ILD MANUAL

A PRACTICAL GUIDE TO INTEGRATED LAND MANAGEMENT METHODS INTENDED TO IMPROVE LAND USE AND WATER MANAGEMENT EFFICIENCY IN THE TISZA BASIN

AN ANALYSIS OF THE LESSONS LEARNT FROM THE PROJECT

Prepared by Béla Borsos
technical advisor
in collaboration with Zsuzsa Flachner, Gergő Nagy, Lóránt Fehér and Péter Balogh

This analysis was carried out under the Tisza community-led demonstration project for sustainable development and integrated land and water management, a part of the UNDP – GEF- Mid-Size Project "*Integrating multiple benefits of wetlands and floodplains into improved transboundary management for the Tisza River Basin*".

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

1. Introductory notes

Rivers and other surface water courses are indispensable for the welfare of human societies. They offer a number of ecosystem services essential for life itself as well as for meeting the needs of higher, organised civilisations. The former function is evidently water for drinking and for water supply to vegetation, while the latter include irrigation water, navigation, food sources and a number of other features. It seems however, that that human societies also keep on running into troubles with rivers. In spite of millennia spent with attempts to establish a '*modus vivendi*', a kind of co-existence with living waters, recent flood events, extensive excess water cover on agricultural land and at the same time enduring droughts are signs that something went wrong with human-river interaction. The current project maintains that rivers must be seen in conjunction with their respective catchment, the land it surrounds them and managed, or better to say, developed in a holistic and integrated way where land and water are not considered to be separate entities, much rather understood as a single, comprehensive and complex semi-living system. When such an approach is applied, this system may be managed and developed in a sustainable manner.

Traditionally, the word sustainable has been used and abused by many in many different and even contradictory meanings. Below, we propose a new interpretation of sustainability with a view to holistic landscape management:

The main and key objective of a functional, long term sustainable landscape management strategy should be to devise, set up, fit into and operate human made systems in line with the holistic, inherently operational and functional systems of nature.

In order to achieve long term sustainability in landscape development actions, some fundamental principles derived from general systems theory are to be met:

- constant and linear system growth is excluded by a dynamic balance established between positive and negative cybernetic feedback loops. In human terms, this means appropriate economic, social incentives to reduce resource and product consumption and convert energies into development instead of economic and material growth;
- the basic material, energy and information needs are met from within the system itself as much as possible building on local resources, taking advantage of local conditions, interests and knowledge whilst minimising the enforcement of external interests;
- interlocking closed feedback loops provide system resilience against external inputs and disturbances. Subsystems are operated in mutual interdependence according to the structural logic of the system, irrespective of the various levels of organisation.

In practical terms and in the case of a living landscape, the implementation of such principles would mean local population recognising and representing their own interest in maintaining the original functional dynamics of the land they live on.

Current water and land use practices in the Tisza valley originate from the modern river regulation activities intended to create more land for human agricultural use. The flawed starting point of these projects was that there was too much water on the land in the plains and therefore, the agricultural production potential of a fertile land (to be clear: growing grain for export) was diminished by natural factors such as dangerous floods and permanent marshland. However, the impact of the hydromorphological alterations carried out in order to overcome "too much water" resulted in an impaired functional system of the original riverine landscape. Nowadays the Tisza valley is considered to be an economically backward area characterised by high unemployment rates and low income levels, prone to flood risk, habitual waterlogging and systematic drought at the same time.

1.1. Systems theory and rivers

The situation is not reserved for the Tisza alone. Large rivers are complex natural systems consisting of both living and non living components. Human societies during history have made repeated attempts to modify and make alterations to rivers in order to take advantage of their resources mainly in the form of water for drinking, sanitation or irrigation. Industrial technology developed to such a level some two to three hundred years ago which allowed for material changes in these natural systems by a number of technical operations. An odd human-technology-nature interaction started as a result. Large rivers globally have become heavily modified and infested with human made infrastructure, which disrupted their natural cycles of operation. The natural behaviour of large rivers can best be described with the help of system theory and the same approach may also be useful in understanding the conflict between the dynamics of river processes and the rigid human made structures imposed on them.

1.1.1. Systems in general

All systems are in dynamic equilibrium with their environment, which is only a different term for the supersystem they are a part of. The parts of the system, its connections and relationships add up to the structure of the system. By doing so, the system is moving away from the homogenous state, assuming an organised, inhomogeneous state in the process. The maintenance of this organised state requires a constant flow of energy, is controlled through the structure of the system, and is remarkably permanent during the lifetime of the system (Borsos 2003). One of the particular characteristics of a system is that it tries to preserve the set of connections and relationships which makes it distinguishable as a system. Would there be no external impact, this arrangement were in a constant equilibrium. Therefore, the system can be seen as conservative in nature. However, the environment keeps on changing all the time, and any system destined to survival will have to adapt to these changes by making adjustments to its own parts, connections and relations over time. This way, external disturbances can be parried and the system itself undergoes a certain development increasing its adaptability, which, in turn, has an impact on the environment, and hence, on the dynamic equilibrium (Gyulai 2009). Over time, all these changes add up to a different state of affairs and different system properties. This process is called evolution, where the positive and negative feedback loops mutually limit each other's exclusive impacts.

Non living systems tend to increase their entropy – rivers do so by levelling the ground diversified by tectonic movements – while living systems increase the level of their organisation, accumulate free energy and loose entropy. Being both living and non-living, rivers and their catchment areas also evolve, while trying to establish a locally maintained dynamic equilibrium within their respective supersystems, the hydrosphere and biosphere. Systems are arranged in a nested hierarchy, each subsystem being a fully integrated, functional part of the supersystem above it. It is worth keeping in mind that irrespective how lucid and ingenious, human society is merely a subsystem of the Earth's biosphere. Unfortunately, seemingly abundant energy obtained from former deposits of living organisms (limestone, oil, gas, coal), the depletion of non-renewable resources (metals, ores, rocks) and overexploitation of renewable resources (fisheries, forests, agroecological systems, water bodies etc.) results in runaway positive feedback loops which inevitably chase modern human society into an accelerated development curve – and into a trap of systems logic.

Water resources can also be overexploited. The energy large rivers contain can only be used sustainably when extracted in a rate lower than their replenishment. If a series of dams is built on a large river, the last one will get much less energy than anticipated, especially when other uses – irrigation, extraction of drinking water – deplete the finite amount of water flowing in it. When the method of exploitation itself interferes with replenishment, for instance in the form of siltation, the resource will not be renewable any more. Also, when there is a climate change entailing the melting of huge glaciers in the mountain ranges of river catchment, the recycling, renewal and replenishment loop will be interrupted. River regulation, draining of wetlands and marshes, extraction of water for human needs gets more fresh water from underground reservoirs into the oceans than recharged through precipitation, which result in drying out of continents: here again, the rate of depletion does not match the rate of replenishment (Horváth 1993).

Therefore, the very term *renewable* is a relative concept. The vulnerability of renewable resources, including most energy resources depend on the intensity of use. Intensive use may shift the ecosystem they belong to from one stability domain into another one with different boundary conditions where the rate and potential of renewal is changed and hence, irreversible alterations occur. The ecosystem service they provide may disappear if the intensity of use is excessive: when commercial fish species are depleted to an extent where their recovery is not possible due to population biological reasons, the change is irreversible even if all fishing is stopped. These irreversible changes are not prevented by the negative feedback loops of supply and demand, which only reflect economic logic and not the biological facts. Since we know too little about the delicate web of connections in a natural system, the only practical way of avoiding overexploitation is to increase the intensity of use in small increments and watch the results. Relevant parts of the social system and the natural system can be monitored for unintended consequences. A decrease in the benefits received upon the increase of intensity of use indicates overexploitation (the law of diminishing returns). When in doubt, it is prudent to follow the precautionary principle (Marten 2001). The main cause of discrepancies between human made and natural systems lies in the linear logic and the excessive use of external energy of the former. These result in depletion of renewable resources and the need for constant growth at the cost of a finite planet's finite resources. Water use is no exception to this runaway curve.

1.1.2. Type One error

Social and technical systems, human societies interact with their superstructure, the natural systems of the planet: ecosystems, biogeochemical cycles and natural resources. During interactions between the social-technological system and the natural systems human needs and population growth usually create a problem which is solved by a technical fix: a linear, technical method. The „solution" has an impact on the natural system which in turn feeds back to the social system, creating an even more complex and comprehensive problem. The new, more advanced solution has an even more detrimental impact on the natural systems, which again feeds back to the social system, and so on, in a positive feedback loop of ever growing dimensions and ever more complex consequences (Borsos 2009). The process triggers more and more interference with natural systems at the cost of both natural and human made system integrity called the ecological and environmental crisis. Additionally, many ecosystem services originally provided by the natural systems free of charge are lost and have to be supplemented artificially, at high cost and – not surprisingly – with the inevitable consequence of creating further problems. Coevolution and co-adaptation of human social systems and ecosystems – a prerequisite to phase out Type one errors – is no more possible (Marten 2001).

The underlying philosophical cause of Type one error is that human technical inventions made up to overcome the problem take almost always – and not only since the industrial revolution – simplistic and reductionist approaches without ever considering a holistic system view. They focus only on a single component of the various natural systems which have inherently complex interactions, modify, omit the component or add a new one in a single minded insistence to "solve" the problem. However, natural systems, including eco-systems behave in a complex manner and react to any intervention in a system-like manner. The whole system will be rearranged and new boundary conditions created. Being completely inflexible, technical solutions can not be adapted to the new conditions and become unfit for the purpose (Borsos, 2003). The self reinforcing mechanism of Type 1 error is illustrated on the Figure below.

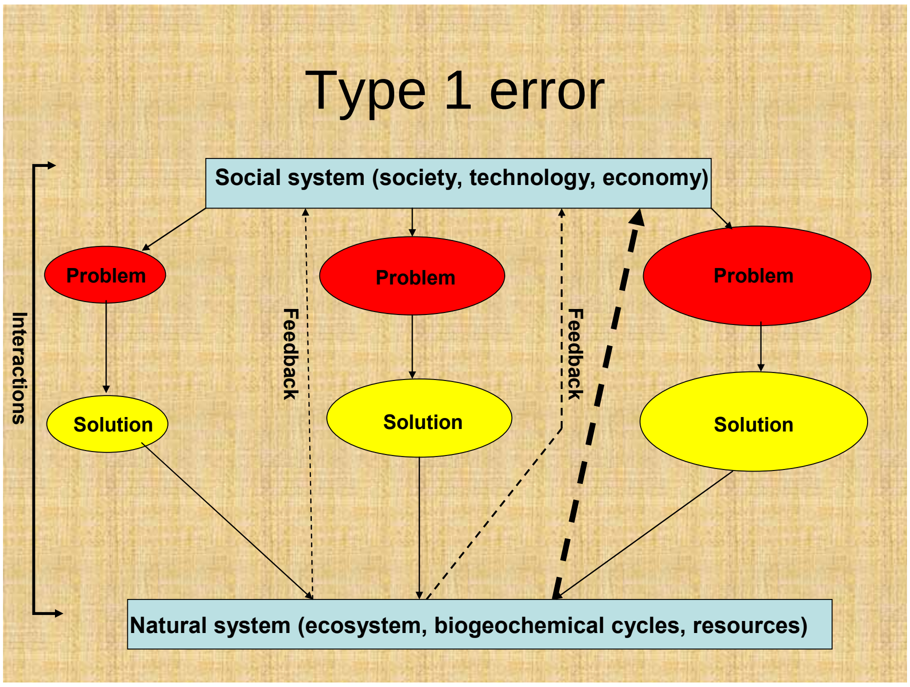


Figure 1: The self reinforcing mechanism of Type 1 error

The training of the Tisza water system and the regulation of the rivers including its tributaries was started in the 19th century and completed in the first decades of the 20th century. Thanks to systems theory we know now that such a manipulation would never be a success in real life because it can not be a success theoretically. The idea of the project sponsors, including the greatest Hungarian – as he is emphatically called by posterity –, Count István Széchenyi and the renowned water building engineer, Pál Vásárhelyi was simply wrong not for ‘professional’ much rather for systems theoretical reasons. Their good intentions went wrong because they were not aware of the nature of the system they were dealing with.

The careful analysis and history of human interventions in the water regime of the Carpathian basin clearly shows – just like in many other parts of the world – that tampering with the environment in reaction to a social need shall not and can not be completed in a manner it is anticipated because of the inherent contradiction embedded in the logic, functional features and cybernetic control of natural and technical systems. This is true not only for living ecosystems but for complex, seemingly non living natural systems such as surface hydrology, the flows, movements, changes and natural dynamics of surface waters. Rivers are dynamic natural systems possessing a range of life properties, therefore they can be called living systems featuring various traits of evolution (Láng 2002). One of the most important differences is that while there are cyclic and recurrent processes in nature, linear human logic makes an attempt to shape cyclic systems in a linear manner by exerting irreversible changes on them. The second fundamental difference is the striking lack of engineering system’s capability to adapt, for which reason they are unable to react to changing environmental conditions, thus intending to embed a single operational state. In other words, they lack the capacity to evolve.

It is worth to have an overview how these mechanisms are manifested in the relations between man and rivers. Human-river interactions here are also prone to the fundamental category of Type one errors. Seeing the huge and thorough going changes of human creation which seem to engulf the entire planet it is now very difficult to believe that – as stressed above – human society as such is merely one, not even the largest sub-system of the planet’s natural superstructure. As such, it shall not be able to act in contrast to the logic prevailing in the supersystem situated beyond it for a very long time. Shortly, Type one errors are technical, social or engineering solutions or phenomena – including population growth made possible by technical, scientific, economic and medical progress – which carry inherently the different kind of logic as a result of the conflict between the dynamics and functional mechanisms of the two respective systems. Therefore, it can be demonstrated that:

- as long, as the logics differ, there shall not be any conceivable solution in principle which could allow smooth interaction of the two, and hence;
- having accomplished the technical solution in turn, it can be predicted (but not determined or identified beforehand) with a great degree of confidence that yet more problems would emerge as a result of the conflict between the natural and the man made technical system.

Type one error is typical when decision makers in a society do not recognise the nature of the problem and are confident that scientific, technical and industrial progress – which keep on developing in lines with the same linear logic – would provide a solution for remedy. Thus a *circulus vitiosus* (devilish cycle) is formed operated by positive feedback, therefore nature's reaction to the most recent technofix would cause even more harm as the forerunner did, and man has to effectuate even more fundamental changes and make more efforts – in terms of materials, energy and money – if a new, transiently functional solution is to be implemented. The feedback loops of Type one error had been formed long time ago, practically since the existence of the first structured human societies. The reason why they did not cause any global problem so far may be explained by the difference in the sizes of the two respective systems: until recently, human societies were negligible in their dimensions compared to the biogeochemical cycles and ecosystems of the planet, therefore they provided basically two kinds of answers upon the emergence of a Type one error: they went extinct, migrated away or fell victim to another society better adapted for the moment, or they brought forward yet another technical innovation which made their temporary survival possible. The case became more serious with the invention of fossil fuels and nuclear energy, which, being abundant, offered an escape route from the consequences of the ill-thought technical novelties by using yet more energy. Initially, therefore, the structural and conceptual trap into which abundant energy drove humanity could not be easily detected.

1.1.3. Systems logic

Disregarding natural system dynamics can be seen in the series of human manipulations in the course and movements of surface waters. In fact, rivers and water streams demonstrate chaotic behaviour, developing a fractal like geometry and carrying out unpredictable movements reflecting the bifurcations in complex systems' development. For instance, you can not set up any model to simulate in which directions the meandering sections of a river would migrate within a larger time horizon, i.e. over the centuries or millennia. Yet if you disregard such movements – and others such as sedimentation, abrasion, siltation, erosion, colmation and a lot of others – when designing water management schemes, the river itself would warn you: it would react to the interventions at the system level and the result will bring yet another problem. In order to understand how and why these problems emerge, we have to get acquainted with the life of surface waters first and the dynamic interactions featured by them when left alone, without the diligent activities of man. Only then can you analyse the interactions of the various technical solutions with the natural system and try to set up an alternative, less harmful solution. Indication for the latter can be obtained from the lessons learnt from historical riparian societies and communities.

The shaping of a river is a function of the composite impact of a great number of factors which is therefore difficult to calculate or model. Direct runoff would depend on the shape of the catchment area, the angle of the slope, material quality of the surface, amount and type of plants and vegetation cover, meteorological conditions such as the intensity, temporal patterns, forms, distribution of rainfall and other types of precipitation, temperature, number of sunny hours, insolation intensity, etc. The outcome of all these is the mean specific runoff. Delayed runoff is understood as water input not instantly reflected by the river water regime, such as snow, ice or groundwater infiltration. Vegetation cover also has a delaying effect due to interception. Water flow stands for the volume of water delivered by the river within a specific amount of time, defining water stage, the level of water in any given cross section. Seasonal and annual fluctuations of the water flow would add up to the water regime of the river. River behaviour is determined by the grade of the bed, that is loss of height within any unit of distance and the mechanism of bed development, varying as a function of the subsoil and the fall of the river. In addition to the above, the strength of the river is basically determined by the amount and quality of rolling and jumping bed load, suspended sediment and the deposit created by them. These factors would decide where will the river build and where will it erode the terrain it is flowing on.

Adaptation to the environment, a key concept of biology, can only be interpreted at the level of the individual or the species. A complex ecological system consisting of interactions among many species and intricate biogeochemical cycles will not adapt, it is in a dynamic interaction with the living and non living components of the natural environment, mutually shaping each other. The entirety of the interactions formed between the building blocks and sub-systems of living natural systems strives to maintain the system within the boundary conditions prevailing in the current state of the system, that is to make environmental impact predictable and permanent in nature. This also entails that selection of living components within such a system is determined not only by the ‘struggle for the fittest’ and the need for adaptation alone, but also the extent by which such a living component contributes to the system functions as a whole. Those species, populations would survive, which are able to effectively assist in maintaining the optimal ‘operational state’ of the system. Such systems have a very high potential buffer capacity, meaning that they are able to compensate for the adverse fluctuations encountered in the natural conditions by negative feedback mechanisms. That is, as long as their constituting sub-systems are intact and cooperating faultlessly, which is the precondition to system resilience (Molnár 2002: p 182). There is good reason to believe that any sub-system which goes against the maintenance of the equilibrium and cybernetic control, will be rapidly eliminated by the adapting, interactive system.

1.2. Project history

1.2.1. Earlier projects

As many international organisations recognised the significance and the need for an alternative and comprehensive land and water management concept in the Tisza river basin, there were a number of projects implemented earlier on with a focus on various aspects of the problem. Such projects included but are not limited to the following:

1. LIFE00 NAT/A/007051**, Living with the river - LIFE-Nature project in the Tisza floodplain, WWF Austria**

The project, carried out jointly by WWF Austria and WWF Hungary, aimed primarily at reintroducing environmentally-friendly management: arable land to be turned into water meadows, former gravel pits, now filled with water, reconnected to the river and new riparian forests planted. Up to 700 hectares of floodplain in 5 subsites along the middle part of the Tisza was specifically targeted by the project activities.

In cooperation with local farmers, a type of grazing-based land use method meeting the requirements of the floodplain meadow ecological communities was tested as a model. The model used the impressive Hungarian Grey, an ancient breed of long-horned grazing cattle. The grazing concepts tested as part of the project were further developed in other agricultural funding programmes. These actions had a benefit for not only the white-tailed eagle, corncrake, bittern and otter, but also the local population, which they provided with new sources of income (sustainable agriculture, ecotourism).

2. LIFE03 ENV/H/000280 **Sustainable use and management rehabilitation of flood plain in the Middle Tisza District**

In this project, expansion of the floodplain’s water retention capacity was aimed at in order to reduce flood risks. The activity included the following operations: clay pit restoration, application of the ‘fok’ method (artificial water retention via the construction of specially designed hydraulic structures [‘foks’ or ‘notches’ in English] in a floodplain area), forest rehabilitation, and adjustment of run-off paths.

3. INTERREG III/A: **Evaluation of a joint land and water management concept in the Bodrogköz region** HUSKUA/05/01/041. Methodology development for integrated river basin management

The Bodrogköz INTERREG project intended to develop a joint landscape and water management concept based on water retention feasibility and designing certain elements thereof in the Bodrogköz area of the Tisza river. The project encompassed the Slovakian section of Bodrogköz as well.

4. GEF Biodiversity Focal Area Strategic Objective BD-2 / Operational Program 2 Medium-sized Project (MSP) GEF ID: 1527 UNDP Atlas ID: 00046904/ UNDP PMIS 1980: **Conservation and Restoration of the Globally Significant Biodiversity of the Tisza River Floodplain Through Integrated Floodplain Management**

The Tisza Biodiversity project was implemented over an approximately three-year period, from October 2005 to December 2008. It was designed to encourage and support alternative approaches to floodplain management that integrate flood control, agriculture, biodiversity conservation and social development, and to ensure these approaches are mainstreamed into government policies. It intended to empower local communities in managing their own development process, and in integrating ecological considerations including biodiversity issues into their approach. It also focused on channelling in the needs of local communities, the preservation of biodiversity, and integrated floodplain management into national priorities and policy guidelines. To this end, substantial efforts were dedicated to develop and disseminate an integrated, pro-biodiversity approach, and to influence agriculture, land use and other rural development activities through technical support to local and regional stakeholders.

The overall objective of the project was to “establish biodiversity friendly, holistic floodplain management as the dominant development paradigm in the Upper Tisza floodplain” with outcomes such as setting up a sustainable mechanism for supporting local initiatives and channelling local lessons into national policy and planning, to support biodiversity friendly floodplain management at different sites of each of the initiatives (local project partners), where land, water, habitats and biodiversity are managed in an integrated manner that is supportive of socio-economic development, and finally trying to effectuate changes in the policy and the implementation of the VTT (the further development of the Vásárhelyi plan, see more in detail in Chapter 5.1) and NAEP (national agro-ecological programme) to integrate biodiversity concerns, feeding into related EU policy and decision-making.

Project activities included remedial actions in areas under threat and sustainable use and awareness components. A common platform was formed to coordinate local and regional stakeholders, initiatives, farmers, communities, NGOs and academia with the intention of articulating the specific needs of the Tisza-region and proposing a relevant strategy and measures for its holistic management. A permanent technical office and a Micro Grant scheme were also founded. Market places and fair trade facilities (virtually on the Internet and at the respective pilot areas) to market floodplain products and services were created which also increased the level and intensity of collaboration and cooperation among the stakeholders, and increased social and economic wealth.

The project focussed on nature conservation; two National Parks (Hortobágy National Park Directorate in Debrecen, and Bükk National Park Directorate in Eger) and several Nature Conservation Areas and Natura 2000 areas (for instance the Kesznyéten Landscape Conservation Area) were involved in the implementation. The local initiatives involved ranged throughout the entire region, with each tightly bound to a specific locality, usually small landscape units: Bereg, Bodrogköz, Tokaj, Borsodi Mezőség, Kesznyéten and Nagykörű. Of the pilot sites, only Nagykörű is downstream of the Kisköre dam, the others are situated upstream, exposed to extreme water fluctuations. On the other hand, the dam shuts the Nagykörű area and pilot site off from the replenishing influence of the river, and drought is more severe in this part than, for instance, in the Bereg. A sixth local initiative, Kis-Sárrét in the Körös-valley, a tributary to the Tisza River, was also instrumental in project activities. The local initiative consisted of members of the Nymphea Association (NGO) and members of the Körös-Maros National Park Directorate. A seventh local initiative, the Nymphea Association in Túrkeve was later involved in the project as an informal project area. This area was not strictly part of the project territory, but the project promoters wanted to leverage the extensive experiences of this NGO in the field of nature conservation, biodiversity, habitat restoration and wetland habitats management.

The lessons learned from the UNDP GEF Tisza Biodiversity project highlighted the need for a wholly and completely integrated land development process, where water management and agricultural production, landscape planning, land use patterns, land consolidation, property exchange, infrastructure development and management and a set of other sectors and activities are seen as a holistic, interwoven whole with the associated social and economic structures governed by natural processes rather than remote economic needs.

In addition to many other useful achievements such as the micro grants to conservation farmers and support to local producers for market entry, this project has seen the establishment of the non-governmental organisation Alliance for the Living Tisza Association (SZÖVET), which is the main sponsor and Lead Partner of the current ILD project.

5. NKTH (TECH-08-A4/2-2008-0169), **Extreme-risk area of water resources for effective, sustainable alternatives to the medium and long-term treatment (WATERISK) 2009-2011**

The national WATERISK project is an ongoing programme which started in 2009 with the objective to have a risk assessment completed for the entire Tisza basin in the light of different future scenarios. In these activities SZÖVET has a dissemination role, which can be combined with the objectives of the demonstration project. For the current project, the programme provides assistance and collaboration in the form of data, human resources in terms of GIS expertise and information flow.

1.2.2. The current project

The current project IC/WD/384-HU entitled *Integrated land development (ILD) program to improve land use and water management efficiency in the Tisza basin* was conceived in the frame of the UNDP/GEF project *Integrating multiple benefits of wetlands and floodplains into improved trans-boundary management for the Tisza River Basin.*

The concept originated from the recognition that if you are to support high level or global policy objectives such as flood control, carbon sequestration, river basin management and if you want to harmonize them with local stakeholder goals, the promotion of ingenious new approaches is required on a number of very different scales (EU, national, regional, community, farm and parcel level), with due regard to transboundary effects of such measures (both nation to nation and region to region). As it was seen in the theoretical section, such an approach requires the acceptance of the nested, embedded hierarchy of human society subsystems as depicted below:

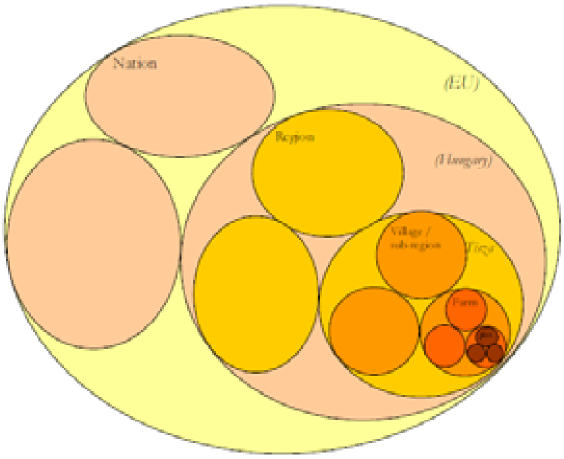


Figure 2: Embedded structure of human society

Having regard to these considerations, a new project was developed with integrated land development in mind. The project's main objective is to develop a kind of guidance document or methodology for integrated land and water management practices with the help of a number of case studies to support efficient and successful water and land management efforts based on the socio-economic concept of floodplain in high risk areas along the Tisza river, exposed to drought, seasonal excess surface water, floods or biodiversity loss. With a view to these objectives, the following outcomes were anticipated:

1. The compilation of a comprehensive study with the assessment of the legal background related to integrated land development in all five riparian countries of the Tisza, but mainly in Hungary, where most preliminary data and results exist. Based on such an evaluation and review recommendations may be made on how to change or amend legal provisions in order to allow for the implementation of the alternative management approach in both the water management sector and land use patterns, including agriculture, forestry, fisheries and infrastructure development.
2. Implementation of the ILD approach at a pilot site in Hungary and development of further demonstration sites at the project partners.
3. Dissemination of the experience and the lessons of the implementation at the partner organisations in Serbia and in Romania to establish better cooperation, understanding of different circumstances and prepare further projects. Training materials were also envisaged to be available for all countries in the Tisza basin with local 'ILD mediators' to support bottom up land development processes trained based on the applications at the pilot sites in the Tisza region. The current ILD manual is an attempt to provide a comprehensive background for the development of such training materials.

As for the methodology to be applied, the project planned the following framework for practical implementation of ILD activities:

1. A detailed analysis of the various factors influencing the necessary land use changes (LUC) and alternative water management approaches at the pilot sites. Such a review included evaluation of current land use patterns, methods and types of cultivation, a survey of the legal conditions and provisions governing such changes, demonstration of the alternative land use method (that is, ILD), participatory planning with land users to involve them, designing and scheduling the necessary works and management of the implementation.
2. Completion of LUC at the selected pilot sites (administration, setting up parcels, improving conditions for grazing such as removal of inadequate vegetation, confinement of adventive species, fencing off the affected areas), to establish grazing land with woodlots and permanent ponds for retaining water by converting current ploughland
3. Adjustment of selected inland water canals – currently geared up to govern drainage of excess surface water after heavy rainfall or winter snow melt – to serve the purpose of ILD at the sites. This could be done in two ways, by simply changing the operation mode of the canals and ditches for water allocation and by improving the structures so that morphological characteristics of such canals confer to those of former natural channels (slope and course correction – to the extent possible), building lateral outlets to let the water out onto the open fields when necessary and collect the surplus volume (steering by sluices)
4. Accompanying land use changes on selected sites with the necessary adjustment to the crops grown and the ground area of the parcels. This entails fitting of parcels to elevation contours and the implementation of morphological and biological changes to facilitate surplus water steering and to promote the evolution of the natural vegetation and habitat pattern (implementing green corridors)
5. Taking advantage of the protocol so developed, the compilation of a practical manual which can be used to put improved ILD methods into practice at other pilot sites (further project development). In doing so, there will be a guidance document available for evaluating the local land and circumstances (identifying possible sites for case studies), for defining the locally adaptive ILD for establishing LUC and to inform the stakeholders about lessons learned, getting a local initiative under way.

The importance of the project is highlighted by the fact that half of the territory of Hungary belongs to the Tisza river basin. The middle section of that lowland region suffers from a chronic deficit of rainfall (the aridity index of the middle Tisza region is 1.5, expected to increase beyond 2.0 due to climate change), yet sometimes devastating floods sweep across that very same region which can not be tackled by current water management practices. The composite impacts of excess inland water, drought and floods cause detrimental damages to the national economy.

It should be known that the landscape is not simply a featureless, flat plain. Different elevations have different functions: river beds and floodplains are for transportation and storage; non-flooded high banks are suitable sites for human settlements. This pattern would readily offer itself as a natural infrastructure for water steering.

