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Reconsidering Landscape and Water in the Danube Region: Challenges for More Sustainability.

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Abstract
Neglected landscapes and polluted waters are indicators of a non sustainable development. The Danube region consists of 18 inhomogeneous countries. A common landscape and water management plan can increase the quality of life in particular for the less favoured inhabitants of the Danube river basin. Recent European frameworks, the European water framework directive and the European landscape convention are considered as tools for the establishment of common guidelines in landscape and water management on different spatial scales. Ecological, social and economic incentives have to emerge together to preserve the given qualities and to develop the potentials. The project ideas presented here refer to the economic sectors agriculture, construction and tourism. They relate individual efforts to a larger program for more sustainability if they are supported by administration and in depth analysis. Thereby multiplications of best practice approaches can be achieved.

Introduction

The Danube river basin is about 0.2% of the Earth surface covering 0.5% of the global landscape. With 815,000 km² it is the 22nd largest river basin in the world and the second largest in Europe. With a length of 2850 km it is globally the 27th longest river. Around 1.5% of the global population or 90 million people are living in the Danube river basin. Some 0.5% of the world precipitation or 550km³ water rains or snows within the Danube river basin. About 0.7% of global river runoff or 270 km³ derive from the Danube and 0.4% of the global evaporation or 280 km³ (figure based on global and European estimates of L´vovich and White, 1990) happen over the land cover of the Danube river basin. The Danube, stretching over 2850 km, has a mean discharge of 6,400 m^3s^{-1}. The estimated mean sediment load is 19 million tons per year and the mean dissolved load is 60 million tons per year (Douglas 1990). A geo-physical division (IHP UNESCO, 1999) divides the Danube into three segments, the upper Danube from the source to the castle of Devin/Bratislava, where the river Morava flows into the Danube, the central Danube from Devin to the Iron Gate at the border Yugoslavia and Romania, and the lower Danube covers the Danube after the Iron Gate until the Danube Delta.

The Danube basin lies in a favourable climate zone. An average precipitation of 680mm with an average annual temperature of 9º C is used as an approximate mean value for the Danube river basin. Depending on the shape of landscape the numbers will widely vary, stretching from a maximum of 2000mm in some mountainous elevations (Alps, Carpates, Balkans) to a minimum of 300mm in lowland plains. People in the basin live with large temperature differences in summer and winter month stretching over 20° C or more. Upstream we find more precipitation and colder climate conditions than downstream. With about 100 inhabitants per km² the Danube river basin is about three times more populated than the world average. As compared to the most densely populated zones of the world it is still scarcely populated. The inhabitants of the Danube river basin have in general good access to water resources. Assuming an average daily demand of 600l freshwater per inhabitant, some 20 km³ are annually converted into waste water. While this amount is less than 5% of the annual precipitation, the distribution over the year can be a problem. This was the case during summer 2000, when water scarcity appeared in irrigated agricultural areas.

We will not find another river basin in the world with a comparable economic disparity of its inhabitants, which is by far larger than the one of the European Union. The average person in Switzerland – the leading country in terms of income - has some 30,000 US$ GNP per person and year, the average income of a person in Moldova – the poorest country not only in the Danube region, but also in Europe - is 500 US$ GNP per person and year. Based on economic figures we find three sectors: a) the economically rich upstream sector with Austria, Germany, Switzerland, the b) moderate rich in between sector with Czech Republic, Sovakia, Hungary, Slovenia, Croatia and c) the less rich sector with Yugoslavia, Bosnia-Hercegovina, Bulgaria, Romania, Moldova and Ukraine (Fischer Verlag, 2001). In addition we find four more countries, Italy, Poland, Albania and Macedonia with minor shares – less than 1000km² - of their countries in the Danube river basin.

