsible to manage, operate and maintain on national level or at least sub-regional is the crucial task at this stage. When this regional centres are operational they can continue with implementation at smaller scale.

WP 8: Operation & Maintenance

This activity is ongoing process that continues even after the end of the project and it will enable system to be sustainable and slowly reach the final goal of wellbeing improvement in DRB.

Activity sheet 3 COMPONENT 2: ESTABLISHING PERMANENT USERS NETWORK	
Objective	to establish permanent users network
Activities	WP 5: Establishment of spin-off company (Spin-WOS) WP 6: Capacity building program WP 7: Implementation WP 8: Operation & Maintenance
Outputs	• Spin-off company – Spin-WOS • Trained users • Report about capacity building program • Guidelines for implementation and using of DeWOS • Local focal points • International cooperation
Key staff responsible	• Leader Team • Project Director

LIST OF ABBREVIATIONS

DeWOS	– Danube Wellbeing Operation System
DRB	– Danube River Basin
EO	– Earth Observation
EU	– European Union
FP7	– Frame Programme 7
GEOSS	– The Global Earth Observation System of Systems
GIS	– Geographic Information System
GUI	– Graphic User Interface
HDI	– Human Development Index
ICPDR	– Commission for the Protection of the Danube River
IT	– Information Technologies
PCA	– Principal Component Analysis
QL	– Quality of Life
Spin-WOS	– Spin-off Company for implementing DeWOS
WB	– Wellbeing
WP	– Work Package

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EU Macroregional Strategies

Thank you for inviting me to this closing session, it is a pleasure and an honour to be here.

I would like to start my reflection going back to some years ago, before the accession of the 10 new member states of the EU, to tell you that I got highly impressed by a lady from the Baltic Republics interviewed about her feeling on entering the EU saying "I do not expect any benefit for myself or my generation; this is for our children and grandchildren".

Well, let me say that lady had a long term vision which national governments often lack and sometimes even EU bodies.

In fact, bearing in mind that interview, when the first macroregional strategy was launched some years later I was not astonished at all it was the Baltic Strategy and the main goal was an environmental one, which is the first concern when thinking of next generations.

I was not astonished either when the EC was given the mandate by the Council to elaborate on the Danube strategy, not only because a colleague from the Representation of Baden Württemberg in Brussels had given me well in advance the first draft of the sentence to be put in the council conclusions, but rather as I knew to what extent our friends from the Danube area were committed to this project, and at that time I thought it would have been a common project.

Unfortunately, due to several reasons, it was not possible at that time to join the strategy as full member even if Friuli Venezia Giulia Region was entitled from a geographical point of view to do so as it makes part, at least for a little portion of its territory, of the Danube River Basin, but I am very happy to see that, thanks to the engagement of the University of Trieste and its proactive attitude in the Alps Adriatic Rectors' Conference and its close cooperation

with the Danube Rectors' Conference, what had seemed for a while a lost opportunity has now turned into a very fruitful reality, that we are witnessing today, here in the Gorizia site of the University of Trieste.

Still, we have to ask ourselves whether macroregional strategies are worth our unconditional support and commitment.

First of all, as you are perfectly aware, macroregional strategies have been developed under the "3 no" principle: no to new rules, no to new bodies, no to additional budget at EU level.

This is for sure true from a technical, I would even say from a theoretical point of view, but what in practice, in particular as long as access to European funding is at stake?

In a few months we are going to enter the new programming period – 2014/2020 – with some important novelties for the cohesion policy: conditionality first of all (both ex ante and macro) – unfortunately no time here to go more in depth into this highly debated subject –, but also ex post evaluation and performance bonus. In addition EU 2020 targets on employment, Research, climate change and energy, education and social inclusion, will be the guiding principles for expenditure on structural funds, like for every other EU policy, as highlighted very clearly in your team works.

Furthermore we will have to compete on a level playing field for the programs directly funded by the EU, like Horizon 2020.

All this happens in times of budget constraints and increased attention at all levels for the effectiveness of public money expenditures, that will make competition for EU funding harder and harder.

Is there any further need to demonstrate that wide area strategies will indirectly imply a higher rate of success and more absorption of EU funds, thus overcoming – de facto – the criterion of no-additional budget for macroregional strategies?

Acting together in the framework of a macroregional strategy with an interdisciplinary approach seems to me the only win-win approach for our territories and it is of the outmost importance that this is the mission of the DIAnet Project, while **sustainable competitiveness** seems to me – in times of crisis and high rates of unemployment, especially for youth – to be the vision.

At present further macroregional areas are (or seem to be) in the pipeline, and among them the Adriatic-Ionian initiative. Italy can act as a bridge between North and South, West and East, and Friuli Venezia Giulia in particular, thanks to its long lasting tradition in international cooperation dating back to the period of the iron curtain (in the Alps-Adriatic Working Community – an actual macroregion ante litteram) can play a role of hinge between Danube and Mediterranean areas and between Alpine and West Balkans areas.

The regional high education system and the University of Trieste in particular have been very proactive in interacting with the Danube area via its close cooperation between Alps Adriatic Rectors' Conference and Danube Rectors' Conference, carrying out a common work on the "knowledge society" pillar of the Danube strategy and I have had the honour to be a direct witness of this best practice mentioned by the European Commission itself in the Danube Action Plan.