Since the Tisza river basin has various sub-basins with quite different characteristics, 3 sites were selected as pilot demonstration projects, each from a different reach of the river. The ILD project wants to identify similarities and connect these pilot sites with the use of the same adaptive, flexible approach – as the Tisza river connects them. Therefore, project has sought 3 locations for the demonstration sites:

- in Nagykörű and its sub – basin (middle section)
- in Zenta and its sub-basin (lower section)
- and in Székelyudvarhely and the upper catchment of a tributary.

Figure 3: The Tisza basin and the 3 pilot sites in the ILD demonstration project

The project proposal was submitted by SZÖVET – The Alliance for the Living Tisza Association (ALT) based in Nagykörű – in January 2009. Thus, the Lead Partner is SZÖVET, but three other partners and a great number of supporters still participate in project implementation. The partners are:

Partner 1: MTA TAKI: RISSAC Research Institute for Soil Science and Agricultural Chemistry
Partner 2: AGORA: AGORA – Working Group for Sustainable Development, Romania
Partner 3: Zenta: Zenta- Senta Municipality, Serbia

Supporters are among others the following organisations and individuals:

- Nagykörű Municipality, Hungary
- Nándor Veres farmer, Mayor of Nagykörű with 800 ha (300 ha self owned)
- First Floodplain TÉSZ (production, trading organization), Nagykörű
- Jászkisér Waterboard (responsible for the Nagykörű flood basin)
- Central Tisza Water and Environmental Directorate (KÖTI-KÖVIZIG)
- Technical University of Budapest (BME), Budapest
- Károlyi Gáspár Calvinist University, Faculty of Law, Doctoral School, Budapest
- Locator Association, Zenta (RS)
- Gradevsinksi fakultet Subotica, Novi Sad (RS)
- Farkaslaka Village Council (RO)
- Local Water Board, Nagy-Küküllő (RO)

Partner organisations contributed to the preparation of the site, for instance RISSAC carried out soil sampling activities in the Nagykörű region in September 2009. Technical University of Budapest contributed to the various modelling and simulation attempts, while the Faculty of Law at the Gáspár Károlyi Calvinist University assisted in the review of Hungarian and international legislation governing the sectors and issues related to the implementation of ILD in any scale. KÖTI-KÖVIZIG and Jászkisér Waterboard have acted as advisors and professional consultants in developing project strategies. The organization of TÉSZ has been established by the LIFE project co-implemented by WWF Hungary. It has a key role in meadow management and can support the LU change at the selected areas.

2. Current situation on the Tisza – present and future concerns

‘The river Berettyó flows through here across this ten thousand acres pasture. It is neatly done, water runs in such a straight canal that it is really a wonderful creation of man and technology. But what happened. This canal will carry water down to Tisza in a dazzling rush. Spring floods are drained while at this time of the year only a little creeklet is trickling on the bottom of it…. What if there were cisterns and polders connected to this canal which could retain high spring waters as a reservoir and when there is no water, we would just let them onto the arid land…’
‘It’s a dream.’
‘No.’

Zsigmond Móricz:
Rain watching company

2.1. *The life of a river*

2.1.1. Features of a functional landscape

Before we could define and identify the management steps required for restoration and reconnection of the native floodplain of a river, there is a need for thorough understanding of the indigenous functional anatomy and dynamics of a living riverine landscape. Such understanding includes hydrological factors and features like the balance of the water regime, rainfall and other precipitation versus evaporation rates, the role and extent of floods in the pristine landscape. The morphological characteristics of a functional landscape are the result of the dynamic meandering, rising and ebbing of the river.

Pending on their geographic location, most rivers have a seasonal, temporal water flow pattern which is the key to their actions and activities. As a result, the river on an alluvial plain will demonstrate dynamic interaction with the very same sediment layer it has deposited over thousands of years in the first place. In its Hungarian reach, the river Tisza runs entirely on a plain built up by the river and its tributaries during the Holocene period. The original role of floods on the river basin without man was to offset relative tectonic subsidence experienced as a result of the emerging mountainous areas at the edge of the Carpathian basin. Rivers erode the rising mountains and spread their sediment all over in the basin. Thus they create an alluvial plain holding – in the case of the Hungarian Great Plain – several hundred metres thick fluvial deposit. As a consequence, floods are not at all irregular and catastrophic events, much rather they constitute an integral part of a healthy river's dynamic life.

In the course of these developments and over the years, river movements created a number of geomorphologic formations and landscape patterns which are of paramount importance for the purposes of a proper landscape management strategy on the plains. In fact, the Tisza river basin is not a completely even surface but a morphologically distinct landscape with strongly marked features. Such features include but are not limited to the following:

- mean-stage river bed, low-water bed/basin and high-water stage
- notches ('fok'), levees, scroll bars, scroll patterns
- distinct flood plain levels: low, middle, high
- polder and polder land, the meander belt
- open floodplain
- floodless high banks
- human made structures: cut off bends, embankments and floodway (the 'active' floodplain), the 'protected' side and the inactive – disconnected – floodplain

Below, a short definition and description is given to all these morphological features in order to facilitate understanding the meaning and significance of the integrated land development methodology this manual proposes as part of the project.

The river bed:

As a rule, the river runs on a bending course along the lowland plains replenishing the landscape with water while wandering to and fro as the result of the lateral erosion process called *meandering,* causing the displacement of the depression which normally holds the river water, i.e. the *mean stage river bed*. The roaming river bed thus creates bends which approach each other as a natural consequence of the lateral erosion on the outer curve of the bend and a slow build up of gravel and sand along the inner arc. After a while the bend gets strangulated, the river bed cut short, separating the bend from the main body of water. Such cut off bends are customarily known as *ox bows*. The reason for this active movement of the river bed is the relatively low fall along the plains (2 to 3 centimetres per kilometre in the case of the Tisza). During certain periods of the year, when rainfall in the catchment is scarce, the amount of water in the bed drops, forming the *low-water bed*. Such a situation is risky for both navigation and the replenishment of the groundwater table. On the other hand, the morphology of the river bed usually allows for higher water levels before the water would be seen stepping out of the bed, which is called the *high-water stage*, a situation not yet considered to be a flood.

Natural formations along the river bed

Levees are low elevations along the mean stage river bed built up by the river rising from its bed during high-water stage, slowing down and leaving its sediment behind. Thus, low shore platforms are formed which are higher than the surrounding plain terrain. A special case of levees is the *scroll bar* or the series of scroll bars (*scroll pattern*) which consists of sediments deposited on the inner arc of the bend during the meandering process. During floods, levees are soaked with water and sometime collapse in the wake of the retreating water. Thus, natural gaps or *notches*, incisions are created (in proper Hungarian they are called the '*fok*') which provide an opportunity to drain the flood water from the plain. Notches cut into the levees are called *primary* 'fok's, while those generated out on the plain connecting river branches, parallel water channels called brooklets or lower lying areas where water is retained, are called *secondary* notches. There is historic evidence that in earlier times humans artificially deepened these incisions so that the river plain be drained more effectively and no swampy, waterlogged areas could be generated. Chapter 3.2 describes some of the lessons learnt from history about the economy where human interventions were made with and not against the natural river system's logic. Through the notches, rising water would inundate the surrounding land gradually, slowly and without causing much erosion, coming from 'below', without having to overflow the levees.

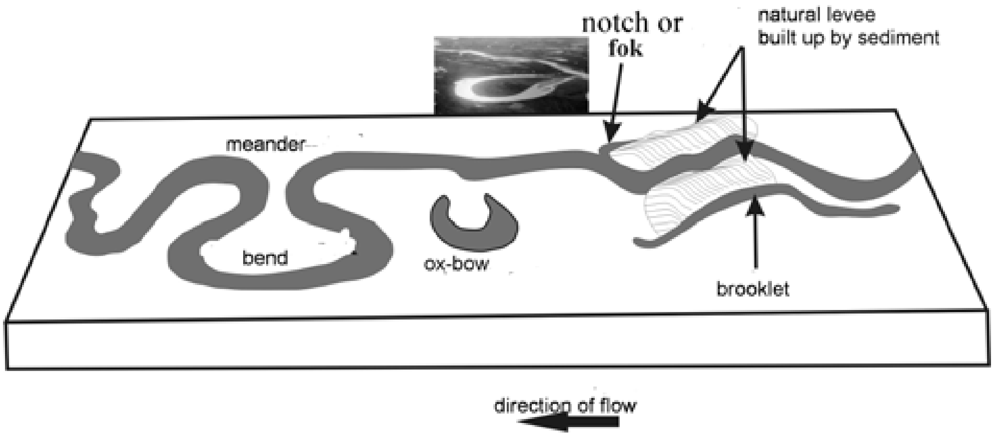


Figure 4: The meandering river (designed by Tamás Bánvölgyi)

Distinct flood plain levels

Using high resolution remote sensing techniques such as GIS and areal or satellite photography, topographical models showing spectacular coincidence with historical maps from before the time of river training illustrate the original morphological arrangements of the landscape shaped by regular inundations. Such images provide a clear insight into a mosaic pattern of historically submerged and flood free areas. The relative location of these areas is determined by their elevation in comparison to the surrounding terrain and the river section concerned. In contrast to the widely held contemporary view, flooded areas were not necessarily situated near the river, pending on the local conditions they may have stretched up to several ten kilometres away. And, pending on their elevation relative to each other and the river, they could be further divided into *deep, low and 'high' floodplain areas*, respectively. This distinction is important for the purposes of designing gravitational draining processes as well as for their relative contribution to the replenishment of the water reserves in the landscape and the type of land use they are suitable to.

Polder and polder land: the meander belt

The *polder* is the wide area of the floodplain which is partially or wholly separated from the main river bed. The main river bed not necessarily runs in the middle of the polder, since during the meandering process it wanders across the polder between both edges, characterised by steep banks. The polder also contains former river bed sections cut off by meandering and side branches connected to the main bed. The string of communicating polders make up the *meander belt*, a section of the alluvial flood plain where the river roamed during the Holocene. Thus, the meander belt can be seen as a more or less permanent feature of the landscape for the last ten thousand years or so.

Open floodplain

Open flood plain is the formation where no sharp distinction was created by the water between the areas under temporary water cover and the flood free areas. Such open floodplain may be delineated by a gentle platform along the contour of highest water level.

Floodless high banks

Floodless high banks appear as the inverse image of the flood plain in the pattern of the alluvial landscape. These are naturally higher elevations where even the highest floods can not reach.

Human made structures

Since the start of the large scale river regulation works a number of human made structures and morphological features appear in the landscape of a plain.

- cut off bends are not naturally laced ox bows but those devised by human interference. They were often drained and put to tillage.
- embankments are the main man-made alterations to the flood plain. These are earthen dykes raised in a distance along the main river bed, thus preventing the river from stepping out of its course at times of high water
- floodway: the 'active' floodplain, which is left for the water after the entire river section was "controlled", that is the space between the two respective embankments along the main bed
- the 'protected' side and the inactive – disconnected – floodplain are what is left of the floodplain free from periodic inundation but put to risk at times of floods when the water in the floodway between the dykes rises much above the height of the original floodplain landscape

2.1.2. Functional mechanisms of a living floodplain

The original, native functional mechanisms of the Tisza river on the Great Hungarian Plain can be best described by the term *pulse floods*, a definition first applied by geographers and hydrologists to tropical conditions. The dynamic, periodical rise and fall of water flow on the lowland is an ingenious natural mechanism to create a balance in the water regime of the landscape. Since the Tisza plain is situated in the middle of the Carpathian basin, continental climatic factors are reinforced here. One of these features is the shortage of natural precipitation: under natural conditions, the land is arid, evaporation exceeds rainfall. In addition, the temporal pattern of water scarcity in the region varies with the seasons. Even though less rain and snow falls in the winter semi annum, due to low evaporation rates and lack of transpiration (water lost through the active contribution of the vegetation) this does not cause any problems. In the summer however, high level of evapotranspiration depletes water reserves in the soil. Without additional flow provided by the river, the land would be totally barren. Fortunately, the natural local water cycle recirculates some of the missing water: evaporated humidity forms clouds which drift towards the mountain frame where water is precipitated during the summer adding to the seasonal floods. Also, natural vegetation in the plains (woody patches and widespread grassland in a steppe-like mosaic pattern regularly replenished by flood water) catches moisture from the air through condensation. Floods spread all over the plains and the periodic inundation replenishes groundwater tables as well as provides nutrients to the rich flora and fauna of the plains. Without human interference the regularly interchanging high and low water stages in the form of the pulse floods represent a functional interdependence and interaction between the river and the landscape. This is characterised by systematic communication of the mean stage river bed with the interconnected floodplains. The landscape exhibits an organic whole through the dynamic functional system of the flooded and flood free mosaic pattern.

The “regulated river” is deprived of this functional mechanism, hence it produces symptoms of a sick patient. The following table shows how the various functions are distorted by the technocratic interventions and hydromorphological changes listed above:

<table>
<tr><th>System component</th><th>Original function</th><th>Current impact</th></tr>
<tr><td colspan="3">Hydrological factors</td></tr>
<tr><td>Humid winter months</td><td>Accumulation of excess water</td><td>Excess inland water, waterlogging</td></tr>
<tr><td>Arid summer months</td><td>Reception of excess water</td><td>Drought, water scarcity</td></tr>
<tr><td>Flood water</td><td>Make-up for missing rainwater</td><td>Dangerous floods</td></tr>
<tr><td>Low level precipitation</td><td>High sunshine duration</td><td>Irrigation need</td></tr>
<tr><td colspan="3">Morphological factors</td></tr>
<tr><td>Varied landscape elevations</td><td>Homogenous distribution of water in the landscape</td><td>Disregarded</td></tr>
<tr><td>Flood plain levels</td><td>Receive and store excess water, wetland habitats</td><td>Inland inundation risk</td></tr>
<tr><td>Flood free ranges</td><td>Refuge for non flood tolerant communities</td><td>Flood risk</td></tr>
<tr><td>River beds</td><td>Communicating with materials, information and energy, delivery of water, living and non living landscape components</td><td rowspan="4">Disregarded or replaced by external sources</td></tr>
<tr><td>Mean stage river bed (main bed)</td><td>Shaping the landscape</td></tr>
<tr><td>Notches</td><td>Communication with the floodplain</td></tr>
<tr><td>Brooklets</td><td>Communication within the floodplain</td></tr>
<tr><td colspan="3">Other life symptoms</td></tr>
<tr><td>Lateral erosion</td><td>Maintenance of morphological and ecological dynamics</td><td>River bed “deformation”, fought against by river bank training</td></tr>
<tr><td>Sediment</td><td>Formation of the alluvial plain and maintenance of local topographical diversity through uneven deposits</td><td>Floodway silt-up, rising flood thresholds</td></tr>
<tr><td>Tectonic subsidence</td><td>The formation of the plains, regional topographical diversity</td><td>Flood threshold</td></tr>
<tr><td>Biomass production</td><td>Rich ecological communities</td><td>Clogging of the floodway</td></tr>
</table>

2.1.3. Water management without man

As it was seen in the introductory section, evolving living systems are necessarily constructed in a nested hierarchy and cybernetic control. Such *sub-systems embedded into each other* can be distinguished on rivers as well, provided they are considered to be a complex evolving system. Components of such a system in the middle section of the river include low water stage river bed, side branches, brooklets, rivulets, draining ditches, notches, dead branches, ox-bows, temporarily inundated flatland, which have a composite meaning to be interpreted as an integral system more than just the sum of the elements. The statement claiming that rivers are living systems is more than just a catching phrase. A middle stage river, including its natural floodplain strives to exploit the relatively narrow physical framework which determine the flood plain river bed alterations and the changes in the hydrological conditions, yet this can only be completed when the natural dynamics – i.e. the life functions – of the river are not limited.

The most fundamental factor of the system functions is the *permanent, bidirectional connection between the native flood plain formed on the alluvial lowland and the river bed formed at times of low water stages*. However, the flood plain should not be seen as just a passive *ad hoc* receiver which is forced to endure to be submerged at times of high water, but a living ecosystem maintaining permanent functional contacts with the river, the underground water bodies, including the upper layer of the groundwater table. Consequently, the wildlife which evolved in this habitat, similarly to the living organisms in the river, 'are not merely adapted to some external natural conditions imposed on them from the outside world, but they proactively contribute to the formation of such conditions in conjunction with the other components of the system. When a living system is in a sound functional state, these components creatively establish a dynamic system equilibrium which allows for the system to remain identical with itself on the long run, or to maintain a state where the rate and extent of changes do not exceed the adaptation capability of the system' (Molnár 2002). In other words, where the system as a whole is able to adapt within the prevailing boundary conditions.

The point in the phenomenon of meandering is that as a result of the asymmetric dynamics of the main-current line it allows a kind of erratic migration in horizontal direction for the river as a water stream within the physical limits – the meander belt – determined by the river valley. Considering that middle and low stage rivers usually run on alluvial or aggradation plains, under natural conditions the meander belt lets a wide room for them to move. Historical data lead us to the conclusion that morphological alterations in the river valley permitted roaming of even the largest water courses in pretty big distances. The flood plain thus formed by the constant changes consisting of bends, strangulated ox bows, emerging longitudinal sand banks, scroll bars and patterns, flatland and floodplain polders formed behind them and chequered with islands and river banks is indeed a differentiated, diverse terrain in spite of the fact that it may seem to be a featureless flat land for the superficial observer. On the other hand, it can be confidently stated that such *a functional floodplain possesses the maximum potential for water retention and storage*. Historical rainfall figures suggest that river lowlands in temperate climate such as the plains of the Carpathian basin have a *negative water balance*, that is they tend to be arid landscapes under natural conditions. Hundred years annual average rainfall data reflect a situation where only 17% of all years bear natural precipitation levels in the Carpathian basin sufficient to farming.

Yet, before the rivers were regulated, drought was never a typical feature of the ‘climate’ in any part of the plains. The explanation is that rivers transported surplus water fallen onto the upper catchment areas in the mountains and they spread it over on the plains. The dynamic mechanism of the floodplains played an integral role in establishing this function. Shortly, it can be said that during times of declining or low water flows the river would deepen or maintain its bed, while in times of high water ('floods', if you like) the river bed is silted up, the river banks are built up and bends developed, that is the space available for the river is actively differentiated. It would change, yet would remain the same. Most rivers have a living, dynamic connection with the *groundwater reservoirs* stretching along the geological formations underneath. In places where they run on gravel or sand beds, a part of the river water is infiltrated into the aquifers below their plain, replenishing that water body and populating it with life. Such underground ecosystems – consisting mostly of invertebrates – are very important in preserving the health of the river system. They would assist in overcoming drought stress and in the restoration of the ecological equilibrium after floods. Due to the activity of the micro-organisms found here pollutants are decomposed more readily during contamination incidents occurring in the river, such as oil spills and hydrocarbon pollution (Grimm et al. 1989, Booth 1989).

However, the balance of the water regime does not only depend on the physical structure of the floodplain and the hydrogeology conditions, but it is influenced at least to the same extent by the nature and extent of vegetation cover in the catchment area. Floodplains are colonised by plants in accordance with the dynamics of the water. Slowly filling up lakes are populated by water chestnut first, later by reeds, while the from time to time water covered meadows are home to sedges, rushes and grasses. Forests grow only on flood free high banks and elevations. There are only a few tree species which would readily endure inundation for any time longer than a couple of days (that is, when the tree roots are covered by water). Floodplains along the Danube and Tisza rivers originally consisted of willow-poplar or ash-oak associations, while higher elevations were overgrown by oak forests typical for the forest steppe biome.

It is well known how important the sponge effect – i.e. water retention by the water interception of the vegetation – of the woodland and forests growing in the regions featuring excess rainfall within the upper catchment of rivers is in maintaining an even water regime of rivers, but the same role of the vegetation in the lower reaches is less known. Both drought and flood are fatal for forests, because they dry out or get rotten, respectively. Forests at higher elevations were not only spared by water, but they missed the sediment layers which could not be deposited there. Instead, lower lying areas were silted up and when they reached the level where woodland grew, water penetrated among the trees and forests were destructed. However, the siltation process carried on and certain parts got dry again, providing the opportunity to natural reforestation.

It can be observed by the analysis of floodplain succession how the condition is met claiming that biological communities play an important role in the life of the river. It was stated that water shortage due to lack of natural precipitation is made up by the high water levels of the river in the lowland areas when it leaves its bed, flooding relatively large areas. Such a huge surface of shallow water ought to be exposed to extreme losses from evaporation, in particular when the flood comes in warm Summer time. Instead, you can demonstrate that starting from areas with permanent water cover the vegetation colonising the floodplain consists of elements each of which operate as a separate water trap. Bulrush, float-grass, rush-beds, sedges and reed-beds protect streamlets and rivulets from drying out. Then hygrophilous grasses and shrubs, softwood appear. Finally, a vegetation cover would be established consisting of softwood and hardwood lots and the grassland, marshy areas connecting them on a soil which is capable to retain extremely large volumes of water, where all stages are present simultaneously, ranging from the open water to closed, climax forest communities (Molnár 2002).

In addition to the global water cycle involving the oceans, there are smaller hydrogeological and biological cycles which are typical for individual, well defined landscape units. Such a unit is the Carpathian basin. There are theories claiming that the local (or regional) climate and hydrogeological conditions of the Carpathians have very strong ties and close relationships with each other and the native vegetation. Historically, both the catchment area and the larger part of the lowlands and floodplains were covered by forests. Trees with their intensive and proactive water regime contributed significantly to the formation of an internal hydrological cycle in the region. Trees in the mountains intercepted rainfall and let it run off only slowly like a sponge. As a consequence, water supply to rivers was more even and homogenous in nature and they did not produced flash floods like they do now after incidents of heavy rains. Trees bound the soil as well, therefore it was not washed out by rain, it did not get into the rivers in the form of heavy bed loads. Downstream, in the plains however trees acted like huge evapotranspirators taking up both groundwater and floods of surface waters, discharging them into the air in the from of vapour and haze. Here again, cloud formation and condensation, precipitation took over and a part of the evaporated water dropped again to the ground over the plains, another part – having been drifted towards the Carpathians – formed rain in the mountain ranges. Thus both the river water and the infiltrated groundwater could get back to the same place where it came from in the first place, at least partially.

The *water regime* of a river basin is determined physically by three major factors: the amount and volume of *precipitation* fallen, *runoff* and *evaporation*. When you deduct the second two from the first one, it will reveal whether the *water balance* of your test area is positive or negative. This simplistic formula does not say anything about the movements of water within the river basin, it does not illustrate the spatial and temporal distribution and inequalities of precipitation, which are however essential for a living system. Terrestrial organisms are unable to exist when water supply is too abundant or too scarce. Consequently, you can claim that the equalisation of the water conditions within the river basin to off-set the inequalities of rainfall patterns is a dynamic process accomplished by the river as a living system in order to meet the needs of one of its sub-systems.

The challenge to be met is to distribute waters originating from the areas with more abundant rainfall (the mountains) as evenly as possible in the areas prone to water scarcity (the plains), and to collect and drain the surplus water – if any – from here. This is a complex task carried out by a complicated but sensitive water system, with non-living components like the geological traits of the river valley and living elements consisting of the different members of plant communities. The most visible structure in a river valley is the river itself, or, better to say, its *main branch*. This is quite clear when you deal with a middle stage river which has a clearly distinguishable meander belt. At the lower section of the river, without human interference like dredging or water steering it is not always clear, where the main branch of the river flows, since the river breaks up into so many branches, there is no main flow. However, *side branches* may also occur in the middle section of the river which break off from the main branch usually upon entering the plains, on the alluvial cone and they may not necessarily return to the same river, but cross over to another river. As opposed to that, rivulets and brooklets run more or less in parallel to the main branch, playing the same role as seepage canals or inland water canals do in the case of modern water structures: they collect the surplus surface water. Water across *notches* or 'foks' found at the lower lying parts of the river banks starts to flow towards the inner parts of the floodplain when it still stagnates along higher banks (Szigyártó 1991). Such incisions usually connected to individual lakes and depressions directly and the flood water got onto the floodplain and into the temporarily inundated depressions or the permanent lakes. Opinions differ whether such fill up took place always from the upstream parts (Szigyártó 1991), or from cuts opened at the deeper lying locations of the river valley, where from water flowed from downstream towards upstream directions, taking advantage of the hydrostatic pressure of the high water in the river running within the main bed, but contained by the higher lying longitudinal scroll bars (Molnár 1992). Ox bows, dead branches and ox bow lakes are permanent structures filled with water which were strangulated from the living water course by cut-offs of meandering bends. Under natural conditions such ox bow lakes take part in retaining water, but they are gradually filled up after a while due to the succession processes. By the time this would happen, however, other ox-bows are formed and thus the entire system is in dynamic equilibrium.

Thus, the system works like that: when there is too much water flowing in the main branch, excess water would slowly flow out over the river banks and notches, incisions onto the floodplain, staying there for a certain period of time retained by the storage components discussed above, roaming over large areas of depressions and flat land. Upon ebbing, the situation is turned upside down and water not used up by the natural structures of the floodplain and the vegetation on it when the water level was high, it would simply flow back gravitationally through the open lower parts of the 'foks' into the main branch as soon as the water stage in the main branch subsides and allows to drain the plains and discharges surplus water into the river. The complete functional integrity of the system assumes that the sponge effect and the intercepting impact of the intact woody vegetation in the upper catchment retains and fritter away the sudden floods, therefore water flows will arrive slower and less high. In such cases the plants in the floodplain has more time to get saturated with water. Integrity of the forests is essential at the plains as well since their litter, spongy topsoil, the evapotranspiration capacity of the trees and the water reservoir role of the plant biomass itself make water storage possible in the plains (Molnár n.d.).

You can conclude that without man the natural dynamics of the regional hydrogeological cycles and the active contribution of the biotic communities make up for the missing precipitation in the landscape at the lower reaches of rivers, including the middle and lower section of the river Tisza.

2.1.4. River regulation – nature knows how to do it but we know better

2.1.4.1. Changes in the mountains

With the advance of the technical civilisation man eliminated his living connections with natural systems one after the other. It wasn't any different with water systems. In Europe, co-existence and co-adaptation of man and environment in the river valleys during earlier history entailed only less comprehensive and, first of all, less consistent and less planned, consciously technocratic transformation of nature. Hence consequences were less tragic until the beginning of the river training operations of modern times. With the emergence of the market economy, changes in the ownership structure and with a number of other modifications in human attitudes and social transformation, the frequency and nature as well as the extent of human technical interventions have changed dramatically.

The most thorough going and most extensive of these changes was the alteration of the vegetation cover and structure in the entire watershed and river basin. In most part of Europe, the process started back in the Medieval and took place in different times in each of the regions. Critical level was reached mostly during the 17th and 18th century which resulted in the changing of the boundary conditions, the depletion of buffer capacities and the damage of certain sub-systems. Consequently the functional integrity of the river valley systems was gradually eliminated.

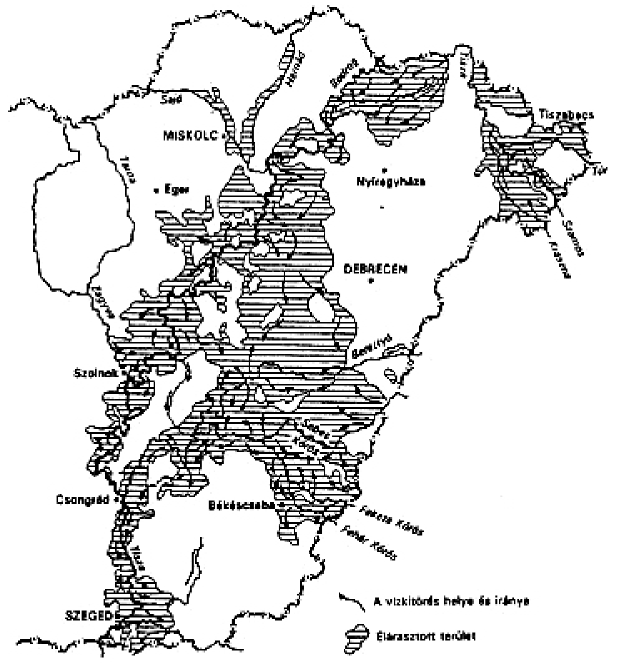
Huge amount of woodland and forest cover was destructed in the river watersheds, in the mountains. Direct triggers and the underlying mechanisms varied from site to site, but industrialisation provided a number of reasons why you could fell trees. In Sweden and Finland for instance, the bottom of the warships at the Swedish Navy was coated with wood tar to make it more resilient against salty sea water, but for this you needed to crack a lot of wood. In Bohemia, forests were put to fire for the sake of the beautiful Czech glassware, while in other places market conditions, opening mines, char coal or lime burning, or simply increased demand for firewood due to constant population growth justified clear cutting instead of selective logging, practiced earlier on. The need for charcoal in the watersheds at the edge of the Carpathian basin caused a declining forest cover with a loss of 50 thousand km^2 of forested area up to the beginning of the 19th century (Szigyártó 1991). The sponge effect was lost and the landscape became barren. In the wake of this change the runoff of surface waters was accelerated, triggering a positive feedback effect by growing erosion and increasing bed loads in rivers. Whole regions were being gradually denuded, where natural reforestation was not a realistic option, therefore the process closed in a devilish circle, tipping the balance of another sub-system of the river, the plains.

Increased erosion resulted not only more sediments and bed loads, but a different composition as well, since the forest soil was simply washed into the water in the form of floating sediment. This was deposited by the river in the lower reaches, elevating its own bed and silting up the river course. The smaller cross section river bed had to accommodate larger volumes of water because of more intense flows. Liquids being incompressible, water had only one way to go, upwards. Flood heights were increased and the water regime more extreme (Molnár 1991).