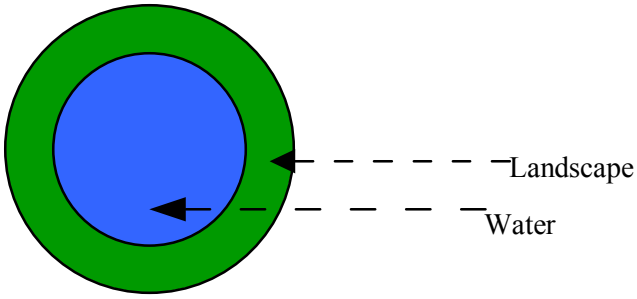
We find several and diverse ways of using and managing land and water in the Danube river basin. In most parts of the world we find tendencies of globalisation. In contrary, our region is characterised by segregation. Difficulties exist as consequences of war in the successor states of former Yugoslavia. Many obstacles like disturbed houses, bombed bridges, mines on abandoned land still exist and many of previous war areas are today depopulated. A general distrust exists between the follower countries. Visa procedures limit the traffic of people and goods. Within the segregated parts we find even after the wars ethnical variety with numerous traditions, but co-existence became a more difficult task. Forming a regional Danube entity remains an overall aim, but for the short term not in view.

Since 1956, the International Association for Danube Research cares for water and water related issues in the Danube River Basin. This period was characterised by rapid transformations and accelerated change. We find inside modifications with land use changes, increase of overbuilt areas for settlements and traffic, construction of large river reservoirs with transformations of river beds, intensified agricultural land management practices with irrigation, drainage systems and multiplication of chemical inputs, growth of urban sewage, increasing demands in water supply in industries and services combined with an increase in waste water. We find outside alterations like climate change, depletion of ozone and consequences after the nuclear accident in Tschernobyl. In a moderate way our organisation IAD can contribute to improve the quality of life in the Danube region. I will present my concept of landscape and water issues in the first part and explain how administration and science could work together in a landscape and water framework. In the second part, I mention challenges related to economic activities suited to contribute to more regional sustainability.

Part I: The Relation of Landscape and Water

The Understanding of Landscape and Water

Figure 1: Relation landscape and water



Landscape is the physical area that can be seen or observed. It is the human scale of territory. Traditionally, landscape was local and the Danube river basin can be understood as a mosaic of different landscapes on the smaller scales. The view from large scale and small scale will provide very different insights on landscape. The smallest landscapes, e.g. gardens, are similar to rooms and have visible boundaries like trees or houses. Boundaries of larger landscapes are mountains or horizontal lines, trees and houses are then elements. In an even larger scale we will find administrative borders of communities and districts as relevant landscape units. We will need a balloon or aeroplane to see the landscape and its borders. The higher we go up, the larger a landscape can become. It requires a high rise – the one of a satellite - to observe the Danube river basin as one single unit.

Water is the liquid state of landscape and can be found everywhere. Water is the connecting agent of the landscape and in form of rivers and lakes it is a distinct element in the landscape. Landscape and water have a similar relation like body and blood. They will always appear together and change simultaneously. Settlements, forests, mountains, agricultural areas, traffic areas, are beside rivers and lakes other elements of landscape. Too much or too little of water can cause harm and damage in the landscape. Any effect on water, either related to the quantity and quality of water, will have an impact in the landscape system and consequently also on all other elements of the landscape.

Landscape is the arena for human actions and contains all social, technical and environmental systems of man. Water has a decisive impact on the economy, carrying capacity and the future development of landscapes. Landscape is under continuous change shaped by previous and current inhabitants and carries the expectation of future inhabitants.
Landscape and water satisfy our basic demands of food and drink supply, our demands for economic activities; they are sources of pleasure for our senses and become the foundations of art and culture.

Because of the varied field of applications, landscape and water does not mean the same thing for all of us. We perceive landscape and water in different ways related to interests, cultural preferences, life styles and experiences.

Sustainability, landscape and planning are closely related. Landscape refers to a spatial reference scale. Planning is any action directed to the future. Sustainability describes how this action is directed into the future; that one can foresee that even future generations have a similar access to resources like we have today. It refers to a combined economic, social and ecological view. Since about 20 years, sustainability is used as a major concept for administration and science. Sustainability is a relative concept. It is dependent on borders in space and time as well as on our interests and perceptions. The term sustainability broadened the interest on ecology and made it applicable for a larger public. Many more people got an attention for environment than what was previously the case.