Coming back to the added value of macroregional strategies, somebody could be also worried on how to strike the balance between subsidiarity and need for "critical mass", possibly implying less autonomy, but I would say that responsible multilevel governance is the right answer: we have to face challenges that do not stop at regional borders nor at national ones: climate change, pollution, energy supply are only some examples but also health-care, transports, research need interregional and transnational coordination, in other words "macroregional policies", whatever we want to call them.

This means that even if working together in a wider perspective could imply that we lose some "room for manoeuvre", still it remains the only path to take, the only responsible choice when thinking for our children and grandchildren sake, like that lady from the Baltic Republics said some 10 years ago, and should make us conclude "beyond any reasonable doubt" that: **YES, macroregional approach deserves our full engagement**.

Bruxelles/Gorizia, 22nd April 2013
2013 DIAnet International School – Closing Ceremony

Giorgio Perini
Member of the Italian Permanent Representation to the European Union

Acknowledgements and Farewell

The time has come to close this first edition of the DIAnet International School. It has been a very innovative experience in the framework of traditional didactic activities of our university. The organisation – as regards both the scientific part (lectures, co-taught seminars, project work activities, excursions) and the logistics – has not been easy since we had to solve many problems in a very short time, and I apologise to all participants, teachers and students for any inconvenience that has occurred during the preparation and the commence of the activity. Ups and downs are to be expected when new roads are opened.

These ten days of intensive work have been very tiring for everyone: participants, teachers, facilitators and staff. Multidisciplinarity and interdisciplinarity require great attention and openness to go beyond the limits of our discipline with the humility to be involved in the achievement of new goals and perspectives. I hope that the result can compensate for the stressful activity and that this experience was positive for all of you in the development of your training and inclusion in research or in civil society activities. Hopefully the participants will go home with something more in their luggage. Furthermore, I hope that they will be able to develop a network of personal relationships initiated in this occasion. This is certainly one of the aims of this International School.

The good response to the call for admission to the first edition of the DIAnet International School shows that the initiative has aroused wide interest in all the countries concerned. Clearly, the time is ripe to propose new paths in the organisation of studies and to seek answers to the uncertainties that characterise the postmodern society.

You might ask: why an international school with a strong emphasis on interdisciplinary approach?

Universities are now facing a challenge: they have to respond to the demands of a globalised civil society, dominated by the idea of the market, without having to give up the solid model of the Humboldtian University, the principles of which were:

- Unity of research and teaching;
- Freedom of teaching;
- Academic self-governance.

One remarkable notion is that in the Humboldtian University all sciences are equally important for *Bildung*: a leading principle of the university was the integration of the natural, social sciences and humanities as Wilhelm von Humboldt suggested. The slogan *Bildung durch Wissenschaft* ("education through learning and research") expresses the idea that science will educate the young generation to understand both the world and their duties in it.

In our time the emphasis is on competition, economic growth, short-term returns, innovation, science and technology. "It is vital to understand that such mechanisms can ultimately undermine the outcomes that are a university's principal benefit to society" (Boulton, G. and Lucas, C. *What are Universities for?* Conference of the League of European Research Universities – LERU, 2008).

We also have to measure up against the new frontiers of education that open in the Internet age (see: Katz, R. et al. *The Tower and the Cloud. Higher Education in the Age of the Cloud Computing*, 2008) – but is online learning really a good opportunity to expand the reach of universities?

As was well pointed out at the Communia 2010 Conference (*University and Cyberspace. Reshaping Knowledge Institutions for the Networked Age*) by Juan Carlos De Martin and Charles Nesson in their paper "The post-humboldtian University", the keywords of the crisis are:

- Weakening of the states
- Knowledge also outside Universities
- Mass education (democracy)

What do we expect then from the University of the Third Millennium?

Crisis, challenge and amazing opportunities. We are debating between the old and the new and looking for a way forward. The keyword can only be "accountability". And the expected tasks:

- More interdisciplinary research;
- More open and transparent science;
- Close collaboration with different stakeholders outside universities;
- Larger scale of problems worth solving.

The DIAnet International School is an ambitious project.

As we read in the presentation: "If we use a new type of interdisciplinary methods and approaches – driven by humanities –, changes of biodiversity, sediment mobility, soils, climate, precipitation, discharge patterns and water quality can be studied in combination with changes in governance, or in the social, economic and legal situation, which will enable us to develop policies for sustainable development of the Danube river basin."

A second edition of the DIAnet International School dedicated to the *Natural Heritage* will take place in 2014 and a third one will focus on *Cultural Heritage* in 2015. It is possible and it will indeed be a welcome result if young researchers participate in all three schools and become active members of the Danube:Future project.

Many people have helped to build and operate the School. First of all I wish to mention Prof. Verena Winiwarter (Alpen-Adria-Universität Klagenfurt) and Dr. Gertrud Haidvogl (University of Natural Resources and Life Sciences (BOKU), Vienna) who have brought their expertise in Interdisciplinarity and their enthusiasm in coordinating and monitoring all activities.

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And now is the high time to say goodbye to everyone, thanks for the participation, and a safe journey home.

Gorizia, 22nd April 2013
2013 DIAnet International School – Closing Ceremony

Prof. Claudio Zaccaria
Director of 2013 DIAnet International School