2.1.4.2. Changes in the lowlands

The adverse effects of the upstream conditions were aggravated by the consequences of the events in the lowland. Deforestation was also present in the plains. Primarily with the intention to set up arable land because cash crops became more and more precious a commodity due to the emerging domination of market economy. Previously, during the Ottoman period in the Tisza valley, military purposes were the main drivers behind deforestation. Perishing floodplain woodlots and gallery forests started again a feedback mechanism pointing towards the deterioration of the boundary conditions. The place of deeper lying woods became waterlogged and the wind blew denuded soil from underneath of the former hardwood communities on higher banks, toward deeper lying parts, the depressions which previously carried out the job of spreading water all around of the plains. These depressions being now filled up, could not comply with their former role and also became waterlogged. In the absence of the powerful forests the water trap was missed and the local climate started to be drier and more extreme, further aggravating deflation. The latter did no good to crops, resulting in a less than expected profit rate of the modern agricultural economy.

History was also very stormy in the Tisza valley. Some areas were deliberately converted into marshland for military purposes, to provide better strategic defence to border castles seated into the river corners. Another damage was done by the operation of the growing number of water mills set up to mill the grain produced. These mills dammed up rivers and other water courses so that all the water could be let onto the mill-wheel, but having accomplished this, water was not let back into the river bed, rather it was let loose towards the deeper lying parts of the floodplain, further accelerating the waterlogging process. By the end of the 19th century more than seven thousand water mills were operated in the Tisza watershed alone (Hamar 2000). Waterlogging was aggravated by the 'foks', which led water into both directions before the Ottoman rule, being neglected and clogged during the times of war and foreign rule. The restoration of the floodplain economy – to be explained in details in Chapter3.2 – could not be realistically hoped for later on because of the changing conditions and the social resistance (Borsos 2000).



Árvizjárta területek az Alföldön ármentesítés előtti időszakban (Ihring, 1973).

Figure 5: The Hungarian Great Plain before river regulations – according to water engineers (Ihrig 1973)

All these factors contributed to the increase of the frequency, speed and extent of floods. When water engineers present maps to substantiate the cause of river regulations, they usually refer to those which depict the situation after the Ottoman rule, just before starting the regulations, with the entire Great Plain becoming marshy and waterlogged (see the map above). Also, such maps can not indicate the tiny spots of high banks in the inundated areas (Lászlóffy 1982). Certainly, the very term of 'flood' is a relative concept. It depended very much on the relationship of the culture in question to nature and the method of husbandry practiced in the plains. Floods were historically recorded only when they caused trouble. In any other cases it was merely the customary annual high water stage. Nevertheless, it can be stated that while in the period ranging from the Arpadian age up to the 1700s the average frequency of serious floods was one in every 30 years, this was reduced to 4-6 years by the time the levees were constructed (Szigyártó 1991). Just think of the large floods of the 18th and 19th century and Count Wesselényi, the Hungarian aristocrat who was called the floods' boatman. These floods caused trouble because the population was larger and people settled down in places where they had not earlier on and because the amount of land farmed intensively on deeper plains was increased. The situation in the Tisza valley became so untenable that the need for a comprehensive river regulation scheme has grown into a national priority to be handled by Count Széchenyi (Gulyás 2000). Europe-wide, the turning point was represented by the end of the 18th century and the beginning of the 19th century, when such a large scale and coordinated nature transformation activity was started which rendered irreversible the changes and the fate of the system. It was made possible by the increasing amount of external energy input in the form of fossil fuels, the use of which gathered speed during the same period in the continent.

It happened for the first time that the cause and effect relation was turned upside down in the relationship of man and nature. So far, husbandry and social hierarchy followed the possibilities provided by technology within the boundary conditions set by the natural environment, now technology was started to be used to custom tailor the natural environment to the needs – and whims – triggered by social and economic changes (Borsos 2000). However, objectives and outcomes differ radically. Disregarding the dynamic patterns of the natural environment – i.e., the life of the river, in this case – has led to a Type one error, repeating itself in a chain reaction which could not be remedied up to now. When the entirety of the natural environment in a floodplain and the human culture settled there is interpreted as an ecological system, it would be seen that human culture as a sub-system of the ecosystem lost its capability of cooperation in the course of adaptation efforts and therefore the system gave way to another system which has new and quite different properties. A cultural anthropologist called this phenomenon bad adaptation or 'maladaptation' (Rapaport 1977, 58 p). And indeed, this is the case: there is good reason to believe that yet more fresh contusions will follow which can only be confined for a time by system alien input (i.e. fossil energy).

2.1.4.3. The works and their direct impact

Now look at it more closely: what did river regulations and river training mean? From the technical point of view, two fundamental operations: cutting through the bends of the meandering river and building the artificial levees – earthen embankments – on both sides along the course of the river. By cutting through the bends the river was straightened. River sections before and after the well developed bend were connected with a narrow canal, and water rushing across that canal formed a new riverbed soon from the tiny human-made structure. The goal was not to spread over water, as it happened before, but to make an attempt getting rid of it as soon as possible, not knowing that this way the amount of natural rainfall will not be sufficient for producing cash crops in the plains. It is quite easy to have an insight that a shorter river (the river Tisza was cut through in 94 bends, thus shortened by 453 kilometres) can keep less water and even if it flows more quickly because the fall of the river increased, it will not be able to drain the flood which keeps on coming much quicker and suddenly than before. Therefore, it would step out its bed which engineers intended to prevent by building artificial earthen embankments, the so called *flood control levees* along both sides of the river, in a certain distance from the main bed, escorting the course of the river. By this move, the native flood plain was finally and fatally narrowed down to an only a couple of kilometres, or at places only a few hundred metres wide area, the freshly created *floodway*. It was intended to achieve that the river did not leave the floodway established for it at all, in other words to form a so called ‘protected side’ which is outside of the embankments and thus is ‘inactive’ in terms of flood drainage. Fluid dynamics suggest that this solution is viable only when it is carried out on both river banks in the entire length of the river, because wherever there is a gap, the river will flood through that opening. The material of the levees must solidly resist the pressure of the high water (Hamar 2000).

Unfortunately however, there was not a bit less water by these interventions to get rid of. It is difficult to envisage how reasonably people could believe that why on earth the amount of water which took 23-30 % of the river plains so far could be confined into a narrow and shorter strip constituting a trifle 5-15 % of its former size even if there is a little bit more room for it to rise upwards. Additionally, a new and dangerous situation was created by the engineers because on the protected side huge areas were now under the water level in the floodway and only the levees protected them from a much more devastating deluge than before. This clearly represented a much higher level of risk, since water did not rise slowly and gradually, but suddenly, in a concentrated fashion.

As stated earlier, the amount of suspended sediment load and bed load transported by the river was increased due to deforestation – since deforestation was carried on during the river training operations – and therefore such loads were deposited on the plains, where the river bed became more and more shallow compared to the surrounding flatland. Finally, the levees caused the clogging and closing of the ‘foks’ and prevented the spreading of the water, thus constituting a source of danger themselves, since the narrower the new floodway was, the quicker it was forced to flow and due to the smaller cross section it rose the higher in times of flooding. Additionally, with the advance of time, the river bed and the floodway bottom got higher and higher as a default since all the bed load and suspended load deposited so far in the entire wide polder belt – the original floodplain – was now confined to the floodway and the river bed, increasing their bottom level. Therefore, if you wanted to maintain the water delivery capacity of the floodways you had to increase the levees’ height from time to time, while the level of the river in comparison to the surrounding land surface was gradually elevated (Schweitzer 2002).

The following figures illustrate how water engineers had to struggle with the ever increasing height of floods and raise the height of the earthen embankments of the flood control levees accordingly. Figure 6 is a schematic drawing of the dikes along the Tisza and its main tributaries, while the first part of Figure 7 shows the main cause of why the dikes had to be increased: siltation causes the river bed and the floodway to increase and diminish the useful cross section available to drain the flood. The second part of Figure 7 explains each of the stages – usually after a major flood – when new standards were adopted to the design height of the dikes. After a while, material properties of earth limited additional increments and this was the time when the idea of the VTT emerged (that is, the year 2000 flood).

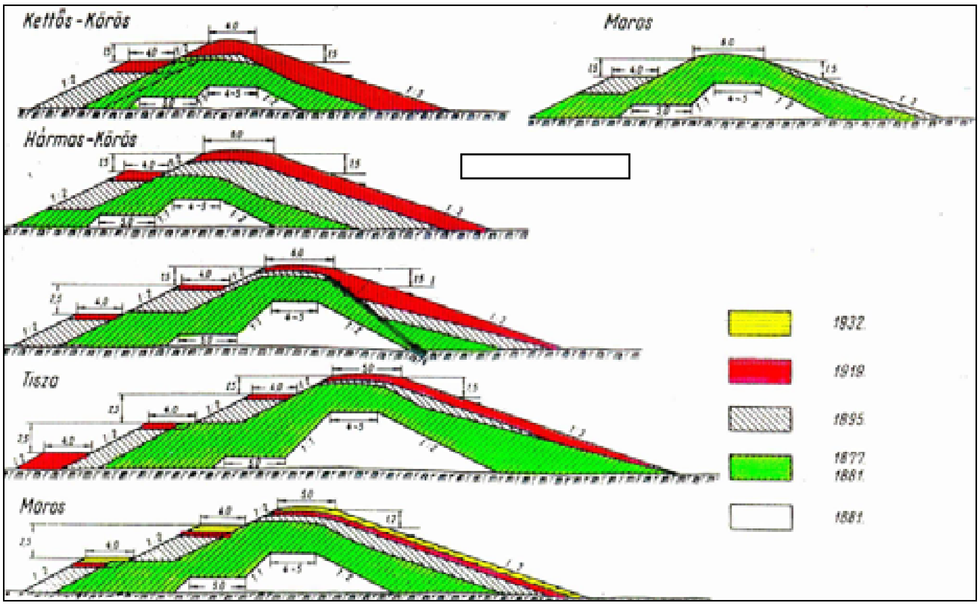
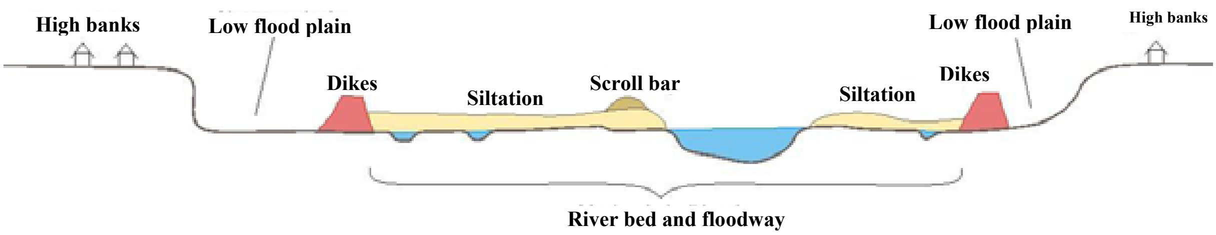


Figure 6: Raising the embankments along the Tisza and its tributaries (Szentiványi 2006)



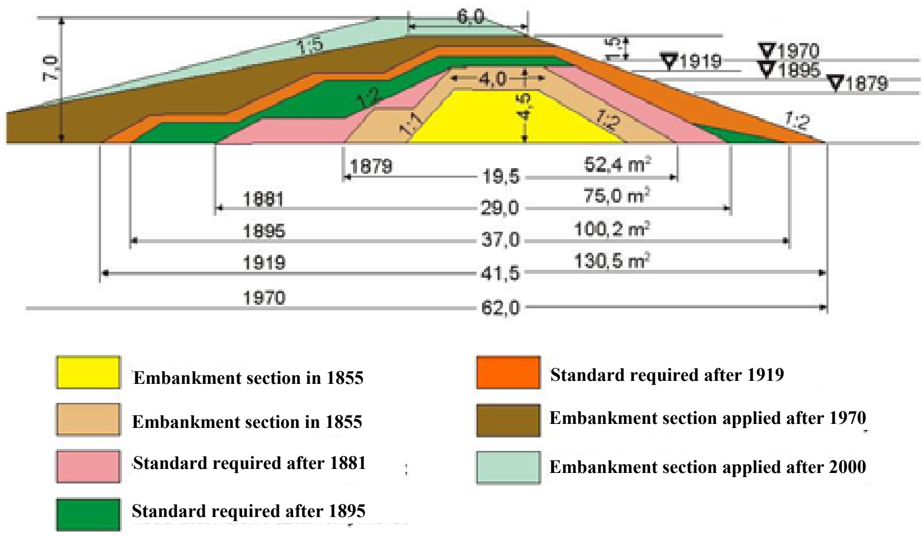


Figure 7: Increasing the height of flood control levees, adapted from Vágás, I and Schweitzer (2002)

Albeit the fall of the Tisza grew by 50 % after the regulations or even doubled at certain locations, thus draining the floods more quickly, yet the design water levels, both the maximum and minimum stage of the water (!) became 2-3.5 metres higher than it was before the regulation (Somogyi 1967). It can not be claimed that it happened incidentally when during the recent decades, more than one hundred and fifty years after the start of the consistent Tisza flood control works, floods are higher and more devastating than ever. In the four years between 1998 and 2001 floods caused a problem each and every year on the river Tisza (Molnár 2002). The peak level in 1998-1999 exceeded the highest ever water stage at several locations (Borsos 2000, Bodnár 2009). More recently, a summer flood outperformed all previous flood in July and August 2008 on the upper Tisza (Bodnár 2009). And finally, in early summer 2010 the tributaries of the river Tisza, Bodrog, Sajó, Zagyva caused tremendous damages in a series of extreme weather incidents. Another property of the technological engineering systems was demonstrated here, namely the inability for adaptation. This time, it was not clear whether again global climate change is to blame, or rather a volcano in Iceland, which erupted in early 2010, injecting volcanic ashes into the atmosphere of the northern hemisphere, causing Mediterranean cyclones carrying much more water over Central Europe than they usually do (see Chapter 2.2.5.1 on Climate change).

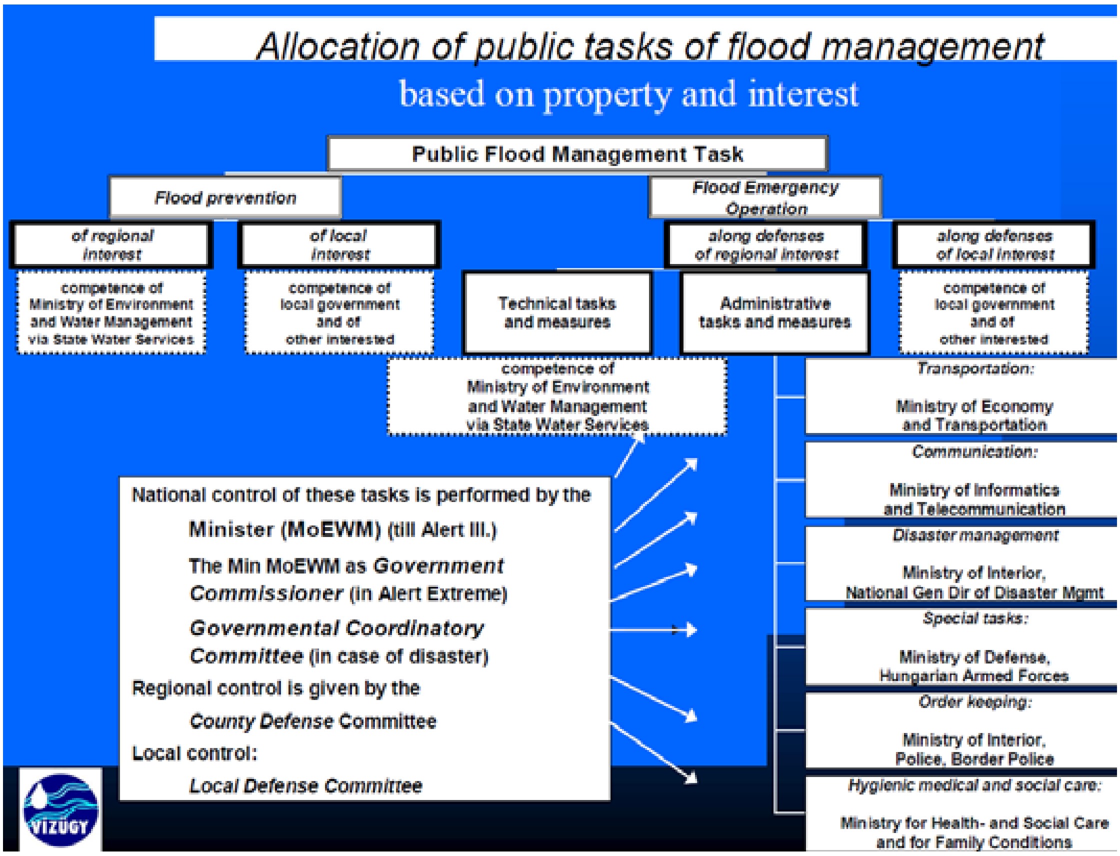


Figure 8: The paralimilitary organisational structure of flood control in Hungary. Source: Szentiványi 2006

The new situation thus created is untenable for a number of reasons. Small floods can be controlled, but floods formed after the regulation works imply more damage by an order of magnitude. Tremendous amount of funds, energy, government intervention and paramilitary organisation are needed in order to prevent even more damages and charity, state subsidies and disaster relief operations are required to mitigate the consequences. The point in it is that there were people with foresight who had seen the root causes of the problem as long as 125 years ago. What is more, it was also suspected, that water management as a sector will be a profitable 'business' for a long time:

'It is widely known that the regulation of the Tisza is not only incomplete but provided the current system is to be carried on, it shall take yet another 40 years and the training operations will still not be quite finished for the simple reason that we will have to raise dykes not only along the banks of the Tisza, but in the tributaries as well, and such heightening of the embankments – sometimes here, sometimes there – will be a never ending story. The son of the water engineer currently engaged in the regulation of the Tisza will inherit his father's profitable job just to pass it on to his own son and to the son of his son – *ad infinitum*. What is the reason why I dare to state that the flood control works will not be completed for centuries to come?

The reason is that the main weight was put not much on sharing and distributing of the water volumes but to build levees and even the cuts were only made as a by-product. I am sorry to say but they were implemented without much reason.

The very same failure was committed with regard to the Tisza regulation as was made at the rivers Maas, Waal and Leck; only that since then – i.e. when their regulation began – some eight hundred years passed. It is inconceivable why we, Hungarians did not learn the lesson at the cost of the Dutch and the Belgians, even though we know from history that cruel floods of the rivers Maas, Waal and Leck devastated sixty villages at one time and a hundred communities another time when the levees burst at several places." [1]

Draining the sudden flash floods became impossible due to closing of the foks, which have become dangerous 'weak spots' in terms of the new concept. Also, the constructions prevented the fish stocks from renewal and reproduction. Water left on the now inactive floodplain became stagnant and foul, stopped flowing across the plants requiring oxygen which thus perished and rotted underneath. Rotting further diminished the amount of dissolved oxygen in the water. Diminishing oxygen contents led to the death of aquatic organisms the decaying proteins from which contaminated the water. Waterlogging and high floods were controlled by further increasing the height of the levees. As a result, the Great Hungarian Plain, once a place abundant in surface waters, has become an arid semi-desert prone to chronic drought requiring constant irrigation. Regulation began in 1846 and by the year 1863 the first problems emerged:

"*You should not only build levees but make sure that wherever and whenever it is needed, the fields could be watered properly. Otherwise… the barren … land of Hortobágy will take the form of the Sahara.*" (János Hunfalvy, geographer)[2]

And, in fact, this is what happened. You can not say that 'nobody told you so'. Land on the inactive floodplain was dried out very slowly and now you could produce grain – for a while. Along the Tisza valley 87.5 % of the floodplain, an area of 10.500 km^2 has become free from water cover, loosing however former sediment deposits and hence, soil nutrient replenishment in the process. At the same time, the new hydrological conditions – infiltration from the now higher running river water, growing groundwater levels and incapacity to drain excess water gravitationally through the incisions along the scroll bars – caused the accumulation of excess surface water – sometimes called incorrectly 'inland water' – in the inactive floodplain after the winter snow melt and any other time when precipitation exceeded the absorbing capacity of the soil. In fact, the extensive presence of excess surface water is a special feature, typical for the Great Hungarian Plain. Foreign references and the technical language of water sciences does not even know a proper English term for the type of areal surface water which is called in Hungarian 'inland water' (Vágás 2007). The original wildlife, flora and fauna perished and local climate also changed: former micro-precipitation (hoar, vapour, dew) was lost due to increased evaporation, soils have been transformed in the now arid areas, the peaty marshland soil became wind drifted infertile alluvial meadow roll and sodification started on the fields with high groundwater table and poor drainage. The now famous Hortobágy has turned from a watered meadow into entirely a 'puszta', a salty desert and the Great Hungarian Plain a place prone to water scarcity and drought (Somogyi 1967).

[1] Alajos Vay: „Észrevételek a Tisza és mellékfolyóinak szabályozásáról (Budapest, 1885)"
[2] Source: http://www.cipp.hu/read.php?frm_id=5816573061

Maintenance of the new flood control works has become a problem. In fact, Hungarian water engineers managed to create by far the longest human made structure not only in Hungarian territory, but in the whole of Europe. Within this system, the Tisza is disproportionately over represented as seen on the figure below.

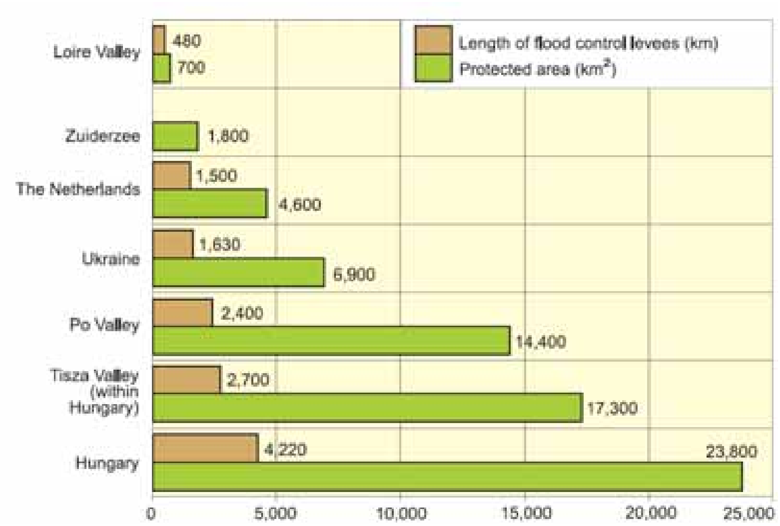


Figure 9: Length of flood control levees and the size of protected areas in Europe (Alföldi 2009: p 55)

In addition, the work was a typical Type One error. The figure below shows clearly, how river regulations made a much larger area prone to waterlogging and seasonal excess surface water coverage than what they actually protected by the dykes (red lines are primary flood control levees, striped areas protected by them on the inactive floodplain and darker and lighter blue shades areas covered regularly, frequently and less frequently by excess water, respectively.

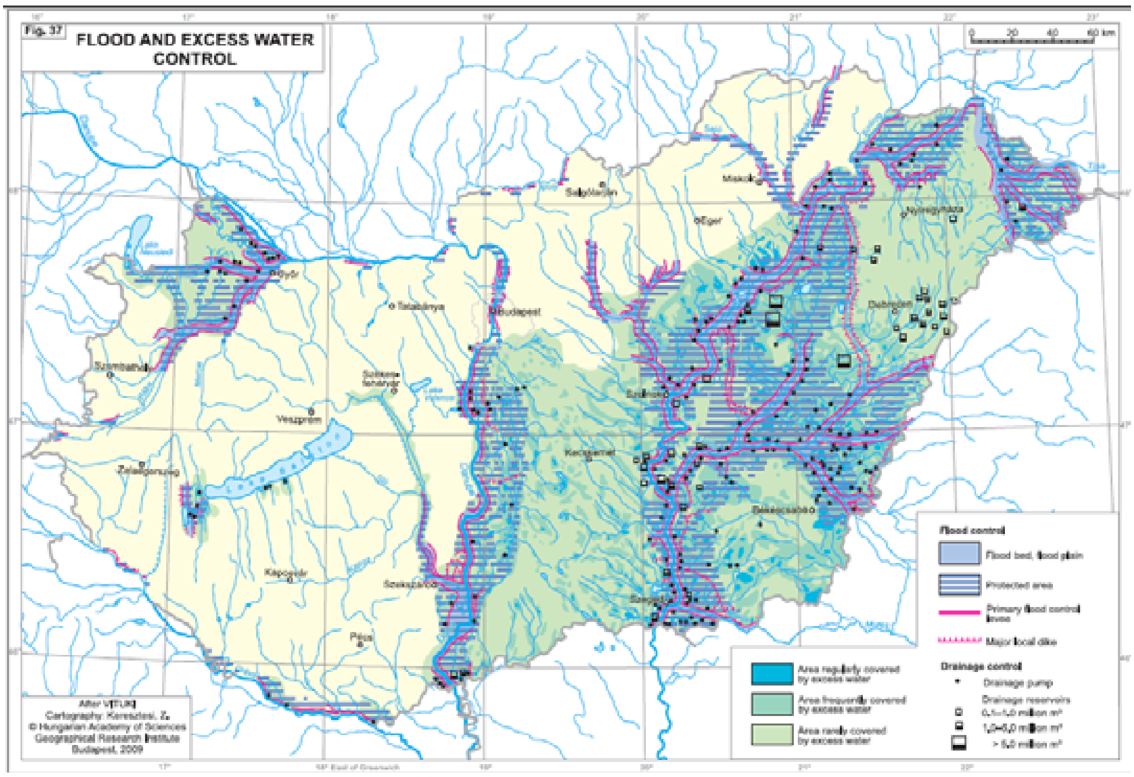


Figure 10: Areas protected by flood control works and exposed to excess water in Hungary (Alföldi 2009: p 54)

2.1.5. Consequences: system feedback

It might be worth to have a look at these consequences again from the systems theory point of view. Over the two and a half centuries passed since the first major river regulation projects in Hungary including those completed on the Danube, the stability of the biologically diverse, rich fluvial ecosystems has been lost due to the large-scale flood control programs, the onset of intensive agricultural production methods and extensive drainage projects. Since at the same time the previously experienced heavy logging and deforestation in the mountain reaches of almost all major rivers were now accompanied by pavement of surfaces and changing land use patterns, the concept itself of letting water down in the main riverbed became a threat.

2.1.5.1. Antagonistic effects: incision and siltation

Water ran more rapidly in the regulated river bed, where due to the shortened meanders and bends cut through, it incised its own bed at times of low water. On the other hand, the river filled up the high water bed between the embankments (active floodplain or floodway) with sediment during high water, because there was not enough place now horizontally to spread the bed load and suspended load over a large area across the former floodplain. It had to rise vertically instead, leaving all bed load, suspended sediment and flotsam and jetsam behind in the floodway (Horváth 1993). The two kinds of effect – erosion in the river bed and sedimentation in the floodways – resulted in lowering the low water river bed and rising of the overall height of the bottom between the dikes (Kajner et al. 2009). These antagonistic changes had several paradox implications. At times of low water the incised riverbed acted as a drain, drawing water from the groundwater table under the lowlands which was formerly replenished by the same river. In addition, water stayed in the area for a shorter period of time because the fall of the river across the plain was increased and therefore it ran down the bed more quickly (Schabuss and Schiemer 2009). As a result, drought was aggravated during the summer seasons on the lowlands in an era of intensive agriculture, when water for high yield crops was needed very much. On the other hand, the floodway started to be silted up with an increased amount of sediment transported by the river from higher reaches. The cross section and hence, the water carrying capacity of the artificially narrowed floodway was reduced while the pattern of water flows also changed: floods arrived more rapidly due to the lost sponge effect in the mountains and rose more rapidly due to the lost floodplain in the lowland. In other words, reverse effects emerged unintentionally beside the achievement of the first priority: increased amount of land. One has the feeling that responses provided by technofix solutions have inevitable consequences which either render the achievement of the very same objective impossible for the sake of which they were devised in the first place, or carry back the same or similar problems through the back door (Tenner 1996).

2.1.5.2. Drought and excess water: the temporal and spatial patterns lost

In theory, what happened was that technocratic approach made an attempt to come up with supplementary solutions first, constructing irrigation schemes and transfer pumps to replenish water in the fields, and elevating the height of the flood control works. Due to the reasons outlined above, the rapid drainage of floods had to be supplemented with the drainage of the marshes and later on of the excess surface water, creating a network of draining ditches. By the time this was completed, it turned out that agricultural production was only possible when the fields are irrigated. Therefore, an irrigation network had to be established on top of the drainage network. Most regulated rivers worldwide are now connected to multiple function artificial water steering systems which try to take over some of the functional elements of the former, naturally developed dynamic control mechanisms – with rather less than more success. Consequently, which was carried out in a single natural process before the intervention, had to be met each by each with the deployment of a costly technical system.

Figure 11: Ploughland under water cover in the Nagykörű area in Spring 2010

However, both solutions have their inherent technological limits and could only be considered as a solution for a very limited amount of time: being a positive feedback loop at work, which is not at all interrupted by these supplementary, auxiliary attempts, sooner or later irrigation becomes prohibitively costly and earthen dikes can not be raised any longer. As an additional consequence, navigation was not improved at all: the low season saw the formation of shallow fords and under flood conditions shipping became more dangerous than ever, ports were exposed to extreme water level fluctuations. The former problem could be overcome by yet another intervention, the so called low water river regulation (dredging and the construction of bank heads, spur guards), while ports had to be dredged and artificially strengthened (Borsos 2010).

2.1.5.3. Supplementary works

One of the most expensive such solution is the canal network designed to drain and transfer excess water from the fields, thus eliminating one of the most spectacular disadvantages of river regulations. Surplus inland waters collect from the precipitation – rain and snow – fallen on the soil and from the infiltrated water originating in the river which runs above ground level as soon as the soil becomes saturated and natural runoff is impossible due to the levees and the higher water level. Therefore, water has to be *pumped* over the dykes. It causes serious damage to agriculture when fields are under water during springtime for several weeks and no power machines can get onto them. The map of inland water canals is overlapping the former flood plain rivulets and brooklets. This is not a great discovery, since now man has to carry out artificially all the functions which was formerly dealt with by the river itself, provided it was left alone (Hamar 2000). But rivers were not left alone. During the fifties dewatering and marshland drainage in Hungary was a fashionable preoccupation of the Communists where supremacy of the ideology could be easily demonstrated. Hanság, an extremely rich, diverse wetland biotope fell victim to this surge of manipulations, to become arable land of low esteem now with the inherent conflicts built into it (Konkoly-Gyuró 2003).