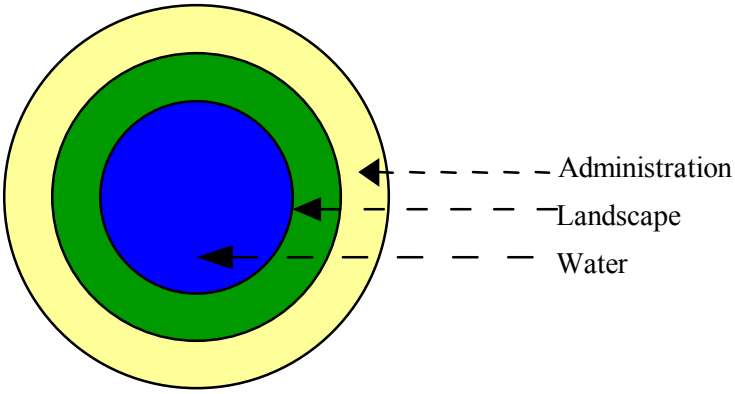
Administration of Landscape and Water: the European water framework directive and European landscape convention

Landscape and water are main topics in politics and administration. Humans have to care for and to develop landscape in order to use it in the best possible way. Patterns of water flow in a particular range and an appropriate quality are necessary to keep the landscape vital. Planning and decision making becomes increasingly more difficult as we find ever more changes in situations we assume as stable. Long term consequences of water use and the results in landscape changes, e.g. in connection with large hydro-electric power plants can extent over decades. Adverse effects have to be addressed long before they become obvious. Combined efforts with concerted actions are required if we want to reduce ecological surprises and to keep control over development and change.

Our concern is to define and promote a sustainable development where ecological, economical and social aspects are equally important. This task became more difficult than what it used to be in the past for the following reasons: the number of actors increased as well as the magnitude of their individual impacts; the number of planning relevant processes multiplied in urban centres, while rural and remote areas are today less important than previously and threatened by a neglect of human care; the dynamics of change are neither stable and steady nor equal in space and time. For this any extrapolation into the future based on models is a difficult task.

Development alternatives of planners are simplifications. They do not include all available knowledge. They are operational with regard to particular issues and a compromise between interests that were articulated before. For this reason, planning can never be completed. Continuously, we have to add new aspects to the planning process and thereby adjust landscape and water to the requirements of our time.

Figure 2: Relation Water, Landscape and Administration (Society)



Two possibilities of adjustment in planning and administration are the European water framework directive and the European landscape convention. To ease a management according to the European Water Framework Directive of 2000, the Danube River Basin was divided into "Sub-river Basin Areas". They combine landscapes of similar hydrologic regimes, mostly the Danube's first-order tributaries. They were developed at national level. In a second step, the national sub-river basin areas were looked at as transboundary regional landscapes, resulting in 11 "Sub-River Basins" of the Danube River Basin. "Significant Impact Areas" characterise particular points of interest from receiving pollution or from their ecological value. The overlay of hot spots and significant impact areas facilitates the needed selection and ranking of pollution reduction and other water quality improvement projects within the Danube river basin. At this level the water framework convention deals with local units or the same areas of interest like the European Landscape Convention does.

The European landscape convention proposes a smaller scale - the community scale - as a reference. Therefore it is distinct to the approach of the European water framework directive. The concept was developed by the Local and Regional Authorities of Europe (CLRAE) and adopted by the Council of Europe in 2000. Many communities have established Local Agenda 21 plans and much of this work is relevant for the landscape convention as well. Europe is a mosaic of single communities, each of them unique, but also a collage of similar landscape elements. We find several thousands communities with more than 90 million inhabitants in the Danube river basin. We get several of thousands local landscape management units over the Danube river basin. Each community which can considerably differ in size and amount of population will be part of one of the 11 sub-river basin areas described in the water framework directive.