On the other hand, the protected side was deprived of water replenishment from the river and dried up. Again, the linear logic of technology found the appropriate solution: irrigation canals and piping networks which delivered water back to the areas exposed to shortage of water. These are extremely expensive investments which would never bear a return had it been real terms cost benefit analyses and not completed with the help of state funding in the 20th century, after the completion of the river regulations of the nineteen hundred's so that farmers could farm at all. After the collapse of the Socialist state system, these canal networks in Hungary found themselves in a difficult situation. Nobody feels to be in charge of their maintenance and care, which is not surprising at all: while all the rivers in Hungary run along a 2790 kilometres path, we talk about a 40 000 kilometres long artificial water containment structure here which has no natural maintenance or sustenance mechanism. It can be noted here that the following technofix solution, large barrage systems and dams on the rivers to impound water are also prone to the systemic reactions of the river and hence can be considered the next cycle of Type one error.

2.1.5.4. Positive feedback: the never ending story

The aforementioned processes are all governed by positive feedback mechanisms and are examples of Type one error. The ever growing water levels obviously had their consequences: higher and more dangerous floods burst the dikes occasionally causing much more damage on the now lower lying "protected" (inactive) floodplain outside the levees than before. Changing climatic patterns and torrent rain flow in the catchment area of the mountains resulted in ever increasing record level floods with disastrous consequences in some years (Bodnár 2009). High water in the elevated river bed also has an impact on groundwater, causing waterlogging of the productive land near the river on the inactive floodplain during the winter and spring season, which turns into serious droughts during summer, when due to the climatic changes less and less rain falls. The dynamic equilibrium of the river as a system and its surrounding environment has been broken on two accounts: the internal regulatory mechanism could not effectuate the necessary changes in parts, connections and relationships any more and the adaptability of the system to external impacts (climate change) was utterly lost. The processes are summarised on Figure 6.

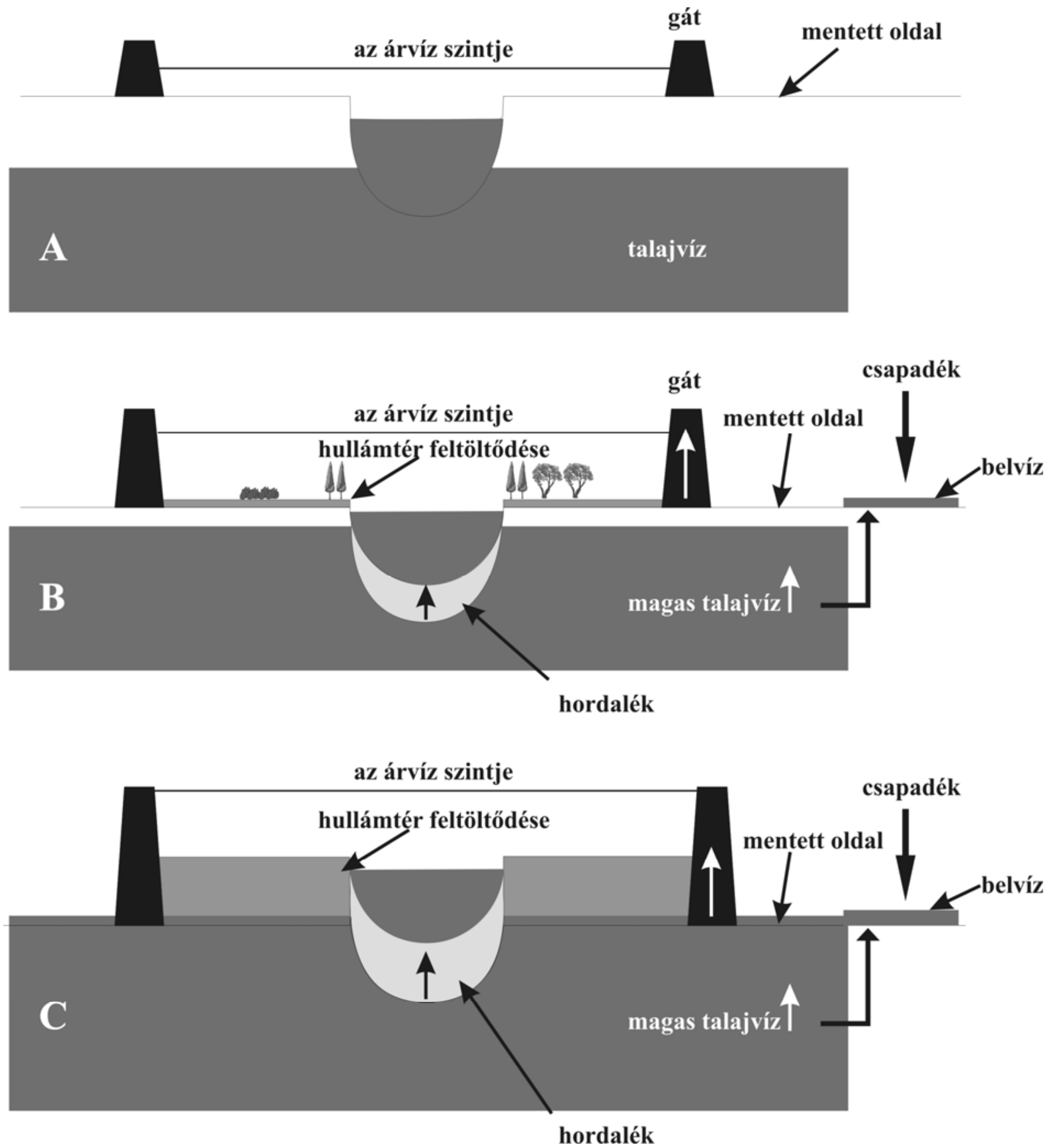


Figure 12: System feedback of river regulations
A: Dikes cause the high water to stay within the floodway, but at a cost of hydraulic pressure building up relative to the protected side. B: Siltation of the floodway rises flood levels further causing excess water appearing on the protected side. Incision of the river bed draws groundwater table during low water season. C: The process goes on in a positive feedback loop until earth embankments can not be elevated any longer (Design by Tamás Bánvölgyi 2003)

2.1.5.5. Summary of historical river management

From the systems theory perspective, the real reason why river regulations did not live up to the hope of their creators is that they simply eliminated the natural homeostatic control mechanism which mitigated the oscillations of the river as a living system on the principle of cause and effect (Odum 1997, 35 p). Shortly, the causes and effects of the linear logic can be summarised as follows:

River regulations in the first place were triggered by

- increased need of land for cash crop agriculture,
- more severe floods due to deforestation and
- the requirements of navigation on the lowlands.

All these factors tended to create a situation which cried for a technical solution. The solution proposed by contemporary technocrats – not knowing or disregarding the basically arid nature of lowland river flood plains – was to get rid of what they thought was excess water. There were three handy measures to do so:

- reducing the length of the river, thus letting water through flood risk areas more quickly. This was achieved by cutting through bends of meandering rivers, straightening its course and increasing the fall of the river, the slope along the lowland it crosses and it had built in the first place;
- limiting the size of area inundated by floods and dissecting natural floodplains into two, permanently separated parts through the construction of artificial levees and dikes: the floodways or the active floodplain within the two opposite embankments in a certain distance from the banks along the river and the so-called "protected" side, the inactive floodplain. This elevation would have been inundated by regular floods had it not been for the flood control works;
- draining the inactive floodplain – thus relieved from the burden of annual floods – of the remaining stagnant water.

The solution, as happens all the time with Type one error interventions, seemed to work well at first. The land was drained, floods contained and cash economy flourished. At a cost, because poverty and disempowerment of local inhabitants increased. They were deprived of their subsistence farming methods and forced into a market economy they utterly disapproved as evidenced by ethnographers and historians (Andrásfalvy 1973, Rácz 2008).

Over the centuries passed since the first river regulation projects, the stability of the biologically diverse, rich fluvial ecosystems has been lost due to the large-scale flood control programs, the onset of intensive agricultural production methods and extensive drainage projects. Since at the same time the previously experienced heavy logging and deforestation in the mountain reaches of almost all major rivers were now accompanied by pavement of surfaces and changing land use patterns, the concept itself of letting water down in the main riverbed became a threat for the following reasons:

- reduced water carrying capacity and
- rising floodway levels, together with
- incised river beds creating both
- drought at times of low water levels,
- sudden rises in water flow (more intense fluctuations) and
- even more floods which, in turn, were intended to be retained by increasing the height of the dykes.

2.2. The life of society

The radically new approach of ILD apparently raises a multitude of questions. After the regulation of the Tisza river in the 19th century, a social environment was formed which, liberated from any limitation imposed by the river, propagated on now inactive large areas of the former floodplain, encroachment – in the form of communities, utility lines, road and other infrastructure networks and inappropriate land use methods – onto land which constituted an integral part of the seasonally inundated floodplain earlier on. At the same time, society's perception of the river and its floods has changed dramatically, and the conviction rooted deeply in people's mind that floods are something harmful and dangerous to be protected from and to parry. Consequently, existing infrastructure, land use patterns and current legal provisions, institutional setup, social structures and psychological factors make it extremely difficult to implement a radically new approach which is, in fact, nothing else but the old one.

Therefore, in order to allow for a successful implementation of the integrated land development concept at the pilot demonstration sites identified by the project, a comprehensive survey of the identifiable institutional, legal, financial, structural and social barriers as well as the possible opportunities need to be carried out first. Later on, the lessons learnt this way should be disseminated, if possible, to all the five riparian countries along the Tisza. During the assessment, possibilities and options need to be explored in terms of all the proposed methods for ILD. With regard to the water management sector, this concerns water steering and water supply in the former floodplain, new type of rural development schemes, diversified land use management approaches in the agricultural sector, and a whole wealth of institutional and legal changes necessary to support and promote the aforementioned shift in landscape management of the riverine system.

2.2.1. Institutional problems: lack of integration

2.2.1.1. The international arena

Before moving to a regional level, an international outlook seems to be expedient first. Three of the Tisza riparian countries (Slovakia, Hungary and Romania) are already Member States of the European Union and the remaining two (Ukraine and Republic of Serbia) are aspirant countries as well. It is therefore advisable to look at EU level legislation which provide a legally binding international policy framework for the riparian countries in their efforts to deal with the river.

Current EU legislation is very fragmented in terms of water management and even more fragmented in terms of agriculture. Even though there exist some kind of a framework approach (the Water Framework Directive for waters and Common Agricultural Policy for land), these efforts need to reconcile a number of various interests in geographically and ecologically very diverse regions. Consequently, the application of the lowest common denominator principle results in vague and at the same time very rigid provisions.

Key laws and regulations affecting the surface waters – including rivers – from the water management perspective include the following:

- The Water Framework Directive (WFD)[3]
- Floods Directive[4]
- Communication on Drought[5]
- Bathing Water Directive[6]
- Water Quality Directive[7]
- Other directives related to water quality[8][9]
- Waste Water Directive[10]
- Nitrate Directive[11]

Even a very superficial look at these pieces of legislation would tell you that regulation in this field was very inadequate and fragmented. Water quality issues for instance are regulated by the last six, each from a different perspective. A somewhat better concept seems to be represented by the WFD, which provides for the preparation of comprehensive river management plans. At the same time, interrelated issues such as flood and drought or water scarcity are still regulated separately. Surface waters and water courses are seen as distinct entities, not in conjunction with adjacent land. Rural development – a key issue in dealing with water management and integrated land development – is not integrated into the minds of policy makers dealing with water. The WFD does not even contain the term 'rural development'. There is much talk on sustainable development and economic and social development, some reference is made to the spatial development schemes, but nothing specifically to rural landscapes, in which rivers flow most of the time.

The situation is even worse in the field of legislation dealing with agriculture. Most of the Community law with relevance to land use and cultivation or production focus on market related matters, subsidy schemes, production quotas and not on comprehensive approaches to rural development or integrated land use. Ridiculously meticulous pieces of regulation govern all aspects of specific products and market arrangements, but nothing is said about the method of cultivation or agro-environmental matters. The piecemeal provisions have overgrown into a teeming jungle of seemingly unrelated rules concerning only a few stakeholders. The situation must have appeared painful quite a while ago, as efforts to simplify agricultural legislation were afoot as long ago as in 1976[12] – in vain.

---

[3] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy *Official Journal L 327 , 22/12/2000 P. 0001 - 0073*

[4] Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks, Text with EEA relevance *Official Journal L 288 , 06/11/2007 P. 0027 - 0034*

[5] Official communication of the European Commission regarding water scarcity and drought 18 August 2007

[6] Directive 2006/7/EC of the European Parliament and of the Council of 15 February 2006 concerning the management of bathing water quality and repealing Directive 76/160/EEC *(OJ L 64, 4.3.2006, p. 37–51)*

[7] Council Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption *Official Journal L 330 , 05/12/1998 P. 0032 – 0054*

[8] Directive 2006/11/EC of the European Parliament and of the Council of 15 February 2006 on pollution caused by certain dangerous substances discharged into the aquatic environment of the Community (Codified version) (Text with EEA relevance) *(OJ L 64, 4.3.2006, p. 52–59)*

[9] Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration *(OJ L 372, 27.12.2006, p. 19–31)*

[10] Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment, and Commission Directive 98/15/EC of 27 February 1998 amending Council Directive 91/271/EEC with respect to certain requirements established in Annex I thereof (Text with EEA relevance) *OJ L 67, 7.3.1998, p. 29–30*

[11] Council Directive 91/676/EEC of 12 December 1991 concerning the protection of waters against pollution caused by nitrates from agricultural sources *Official Journal L 375 , 31/12/1991 P. 0001 - 0008*

[12] Council Resolution of 23 November 1976 concerning measures to simplify agricultural legislation (OJ C 287,

The chapter on agriculture of the Directory of Community Legislation in Force[13] reveals that the structure is still utterly inappropriate. The following titles are listed:

- General
- Statistics
- Basic provisions
- European Agriculture Guidance and Guarantee Fund (EAGGF)
- Agricultural structures
- Monetary measures
- Approximation of laws and health measures
- Products subject to market organisation
- Products not subject with market organisation
- Agreements with third countries

Even titles like General cover mostly issues such as the registration of geographical indications and designations of origin, while basic provisions concern national aid schemes, the Common Agricultural Policy mechanisms and legislation on accessions: which requirements various candidate or accession countries have to comply with to become full right members of the European Union.

Set aside schemes[14]

A promising opportunity to relieve farmers from the treadmill of intensive crop production was the system of so-called set-aside schemes and entitlements. Again, the trigger has nothing to do with environmental considerations or wise land use efforts. The system of subsidising farmers for setting-aside areas of land from agricultural production was introduced in the 1980's in order to curtail over-production, which had generated food surpluses and caused a dramatic reduction in some commodity prices.

The scheme was effectively abolished by the European Commission in 2008 after harvests were devastated by extensive flooding and global food prices began to soar. Environmental groups and conservationists did not welcome the decision as the uncultivated land provided a vital source of food and refuge for wildlife in agricultural landscapes, especially birds[15]. For the purposes of integrated land development the scheme could have been used to off-set farmers for withdrawing some of their lower lying land from intensive cultivation and pay them compensation for tolerating open water seasonally. At the same time, such land ought not necessarily be withdrawn from cultivation altogether, other types of husbandry such as meadow, hay making or energy crops could be allowed on it.

Rural development

Rural development as such has never been of great importance in the European Union. The first CAP was launched in 1962 and one of its aims was to ensure a fair standard of living for

4.12.1976, p. 1–2)

[13] http://eur-lex.europa.eu/en/repert/index.htm

[14] Council Regulation 1782/2003/EC establishing common rules for direct support schemes under the common agricultural policy and establishing certain support schemes for farmers and amending Regulations 2019/93/EEC, 1452/2001/EC, 1453/2001/EC, 1454/2001/EC, 1868/94/EC, 1251/1999/EC, 1254/1999/EC, 1673/2000/EC, 2358/71/EC and 2529/2001/EC.

[15] Posted by Jo Savage at The Ecology & Policy Blog is run by the Science Policy Team at the British Ecological Society, Monday, 16 February 2009.
Website: http://ecologyandpolicy.blogspot.com/2009/02/return-of-set-aside-schemes-for-farmers.html

the agricultural community in rural areas. Since it was mainly market oriented, it caused a lot of problems in rural livelihood. Therefore, it was first reformed in 1992 (McSharry Plan) to accommodate these concerns and to move away from a price support scheme towards an income support system based on direct payments, thought to be more beneficial at the time. Even though there were some so-called accompanying measures, two of which included environmental aspects as well (agro-environmental protection and afforestation of agricultural land), no significant changes in rural development policy was realised and market oriented measures remained the key element of CAP.

For a while, there was only one regulation which provided some opportunity to rural development concerns from the environmental and ecological perspective[16]. The situation has changed to some extent in 2003, when the latest CAP-reform put the emphasis from the first pillar (market policy) to the second pillar (rural development) through compulsory modulation[17]. In 2005, the financial framework of the European Commission for the next budgetary period of 2007 to 2013 was adopted[18]. In this, somewhat more importance is given to rural issues, such as:

- Increasing the amount of support for rural development
- Rural development policy is separated from structural policy
- A new fund will be created, a so-called European Agricultural Fund for Rural Development (EAFRD)
- This fund simplifies programming, financing and monitoring
- LEADER initiative is compulsory and more widely in rural development programming

The three main objectives of the new rural development policy between 2007 and 2013 are as follows:

- Improving the competitiveness of the agricultural and forestry sector by supporting restructuring, development and innovation
- Improving the environment and the countryside by supporting land management
- Improving the quality of life in rural areas and encouraging diversification of economic activity.

As it can be seen, the term land management emerged at last in the wording of policy makers. To achieve these objectives, a four axis model needed to be created as follows:

1. axis: Improving the competitiveness of the agricultural and forestry sector
2. axis: Improving the environment and the countryside
3. axis: Improving the quality of life in rural areas and diversification of the rural economy
4. axis: LEADER (It supports the implementation of local rural development strategies according to one or more axes. It contains measures like supporting collaboration projects, creating local action groups, acquirement of skills)[19]

[16] Council Regulation (EC) No 1257/1999 of 17 May 1999 on support for rural development from the European Agricultural Guidance and Guarantee Fund (EAGGF) and amending and repealing certain Regulations

[17] Council Regulation 1783/2003/EC was accepted in September 2003, which modified the former regulation (1257/1999/EC).

[18] Council Regulation (EC) No 1698/2005/ EC

[19] Nagy, Zsuzsanna: The Rural Development Policy in the European Union and in Hungary. Proceedings from the First International Conference on Agriculture and Rural Development, Topusko, Croatia, November 23-25 2006, published in: Journal of Central European Agriculture, Volume 7 (2003) No 3, pp 595-599

With this, finally, at least in principle, the possibility was given to decision makers to deal with rural development and environmental issues more comprehensively. Even though there are some suspicious formulations in these four axes (competitiveness on a liberalised monetary market is not the most important feature which agriculture and forestry should attain, and it is not clear, how the environment can be 'improved' – or the countryside, for that matter), the quality of life can indeed be improved when done wisely and diversification of the rural economy is really a must.

In the other area, the river basin management plans, required under the Water Framework Directive, provide opportunity to embrace the new rural development concepts as well. River basin based management of surface – and to an extent, underground – water resources and water bodies would be of paramount importance in integrated concepts for land management. Such approaches encompass all movements of water from the rain drop to the seas, including other types of material flows.

After centuries long misconception politicians and decision makers seem to recognise finally the fundamental principle of river dynamics. Flood events are a natural feature of all river systems but their impacts have been worsened by past decisions related to the management and use of river systems. Climate change is expected to increase the magnitude and incidence of adverse flood events in the decades to come, if the business as usual scenario is continued. However, while floods can not be prevented, returning rivers to a more natural state and undertaking a set of sustainable measures across the basin (catchment area) of the river can substantially reduce the intensity, frequency of floods and the extent of damage they cause.

For this to happen, a dramatically different approach to water and land management as well as to regional spatial development is needed. As a first attempt to transition from sectoral to comprehensive and holistic management concepts, the International Commission for the Protection of the Danube River (ICPDR) published 17 sub-basin flood action plans covering the entire Danube catchment[20]. The approach of these action plans contains some key components which seem to recognise the necessary shift from defensive action against hazards to proactive management of risks. For the last two hundred years or so the slogan in Europe was to conquer nature – including its rivers – instead of living with it. This is now to change and the commission expressed its view and belief that people will need to accept flood as part of their lives. The action plan documents applied the river basin approach taking into account the Water Framework Directive of the European Union and stressed the need for joint actions by governments, municipalities and stakeholders in flood risk management and awareness raising. As for the methods to be applied to this end, reducing flood risk via natural retention, structural flood protection and hazard reduction are mentioned. These are fair words which however cover up a lot of different views from the scientific, technical and even the philosophical aspects.

A warmly welcome notion of the report is the need for "solidarity", the belief that one region along the river should not pass on water management problems to another. Most frequently long rivers with many riparian countries or nations along their path see the building of various water diversion structures upstream such as dams and irrigation schemes, thus depleting the flows and draining the vital resources away from downstream regions or nations. The opposite may also happen when dangerous floods or erosion causing hydro peaking are let onto downstream sections of the river. There are a multitude of examples to both types of

[20] ICPDR: Addressing Flooding in the Danube Region. The ICPDR Flood Action Plan for the Sub-basins 2009

selfish and unilateral water use ranging from the Colorado river in the United States through the Euphrates in Turkey up to the Danube itself in Slovakia.

Since water scarcity is a current concern and water demand is predicted to increase in the next decades along the Tisza countries, the document argues for a three-step approach of retaining, storing and draining. According to the ICPDR regions should make every effort first to retain rainfall in situ; store excess water locally and, only after this has been attempted, allow the water to be discharged to the watercourse. Although the strategy is well founded and legitimate, it has to be noted that limitless increase of water demand may result in water scarcity regardless of how well the threefold approach works. Therefore, it can only work if a stringent regulation on water use exists as well. Pricing alone is not a sufficient means. As is the case in most natural resources, needs increase in times of relative scarcity (summer, in times of drought) and in other times storage or drainage of excess water is a problem (in times of floods or excess surface water in the lowland). With renewable energy resources used for heating, the opposite is true: solar radiation is relatively weak in winter when most of it would be needed. The energy parallel is applicable to regulating demand as well: as long as water saving practices and novel approaches to avoid or diminish artificial water use – in particular from underground reservoirs – do not gain ground in face of forced economic growth, no solution to retain water will prevent overconsumption.

Solutions lie in good husbandry and wise management. This is why the targets and measures are based on the regulation of land use and spatial planning, increase of retention and detention capacities, and in addition to technical flood control, preventive actions and non-structural measures. The Water Framework Directive obviously has its limitations in this respect. It was the Carpathian Convention which first emphasised the need for integrating land use and water management, while making an attempt to reduce the weight of thinking in terms compartments and sectors[21]. The convention also deserves attention because it has a bioregional scope as opposed to political boundaries.

2.2.1.2. Institutional problems domestically

Below, based on the Hungarian situation and conditions, a short overview is presented of those barriers which prevent comprehensive implementation of the aforementioned principles and approaches along the Tisza on a major scale.

The institutional setup of the state administration and other official bodies reflect the century old view of water management as a technical issue which is to be regulated in compartments and each of these compartments have very little to do with each other. In the Hungarian situation in particular this institutional fragmentation is best seen in the structure of the government agencies dealing with water, land, rural development and local community issues.

Institutional obstacles exist in the institution of land ownership as well. Since the privatization in the beginning of the 1990s the Tisza river region suffers from over-fragmentation of parcels and unclear ownership. This fact has been established by a number of previous reports such as the Farland report[22], 2007; or the ICDR Tisza Analysis itself in 2007[23], but no

[21] Framework Convention on the Protection and Sustainable Development of the Carpathians 22 May 2003 Ukraine, Kiev

[22] Jagt, Pat van der et al.: Far Land Near Future. A publication of the INTERREG IIIC project „Future Approaches to Land Development (FARLAND), The Netherlands, 2007, 148 pp

comprehensive analysis was made in terms of the underlying causes or mechanisms. The problem occurs mostly in rural areas suffering from high flood risk on former floodplains. The new flood risk reduction, regional revitalization projects in the frame of the New Vásárhelyi Plan (VTT) also suffered long delays due to unsolved ownership problems, lack of capacities at implementation organizations and poor land management procedures.

Land related issues are highly influenced by politics at all levels, so management related action programs have to struggle with these problem at each location, causing protracted implementation, even financial losses (e.g. Bodrogköz polder development, land expropriation) (TALK, 2005). That's why independent, efficient external assistance, oriented on sustainable use of local resources, is needed to help the actors involved.

Institutional barriers may exist and are therefore to be addressed at the national level, while others are specifically linked to local relations and institutions such as councils or water boards.

Key obstacles to integrated land development which have to be dealt with institutionally include the following:

Property issues:

- undivided common properties
- small parcels jointly utilized by lease
- large parcels owned by absentee owner groups
- unfinished land privatization

Degradation of natural resources (soil, biodiversity, water, forests):

- shallow flooding in former floodplains is a missing function, therefore wetlands are impoverished and deprived much of their former diversity
- water retention areas for improved 'small scale water cycles' would be needed

High flood and water stagnation risk:

- large parcels are exposed to stagnating water (excess surface water) in times of snow melt or rainfall during the spring
- the boundaries of parcels do not match the natural elevations and soil properties

These issues have to be dealt with before any successful large scale integrated land management and development project can be envisaged. An additional problem is the existing infrastructure. Roads and railway tracks may or may not be a barrier, pending on their routing. However, other fixed line utilities such as high voltage transmission power lines or underground cables, gas or oil transmission lines are tough barriers since no construction activities can be carried out along their path. In addition, the 750 kV power line, the largest high voltage electricity cable in the country, runs exactly through the Middle Tisza region in the flood plain, not really taking into account where natural relief of the terrain allows seasonal inundation. Legal provisions are in place which forbid inundation of the pylons the power line is carried on.

Lack of integration and conflicting regulations aggravate consistent thinking. The flash flood in May and June 2010 provided an excellent example to the maze of bureaucracy, local politics, development, flood control and state administration. Sajó is one of the largest

[23] ICPDR (edited and written by Kirstie Sheperd and Paul Csagoly): Tisza River Basin Analysis 2007. Summary Report. A Call for Action, Vienna International Centre

tributaries of the Tisza which crosses the city of Miskolc at the outskirts, connecting the city to an adjacent community called Felsőzsolca. The river makes an elbow turn at a point where the two settlements are connected by the main road marked No 3. The road – obviously – runs on an embankment and thus creates an impediment in the way of the water. In addition the flood carrying capacity of the river bed is strongly reduced by the elbow. In the seventies there were social housing facilities in the floodway which were totally destroyed by a flood in 1974.

Yet, urban encroachment reached this vulnerable site again. Auchan, the multinational supermarket chain applied for and received building permit just exactly on the land which was prone to flooding. Mind you, this is the floodway, or in other words the extended river bed designed to carry the high stage water flows. The environmental and water management authority first declined the application, but it was finally granted on appeal to the authority of the second instant. The reason was both institutional and political: a government decree laid the right of decision making in respect of construction permits in the floodways into the hands of the operator of the floodway section concerned. The riparian areas of rivers are operated by a number of various operators, pending on the section of the river, which is an impossible situation in itself. The Sajó floodway was in the hands of the Miskolc council and the council decided in 2004 in relation with an urban master plan that the area was zoned for development. On this example, the various interests and sectors can be clearly demonstrated. For instance, if the road had been built in pillars instead of an embankment, the water could have gone further to the north, causing much less harm. Instead, the supermarket and shopping centre (including a Decathlon facility and a horticulture implements outlet) stood 80 cm high in water during the flood. These questions raise technical, economic, political, social organisational problems and reflect mainly the attitude and worldview of different stakeholders (Pusztai and Szabó 2010).

Figure 13: Sajó goes shopping to Auchan Miskolc

In the current institutional framework, stakeholder relations in the government structure is very fragmented and counter productive. Agriculture, energy matters, water management, land use issues, regional and spatial development, rural development and urbanisation are all separated within the administration and information flow between the various departments is limited or almost non-existent. Perceived or real interests of the individual sectors and departments are contradictory to each other, all compete for the same resources (i.e. the national budget and the EU subsidy and funding schemes), therefore they regard the other as an enemy or an indifferent entity at best. These animosities can be seen within departments as well. The respective organisation charts clearly reflect this situation. For instance, the Ministry of Environment and Water Management consists of three distinct lines, which do not interfere with each other and since Environment and Nature Conservation are historically weaker in interest representation and advocacy, Water Management obtained and used effectively much of the VTT funding.