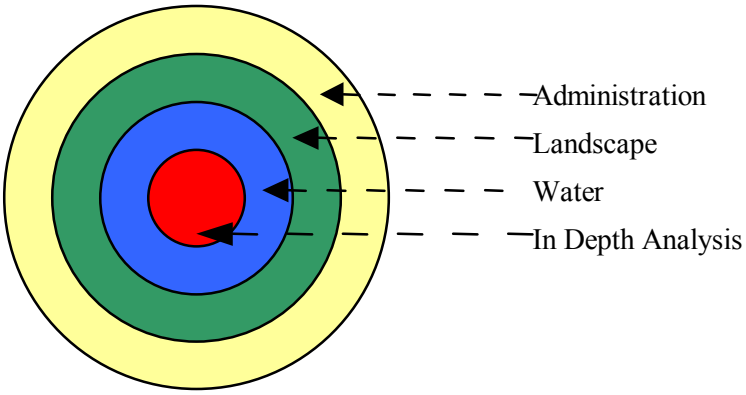
The large overview on water issues remains within the responsibility of the water framework directive. The practical improvements have to happen on the local scale, where actors and decision makers can be defined more easily. Both tools should be seen as a package complementing each other. Industries and other point sources may be expected to be under better control by 2006 as a result from efforts related to the water framework directive, the issue of non point sources is likely to remain. The largest amount of

non point pollution comes from agriculture, households and small entrepreneurs. Those groups are currently out of scope from the European Water Directive and actions have to be addressed on the community scale. An example of how such a local management could look like exists and was recently presented by the IAD country representative of Switzerland for “Kleine Emme” in the canton of Lucerne (Stadelmann et al. 2000). At the community scale one can go into the details and tackle the open questions why river basin management on larger scales is not successful.

In an ideal case, other administrative frameworks with different spatial reference scales might be used to complement the European water directive and the European landscape convention. However, these frameworks do not exist yet. I consider an intermediate scale between sub-river basins and communities as necessary to ensure a certain level of consistency throughout the Danube region.

In depth analysis of landscape and water: science and arts

Figure 3: In depth analysis of water, landscape



Science and art are particular interests in landscape and water as compared to the general interest of the administration and public management. Science and art will present the new issues and compete for a general acceptance in society. While the group of administrators and managers tries to keep the control over an increasingly complex relation of landscape and water, the group of scientists is challenging them by producing ever more knowledge which the administrators have to consider and to integrate into the existing base. The in depth analysis can have a focus on science, a focus on intuition or a mixture of both.

The first way is to compare different landscapes by generating indicators and to explore in how far it varies in place and time. Land and water indicators on a qualitative or quantitative base are necessary to compare the smaller units within the larger unit. Here we can refer to recent IAD examples. Several applications were made within the field of water within the 5th framework research program of the European Union.

The second way is to see each landscape as a unique entity different to all other landscapes due to the particular arrangement of its elements and with a unique history. Expressions of artists in the landscape – in form of houses, sculptures, and monuments – give a particular value to the landscape. They can be tracked back throughout history. Painters and photographers at a particular state conserved impressions of the landscape. We can read the history in the monuments of landscape or the shape of water bodies.

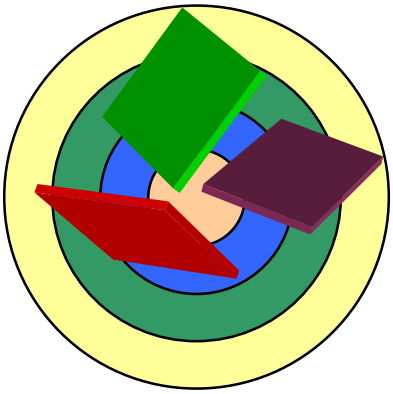
Combining the scientific and artistic approach we can reconstruct the old and find new patterns of our life stiles in landscape and water. Many aspects of landscape and water remain unknown or insufficiently understood. Science tries to bridge this gap. Artists express feelings and can either cause harmony or provocation. Their work yields contrasts to the established perceptions on landscape or water and brings the impulses to new insights.