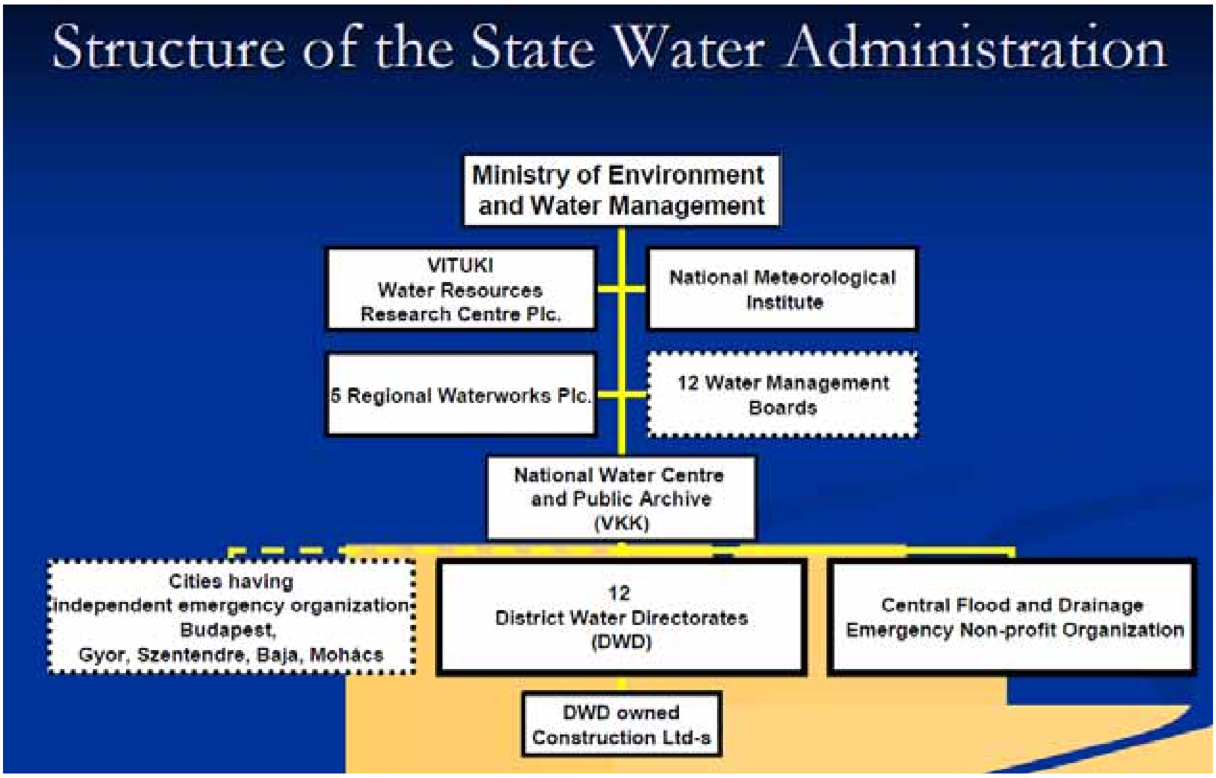


Figure 14: The water administration in 2006

Note that National Water Centre and Public Archives (VKK) has been renamed Water Management and Environmental Central Directorate (VKKI) since then. Also note, that the 12 water management boards are independent entities, while cities with independent emergency response systems in place are also under the management of the respective municipalities (both with dotted lines). Source: Szentiványi 2006

However, even within Water Management there is a severe dichotomy of the various sub sectors. The organogram below shows the organisation setup of the current main administrative body of water management affairs, Water Management and Environmental Central Directorate (VKKI, not to be confused with VTT, which is the further development of the Vásárhelyi plan, or VKI, which is the Hungarian abbreviation of the Water Framework Directive). VKKI has four technical directorates, each dealing with various aspects of water management and it is known from interviews with officials of the establishment that the first one (Water and Environmental Damage Relief Department) is the most dominant of all, since flood control has a much larger budget than for instance drainage of excess water or sewage treatment. Interestingly enough, River Basin Management was given an independent department, as if it had nothing to do with floods. Investments are implemented in a completely different structure of a Project Directorate. This setup has not been changed yet by the new government, although press releases and interviews with officials suggest that a major administration re-engineering is in the pipeline to centralise some of the now discarded functions, increase the headcount and to transform the water management sector into a strong paramilitary organisation capable of acting in a coordinated way (Pusztai and Szabó 2010, Szabó 2010).

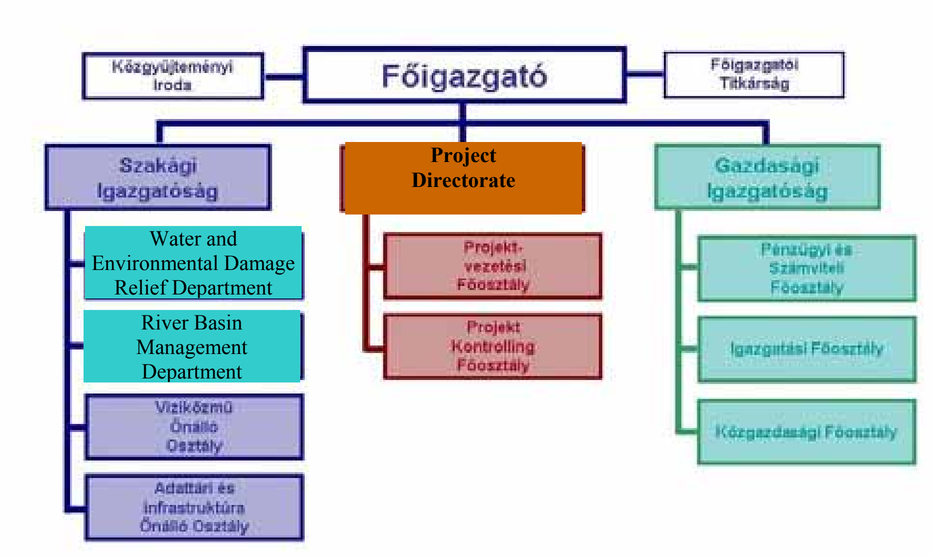


Figure 15: Organisation of the water administration agency

Source: http://www.vkki.hu/index.php?mid=135

There is no framework in the institutional setup which could facilitate benefit transfer recognition. Conservative water management thinking is a problem: there are still views which hold that barrages are not only needed but in fact good for you. A typical example is the so-called Tisza Lake, the impoundment behind the Kisköre barrage, considered to be a great success, both in terms of water governance of the river and as a social benefit. Recreational opportunities, fishing, bird watching and the like are mentioned most frequently.

Conservative and rigid nature conservation measures and approaches do not facilitate dynamic systems thinking, either. Again, the Tisza Lake is praised for its role in boosting biodiversity. There is only one aspect which is missed by most observers: as the name indicates, the reservoir behaves exactly like a lake: a stagnant water, with all the associated properties, in the middle of a living water course, disrupting the dynamic pattern of floods and low water stages (Teszárné 2009). The complete eutrophication of the lake can only be avoided by permanent anthropogenic manipulation.

The same technocratic view is seen in the field of urban planning. Szolnok for instance, the largest city in the middle section of the Hungarian reach, considered the river as part of the infrastructure and not part of the landscape which has to be left room to move. As a result, near misses of dyke burst thrilled the inhabitants of the city during the serious floods of the last twenty years. An option would be in such situations for the cities to pay the countryside for storing flood water, but due to the incoherent system and legal barriers this can not be implemented at the time being. A ray of hope was seen in the river basin management planning, but poor coordination and lack of effective power prevent real integration of measures. National sovereignty versus natural watersheds is another matter needing reconciliation. Various interests of downstream and upstream countries sometimes make coordination within the same river basin difficult, as analysed in the last section of this paper under the title Threats. Interests may differ even within the same country from region to region: Bereg, Bodrogköz and Nagykörű have all different physical conditions and hence, diverging interests in the management of the river.

Due to the strict separation of the various sectors and the organisational, psychological barriers towering in front of collaboration there is not a single interdisciplinary programme in place. No wonder that the legal environment in the country is constructed in a manner which does not allow flexible cross-sectoral approaches of complex landscape development problems such as the integrated management of a whole river valley. This way, the imminent threat is that implementation shall face rigid sectoral frameworks which render successful implementation impossible.

2.2.2. Legal background

Legal barriers to the implementation of an integrated land development scheme can be basically divided into two major clusters of obstacles: one set is related to current water management practices and the way government sees water as a resource or commodity, and the other set consists of many different legal provisions, but all related to the land use changes necessary for integrated land development. Please note that for the purposes of interpretation land use throughout this paper is not restricted to arable land but all types of land use including forestry or urban encroachment. Nevertheless, the most important and imminent land use changes are envisaged in respect of agricultural land. This is the most abundant type of land along the river Tisza covering most part of the former native flood plain.

2.2.2.1. Legal barriers related to land use

As a result of the land compensation procedures and privatisation taking place in Hungary and most Central and Eastern European countries after the political transition of the nineties, land ownership structure has changed dramatically. Private ownership of land was once again appreciated by society and recognised by law. However, the process was implemented poorly and – in the form it was done – without much reason, prone to political manipulation. Consequently, the fragmented ownership structure proved to be dysfunctional and over time land tenure practices became established for most of the land owned by private individuals.

It was determined during the preparatory phases of the project, that for the purposes of integrated land management and development under the current legal framework in Hungary, the only feasible option would be to change current land use practices on those areas which are designed for periodical or seasonal inundation or for water storage and retention. There are several barriers in the way of such an approach: the ownership structure, the land users and the type of cultivation. If an area is to be submerged on a larger scale deliberately, the following preconditions need to be met first:

- Undivided common tenure has to be eliminated by surveying and dividing up common parcels and each land owner should have physically delineated plots;
- Proprietary relations have to be consolidated and pooled in a land consolidation procedure so that appropriately sized convenient pieces of

land could be surveyed, which offer themselves for land management through their geomorphologic properties;
- Surveyed pieces need to be subdivided so that a new land parcel (or sub-parcel) could be delineated according to the most suitable contours;
- Type of cultivation need to be changed on the newly formed parcels to a type which does not contradict to seasonal flooding and is not prone to stagnant excess surface water or waterlogging.

2.2.2.1.1. Reprivatisation versus compensation

If you really want to understand properly the complicated and helpless situation of land ownership issues in Hungary at the beginning of the 21^{st} century, you have to go back to the political transition of the 1990s. The key issue at the time was how to restore private ownership after the expropriation process carried out by the Communist government and decades of state propriety. In principle, restitution of property rights could be implemented in two different ways:

- physically, by simply delivering back physical assets to their former lawful owners on the basis of a historically delineated period from the date when they were owned by them and another date which should be the benchmark of state ownership; or
- organising a so-called compensation process whereby eligible former owners are entitled to marketable vouchers issued by the government in return of their confiscated former assets. The vouchers then can be used to acquire various properties and assets.

After lengthy and heated political debates the second solution was applied for several reasons. First, the country was not in the financial and economic position to afford full reprivatisation and second, physical restitution could have proven to be impossible due to the material changes taken place in the four decades of Communist ownership. Another additional benefit provided by the compensation process was that this way the road was open to privatisation proper, that is to sell state owned assets on the free market to interested investors. At the same time, compensation as a notion was not easily understood by many and beneficiaries felt deceived because they were not given money. Instead, a vague and ill defined concept of vouchers was set in motion. Unfortunately, these vouchers were very difficult to use properly but easy to manipulate and speculate with. The compensation process was not a political success at all and its aftermath is still lurking behind the scenes.

Land was always considered to be a property of special legal status. As opposed to other types of assets, in the case of arable land the Independent Smallholders' Party insisted on the positive discrimination of the former land owners by providing them special rights through reprivatisation. Although the Constitutional Court ruled that all eligible owners had to be dealt with equally, the land issues remained a hot potato for the coalition government between 1990 and 1994.

Finally, four categories became eligible for compensation: a) state assets subject to privatisation b) dedicated land funds of agricultural cooperatives and state farms c) city council tenement flats assigned for alienation, and d) life annuity acquisitions. In addition to residents of Hungary, any foreign citizen found eligible as possessing expropriated assets before 1947 could participate and acquire property, including land.

Issue of the compensation vouchers started in 1992 and ended in 1995, after a change in government as a result of the general elections. The system caused tremendous problems in almost all of its aspects, but we will focus only to those related to land use here. First of all, the compensation claims received from eligible former owners ranged up to approximately 250 billion Hungarian forints, an amount poorly covered by available land.

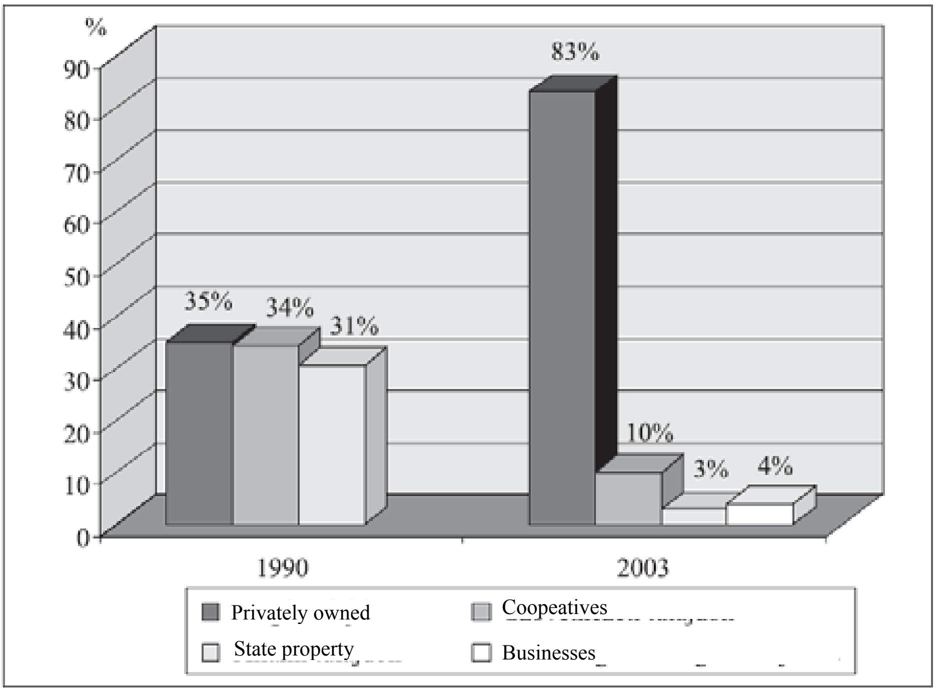


Figure 16: Ownership structure of agriculturally productive land before and after the compensation process in Hungary.
Source: National Land Consolidation Strategy, AKI 2004

On the other hand, the quality of land was still based on an outdated and severely biased valuation system which was supposed to reflect the fertility of the soil and its suitability for crop production, but in reality it is a very vague and poorly established, rigid categorisation called the Golden Crown system. It is still the same land valuation method which was originally used in 1875 for the purposes of cadastre (land registry). During the compensation process, the vouchers received by primary beneficiaries were denominated in Golden Crowns and land was available on auctions in return of these vouchers according to the value of the land in question as determined by the Golden Crown level registered in the relevant land registry office. Vouchers could also be sold as a freely marketable entity for cash or on the stock exchange. There were a number of factors influencing these transaction:

- Many of the original beneficiaries were elderly people not interested in assuming the responsibility of farming and husbandry.
- New land owners were subject to obligatory land cultivation (see later).
- The calculation of eligibility resulted in sometimes very low amount of compensation vouchers, not sufficient to buy any reasonable amount of land.
- The market price of the vouchers proved to be volatile and ranged from HUF 500 per Golden Crown up to several ten thousands.

- Land was not available in the amount necessary, for state owned farms had to reserve land for national purposes and some of the cooperative or state farm land was sold to third parties earlier on during the so called transition period.
- The same compensation vouchers could be used to other purposes, for instance to take part in the privatisation of other state assets, to purchase shares on the stock exchange or get involved in employees' stock ownership plans (ESOP).

A psychological aspect of the land restitution process was also the creation of a legal basis for private property. By the end of the nineties, it has been legally established that the land offered for compensation by the Land Restitution Committees will become the lawful legal property of the new owner and none of the former owners may claim ownership over it any more. Thus, the overwhelming majority of agriculturally productive land in Hungary, a key resource of national importance has become private property. More than 50% of the entire national territory, 5.6 million hectares of arable land is now in the possession of 2.6 million private persons.

2.2.2.1.2. Land consolidation as a way out?

Due to the conditions described above, the restitution process resulted in an extremely fragmented and ill-arranged structure of cultivated plots and parcels. The new owners were typically given the land acquired not in a single parcel but in the form of many, scattered plots frequently in a distance from each other. A specific consequence of land privatisation has become the existence of larger parcels where several proprietors are in the possession of a single piece of land without physically knowing which part of the administrative parcel belongs to them. Such a situation is called the *undivided common*. At the beginning of the 21st century, 1.5 million hectares were still listed as plots of undivided common.

At the same time, the number of absentee owners, who are not at all or only remotely related to agriculture has grown substantially. Business organisations and individual agricultural entrepreneurs (land users) mostly use their land in the form of lease. Land use changes are shown on the figure below. Please note, that the illustration is somewhat misleading in the sense that ‘companies and entrepreneurs’ meant state farms in 1990 but genuine capitalist businesses in 2002:

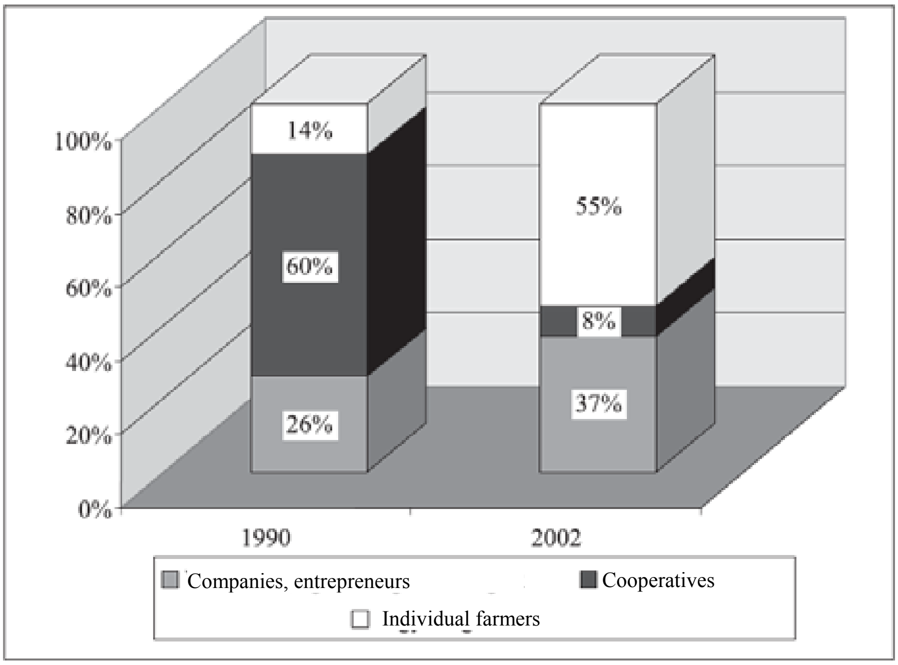


Figure 17: Changes in the structure of land users
Source: National Land Consolidation Strategy, AKI 2004

Beside being ill-proportioned, current land use patterns are therefore considered to be strongly bipolar in character: in terms of number, the domestic farm structure is dominated by a large number of fragmented, tiny farms (see the figure above, which reflects the number of business entities and not the size of land), while on the other end a mere 1.6% of all the holdings farm 75% of all arable land (80% by 2008) (Ripka 2005)! Another source reports that 0.5% of all farmers and holdings operate 60.7% of all arable land (Somodi 2006). They consists of legal entities and large individual farmers. Even if you account for the natural persons as land users, the average size of their farm is merely 6 hectares, while those used by legal entities ranged up to 179 ha. (Please note again that this is only the current land use pattern and not the actual ownership structure. Business organisations in Hungary are not entitled to own land, as we will see a little bit later). Yet, the legal regulation of eligibility of subsidies was recently changed to favour those large land users (see in the Finance section).

Land consolidation is a legally regulated complex activity supported locally by land owners and land users during which land ownership and land use patterns and structures are rearranged. Under the land consolidation procedure undivided common is to be surveyed and distributed physically among the various owners, then scattered pieces of owners and users are exchanged or unified with the purpose to form sensible and reasonably sized holdings with a view to facilitate agricultural production and promote rural development. In fact, the current approach to land consolidation intends to promote cost efficiency in proper liberal market economy terms by assisting in the setup of (economically) optimally sized tenure and parcels.

After the compensation and land restitution process was completed, various efforts were made to facilitate land consolidation.[24] [25] Up to recently, the agricultural subsidy system was also

[24] Land consolidation training by EU experts for staff members of the Hungarian land registry offices and the National Land Fund, March 2004, Budapest, Ministry for Agriculture and Rural Development

[25] Dutch-Hungarian TALC (Technical Assistance on Land Consolidation) project supports the Tisza River's Vásárhelyi Plan Development, Central European Land Knowledge Centre (CELK Centre), Source:

available for purchase and exchange of arable land with a view to land consolidation[26]. Land could also be consolidated on a voluntary basis. Yet, results are scarce. The reasons for this are to be attributed partly to lacking financial resources (the title for subsidies was discontinued in October 2007 with reference to lack of interest on behalf of land owners), insufficient technical and organisational means necessary to meet larger volumes of such needs, but firstly and mostly the non existence of a proper land consolidation law. Land consolidation has not been embraced by Hungarian agricultural policy. This is partly due indeed to the lack of interest on behalf of the land users, who have not yet experienced the benefits of consolidated tenure. Also, the general public is very suspicious in this respect for historical reasons. Land consolidation rings the bell for some and reminds them of nationalisation. Therefore, politicians handle the issue very cautiously and make only vague statements without proper commitments.

The new concept of ILD managing the adverse effects of surface waters and water courses wishes to go beyond the simple economic approach taken by land consolidation efforts seen so far, by providing the opportunity to a land use pattern accommodating the original, native functions of the landscape. Dependence from external resources and inputs can be eliminated this way and a land and landscape use method taking advantage of local natural conditions and resulting in sustainable land management can be implemented.

Land consolidation as a legally regulated complex activity first appeared in the Hungarian legal system in Act No LV of 1994 on the agricultural land. It provides for the execution of a land consolidation process for the benefit of the land owners by pooling of separated, scattered parcels in order to establish holdings with a production setup better suited to natural conditions. However, the law did not contain any specific provisions to this end, it merely referred to a separate piece of legislation which will govern the process, and until that voluntary land consolidation initiatives can be carried out for the purposes of land pooling in holdings. (Pooling means the exchange of land with others or the unification of small, fragmented, physically scattered parcels or plots with a view to facilitate agricultural cultivation and good husbandry.) However, due to reasons referred to above, the 'separate piece of legislation' specified in the Article concerned was never adopted in the 16 years passed since the Act on Agricultural Land has taken effect.

Another possibility would be the National Land Fund, a government backed attempt to promote the structural reforms of land ownership, which has the goal to purchase land and pass it on to farmers to increase and consolidate their holdings. It also has the mission specifically applicable to ILD "to improve the holding structure which is unsuitable to efficient agricultural use by reconciling it with rural development objectives, to support the establishment of profitable holding structures, providing arable land to voluntary parcel exchanges and the exchange of land parcels on the floodway and land on the protected side but exposed to water cover"[27]. Unfortunately, the agricultural land constituting the National Land Fund are utilised mostly and predominantly by lease holding to medium or large scale agricultural businesses due to the maintenance of the tenancy agreements concluded by the legal predecessors. Only when these indenture agreements expire will have the National Land Fund a proper size of land to be put to free use through which the holding concentration

http://www.4cli.org/CELK/wwwcelknew/landconsolidation.asp retrieved on 3 May 2010

[26] Article 35 of Decree No 25/2004 (III.3.) FVM of the Ministry of Agriculture and Rural Development on national subsidies to agriculture and rural development

[27] Article 2 paragraph (1) of Act No CXVI of 2001 on the National Land Fund.

currently seen due to the leaseholds can be substituted by a land use form based on proprietorship of land in which the National Land Fund can play the role of the land bank.

Land consolidation issues and undivided common

Costs related to a division programme of undivided common properties would be astronomical. Since most of the owners in such a situation own only a very little piece of land in the parcel concerned – an ill-fated heritage of the half-heartedly executed restitution programme of the nineties –, the process would entail a lot of surveying and administration. Each of the new parcels had to be pegged physically by a surveyor and administered by the land registry office. Separate topographical numbers have to be dedicated to the parcels and all and any information and data related to them collected, entered into the records and kept updated.

Division of plots and parcels under Hungarian law is a lengthy and costly process. Whether it goes about a voluntary consolidation process or one enforced by the government (see the section on legal opportunities), a surveyor has to be called in and a division layout diagrammatic drawing drawn up. The surveyor also has to mark-out the physical boundaries of all the newly formed subdivisions or sub-parcels. A single such operation costs approximately HUF 60 000[28] under current conditions and at present prices. The division layout diagrammatic drawing then should be submitted to the building authority for approval. The cost of the procedure is about HUF 4000. Following endorsement of the layout diagram by the so-called technical authorities (environmental agency, soil protection, etc.) the regulator issues the permit for the division. Then the proponents may go to a lawyer to get the appropriate dividing document prepared. This entails a further HUF 30 000 for each of the new parcels and only afterwards can the document be submitted to the land registry for registration and assigning a new topographical number.

All these steps are related only to the very first stage of the legal arrangements: the division of undivided common. Same or similar steps need to be taken for attempts to consolidate or to pool land ownership.

2.2.2.1.3. Who owns the land?

The land ownership issue remained a holy cow for the governments even since the restitution process was more or less completed. Before the Act on Agricultural Land was enacted, the Hungarian society lived in complete uncertainty about the desirable and probable changes in land ownership and nobody could predict the outcome of the political struggles around it. “Agricultural land is a national heritage” was the slogan and it was feared that Hungarian soil will be sold to foreigners. On the other hand, there was a short period between 1992 and 1994, when the so called ‘transition law’[29] enabled interested individuals and businesses to ‘privatise’ fertile land from cooperatives and state farms to themselves at discounted prices. However, once the Act on Agricultural Land has been adopted, the right of accession of property was restricted insofar that domestic legal entities were not eligible – with some exceptions – to buy agricultural land[30].

[28] 270 to 300 US dollars, pending on the exchange rate.
[29] Act No VIV of 1992 on the sale, utilisation and protection of tangible assets held by the state on a temporary basis
[30] Article 6 paragraph (1) of Act No LV of 1994 on agricultural land

Therefore, from this time on, any proper land consolidation and well meaning institutional efforts have become impossible: not only companies, being entities holding a legal personality, non-governmental organisations, foundations and associations are also all excluded from owning land. Ironically, the ban on land purchase had no effect on vested interests, therefore those who have privatised agricultural land during the transient period could retain it, by which a mixture of private and business ownership was created right away. Politicians justified their weird preoccupation with natural persons on the pretext that this way foreign land ownership can be excluded: only domestic natural persons were entitled to buy land. Needless to say, how difficult it has become this way to carry out any of the processes referred to in the section written on land consolidation. The situation is a legal trap: since most of the land owners are natural persons as a consequence of the restitution and compensation procedure, and since most of them lease their land to business organisations to cultivate it, and since these business organisations are unable to buy the land from its lawful owner, the chiasm between land property and land use remains.

The situation was supposed to be changed after the accession of Hungary to the European Union on 1st May, 2004. Yet, in a rare moment of consensus, the Hungarian parliament and government endorsed a derogation application requesting a moratorium on land purchase for a period of seven years. This way, the state of affairs remained unchanged ever since. The moratorium is about to expire in 2011. Now, the Hungarian government submitted yet another application to Brussels in April 2010 to extend the moratorium for another three years. The argument this time goes that young farmers need to increase their holdings if they are to survive. For them, the moratorium would mean low prices and hence, the possibility to grow. On the other hand, as mentioned above, there is still 1.5 million hectares of undivided common in Hungary, and no serious land consolidation programmes are envisaged. The Ministry of Agriculture and Rural Development records are aware of 3.3 million land owners, having an average holding size of less than 2 hectares. This points out that urgent increase of land purchase and sale turnover would be necessary if the deadlock situation is ever to be overcome (Kelemen 2010).

Prices also speak for a liberalisation rather than maintaining the biased conditions. Those stuck with their reconstituted land in small parcels unable to cultivate could sell it at a premium price all at once, earning money and allowing farmers or business organisations to take advantage of their land. In terms of ILD, the moratorium for instance disables SZÖVET – which is an association by legal status – from buying land for the purposes of the pilot demonstration site.

The impossible situation is further aggravated by a legal regulation of leasehold and pre-emptive rights related to land[31]. In this, land relations, which were impossibly confused anyway, were complicated even more by the priority list of pre-emptive rights concerning land purchase and even land lease. The priority list was supposed to establish the priority of local resident, registered inhabitants deemed to be a husbandman/woman over anybody else. Even this was subjected however to obtaining a waiver from the National Land Fund and the nature conservation authorities before any tenancy agreement or Purchase and Sale Agreement could have been implemented.

[31] Government Decree No. 16/2002 (II.18.) laying down the detailed rules for exercising land tenure rights and pre-emptive rights of agricultural land

Therefore, land purchase or even simple lease holding has become an extremely sophisticated and lengthy procedure raising the issue of illegitimate limitation of proprietary rights and the freedom to contract. Additionally, the procurement of the waiver from the Land Fund and the nature conservation agency became yet another time consuming and resource intensive task to be fulfilled. First the priority was given to local neighbours, disregarding the interests of existing tenants, and it was only amended later on to set the tenant in the first place and the neighbour to the second. Such strict and rigid regulation would make it absolutely difficult to use land in a flexible manner as proposed for landscape management purposes, where the same piece of land should be used sometimes for retaining water and sometimes to put under crop.

There are also problems with the surveying and dividing up of parcels: for the purposes of integrated land management and development, the boundaries of the sub-parcels or new topographical numbers to be established ought to follow the natural contours of the relief and not that of man made infrastructure (roads, ditches, canals, transmission lines, houses or other facilities in most of the cases). From the technical point of view it is much more convenient for surveyors to draw straight lines on their schematic diagrams for sub divisions than squiggly contours along meandering elevations.

2.2.2.1.4. The obligation of cultivation

Bureaucracy is not only proliferating and propagating itself in land consolidation and registration. Unlike in many other countries, in Hungary there is a rigid delineation of various types of cultivation and pending on the class the piece of land concerned is registered in, the owner or lawful user shall cultivate agricultural land in accordance with that type of cultivation or to maintain its status corresponding to the officially registered utilisation type. The *type of cultivation* is a concept used for the identification of the mode of utilisation of agricultural land carried out systematically over the years. Agricultural land, on the other hand, is typified into a limited number of categories for cultivation in the land registry of title deeds, which has to be defined for all land parcels and sub-parcels (a sub-parcel is a part of any one parcel with the same topographical number but surveyed and delineated as a separate land registry entity which may or may not have a different cultivation type assigned to it than that of the main parcel).