PartII

Major Challenges for more Sustainability in the Danube River Basin

Improvements in ecology and quality of life are closely related to economic activities. Major ecological and social advancement will be closely linked to the establishment or re-establishment of a stable economy. Three approaches related to the major economic sectors are challenges for more sustainability in the Danube river basin and shortly described here. The approaches will work throughout the region despite the mentioned differences. They include manifold individual smaller scale projects throughout the region with the aim to become a large sector program stretching over the countries, regions, provinces and districts of the Danube river basin. The ideas mentioned here have to be supplemented by others. They are a starter to a wanted kind of development and by far not complete.

Figure 4: Restructuring of Economic Sectors for Sustainability



Agriculture
Construction
Tourism

Challenges in Agriculture

The role of agriculture is generally seen as problematic, when new countries apply for membership in the European Union. Agriculture is a key factor in the economy of the European Union and agricultural subsidies amount for three quarters of the budget of the European Union. New ways of agriculture are required to avoid a break down of EU financial systems.

At current, more than 80% of the Danube river basin is situated outside the European Union. Only Germany and Austria are part of the European Union. The huge agricultural areas within the Danube river basin, e.g. the fertile Hungarian planes, Slavonia region in Croatia, Voyvodina region in Yugoslavia, the most fertile zones of Romania and Bulgaria, are currently outside the European Union.

While agriculture is seen as an obstacle in entering EU, this situation could turn to the better, if we consider organic food production as an option. After BSE and foot and mouth disease effected large parts of the industrial agriculture of Europe, organic farming products got much more requested on the market. The demand is reported to be 5 times higher than the supply (Ernte Verband). At current, the agricultural production in Voyvodina, one of the richest agricultural areas of Europe could be classified as organic one. During 10 years of war, isolation and economic decline, it was not possible to buy fertilisers and pesticides. During this period, the water quality improved significantly (Matavuly, 2001 personal communication). At current it would be possible to supply large quantities of the European organic food demand from this region. The major problem however is, that this change was not a concerned voluntary one. It was enforced by war. Additional support programs to secure the current state of ecological benign production are urgently required.

The genetic variety within agriculture should be kept to a maximum extent. In particular in the lower Danube river basin we find many varieties of old agricultural plants and traditional animal husbandry. Modern agriculture substituted many indigenous kinds by more productive varieties. In general, the indigenous kinds are ecologically more favourable because they need less artificial additions, pollute less, and cause no agricultural surplus production. Within the European Union, where the current production is suitable to supply a much larger market, the ecological production will be cheaper for the European Union than an agriculture based on maximisation of the production and producing even higher surpluses. High quality ecological agricultural products have much better chances to compete on the European market. A major concern has to be the education of farmers, which were brought up in a maximum yield philosophy, and which will find them in a different context.

Fishing, river morphology and water quality is highly correlated. While in the upstream countries of the Danube fishing is not an economic issue, it remained of economic importance in the lower Danube areas. Many varieties of importance e.g. the sturgeon already died out in the upper and Central Danube countries. Improving the water quality and adjusting construction works will give better income opportunities to the remaining fishermen of the Danube and its tributaries. The correlation between landscape, land use, aquatic eco-systems and water quality was recently addressed by an IAD proposal (Orthaber 2001, personal communication). Here, the idea is to use recent remote sensing techniques to explore the correlations between these factors.

Challenges in the Field of Constructions

During the last 50 years many constructions changed the appearance of the Danube and its tributaries. In general the river beds were straightened and the throughput flow of water accelerated. The reasons for this were numerous. Just in the last two decades efforts are undertaken to break up the straight form of channels and riverbeds and to design a more nature near appearance of rivers. Straight lines became less popular and biologically working systems more important. Keeping water in the landscape is a guiding rule and the easiest way to do so is an increase of vegetation and to allow the

infiltration of water into the ground. It became obvious, that the negative impacts of constructions have to be balanced by further human alterations in an ecologically benign direction.

In particular plants for electric power generation modified the rivers within the Danube basin. Artificial lakes and changed flow velocities were a consequence. This in turn changed the composition of species of the aquatic and terrestrial ecosystems. Migrating fish species could no longer proceed. Fish ladders were in many cases not included into the construction process. Most severe are hinders of Iron Gate 1 and 2 with length of 28m and 36m along the borders of Yugoslavia and Romania. A recent initiative of IAD and other organisations was the promotion of the sturgeon project for the Upper Danube. The aim is to reintroduce the sturgeon to the upper Danube countries. The migrating sturgeons can only reach the Iron Gate and it will not be able to leave Romania and enter Yugoslavia. Due to caviar production, the sturgeon is very valuable and a catch – despite prohibited – can bring wealth to the fisherman. IAD experts (Bacalbasa, Suciu 2002 personal communication) expect the sturgeon to be extinct even in Romania within the next 5 years, if no key action is undertaken to preserve it.

Sewage treatment plants became increasingly more important, first in the upper Danube countries and now primarily in the lower Danube countries. The plan to have a complete coverage with sewage treatment plants is costly and a complete coverage is not in view. Cheaper alternatives are required for the time being. The current treatment of most sewage systems is costly and more ecological benign solutions are available. Large quantities of fairly clean water get into the waste water system. One alternative would be the separation of drinking water and usable water for cleaning purposes. In countries like Austria and Germany this would mean a re-design of the whole water supply and wastewater disposal system. For other countries like Romania, Bulgaria, Moldova and Ukraine, where a new design is on the way, this could be done more easily. A problem is the fixation on existing models that come from the upstream countries and the lack of resources to develop own and innovative designs of sewage treatment systems.

Devoting agricultural land for wastewater and sewage treatment is not a new idea. This method was first proposed for Germany (Riepl 1994). While there was considerable resistance to take up this idea, the proposal is valuable to be tested in the lower Danube area. Here resources to construct sewage treatment plants are often not available and population densities are lower. Some of the huge agricultural co-operatives may have to look for new purposes, if agricultural surplus production should be reduced and organic food production is not possible due to residuals in the ground. In the lower Danube countries, sewage treatment plants will be established only in large cities while smaller cities are not yet included in such a plan. Here the method of devoting agricultural land for the purpose of improving water quality seems appropriate.

Challenges in Tourism

Tourism, in particular a less intensive tourism with emphasizes on culture has a great potential along the Danube River. So far we find several areas that are already very well adapted for tourism, e.g. the Wachau region in Austria or the Danube Delta in Romania. The Wachau region was recently accepted as a UNESCO world heritage. The Danube Delta is perhaps the last region in Europe where it is usual to move by boats and where we find a unique bird and animal life and protected as national park. But the Danube is extraordinary in other sequences as well. It could be an aim to emphasise the tourist values of the other region and highlight the qualities. Here in particular, the artwork of the last centuries can be outlined and used to bring income to the population.

The Danube invites to be slowly conquered by appropriate means of transport with high recreational value: boat, bicycle or even balloon. The Danube is a lifeline and guides into most fascinating cities. The boat traffic is so far limited to particular sequences along the Danube River. In May 2002 the first tourist ship reached Beograd after a decade of severe implications. In many areas we find a bicycle path next to the Danube. Similar to annual rowing event Ingolstad – Sulina, there could lead a 2850 km long bicycle path along the entire Danube, with hotels, hostels and camping places.

Wetland tourism became a particular kind of nature near tourism and gave an economic incentive in several areas along the Danube. Beside the Danube Delta these are Kopacky Rid in Slavonia, a Croatian region severely effected by the war within former Yugoslavia. At current we find here a project of the world bank. Neighbouring Apatin Rid and Kovaly Rid in Voyvodina offer similar qualities in Yugoslavia. After a severe economic decline it is important to stimulate the local economy. Two years ago wetland areas of Bulgaria, Romania, Moldova and Ukraine received a particular protection by an international agreement. The more people that get attracted by this kind of tourism, the higher the potential that these areas will receive further attention and a higher level of protection. A final aim would be a green Danube net with the connection of all major Danube wetland areas.