Thus, agricultural land is the type of land, which is cultivated as: plough land (that is, anything under crop), vineyards, orchards, gardens, meadow-land (for cutting grass), pasture field (for grazing animals), reed plots or reed beds, forest, afforestation (plantations) and fish ponds[32]. And each of these categories have to be maintained by the land user with proprietary solicitude[33].

If you are to discharge water seasonally and deliberately onto areas which are classified as plough land, the obligation to cultivate such land for cropping will exclude the possibility to retain water on the land for any substantial period of time, in particular during the early spring and summer season when water is abundant, because arable land has to be tilled and sown at that time, which is impossible when it is under water. Therefore, another type of cultivation –

[32] Decree No 109/1999 (XII.29.) of the Ministry of Agriculture and Rural Development implementing Act No CXLI of 1997 on landed property registration

[33] Article 5 paragraph (1) of Act No CXXIX of 2007 on the protection of agricultural land

preferably meadow-land or grazing land, woodlots or plantation, maybe forest – must be found to make it feasible. Grass and wetland can endure periodical inundation just as much as certain tree crops – willow, poplar, alder do. For the purposes of more convenient administration, it would be possible to change the type of cultivation only for newly established sub-parcels and not only entire parcels. Sub parcels can be established beyond the size of 400 m^2 for most types and above 1500 m^2 in the case of forests. A single parcel can be subdivided into maximum 20 sub-parcels.

Changing the type of cultivation on a piece of land, although not impossible, has its own difficulties. Earlier on, plough land was considered to be more precious type of cultivation from the national economy point of view than grassland, therefore you had to justify your cause if you wanted to change the classification and the method of farming. Under the legislation currently in place[34], the owner or land user is only obliged to report changing the cultivation type of any sub parcel to the land registry authority within 30 days upon the change has been effectuated. In certain cases the change is still subject to approval from various cognisant authorities. For instance, if the land in question is an area protected by nature conservation measures, the endorsement of the nature conservation authority has to be obtained first. With regard to ILD, this is important because much of the prospective low lying areas which may be considered for periodical inundation, are covered by the Hungarian national legislation issued to implement the Natura 2000 programme[35]. In such areas special permits need to be obtained when forest type of cultivation is about to be established or abolished or when commodity producing vineyards or orchards are planted or cut out.

Change in the cultivation type is defined as conversion of one type of cultivation to another within a sub-parcel or as changing the physical boundaries of a sub parcel. Also, you talk about a change in cultivation type when a piece of agricultural land is withdrawn from cultivation or if a piece of land previously withdrawn from cultivation is put to agricultural use again. Provided the land user fails to meet his or her obligation to report the change of cultivation type or to farm the land according to the effective registered classification, he or she shall be subjected to pay a land protection fine. Since there is no cultivation type which would provide for seasonal inundation on a piece of land, it would be difficult for land users to avoid such fines under the current legal framework. Changing the physical boundaries of parcels is also possible, but it is also a very bureaucratic procedure called parcelling, regulated by a Government Decree[36]. Establishing sub-parcels is somewhat easier because you don't need to carry out an entire parcelling procedure, it is sufficient to submit a change control schematic diagram to the land registry office prepared by a chartered surveyor.

From this short overview it can be seen that there are tremendous legal, institutional and administrative-bureaucratic obstacles in front of any larger scale integrated land management and development planning concept. A similarly unfavourable legal environment prevent more flexible actions in the field of water management as well.

[34] Article 27 paragraph (2) Act No CXLI of 1997 on landed property registration

[35] Government Decree No. 275/2004 (X.8.) on special areas of conservation of European Community significance

[36] Article 17A to 17/C of Government Decree No. 338/2006 (XII.23.) on the land registry offices, the National Institute for Surveying and Remote Sensing, on the Committee for Geographic Names and laying down the detailed rules for landed property registration

2.2.2.2. Legal barriers related to water management

Water management is governed predominantly by Act No LVII of 1995 on water management (the Water Management Act). It defines water management in the same dichotomy as seen in the institutional setup of the government bodies: it lists the various methods of use and utilisation of water as a natural element for human purposes on one hand and mitigation or elimination of damages caused by water through protection and control on the other. Water management is a complex activity where the nation state, regions, local governments, water authorities, water management associations and the water users (whether natural or legal persons) participate jointly. The legal structure built on this approach reflects the dichotomy and the chiasm between the various sub-sectors within the sector. Only in 2004, with the adoption of the VTT Act[37] has the notion gained ground that coupling of water usage (utilisation) and water control (water damage mitigation or elimination) was possible in the new concept of excess water management.

Yet, the legal environment at the time being does not encourage controlled discharge of excess water received in live surface water courses – rivers, creeks or streamlets – onto the inactive side of the fluvial flood plain, retaining it there for a certain period of time and then draining back, or using it to cover missing volumes in times of drought.

2.2.2.2.1. Partitioning water management

In Hungarian law, water is an environmental element (a natural resource) in the sense defined by the Environmental Protection Act[38], occurring in a limited amount both in terms of time and space. As such, it has to be ensured that water as an integral part of the landscape be maintained in the conditions necessary for preserving the biological resources built on it. In principle, this is provided for by the Water Management Act, with many difficulties. As mentioned before, the Act divided up water management into two major functions: water usage and water damage relief. Water usage functions include – in this order (!) – the provision of water for basic drinking, public health, disaster relief, medical, production and service activities dedicated to direct supply of the population, livestock drinking, aquaculture, nature conservation, business and other (such as recreational, sports, swimming and touristic) purposes. Of the purposes of usage, agricultural plays a special role in ILD, and, ironically enough, it is regulated in a separate piece of legislation as water usage with business purposes[39].

The situation is not a bit less confusing in other types of water usage, either. Pending on the ownership, the Water Management Act specifically lists all those surface waters – rivers, streamlets, creeks, ox-bows, side branches and their respective beds – and all water related facilities, which are exclusive national property and hence, can not be transferred for operation to any other business organisation. They are managed by the respective water administration bodies. Such entities however do not include water courses and water related facilities intended to be used for agricultural purposes. They are to be handled and in those

[37] Act No LXVII of 2004 on the public interest and implementation of the programme aiming at the enhancement of flood control safety in the Tisza-valley and the spatial and rural development of the affected region (the Improved Vásárhelyi Plan)
[38] Act No LIII of 1995 laying down the general rules for the protection of the environment
[39] Article 9 paragraph (5) of Decree No 2/1997 (II.8.) KHVM on the operation of water supply works dedicated for agricultural purposes

respective areas the management of water usage and water damage relief tasks are to be completed by the Minister of Land Use and Rural Development[40].

Yet another group of waters and facilities relate to those which are owned by the state but handed over to other business entities. Such waters have to be managed with the help of *water associations (water boards*). Waters and facilities held in exclusive national ownership can be also managed through *water management associations*, a form of which are *water boards*, another form is the *public water utility board*. Distinctions between these legal entities is very important but very difficult for a lay person to make. It is so complex and ill-defined that even professionals are sometimes at a loss. A public water utility board is a public body in charge of public water supply, sewage disposal, waste water treatment, surface drainage in the inner areas and rainwater disposal in communities.

On 2nd January 2010 yet another piece of legislation has taken effect, regulating water boards[41]. With this Act, regulation of water boards was effectively taken out from the scope of the Water Management Act and it was defined that 'water boards are to complete areal land drainage and surface drainage, water damage elimination and agricultural water usage tasks in the public utility water management works (hereinafter referred to as the board works) in its proprietorship, asset management or operation, establish public utility water works and facilities and provide maintenance and operational activities. They may, within their respective area of operation, carry out environmental, nature conservation, field or holding melioration water and water service functions'[42].

In other words, there are at least four to three players in water management operations, pending on the classification of the water body or the water course, and the land covered by it:

- the national government, through its regionally cognisant authorities, the directorates,
- the municipalities, through their respective local governments and the public water utilities set up by them,
- the water boards and
- the land users themselves.

State owned waters and water facilities are distinguished as follows:

- those, which can not be allowed to be operated by a business organisation. These are used and operated by the regional Water Management Directorates (in the case of the Middle Tisza region, the Middle Tisza Water Management Directorate, KÖTIVIZIG);
- those which can be put in concession to business organisations. They must be distinguished as follows:
  - waters and water facilities. They are managed by water boards.
  - public water utilities. They are managed by business organisations owned exclusively by the state or by the state and local governments, or by other business organisations under a concession agreement.

The various water management bodies are very distinct in their missions, means and interest representative power. Albeit both are state-owned and government-run entities, water boards,

[40] Government Decree No. 162/2006 (VII.8.) on the scope of authority and jurisdiction of the Minister for Land Use and Rural Development
[41] Act No CXLIV of 2009 on water boards
[42] Article 3 paragraph (2) of the Water Boards Act

which also own and manage inland excess surface water drainage networks, canals, ditches and water transfer structures (pumping stations, sluices), possess a lot less financial means than water directorates, which are usually seen as the entities in charge of flood control (which they really are – amongst many other things).

2.2.2.2.2. Defence against the damages of water

Legislation on the defence against damages caused by water clearly reflects this segmentation approach. The entire system is geared up to discharge and drain excess water when it is there, be it either within the floodway (floods) or in the original floodplain ('excess surface water'), another approach is taken when water is in short supply. In order to achieve this, the applicable legislation provides for the obligées to defend property against the damages caused by water to carry out their protective actions 'along the flood control lines and within the excess surface water drainage systems', which are to be divided up into defence sections[43]. The building, development, maintenance, operation of control works and the controlling activities are defined as the joint and several liability and obligation of the state, local governments and other stakeholders interested in damage prevention or elimination. Thus, while funding and organisation is quite different for excess surface water and floods, the legislation draws them under the same hat.

What should be a design flood level, is determined from time to time by the respective minister in charge[44]. In this decree all rivers are assigned a design flood level to which their respective flood control plans have to be developed. All aspects of the flood control works need to be defined in these plans, including longitudinal sections, crest of the dams/weirs, highest and design flood levels, the course of the river, the floodway and many other details. However, no option is there for controlled discharge of excess water.

On the contrary, excess water in the fields has to be drained and even actively pumped over the crest of the dikes, whenever it occurs. For both floods and excess water, there are Grade I, Grade II and Grade III alertness classification grades specified with the respective associated actions to be carried out. At cross-corners with the needs of ILD, inundation of the flood draining reservoirs of the VTT shall only be allowed when all three grades have been depleted and due to the unusually high water an emergency flood incident is announced[45]. In other words, even if you had an appropriately sized reservoir under the VTT with a low inlet bottom sill to fill it up at mid-stage water, you could only fill it up legally once there was an extreme risk of bursting of the dikes.

In the same spirit, Grade I excess water emergency alertness has to be announced when the canal network is to be put to use. Grade II involves the active transfer of water from the drainage system into the living water course in two shifts, while Grade III means that all pumps are working at least 75% of their capacity and emergency storage has to be contemplated. Emergency storage – that is, effectively retention of water in the landscape, our main goal – is allowed only when an extraordinary emergency situation is announced because excess surface water threatens residential areas, industrial areas or transport infrastructure. Again, this provision is in flat opposition to what would be needed for ILD.

[43] Decree No 10/1997 (VII.17.) KHVM on flood and excess surface water control
[44] Decree No 15/1997 (IX.19.) KHVM on design flood levels of rivers
[45] Annex No 1 Section 34 of the Water Management Act

2.2.2.2.3. Rules of fishing

A very interesting problem – a truly 'interdepartmental one' – emerged during the flood of 2010 in Nagykörű. As an outcome from a former project, three local inhabitants received proper training in professional fishing with traditional, old style methods, a part of the efforts to restore diverse land use patterns and mitigate the pressing unemployment and poverty. When the water left the riverbed and inundated the fields under crop in the floodway, they paddled out to practice their newly acquired skills. The officials of the business company exercising fishing rights along the whole section of the Tisza alerted the police and poor fellows were caught in the red: as it happened to turn out, the law does not make any distinction between professional large scale fishing in the river – leased to big business – and subsistence fishing with traditional tools on the land – even although it was temporarily inundated. A lawsuit followed and the fishermen are now accused of poaching.

2.2.2.3. Labyrinth of laws and regulations

The aforementioned provisions are only a small piece of all the relevant laws and regulations governing complex water management project. The following example clearly indicates the delicate intricacy and sophisticated entanglement of a densely woven network of unnecessary, exhaustive and meticulous legislation which has to be overcome before anything can be made on the ground.

Once upon a time it happened that the Middle Tisza Water Management Directorate intended to dredge a drainage canal within its respective authority. The canal, being an exclusively state owned structure, is operated by the Directorate. The simple dredging was baptised to canal bottom development and reconstruction works and involved the excavation of mud from the canal, which has to be dumped on both sides of the canal.

First of all, a preliminary assessment had to be made, commissioned by the Directorate to an independent consultant firm, which described the proposed project and it was submitted to the relevant licensing authority. In the administrative licensing procedure, Middle Tisza Regional Environmental, Nature Conservation and Water Management Inspectorate acted as the authority of the first instant. Mind you: this is the same ministry, the same region, the two regional bodies – one in charge of water management operations the other in charge of licensing them – are seated in the very same building. The resulting decision runs on 9 densely packed pages. In addition to the detailed description of all operations of how, when and where they have to be conducted, the decision referred to the following laws and regulations:

- Government Decree No. 314/2005 (XII.25.) on the environmental impact assessment and unified environmental use procedure
- Maximum permitted noise levels pursuant to Annex No 2 of Joint Decree No 27/2008 (XII.3.) KvVM-EüM on noise emissions;

- Publication of the proposed investment project pursuant to Article 29 paragraph (6) of Act No CXL of 2004 laying down the general rules of public administration procedure and services;
- Act No LIII of 1995 on the protection of the environment;
- Act No LXIV of 2001 on the protection of cultural heritage;
- Decree No 4/2003 (II.20.) NKÖM on the cultural heritage protection impact assessment;
- Decree No 18/1984 (XII.13.) EVM on the technical records maintained on routed line installations in outer areas;
- Decree No 18/2001 (X.18.) NKÖM laying down the detailed rules for the excavation of archaeological sites and financial remuneration of discoverers of archaeological sites or findings;
- Decree No 33/2005 (XII.27.) KvVM on the administration fee for official environmental, nature conservation and water management procedures.

The decision conditioned the permit to the preparation of a cultural heritage protection assessment study and solicited the endorsement of the following partner authorities: Northern Great Plain Regional Institute of the National Public Health and Medical Officer Service (NPHMOS), the town clerk of three cities in the neighbourhood, the Plant Protection and Soil Protection Directorate of the County Agricultural Technical Services Agency, Cultural Heritage Protection Office. It was also established that the project due to its size and nature does not require the completion of an environmental impact assessment. Imagine what would have happened if it did.

And this was only one relatively small project with good intentions to restore some of the natural conditions in a formerly living water course now used to drain excess water in the spirit discussed earlier on. You can imagine the administrative procedure when you intend to implement a larger scale water and land management project affecting not only an already existing water course.

2.2.3. Disruption of traditional communities

> You can transfer knowledge. But not wisdom. Wisdom you can find, you can follow, align with the flow, make miracles, but you can not speak out and teach it.
> *Herman Hesse: Siddhartha*

Most of what is written in this section characterises communities not only in the Tisza valley but in the whole world. Naturally, the process has its own special features in each region and country, but the main message does not change: traditional local communities perished and are dissolved in the globalisation process driven by constant economic growth, insatiable hunger for profit and all encompassing deluge of technology and gadgets.

It is safe to say that traditional communities were functional and vertical communities. What does that mean?

Functionality of a community is understood as an organised structure with the main objective to meet the challenges of the natural and social environment within a clearly marked local region where most ecosystem services are taken advantage of the inhabitants of that region. As a consequence, feedback loops are instant and direct. Subsistence farming and small scale handicraftsmanship are exposed directly to the consequences of their activities. Reward or punishment is clear and easily seen by every member of the community. As market economy encroaches the local relations and people try to make money instead of earning a living, these close ties become less apparent and much more indirect, influenced by remote social factors such as market prices, economic crisis, production boom and overproduction or scarcity of raw materials, distant warfare and social changes. Without knowledge specialised in world affairs local people are disempowered, helplessly exposed to those changes beyond their control and hence, despaired and depressed.

Yet, traditional communities were indeed very specialised human structures, but in a different meaning. Instead of being knowledgeable in stock exchange trends and production methods based on scientific technology, they know everything – or very much – about their local environment, local social structures and the natural processed they were exposed to. In other words, instead of being trained in horizontally applicable techniques and measures – that is, technology and economics which can be applied from the North Pole to the Equator – they carried wisdom well suited to their bioregion vertically. That is, they were aware of the dynamic interactions between their community and the natural environment, be it the floodplain of the Tisza or the Kalahari desert. Such a knowledge, albeit not interchangeable and compatible with that of other bioregions, is very much adaptable to the changes occurring within the region it was formed. This is how traditional communities along the Tisza have adapted to the floods of the river for centuries until the age of market oriented production arrived.

According to the representatives of the human sciences, disruption of traditional local communities starts when a powerful minority of a local human society launches a fatal and interdependent series of events by excluding the majority and altering the ecological conditions of the region. Such changes entail social and natural crises, and results in the impoverishment of the biodiversity in the region and of that majority of local society which was excluded from them. This is what happened along the Tisza when major water works began and in 1767 the rules related to statute labour were consolidated by the Habsburg empire in favour of the landlords. The second stage of detachment of people from their land and landscape took place in and after 1945 when land was distributed to the poor but collectivised promptly afterward. This way, the new and inexperienced owners were also made disinterested in the fate of their land (Andrásfalvy 2009).

People living in the land were absolutely aware of the detrimental consequences of the new rules and the technical changes imposed on them. In fact, resurrection and revolt was quite common initially, once more peaceful ways of resistance, such as petitioning achieved no impact. The same procedure, which is known in England as the ‘enclosure of the commons’ was also seen in the Habsburg empire (Barta 1996).

The new order started a migration process from the country toward the cities, while those remaining lost more and more connections with their environment and became helplessly exposed to factors beyond their control such as job availability and the price of labour. Their knowledge now seemed lost its precious value and nobody cared for it any more. Machines took over the care for the land, agronomists calculated the time of sowing without even looking at the sky. Production went on regardless of the local conditions. In times of Socialist cooperatives and state farms, money was poured into the new type of farming without being counted. Distorted market relations – the Socialist economy – prevented people from the need to take care of themselves.

After the political transition a very luxurious agricultural subsidy scheme took over the role of the Socialist planning economy. The new elite was still the old one, salvaging itself from the ruins of the Communist regime and becoming suddenly a newly formed landlord community. Subsidies and aids went to the new landlords and the majority of the rural population got nothing again. Social welfare schemes had to be set up to prevent deep poverty and to save untrained local population from starvation. Social benefits however make you comfortable and content with low standards. The lack of instant negative feedback makes people lazy. By the end of the millennium, large number of people in rural communities became convinced that their main source of income was social benefits which was a donation the government owed to them. A counterproductive population dynamic spiral was launched, where large segments of the rural population received more income when they had more children then if they worked and assumed less children. Chronic unemployment has become a mode of living which is now very difficult to change.

As a result, the area around the river is exposed to high unemployment rate, an aging population with increasingly more intensive tension from Roma minorities, socially deprived families with extremely low income levels, and intensive and in many areas inappropriate agricultural practices. The activities proposed under the ILD project take advantage and exploit fully the self-organising capacities of the local community in Nagykörű, which is not a very common practice in rural settlements in Hungary. If the local stakeholders can be convinced that the proposed programme was appropriate for them, improving their livelihood and opening new vistas for economic activities, agricultural practices and local businesses such as hospitality industry and food processing, they may be more receptive in respect of the ILD concept.

Village councils along the Tisza River struggle with the complex problems of poverty, lack of economic and business opportunities, unemployment and poor infrastructure aggravated by the recurring floods, intermittent drought and waterlogging problems. Some of the local municipalities seek to overcome these handicaps through innovative new models of development where local natural and human resources are accounted for and taken advantage of. For the most part this means the promotion of so-called 'village tourism', a fashionable holiday-making approach based on attractions like peasant houses, horse-riding and various recreational facilities. Other village development approaches driving job creation include providing in-kind contributions to alternative agricultural projects such as agro-environmental measures, organic and traditional extensive farming, local food processing or various handicrafts. The development goals and objectives of the Tisza biodiversity goals matched these efforts perfectly. An excellent example is again the village of Nagykörű, where the local council made constant efforts to revitalise the village long before the project started.

A deeply rooted sense of danger and evil associated with the term and notion of flood is typical for people living along the riverside now. Their perception is a long shot from those who operated the flourishing ‘fok’ system centuries ago. Traditional local knowledge and age old experience is slowly but inevitably vanishing, the neatly sounding buzzword of lifelong learning does not take place in real life and even the higher education institutions are falling apart in the wake of the forced introduction of a non-native education system under the Bologna process.

Overcoming stakeholder resistance is a key to success. But also the most difficult task of all. Farmers tend to be very rigid and inflexible in their approach to farming. They are accustomed to business as usual scenarios and are heavily dependent on subsidy schemes. One of the lessons from the farmers' forum organised at Nagykörű on 30 April 2010 for owners of the four selected pilot demonstration sites was that they are not interested at all in any changes proposed or to be made to the current arrangements of their land use patterns. Attendance of the meeting was very low and the overall impression by the people present was that the proposed changes do not constitute any actual goal from their own perspective. They did not comprehend the benefits arising for them from a potentially more diverse and balanced water regime at the cost of scarifying some of their plough land. The conversion of the land cultivation classification of the parcel subdivisions was a totally strange concept to them. Most of them don't even know where physically their piece of land is situated within a larger parcel of undivided common. Forest plantation as an operation deviating from their current practices was also met with suspicion. They were afraid of the agrotechnology to be applied as well. Much of the confusion is about the differences between owners and land users. Tenants ought to be in charge of deciding about land use issues, not owners, some said. On the other hand, it may be possible that the owner agrees but the tenant not, and there will be a friction between the two. How owners can be motivated to change their attitudes?

A special issue is the attitude of absentee owners. People who have benefitted from the restitution process of land property rights – customarily known in Hungary as 'compensation' – are usually not outright farmers living on the land. Many of them are city dwellers and they lease out their land to tenants. At the same time, they consider such reconstituted property rights as their natural entitlement which they do not want to part with.

Clearly, a different mindset is needed for many of the stakeholders if an ILP scheme is ever to succeed.

2.2.4. Financing problems

Financing development is a tricky issue. In the past decades, public money was spent in a procedure called public procurement procedure and the process of tendering became an all-pervasive phenomenon across all levels of public administration. Collection and redistribution of taxpayers' money is thus channelled into an inherently faulty mechanism, which is a misconception for two distinct, basic reasons:

- if you want to redistribute money by tendering, the particular requirements to be met by applicants and the technical and other specifications as well as the topics to which you want applicants to submit tenders for limit the scope of activities supported or promoted necessarily by definition;
- government funding procedures tends to be over bureaucratised or influenced by political interests or both, thus blurring the original intention. Sometimes, even the original intention is diverted by political lobbies.

It is interesting to see how originally progressive and well meaning thoughts like the promotion of renewable energy sources are picked up by powerful and influential lobby groups which then shape legislation and influence policy makers to their own benefits. In the process, the original objective is totally lost or turned upside down. The aggressive promotion of biofuels by the European Commission will easily disrupt the agricultural potential of the Union and distort the ecological balance of agro-ecosystems. At the same time, there is very little chance for small, independent entities to successfully obtain funding from large budgets with complicated, sophisticated application procedures. Writing proposals is a thriving business and a lot of people earn a living by it. All their income is reduced from the same amount of budget dedicated for redistribution. Administration of the system also gobbles up a lot of resources in terms of man power, time and financials. The more attracting the available funding is, civil servants feel the more control mechanisms need to be put in place in order to check compliance with the ever more stringent conditions. The more controls are in place, the more resources are taken up by the administration itself.

In the field of ILD, this means the prevalence of the interest representation capabilities of the water management and construction industry lobby in face of small independent actors, and the success of large agribusinesses as opposed to small holders. The first signs of such distortion can be seen in some of the reservoirs under the VTT, which are preferred targets of large biomass oriented businesses and were designed and built to provide work to large construction companies.

Funding is also divided up across political formations and not in accordance with the needs of natural conditions or physical geography. For instance, the European Union does not fund non EU Member States. Along the Tisza river, there are three riparian countries which are Member States of the European Union and there are two others which are not. Therefore, it is very difficult to get funding for a comprehensive project which would deal with the river as a natural entity and not as a development goal of some political units such as nation states.

Yet another funding source is destined to drop dry soon. Global Environmental Facility (GEF), the UN money bag for environment related matters decided recently that the countries of Central and Eastern Europe shall not be subject to GEF funding any more and from now on, they would focus on developing countries only[46]. In New York, the European Union as a whole is deemed to belong to the developed world – at least concerning the funding possibilities. Again, the rigidity of bureaucratic systems can be seen here. Anybody with a reasonable judgement would tell that some of the Central and Eastern European countries are a far cry from Belgium or Luxemburg in terms of GDP or overall standard of living, state budget and social infrastructure.

Another problem with project oriented development funding is that it is usually available for investments only and not for maintenance or operation. In the case of facilities established, developed or updated under the Operative Programmes with the use of funding obtained from European Union aids and national subsidies for instance, the expenditure necessary for maintenance will increase without having any resources actually available for the purpose. Ongoing services can not be financed from such sources, either. Statistical assessments demonstrate that the gap between amounts actually spent on maintenance and operation and the amounts which would be needed for the same purpose is growing. Since the Water

[46] Klara Tothova, UNDP Bratislava, personal communication 28 April 2010

Framework Directive is built on the principle of full return, beneficiaries are obliged to cover all costs of maintenance of the development projects implemented from 2010 on.

At the same time, these development projects are not the type which are profitable in themselves (just think of flood control works), and therefore the cash flow of the facilities will always be short in cash available for operating expenses. This will lead to an impossible situation, the resource gap will further increase and costs incurred by renovations, refurbishments or maintenance and operation will grow dramatically. With regard to water management projects there is no real possibility to cover such continuous costs from other sources (Glatz 2009). In fact, the Cigánd reservoir, operational in principle since 2008, was allocated no overhead costs in the budget appropriations of the respective section engineering unit of the regional water directorate and control, grass cutting, safe guarding and technical maintenance of the structures and the embankments must be accomplished by re-arrangement of existing man power and resources[47].

On the other hand, there are regulations in place which associate the use of water with the intention to preserve a precious natural resource. These regulations were adopted with the conventional approach in mind, that is when it was understood that the use of water include the loss or impairment of it. It has to be investigated, whether financial obligations related to water use such as water resource use contribution or water supply service fee have any implications for the proposed water uses related to integrated land management and development.

An important aspect of financing ILD is the profitability of the alternative land use methods proposed by such a change. Since the entire agricultural business sector on the large scale is geared up to ready-made intensive cash crops such as grain or other cereals, and since the complex programme would also entail a radical re-arrangement of land ownership structure and land user stakeholders, it is of paramount importance to shift financing of local rural activities from subsidy-based export oriented economy to local processing and marketing opportunities. Unfortunately, the legislation governing the processing, market entry and administrative opportunities of small primary producers – a type of business strongly promoted by the ILD concept – up to recently was far from satisfactory, rather inhibiting producers from earning a decent living by selling their goods themselves or distributing them locally than encouraging such self sufficient and self reliant business models[48].

The situation was to be further impaired by the introduction of the Hungarian version of the new single payment scheme where the historical benchmark of payments was drawn up arbitrarily in the year 2006 and focused mainly on the tenants, not the owners, thus depriving 80% of the owners (small holders) from the benefit and favouring large capitalist agribusiness companies (which farm 80% of all land)[49]. The President of the Republic turned to the Constitutional Court asking for a control with regard to this paragraph and the Court rules on 12th July, 2010 that the law was against the Constitution. The new government also disapproved the SPS rules. Therefore, at the time of writing (September 2010) nobody knows in Hungary, how agriculture will be subsidised in the coming years[50].

---

[47] Personal interview with local officials in August 2009

[48] Joint Decree No 14/2006. (II. 16.) FVM-EüM-ICSSZEM on the condition of food production, processing and marketing by small producers

[49] József Ángyán: The agricultural subsidies law is against the Constitution. Magyar Nemzet Online, 29 October 2008

[50] Retrieved on 31st August 2010: http://www.jogiforum.hu/hirek/23434#axzz0yCQG6JLH

2.2.5. External drivers

2.2.5.1. Climate change, extreme weather conditions

You can not afford to disregard the fact that the local conditions of the Hungarian Tisza valley are exposed to very serious external impacts which can not be influenced or avoided locally: they have to be handled and adapted to. From the perspective of flood control, the most worrying, best visible and therefore seemingly most frightful event is the appearance of sudden, high intensity torrent rainfall mainly in the Carpathian section of the Tisza, in Ukraine. This was not so typical feature earlier on and can not be attributed to the deforestation alone, but also to changing weather patterns and altered temporal and spatial distribution of precipitation. The local hydrological cycle which had provided reassuringly even distribution of rainfall earlier on is now disrupted irreversibly. The figure below shows clearly that on certain parts of the Carpathian basin, for instance in the Kárpátalja, an amount of rain equalling half a year of precipitation was poured upon the denuded forests which were obviously unable to cope with such a load. The rain arrived at the beginning of November, where the river bed was already full and the catchment area saturated, with no sponge effect left to retain runoff water (Bodnár 2009).

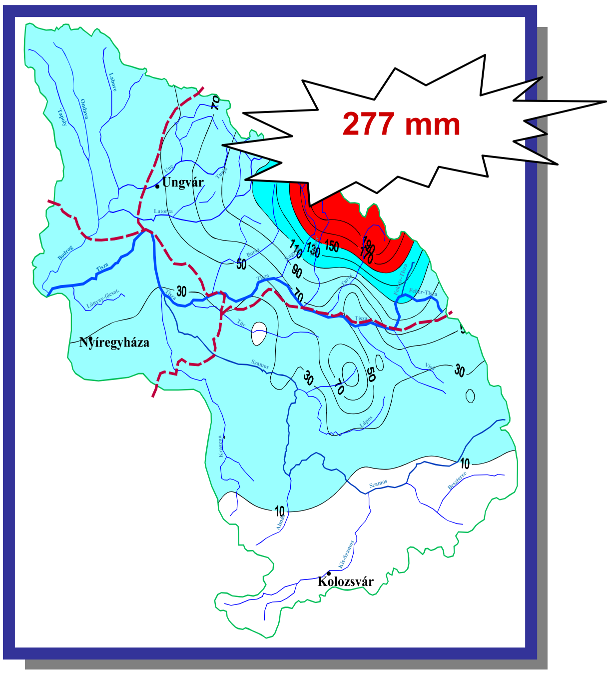


Figure 18: The 1998 November flood

Within three days, 277 mm of rain has fallen onto the barren land in a limited area. Source: Gáspár Bodnár, 2009.

The phenomena observed in the Carpathians is not a single event, much more is a local manifestation of the global climate change. It is less known that in addition to the global climate change anthropogenic airborne pollution may also be a cause of extreme weather events, because the tremendous amount of metal dust and mineral particles reduce the specific heat of the air masses and air will be cooled or warmed much more quickly than before, thus paving the way for the formation of extreme weather conditions. Watershed balance of the individual river basins has been shifted as well. For instance, while the Danube river basin used to be more humid in the past, the Tisza catchment receives more rain these days (Borhidi, 2009). All these factors, taken together with the elevation of the high water bed and erosion of the low water stage river bed results in a dramatic hundredfold differential between the low water flows and high water flows in the Upper Tisza region:

Tisza, Tivadar	
Q_{min}	35 m^3/s
Q_{av}	239 m^3/s
Q_{max}	4040 m^3/s

Such a significant increase may in addition appear within a very short period of time. At the cross section of Tivadar, where an unfortunate bottleneck is formed because unauthorised constructions and a break in the course of the river prevent the floodway from carrying and draining the floods, the record change of the Tisza water level was an increase of 8 to 10 metres within 24-36 hours (Göncz – Barabás 2009).

Meteorologists predict serious changes in many more aspects of the weather as a local consequence of the global change in climatic patterns. Forecasts for Hungary assert that annual mean temperature will grow, while the annual quantity of rainfall is uncertain and unpredictable. It can be assumed that the temporal patterns of rainfall distribution within the year will change. Aridity is to grow up to 2.80 – 3.10 by the middle of the century, in particular in the Central Tisza region of the Great Hungarian Plain, and while winter precipitation is expected to increase, the summer season will be drier.

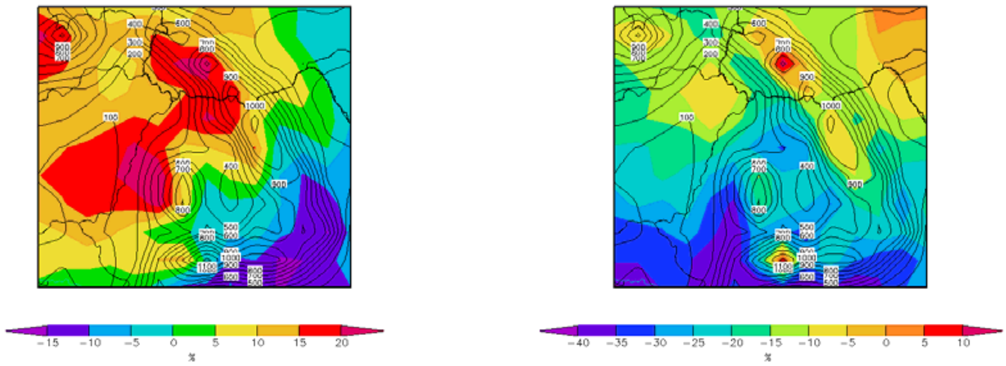


Figure 19: Expected relative change in precipitation in the Tisza river basin from the 1961/1990 period to the 2061-2090 period. Source: Max Planck Institute for Meteorology, Germany

During the Spring and Summer of 2010 extremely long winter months were followed by very high rainfall, going seemingly entirely against the forecasts of the meteorologists. However, just as the rivers, sometimes the weather patterns also divert from the river bed of the climate. This however does not mean that the overall trends – and hence, the forecasts – were utterly wrong. Climate is the consolidated product of weather patterns manifested over several decades. Although also inherently non linear and therefore subject to unpredictability, climate can still be modelled and to some extent forecasted. Such events only reinforce the scientific statement that the weather patterns are fully chaotic and prone to unpredictable factors.

Such an unpredictable factor this year was the eruption of a relatively small Icelandic volcano called Eyjafjallajökull (the name not quite easily remembered unless you are a Viking) on 15th April. Though not the size of the Pinatubo eruption on the Philippines in 1991, the volcano was still strong enough to eject volcanic dust and gases into the atmosphere, influencing the seasonal weather of the region, mainly that of Europe. Solar input was reduced by the volcanic dust cloud in the Euro Atlantic belt, therefore the air did not warm up to the usual degree. In opposition to this, air masses over the Sahara and the tropics warmed up too much and a strong contrast arose between the warm and cold air masses. This is the source of the large Mediterranean cyclones. And the cyclones were formed, indeed two of them. One called Sophie, the other Angela. Mediterranean cyclones are natural phenomena in the temperate and continental climate of Europe, bringing moisture laden air and southern wind to the Carpathian basin in the Summer. But this time volcanic dust increased their strength, intensity and duration. Even though meteorologists can not agree on what really caused the formation the deep cyclones over Europe (whether it was indeed volcanic ash and sulphur in the stratosphere or just another oscillation of the non linear climate pattern in the changing climate), the case is still that unusual and extreme events happened in the Carpathian basin. According to another theory derived from model simulations the sudden changes are due to a transition zone stretching along this part of Europe: to the north, precipitation is expected to be higher, below that, transition zone, in the south it is expected to be lower in the coming decades (László Bozó, President, National Meteorological Service, personal communication, 7 September 2010).

Figure 20: The eruption of Eyjafjallajökull

Both cyclones marched across the Tisza basin – and other parts of Central and Eastern Europe – with devastating effects. Rain fallen onto the catchments of the river Bodrog and Hernád, two tributaries of the Tisza exceeded 100 mm within 72 hours. Since due to the otherwise predicted climatic pattern change the winter was more rainy than before and than usual, all water storages and reservoirs, groundwater tables and surface water courses were saturated with moisture and the water could not be absorbed, it ran off on the surface and into the rivers, washing away the soil from the not yet crop covered fields. Within two weeks the second lady, Angela arrived and poured an additional 50 mm rain onto the same Northern catchment areas. After two more weeks, a huge tempest destroyed man and assets on the southern part of the Great Plain. Hailstorm crashed 8 000 hectares of a single agricultural holding and wind speed reached 120 km/hour (Laky 2010).

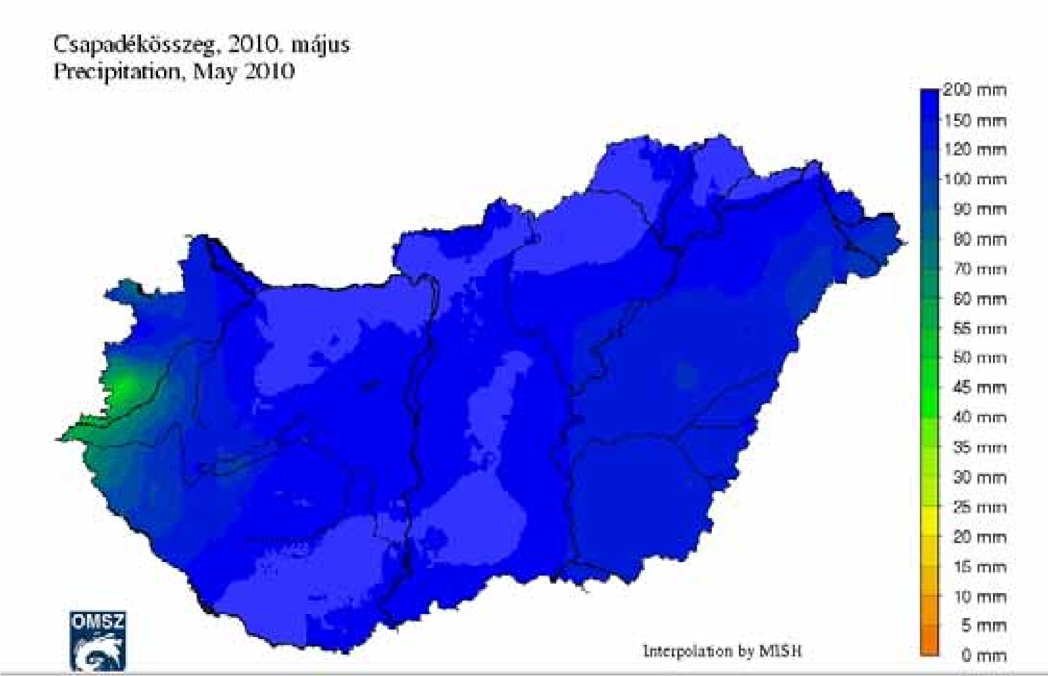


Figure 21: Consolidated precipitation in May 2010 in Hungary

You can say that extreme events were atypical, the lesson is still that modern societies are not a bit less exposed to them than their forerunners, but a lot less adaptable. Most of us are unprepared and vulnerable to such conditions and therefore the rigid technical systems designed to protect fields, crops and assets do not perform very well in emergency situations. You can argue that an integrated land management concept would endure much more stress and shock because of the adaptability of the concept.

2.2.5.2. Peak oil; the global financial system

An additional condition to be taken into account and to reckon with is the mutual dependence of world market players on fossil energy and the global financial system. Profit oriented businesses are subject to constant growth and constant growth requires ever increasing amount of energy (irrespective of the eventual improvements in the efficiency rate of its use). However, energy is in short supply and according to certain observers the age of cheap oil is over and the world already consumed more than half of all the reserves. We have passed the peak of oil extraction (Roberts 2004, Legget 2005). It remains to be seen what happens when such resources will be prohibitively expensive and how a new type of energy – most probably nuclear – will take over, but due to system theoretical reasons not to be discussed here there is not imminent solution to the lurking energy crisis. Definitely a new world order is to be formed soon. ILD is easily adapted to an energy scarce scenario as well. Especially, that whenever transportation of large volumes and weights of bulk materials will be too costly (no nuclear trucks and lorries have been discovered yet), the food industry has to reset to the default setting: local production to local demand.

3. Husbandry on the floodplain in the past

3.1. Anthropogenic changes in the Carpathian basin before industrialisation

Sometimes it is questioned by scientists why such a great significance has to be attached to the cause of biodiversity. Ecologists provide the answer: biosphere – and in particular the terrestrial ecosystems with higher plant and animal communities – of the planet Earth has been operated quite conveniently before the emergence of man for millions of years, in spite of radical changes in the boundary conditions and huge natural disasters such as planetismal cataclysms and ice ages. A planetary cybernetic control system was established which ensured the survival of life even in the most adverse conditions. This control system is built on biological diversity, the resilience of the network consisting of a great variety of living forms which all contribute to the welfare of the whole, local and global ecological systems in a symbiotic relationship (Vida 2000). Biodiversity has an essential role in ecosystems.

Deterioration, transformation of the natural environment by the manipulations of man is a key problem of the 21st century on economic, political, scientific, but mostly and predominantly moral grounds. In the course of human development biodiversity is almost always lost. The Carpathian basin has a high level of biodiversity but this diversity is very vulnerable to external impacts. Research has shown that societies in the past made an attempt to ensure their livelihood with as little destruction as possible. Ethnographers and cultural anthropologists have repeatedly demonstrated that in most traditional communities the intention to preserve the wealth of the natural environment was quite conscious (Andrásfalvy 2009). Farmers would have known that diversity of their crops meant greater productivity from the same acreage (Gyulai 2003: 17). Ecologists repeatedly stated that halving the diversity of a plant community results in 10-20 % less biomass production, while the productivity of parcels planted with a single crop is 50% less than that of the same parcel planted with 24-32 different species (Bajomi 2004). In agroecosystems this diversity means not only higher volumes of yields but more nutritional value as well.

Agriculture was not specialised in traditional societies to the extent it is understood today. For instance, apple trees were mingled in the forests and had a great variety. Along a short section of the Danube river 65 different apple varieties were recorded. They did not only differ in terms of form, taste, flavour, resistance to pests and diseases, preference of soil and climatic conditions, but their harvesting time was different as well, thus providing a great level of security to harvesting: should have any of the varieties failed to bear fruits, there were still a number of others to take over its place. Also, people could enjoy eating tasty apples throughout a long season without necessarily having to put them in cold stores or grow them in far off warmer climates just to boost global trade (Andrásfalvy 2009).

In line with the floodplain husbandry discussed below, forestry management also had its non-industrial, not market oriented, environmentally sound alternative throughout history. According to recent research forest cover of the Carpathian basin could not be more than 25% throughout Hungarian history including the Mediaeval age. These forests have been carefully managed by our ancestors. In Eastern Europe forests were started to be cut for timber and industrial purposes only from the 18th century on. Up to that time, forests were a multiple purpose and multiple use 'living ground' for the local population. It was the ethnographic research which revealed that a special type of forest, ‘pasture wood’ was a conscious anthropogenic creation where the loose, stand alone trees for which such a landscape is so famous were intentionally grown by pastoralists. Each spring for a number of years when the pasture was cleared, the place where they intended to grow a tree or a couple of trees were not cut and thorny shrubs protected the seeds of trees from livestock. Such a patchy vegetation provided a heaven for various plant and animal species, ensuring ongoing biodiversity of the agroforestry system. Thus, pasture woods are the result of conscious human cooperation – collaboration – with nature. On the other hand, firewood was grown in another type of forest, where coppicing or truncating of the tree stumps basically ensured eternity for the stump whilst providing easily harvested cheap and abundant, sustainable supply of firewood (Szabó 2009). A key foraging base of livestock husbandry in the Bodrogköz, a riparian region of the Hungarian upper Tisza valley was the acorn oak forest where pigs were masted in great numbers in the 18th century (Szilasi et al. 2008). You can argue that should there be such a diverse forestry management retained in the upper catchment and along the Tisza valley, the temporal patterns of the floods would be quite different due to the sponge effect.

Although there are authors who accredit significant geomorphologic shaping and river valley formation works to earlier peoples with reference to archaeological and historical sources, such as the system of ‘győrs’ from the age of the Avars (Molnár 1991, Hamar 2000), or, more recently, the Medieval ditch system in the Kisalföld (Little Hungarian Plain) (Takács-Füleky 2003), it is quite probable that these works have never resulted in consequences which would have triggered the never ending spiral of Type one errors. To be correct, the official historiography of the water management sector denies even the conscious and planned nature of floodplain or 'fok' economy, let alone the water management related purpose of any other earlier archaeological discoveries (Deák 2001). Truth, as in most of the cases, may be somewhere between the two and it holds true that during the Mediaeval and before no thorough going changes into the dynamic systems of the rivers and no tragic devastation incidents caused by them were typical.

There are good reasons to believe that loss of biodiversity – and other components of the local natural environment have mutually reinforcing connections with population growth, poverty and social disempowerment. This observation gave rise to the theory of biophylia which claims that systematic relations with nature and other species are of paramount importance for sound mental health and human welfare, consequently the appraisal of the inherent value of nature is an essential part of all human cultures. Biological diversity, in conjunction with the need for food, water, shelter, sexuality and social relations might easily be an integral part of the basic needs required for properly enjoying life. Market prices are inherently inapt to reflect such needs (Gowdy 2004: 59).

Tipping of this balanced structure and deterioration of biodiversity usually happens when a part of the local community, grasping political, military and economic power extends the area cultivated for purposes of production activity way beyond the subsistence level and when the legal and technical background for such market oriented production is created. This happened in the 18th century in the Tisza valley, when the Great Plain was taken back from the Ottoman and the Emperor's court in Vienna sent settlers in the depopulated areas to boost cash crop and commodity production. Large volumes of marketable grain was produced and this had to be transported on inland waters, including the Tisza. This is the beginning of the river regulations.

3.2. Flood plain economy: 'fok management' in the Carpathian basin

The landscape management practice able to accommodate diverse demands on the use of water and land is not a new concept. A very successful husbandry method and farming system was operated on the Great Plain in Hungary before the Ottoman conquer which took into account the natural dynamics of the river and is called therefore by ethnographers and historians the *floodplain economy or floodplain husbandry*.

Floodplain economy by definition is the environmentally sound multifunctional land use system and agricultural practices on riparian zones along major rivers in the lowland.

Environmentally sound in this context means a type of agricultural cultivation method and human land use pattern which takes the functional characteristics of the floodplain into account (hydrological patterns in river flow, morphology and climatic conditions) without taking more from the system which can be replenished by natural processes.

Floodplain economy or husbandry is one of the best known and researched such method practiced during the Mediaeval Age throughout Europe. In Hungary, both along the Danube (Andrásfaly 1973) and the Tisza rivers (Molnár 2002, Fodor 2002), including their respective tributaries such as the Bodrog (Borsos, Balázs 2000), flood-plain economy was the main form of land use. The approach applied was to take advantage of the several metres high and sometimes many hundred metres or even – in the case of major rivers – one or two kilometres wide flat natural levees, the scroll bars built by the rivers on the floodplain through their recurrent accumulation of sediment. Water was led onto the deeper lying floodplain areas in small creeklets or streamlets with the help of incisions ('fok' in Hungarian), cut into these natural formations. There were also naturally occurring incisions where side branches feeding permanent water surfaces in the river valley started. However, most of the smaller foks were human made and acted as outlets to deep bed canals branching off from the middle stage water bed of the primary river, where the direction of water flows was dependent on the water level in the main river bed. At high stage water levels the incisions discharged water from the river onto the floodplain thus reducing the floods, while upon ebbing the same structures drained flood water back into the river. The various sizes shallow floodplain ponds and major ox-bow lakes played an important role in the local economy during the late Medieval in addition to serving as natural water reservoirs. The ecological potential of the floodplains with the help of the foks was utilised with a wide variety of means ranging from fishing, fruit orchards and livestock management to reed harvesting and logging, and, occasionally on the higher elevations, tillage. Cash crops did not have a predominant position in the mix of agricultural produces. The canals and streamlets even provided convenient transport routes for timber, reed and hay, while water flows in them were used for milling (Rácz 2008).

The spatial structure established in the early Mediaeval – i.e. livestock husbandry on flood prone lower and crop farming on flood free higher elevations – was stabilised for centuries and eventual changes in farming practices never affected the natural profile of these two types of terrain. The system was effectively abolished during and after the Ottoman domination covering the majority of the river plains when during warfare the flow of water courses was diverted for defence purposes which led to extremely chaotic hydrological conditions. Also, the native population could not manage the foks any more and the incisions and the canals fell in disrepair, were blocked and drained or became waterlogged (Alföldi 2005).

In fact, as it turned out from more recent research, there was a forerunner to the fok system in the Carpathian basin in the form of a centralised canalisation system in the Arpadian era (Takács 2000, 2003). Historical findings in archives as well as field excavations support the notion that in the 11th and 12th centuries Hungarian kings employed a great amount of man power to construct a network of canals throughout the river plains. This was a sophisticated and highly adaptive water management scheme where – with the help of three parallel canals, higher embankments and occasional sluices in between them – the surrounding terrain could be easily and wisely managed as the needs dictated. Water could be evenly distributed on the meadows and pastures from the higher lying central canal in case of floods so that settlements and crop fields would not be inundated and drained back into the side canals when the flood subsided, but the same canals could also be used for areal irrigation on the grazing land or to fill up the fish ponds. The densely planted shrubby vegetation on the banks of the central canal was also hedging livestock away and acting as an effective boundary to separate fields of various use from each other.

4. Natural geography of the river valley

4.1. Natural conditions of the landscape

Cutting off of the floodplain from the living waters conserved the state of affairs typical for the Great Hungarian Plain at the time of the river regulations. That is, instead of a constant, dynamic reorganisation of the various levels – high banks, deep, low, and shallow floodplain areas – they are now as they were at the time. Most people living along the river would not now why are there marked terrain stairs every know and then scattered in the landscape in a seemingly arbitrary manner.

These several metres high differences in relative elevations – with a little help from modern technology such as digital relief models – could easily peg out the flood flee and flooded areas in the plain. In addition, the entire plain being an alluvial aggradation plain, these terrain levels are not situated just in a narrow band of classical main valleys and side valleys but cover a great area in a complicated and sophisticated natural network of branching off side branches and flood plain areas. If you calculate all the available area, the following table can be set up:

	Name of the flood plain area	size of the area to be flooded in km^2	storage capacity in million m^3
1.	Bereg	100	100
2.	Szatmár plain and Ecsed marsh	100	100
3.	Rétköz	60	100
4.	Bodrogköz	200	200
5.	Inérhát, Taktaköz	100	150
6.	South Borsod	100	100
7.	Polgár – Tiszafüred, Hortobágy	800	600
8.	Cserőköz – Üllő lapos	80	100
9.	Mirhó	100	150
10.	Nagy Sárrét	450	400

11.	Saj-fok	200	300
12.	Nagykrű-Fegyvernek-Törökszentmiklós	50	50
13.	Tiszazug	100	100
14.	Dóc	60	150
Total		2500	2600

These figures are rough estimates but concur confidently with the state-of-the-art model experiments discussed in Chapter 6.1.1 Modelling. Should they be exploited to the full extent, they would represent a 50% redundancy compared to the current needs of flood detention. In addition, their use could be implemented with much less resources and external input than the total storage capacity (1.5 bln m^3) of the artificially built reservoirs currently envisaged under the VTT.

Water flow volumes of the Tisza water in the Hungarian reach of the river typically stay within the 300 million m^3/day limit during most of the flood events. A flow rate of approximately 1500 m^3/sec can be accommodated in the middle stage river bed of the 3500 m^3/sec peak flood discharge. The upper one third of the flood wave – a maximum amount of 1200 m^3 daily discharge – can be spread over the floodplain with the 'fok' system with a design discharge capacity of 1200 m^3/sec. You should note however, that due to the nature of the 'fok' operation the polders are filled up gradually, using the very beginning of the flood wave and hence, avoiding any damages caused by the drastically high discharge rate of the structures built on the upstream section of the flood retention reservoirs.

Unfortunately, geographic conditions are not aligned with political and national boundaries. The current national territory of Hungary does not allow for taking independent measures in the upper catchment of the Tisza. The enhanced risk of floods on the Hungarian Upper Tisza region emerges from the fact that collection time in the upper catchment (Ukraine, Romania) is very quick and the mountain watershed is very close, causing a funnel effect on the Hungarian plain. Fok based management systems are not really viable in the mountain areas where the first priority would be the reduction of collection time after rainfall. This requires water management measures (flow reduction structures, meandering river bed restoration, broadening the floodway) just as much as other measures (changing land use patterns to slow down runoff speed, afforestation to increase the sponge effect and clever design of paved areas).

As these options are not currently feasible and realistic, and as conventional flood control measures such as rising the dykes and clearing the floodway depleted their potential opportunities, efforts need to be made to accommodate the floods in polders as soon as possible. The first opportunity to use a major polder is Bodrogköz, but flood waves can only be spread finally and safely downstream of Tokaj with the use of the relatively large polder of the Hortobágy-Berettyó system. The 11 other polders available from the Szamos mouth to the Körösök is also able to provide a solution to flood risks along the Middle Tisza region, while on the lower section of the Hungarian Low Tisza the Dóc polder would be able to tackle the discharges of the tributaries and the impounding effect of the Danube if no more high floods arrived in the main river bed (Balogh 2002).

The Bodrogköz – the first polder within Hungarian territory suitable for flooding – is a low lying area of the Tisza valley between the confluence of the river Bodrog and the Tisza proper, a natural candidate for a larger scale integrated land management and development project. It is not by accident that the official water management professionals designed the first VTT reservoir here.

However, in order to use it as intended, the natural conditions provided by the region must be taken into account. For instance, the geological structure, soils, natural vegetation and topography mark out the road on which proper land use patterns can be established. In the Bodrogköz region of the Tisza valley soil forming rocks include heavy clay and sand, both of them of alluvial origin. Typical formations are sand hills, which have always represented a flood free terrain. Floods reached remote areas in the region and deposited fine sediments which later on was compacted to form clay lenses within and between the sand hills. High groundwater levels caused the propagation of iron and manganese reducing micro-organisms. During dry seasons re-oxidation of these elements resulted in gleyisation of the soils on the lower parts, but the top of the hills remained dry and hence, suitable for human habitation (Dobos and Kobza 2008).

From the natural ecosystem perspective, Bodrogköz is a potential forest area covered by willow and poplar bottomland forest and riparian forests, elder and ash marshland forests on lower parts (softwood) and hornbeam mixed closed English oak forests on the sand hills (hardwood) (Gyarmati et al. 2008). The alternating spots of softwood and hardwood operated the mechanism of the flood plain sponge effect. During the floods (high water stages) the soil and litter soaked up water on the lower reaches. When there was a green flood, the vegetation also contributed to the effect by active evapotranspiration, thus saturating the lower air masses with moisture (softwood effect). When the water level ebbed, groundwater tables were left at a higher level and the deep reaching roots of oak trees on flood free banks (sand hills in the case of Bodrogköz) were able to pump up water into the air again (hardwood effect). The structured, multi layered forest architecture constituted a perfect water trap, where a meso-climate was created and the surplus water retained naturally for a long time. Return into the lakes and the river could happen only in several steps, once the sponge effect turned into the other side of the cycle and released water slowly from the reservoirs (Molnár 2002: p 187).

Traditional communities were absolutely aware of these processes just as much as the suitability of various soil types for agricultural cultivation, tillage and farming. A Hungarian research scientist developed a method by which it can be determined scientifically, which type of soils are suitable for various kinds of farming (Konkoly-Gyuró 1989:45). Factors excluding tillage include the following conditions:

- topsoil thickness is less than 40 cm,
- organic matter is less than 100 t/hectare,
- groundwater table closer than 200 cm to the surface, and
- extremely poor water regime in the soil.

Similarly, there are conditions which only limit but do not exclude entirely the availability of the soil for cash crop farming by tillage:

- relative soil fertility is less than 40 % of the most fertile soil,
- organic matter is between 100-200 t/hectare,
- groundwater table is between 200-300 cm from the surface, and
- the soil has poor water regime.

The method can be adapted to the flood plain of Bodrogköz with some additional considerations. Soil properties are subject to rapid alterations with environmental conditions, recent investigations therefore have only limited historical value. Also, the Slovak soil valuation system differs from the Hungarian one and the method can only be adapted to the southern part of Bodrogköz which lied in Hungarian territory (Borsos 2000: Optimal land use map). However, recent efforts to reconcile the two types of soil valuation system resulted in a map illustrating the cropland potential of the entire area (Molnár et al 2008: 188-190, and Map XXII. 3.)

4.2. Agriculture: changes in land use

Sometimes proponents of ILD encounter with the argument that under market economy was a must and that the market rewards only profitable agriculture. First of all, as said in the Barriers section, agriculture can only be profitable under free market conditions when subsidised either directly (market organisation in Europe) or indirectly (low fuel prices and vertical integration in the USA). Second, inappropriate land use not taking the agro-ecological potential of a field into account takes a revenge sooner or later. Erosion, deflation, water scarcity and pollution are all consequences of such inconsiderate production methods. On the other hand, research carried out by agronomists, biogeochemists and ethnographers in the Tisza region for the Bodrogköz area clearly demonstrated the inevitability of such consequences just as well as the readily available alternatives in land use methods to avoid such consequences in the future.

The results of this research project harmonise very much with ILD objectives and targets as well as the novel approach to water management. Suggestions for land use in the 21st century include the following recommendations (Molnár 2008: 192-195)

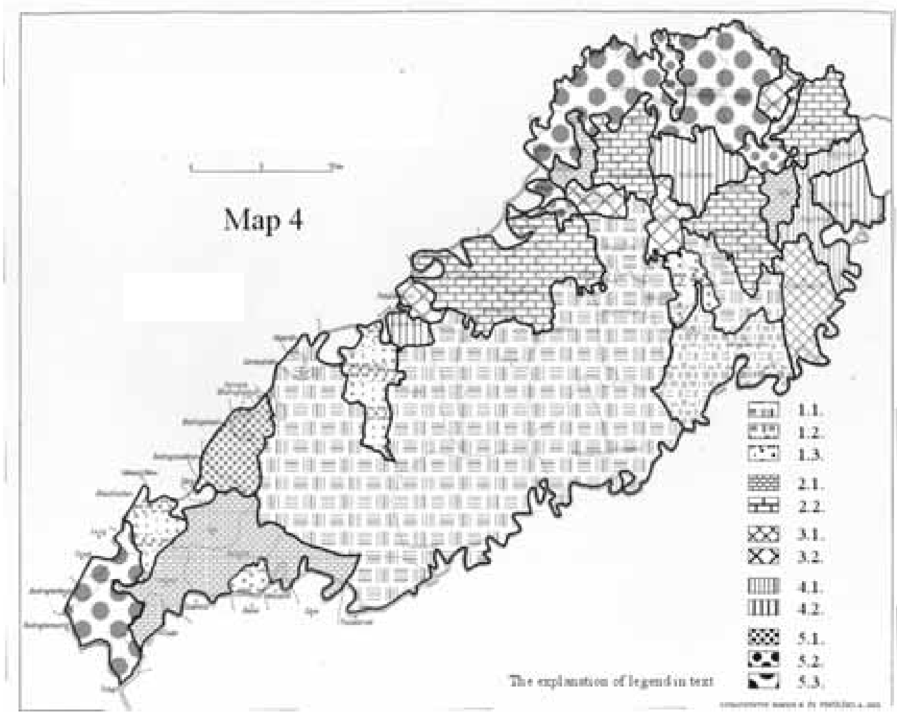
- Revitalization of former Tisza branches (Karcsa, Tice) and some smaller creeks
- Creation of lakes in lower lying areas for fishing
- Reforestation with original wood-types (oak – hornbeam, ash – elm, willow – alder)
- Decrease of arable plough land to 35-40 %
- Instead of large fields, establishment of a mosaic-like structure of land use depending on soil and morphological conditions

As for the mosaic-like land use patterns, recommendations can be derived from the traditional land use methods on the same land, depending on soil and water-conditions (Molnár 2008: 195-197.)