So far shipping is possible on the Danube and on some parts of the major tributaries like Tisza, Save and Drava.. While transportation of goods is in most cases a prime consideration, the approximately 5000 km of river roads could be used more intensively with tourist boats. The major channels provide possibilities for recreation for smaller boats. Water traffic for tourists could bring several advantages as compared to traffic for goods. Boats can be considerably smaller. Deepening of riverbeds like often demanded for the transportation with large ships would not be necessary. A net of smaller irrigation canals for agriculture could be used to complement the river traffic along the Danube. Their maintenance is perhaps problem in the agricultural zones and the tourist purpose could help to do so. However, the channels have to be adjusted for this purpose. Along the waterways and channels an attractive design will be required. A mix of vegetation with bicycle paths should increase soil stability and decrease the amount of sediments leaching into the water. Further attractions for tourists have to

be established to achieve a more varied package than what is usual today. A switch from different means of transport, boats, bikes, busses or trains to explore the area on land should be easily possible.

Actors in different scales of action

Single projects have to be initiated by locals, without their support the list of project ideas is worthless. They call for co-ordinated administration of planning and for major in depth analysis of landscape and water on the smaller scale administrative units. Many people should contribute and become actors to ensure the success even as a program for more regional sustainability.

So far we have some - perhaps not adequate - awareness about the challenges described on the international scale. The national scale co-operation is something well established. Since 1997 we find a co-ordination international authority, the International Commission for the Protection of the Danube River (ICPDR) in Vienna. The main task is to enable co-ordinated actions throughout the entire Danube river basin. The European Union countries have to follow the directives of the Union and the European water directive is considered as an appropriate instrument to cope with. The pre access countries like Czech Republic, Slovakia, Hungary, Romania, Bulgaria and Slovenia are not obliged to cope with the expectations of the European Union but they do it in expectation to become soon EU members. The countries outside the EU try to go conform with EU regulations what concerns the national level. Regarding the time perspective, the year 2006 is a common date to have for the first time water management plans. At this time many international research projects within the 5th framework program of the EU will be completed.

The formal agreement to the convention does not mean the realisation in place. In general local politicians and administrators have little to do with the frameworks. Coming down from the international to the national scale and further to the provincial and local scale there will be a larger gap. While the difference between national experts is small, the one between provincial administrations in different countries can be a large one. This is a general problem, that – primarily due to financial constraints - only a selective minority of the downstream countries can be part in the process, while participation of upstream countries is in general open to many more people. The time horizon for successful participation of communities in the landscape convention should be longer than the one of the water framework directive.

Public participation in the challenges described ahead seems to be even a more difficult task than to involve the local decision makers. Here a hard piece of work is convincing the local people, which have to carry out these projects. In general, the projects are not suited to become rich within short time. They are suitable to get an appropriate income in the long run and to keep economic less favourable places populated.

Conclusions

So far the development is not comparable throughout the Danube region. Primarily the economic differences were responsible for an unbalanced development in the region. We can find some common principles for a development that are valid everywhere. The economic and environmental thresholds are different in each country and region of the Danube river basin. This makes the difference in the successful implementation of project ideas and initiatives. The logic of actions will change with respect to the context.

The projects described here are neither new nor mainstream. They were incited at some places and could be developed at others. In a larger connected total they would get additional value. For their realisation the European water directive and European landscape convention could be two tools of guidance and practical value on different spatial scales. Focused research and in depth analysis is required at most places. However, a personal touch and identification with landscape and water cannot be achieved by copying a solution from one place to another. For this authentic creations at each place are required.

The package with its possibilities and combinations of integrated landscape and water management is a challenge for an economically, socially and ecologically more sustainable development than what we have today. For this assignment a strong IAD can give valuable contributions. IAD has an important mission in informing a larger public about the Danube and the Danube region and disseminate ideas between upstream and downstream and to invite for a co-operation on a larger scale. For this purpose this paper was written.

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