Traditional land use
- Open water: fishing
- Lakes, lakesides, riversides with vegetation cover: gathering
- Riparian forests: orchards and animal husbandry
- Flood-free areas: human settlements, masting on acorns, arable land
- Small (sand)hills: vineyards, forests, grazing

Suggested optimal land use
- Open water (rivers, lakes, creeks) and wet marshes: biosphere reserve, fishing, eco-tourism
- Flood-prone areas: pastures, meadows, woods of the river flats, orchards
- High flood areas: pastures, meadows, hardwoods
- Flood-free areas, sand-hills, hills: settlements, ploughlands, orchards

Livestock husbandry and animal breeding would be an advisable solution for areas with dynamic water regimes, where farming for tillage is difficult to implement. The ethnographic surveys of the Bodrogköz revealed that this direction of farming still has a high potential as there are some communities where all of the households have at least some kind of domestic animals. Also, it has been shown that the encroachment of plough land onto the flood plains was possible after river regulations and drainage of the marshes in the first place. Consequently, there is a natural tendency to revert these areas back into pastures and meadows. The image below is the result of a computer rendered analysis of the areas where the ground was only broken after the water management projects in the late 19th century. It can be seen that in particular in the middle of the region tillage and cultivation by ploughing was only possible after the area was drained and the dikes built.



Legend:

1. After regulation (drainage in 1895)
1.1. plough-land increased at the expense of meadows and pastures
1.2. plough-land increased mainly at the expense of forests, besides meadows and pastures
1.3. plough-land did not increase
2.At the expense of meadows and pastures
2.1. increase > 10%
2.2. increase < 10%
3. At the expense of forests
3.1. increase > 10%
3.2. increase < 10%
4. At the expense of forests, pastures and meadows
4.1. increase > 10%
4.2. increase < 10%
5. No land use change
5.1.Plough-land increased at the expense of forests.
5.2. 1855 - 1910 increase > 10%
5.3. 1855 - 1910 increase <10%

Figure 22: Changes in plough land area in the Bodrogköz after 1895. Source: Balázs Borsos (in press)

The conversion into a diverse and multi purpose land use pattern like the one presented above could be facilitated by a properly fashioned CAP reform. As seen earlier on, the single payment scheme is not appropriate for this purpose, but according to the present intentions the second pillar of agricultural subsidies will remain in the form of aid to diversified rural development schemes. These are exactly what an ILD project might need in the form of either a re-engineered set aside scheme, or in the form of a geographically varied and dynamically custom tailored agro-environmental subsidy system. This way, ecological restoration of the region could be implemented with financial incentives at the proper place. The system is nothing new. The information technology system is suitable for classification according to agricultural suitability since it has been surveyed and digitalised earlier on for the purposes of least favoured areas (LFA). This now can be used as a hierarchic map for land use planning, and the financial incentives geared up accordingly.

5. Operation of and expected results from the landscape and water management activities

The dynamic interactions described so far can be illustrated by presenting the same river section in four different stages as follows:

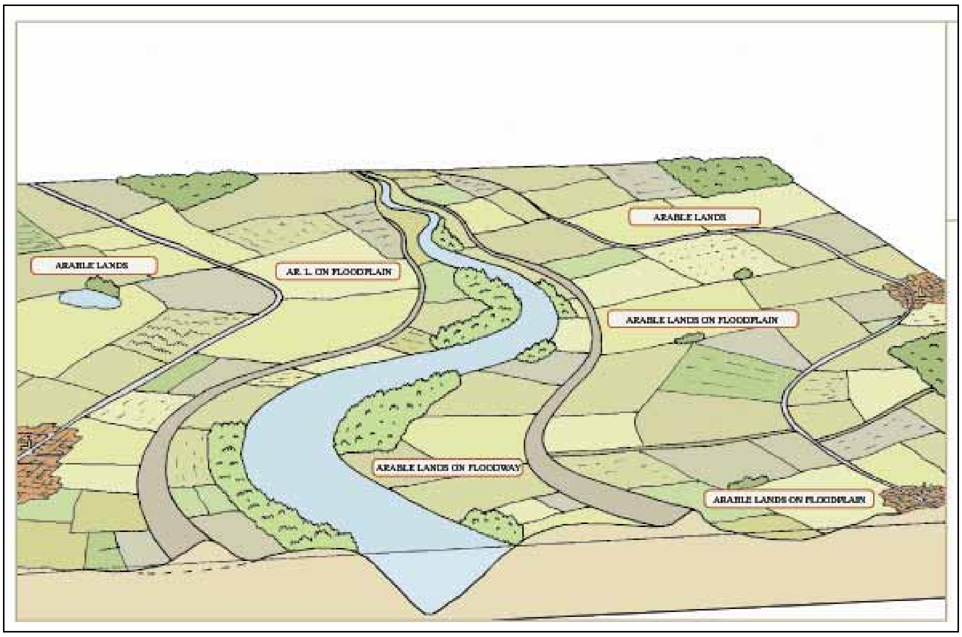


Figure 23: Low stage river bed of a trained river

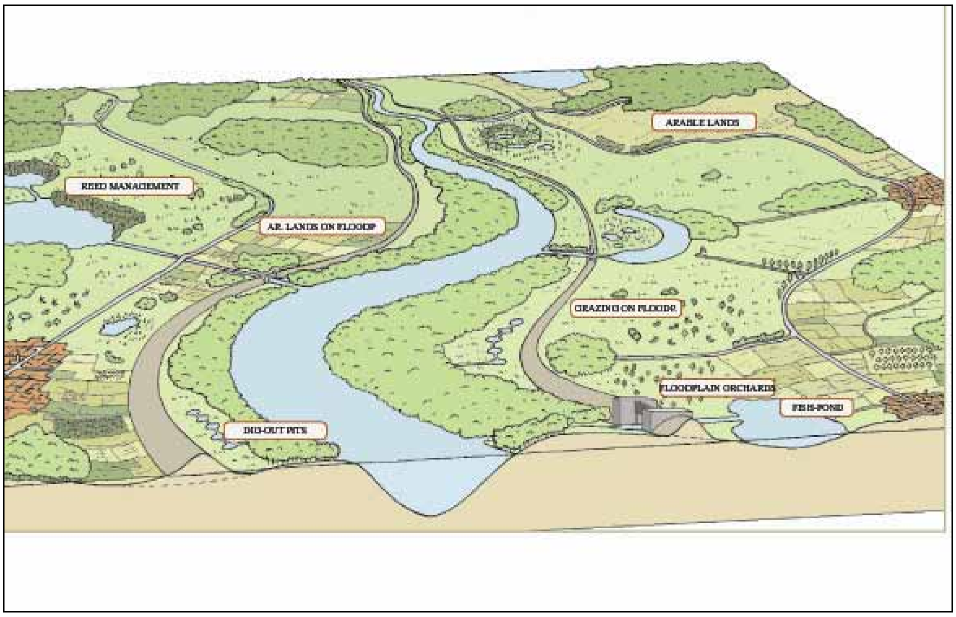


Figure 24: Low stage river bed of a river developed by ILD

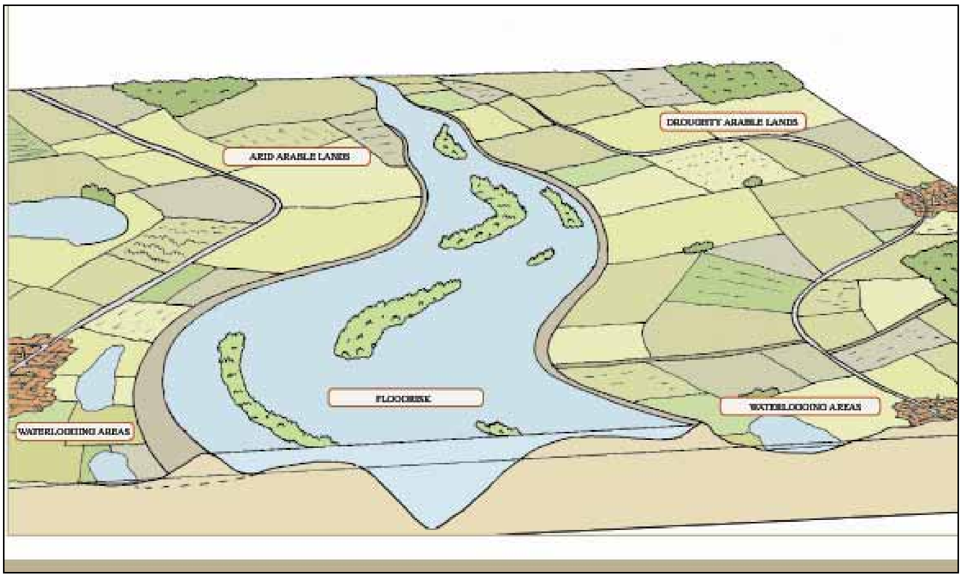


Figure 25: High stage river bed of a trained river

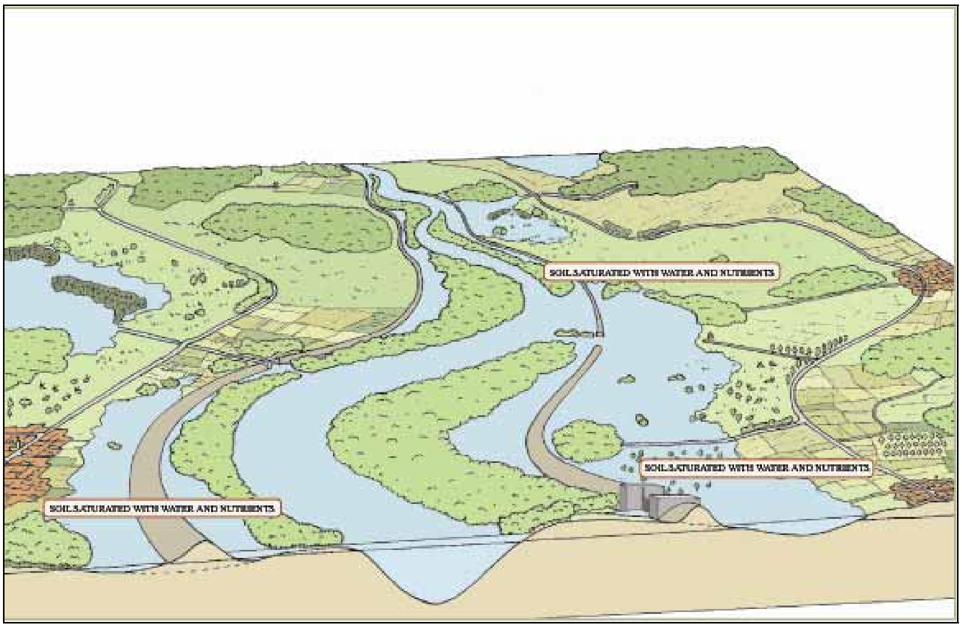


Figure 26: High stage river bed of a river developed by ILD

5.1. The official version: the further development of the Vásárhelyi plan

Triggered by serious flooding incidents and constant risk of high water, occasional drought and occasional excess surface water encountered in spite of serious flood control and water management efforts along the entire Tisza catchment area, Hungary has decided to take a new approach and set up a *flood reduction and mitigation system consisting of engineering structures and polders dedicated to the controlled discharge and eventual return of floods into the river as necessary (or transferring excess water onto areas in shortage of water)*[51].

In remembrance of the original river training concept envisaged by the short lived but influential water engineer Pál Vásárhelyi, the new programme was named as the further improvement of the Vásárhelyi plan or shortly the improved Vásárhelyi plan (VTT in Hungarian shorthand)

The selection of the name tells a tale. The problems emerged from the original Vásárhelyi plan have ongoing effects onto the life of the Tisza valley up to date. The first and main result of the Vásárhelyi plan which was implemented poorly and incompletely even within the theoretical framework of the technocratic approach of the time became a structural trap in chancery. Only after a hundred years or so after completion, repeated flooding incidents, recurrent drought and excess water could not be overcome by the system any more. Theoretically, there are two inherently different possibilities to find a way out of the emergency situation and the case of necessity: a) keep on to apply the conventional water construction logic and build various technical structures one after the other to mitigate the risks, or b) to take into account the natural processes and dynamics of the river, letting them shape the landscape and adapting to the changes.

[51] Act No LXVII of 2004 on the public interest and implementation of the programme aiming at the enhancement of flood control safety in the Tisza-valley and the spatial and rural development of the affected region (the Improved Vásárhelyi Plan)

The VTT proudly boasts of a shift in attitudes, even a paradigm shift. And indeed, the focus was shifted from defence (military like organisation) to regulation, control and prevention, long term sustainable solution with ecological considerations in mind. The most important change in the approach was the idea of retaining water instead of draining it from the plains. The technical solution however did not really reflect that much quoted paradigm shift. The published programme still thinks that the key objective was to enhance flood security in the Tisza valley, and not the implementation of an integrated land management and development practice which renders the very concept of risk, danger and exposure to floods irrelevant.

There are three major segments in the programme, of which only one is a relatively new idea, the other two are business as usual methods:

1. Improve the water carrying capacity in the high water stage river bed on the Tisza (in other words: clear the floodway)
2. construction of a flood detention emergency reservoir system with a total storage capacity of 1.5 billion m^3 (10-12 reservoirs)
3. development of the existing flood control system and structures.

The original programme was outlined by water management professionals in April 2001, but later on – upon pressure from various advocacy groups and interest representation organisations – the VTT has grown into a complex program and – at least on paper – an additional objective of equal rank was added in 2003: completion of the rural and spatial development, landscape management and nature conservation tasks in the Tisza region.

The components of the VTT programme have been advanced as follows:

- flood control measures (i.e. the three original objectives)
- infrastructure development in the settlements concerned (excess water drainage in the built up areas, sewage system, waste water treatment plants, replacement and construction of by-roads, bicycle paths)
- implementation of natural conditions driven husbandry methods (landscape management)

Only the latter can be associated directly with the ILD concept, but the first two are also very important aspects. For instance, as part of the flood control measures, the bank protection works at the bottleneck in Kisar were reinforced, but nothing happened to overcome the bottleneck itself.

As it happens all the time, construction works were done they cost several times the original budget and operation costs were not appropriated or allocated for. The funding of the programme was coordinated by the water authorities and in spite of the existence of an inter-departmental coordination committee and in spite of the promises, available funds went mostly and predominantly to the water construction industry. Since funds were on a short supply to such an ambitious project, the programme was divided up into two stages. In the first stage, three reservoirs were envisaged and in the second stage another three. The originally planned 11 reservoirs seem to be a far shot at the time of writing. The first structure to be inaugurated was the Cigánd reservoir in the Bodrogköz in 2008 and the second near the project area in Tiszaroff. The case study in Chapter 6.2.2 highlights some of the weird features and the functional inaptitude of the reservoirs which are thought to make up a complex system by the time they all are completed.

5.2. The condition precedents for an alternative

The original approach of the further development of the Vásárhelyi plan has been diverted somewhat and a fresh view is needed to take all aspects of the problem into account.

The key action in the new concept is controlled discharge and return of river water from and to the main – regulated – river bed. However, the method deviates from the official governmental approach in two major aspects:

- discharge is anticipated onto large areas on the lower lying parts of the former, originally active floodplain, and;
- discharge is envisaged at much lower water levels than currently designed for the emergency reservoirs of the Hungarian VTT (shorthand for the new Vásárhelyi Plan). In fact, the desired outflow threshold would be somewhat beyond the mean stage of water in the main river bed.

The radically different approach to land development to be outlined below requires radically different policy options as well. Both the political, financial environment and the legal conditions need to be changed in order to accommodate a shift in land use and water management practices.

<u>Political and financial framework</u>

- The Water Framework Directive should be amended to accommodate floodplain reconnection and restoration on a large scale.
- Best Practice in Sustainable Water Management should be developed to involve ILD
- ITRBM plan is to integrate ILD
- All opportunities offered by the Hungarian further development of the Vásárhelyi plan for the Tisza region (VTT) need to be taken into account and ILD options incorporated into the VTT.
- During the review of the EU's Common Agricultural Policy (CAP) the emphasis is to be shifted from agribusiness to more sustainable land use methods and the promotion of small scale family farming for a larger proportion of non-cash crops
- In line with these overall framework changes, new type of agro-environmental subsidy schemes should be introduced with a special focus on the following:
  - Highly efficient incentive systems to promote diverse land use
  - Differentiation according to geography and ecological conditions

<u>Legal framework for sustainable land development</u>:

- Revisiting the principles and practice of water right licensing, the procedures for water governance approvals, authorisations, water rights;
- In terms of legal titles for land, management of undivided joint property, land consolidation procedures need to be clear cut and simple, local control of water and land management administration established.

<u>Promotion</u>

- Preparation of an exact and competent agricultural methodology and technology guide to assist farmers in both the water management changes and the land use changes, the different farming methods and technology
- Setting up a landscape management information centre, advisory services, consultants, market organisation

5.2.1. Institutional frameworks

5.2.1.1. Integrated river basin management

Under the Water Framework Directive, Hungary has also started to complete the River Basin Management Plans for its four sub-basins, including, beside the Danube proper, the Lake Balaton, and the river Drava the Tisza River as well[52]. These contain measures and actions to maintain or reach the healthy status of the waters within their respective design areas, taking into account the needs of human existence and ecosystems alike. They also identify the problems to be remedied and the priority list of measures intended to improve the conditions in the watershed. The Tisza River Basin Management Plan, in its current state offers some opportunities to a broader concept of water management[53]. It clearly defines the main problems:

- flood control dykes have cut off – due to territorial needs of human activities – a substantial part of the floodplain from the living water course, which resulted in the deterioration of wetland habitats, originally having a beneficial influence on the biodiversity of the landscape;
- the agricultural sector, an intensive player in the area demands drainage of excess surface water which is in contradiction with the needs of nature conservation to retain water;
- there are water quality problems (high concentrations of organic matter and nutrients) originating from agricultural runoff and rough sewage from communities;
- stagnant water bodies are cut off from regular water replenishment opportunities which results in water levels diminishing below the ecologically necessary levels, exerting a positive feedback effect on nutrient and organic matter accumulation;
- in areas along the river, seasonal inundations by excess surface water in springtime are followed by systematic drought incidents in times of summer;
- water carrying capacity of the floodway is reduced by inappropriate land use methods practiced in the past decades and due to silting up of the floodway bottom, thus increasing the exposure risk to high floods.

Even though the underlying rationale behind some of the problems is erroneous – for instance, water retention in the landscape is not only a need of nature conservation but the landscape itself, including a more sensible agricultural practice, and the reduced water carrying capacity is caused not so much by inappropriate land use, much rather by inappropriate narrowing of the meandering high stage river bed –, there is good reason to believe that such an approach

[52] Government Decree No. 221/2004 (VII.21.) laying down certain rules for river basin management
[53] http://vizeink.hu/files/vizeink.hu_0351_Reszvizgyujto_VGT_Tisza_4.pdf

could have a beneficial effect on the landscape of the river. In particular, solutions are recommended in the priority set forth below as well:

- water quality and water quantity related measures need to be implemented in close cooperation with all countries along the river;
- longitudinal connectivity of the Tisza must be secured for living creatures in spite of the water work structures (this means in practical terms fish ladders);
- areal water retention should be implemented;
- good fishing and angling practices should be introduced;
- the VTT should serve not only the reduction of flood risk but also the restoration of the water balance in the region.

Three of these are of paramount importance: namely, no measures are effective if not implemented simultaneously by all the riparian countries, and areal water retention is a key to the last priority, i.e. to restore the water balance in the region.

The suggestions for actions reflect some opportunities for ILD:

In terms of reducing nutrient and organic matter loads:

- Agro-environmental measures and change of land use methods in vulnerable areas in the lowland (reduced pesticide use, changing crop composition and method of tillage);
- Changing the type of cultivation in vulnerable areas in the lowland (plough land to wetland, grassland or forest, see set aside schemes);
- Setting up excess surface water reservoirs to retain excess water, conversion of the surface water drainage system to multifunctional arrangements;

Measures improving the hydromorphological status of water courses and stagnant water:

- Restoration of flood plains and creating the conditions necessary for a flood plain economy;
- Conversion of land use relations in the riparian zones to land use methods more appropriate and tolerant to regular flooding;
- Setting up riparian gallery forest strips along water courses to separate plough land from rivers and to reduce agricultural runoff;
- River bed rehabilitation in hillside and low land small water courses, restoration of riparian vegetation zones, meandering of the water courses.

Implementation of sustainable water usage forms, improvement of water quantity status:

- Water efficient crop production methods (low requirement varieties, water saving irrigation methods);
- Water governance, restoration of flow conditions corresponding to natural relations, gravitational flows, connections;
- Curtailing unauthorised water extraction.

Although very promising, the river basin management plan was mainly prepared by water experts and it does not take into account the legal changes necessary for such an approach. Again, the most important of these is to put land relations in order which is an absolute condition precedent to the implementation of any alternative methods.

Under the Water Framework Directive and the properly designed and implemented river basin management plans there might be some opportunities for a larger scale integrated land management and development internationally as well. However, here also must be a number of condition precedents fulfilled before such a programme could be envisaged. First of all, you need champions of progress who undertake the seemingly impossible task of higher level integration above the national boundaries and across disciplines and sectors. ICPDR could be such a champion and the Tisza the example for good practices of ILD, but this is only an opportunity at the time being. Such an approach needs a dedicated, ear-marked budget which is not diverted by various tenders and is not nipped away by bureaucracy and administration.

Instead of rigid accounting, green accounting and green budgeting has to be developed. Ecosystem services is a difficult but promising concept with the intention to internalise some of the benefits currently externalised by conventional economist thinking, but it needs further refinement before used for purposes such as verification of benefits. Recent publications substantiate the notion by revealing the intricate web of life which is strenghtened the more the more diverse the communities building it up are. For instance, resistance and resilience are properties of ecosystems, but their efficiency depends upon how living organisms respond to being exploited. Very moderate felling of trees in a forest should permit most of its ecosystem functions and services, such as regulation of water supply, to continue, and hence the ecosystem could be said to be resistant to this level of exploitation. Clear-felling of patches of forest has a larger impact, but in resilient ecosystems the patches are eventually recolonised by trees, and recover normal ecological functions (Silverton 2010). The advantages of water retention, ecological revitalisation, boosting biological diversity and benefit transfer must be calculated with and accounted for. It must be investigated, explored, revealed and defines with scrutiny, what kind of benefits are brought about by any action or measure and where do they manifest themselves. Also, who are the ones to pay for it. Beneficiaries and payers need to be reconciled, whether they are the national economy as such, global market operators or local players. Such an initiative is the TEEB project[54]. If the calculation and accounting is made properly and honestly, there might be surprising outcomes which actually divert developers from a certain action or project, as seen below in the box.

Box: Assessing the benefits of not converting a floodplain in Delhi

Around 3,250 ha of floodplain between the Yamuna River and the landmass in Delhi offer benefits such as provision of water, fodder and other materials, fisheries, and recreation. Faced with pressures to convert the floodplain into areas suitable for habitation and industry, the decision makers, even though acknowledging the ecological role of the floodplain, were not able to establish sufficient justification for conserving it without economic valuation of the ecosystem services to enable a cost-benefit analysis of conversion.

Value estimates for a range of services totalled US$ 843/ha/year (2007 prices) (Kumar 2001). The embankment of the Yamuna would virtually dry the floodplain, causing disappearance of these services. These ecosystem benefits exceeded the opportunity costs of conservation (estimated from the land price, assumed to reflect the discounted value of 'development' benefits) for a range of discount rates from 2 percent to 12 percent, justifying the maintenance of the floodplain. The Delhi Government halted the embankment plan of Yamuna until further order.

Source: Kumar et al. 2001

[54] TEEB for Policy Makers – Responding to the Value of Nature. The Economic of Ecosystem and Biodiversity for National and International Policy Makers. A Summary Report 2009.
Source: http://www.teebweb.org/LinkClick.aspx?fileticket=I4Y2nqqIiCg%3d&tabid=1278&language=en-US

5.2.1.2. The institutional landscape in Hungary

The general elections, held in April 2010, have rearranged the institutional landscape of Hungary in terms of several sectors concerned with integrated land management and development. The new government, holding the authorisation of a House of Parliament, where more than two thirds of the seats are occupied by MPs of the same party, FIDESZ, is being set up in an utterly different structure than its forerunner.

FIDESZ calls itself a civic party, and is not really interested in rural affairs. The attitude is reflected in the organisational setup of the new government. Agriculture, rural development, environmental protection and nature conservation, all key sectors for the purposes of ILD have lost from their respective relative weights in the government. The formerly independent Ministry for Environment and Water Management was dissolved and partly integrated into the new Ministry of Rural Development which lost its "Agricultural" part from the name. However, much of the functions of the former ministries was merged into the huge new top ministry called Ministry for Infrastructure and Asset Management with an experienced business manager in charge. Under such conditions it should be feared that the new structure – instead of benefits – will affect the various policy approaches adversely and will create less opportunities than hoped for to the implementation of the integrated land management and development concepts.

The new integrated Ministry of Rural Development has six secretaries. Separate secretary controls environmental and water management matters, agriculture, rural development and EU coordination, and food safety. Two of the secretaries have administrative and parliamentary functions. However, the integrated structure only covers up the fact that the role and weight of the important matters such as environment and rural development was diminished in the new government. The framework is not sufficient to enforce the interests of ILD. In addition, the new government is also very much exposed to lobby interests, in this case to that of large farmers and agribusinesses which are associated with the party.

The measures taken during the first couple of months show a varied picture. The water management administration is promised to be strengthened, new and additional reservoirs to be built along the river Sajó where the Spring flood devastated large areas and a centralised, paramilitary water administration organised. On the other hand, many individual measures point to the opposite direction. For instance, discharge of salt laden waste water from geothermal power plants into living surface water courses was endorsed for lobby interests and all but two of the reputable, recognised directors of National Parks were dismissed. The law governing water management boards is also subject to changes. Even nationalisation of the boards was raised as an option (Varga 2010). Environmental administration is loosing ground in property issues. Not only mines and radioactive waste, but – more importantly from the point of view of ILD – the management rights of national forests in nature conservation areas were taken out of the hands of the department and put to the National Development Ministry (NDM). Energy policy decisions are also expected to be exposed to business interests, thus making a considerate approach of energy crops in ILD areas more difficult to achieve (Szabó 2010).

You also have a mixed feeling with regard to the agricultural matters. Good intentions were much voiced before the elections by party candidates. They wanted to transform land use practices, mainly by measures such as the priority ranking of land tenure and leaseholds in order to open up new opportunities to small farmers. The attempt was torpedoed by the interest group formed by those newly rich large farmers who managed to privatise 12 state farms during the nineties… The top management of the new rural ministry is quite mixed. A single champion, the parliamentary secretary represents agro-environmental concerns with unbending determination. He is already targeted by the parliamentary faction of the party. They believe that the secretary needs to limit the extension of national parks called the 'bird nest lobby'. And the ministry needs the support of the faction as they intend to reform the agrarian subsidy system (Kelemen 2010/2).

5.2.2. Legal framework

5.2.2.1. The role of ownership

Land consolidation

Due to historical reasons the current ownership pattern of arable land parcels in Hungary has a very complex and unreasonably shaped structure as discussed in Chapter 2.2.2.1.1 to 2.2.2.1.4. Parcels are fragmented and boundary lines of properties are drawn according impact from external factors not with due regard to the functional and structural characteristics of the landscape. Before the proposed land use changes and the related development projects are carried out, a reasonable land consolidation procedure must be initiated and completed to the extent possible which would homogenise land titles and provide an easier administrative framework.

A pre-requisite to any larger scale ILD project is to reassuringly complete land consolidation arrangements first. Land consolidation has several benefits in terms of land use patterns as well as more flexible land use changes.

Comprehensive general objectives include:

- reducing the fragmentation of freehold estates,
- diminishing the gap between land use and land ownership,
- elimination of divided tenures,
- increase of profitability in agricultural production,
- integrated rural development – improving life conditions of rural population.

Specific operative objectives include:

- promote land consolidation with the appropriate legal means (legal provisions),
- operate an effective institutional system adapted to the needs,
- prepare stakeholders to land consolidation,
- awareness raising, attaining public acceptance of land consolidation as a means for improvement or rural livelihoods.

Priorities:

- laying the theoretical and legal foundations for land consolidation,
- setting up of a coordination institution and modernisation of the associated institutional system,
- create the appropriate financial and other conditions,
- public acceptance and preparation, awareness raising.

Organisation of such a comprehensive land consolidation process includes national level coordination, local coordination, implementation (execution) and ensuring legal remedies.

During the mid 1990s the Ministry of Agriculture and Rural Development envisaged a set of Local land Consolidation Committees to be assisted by intermediary players such as experts and data bases. Certainly, the regionally cognisant land registry offices shall play a crucial part in the process, being in the position to manage land administration and possessing the necessary tools including GIS databases. However, personnel in these offices need a proper training in order to deal with large scale land consolidation issues.

Methods of land consolidation include the following options:

- Spontaneous land consolidation on a voluntary basis initiated locally. It has minimum effect on a larger scale and is not expected to be executed in any larger scale;
- Institutionalised land consolidation procedure with moderate results. This version relies on national, EU and private sources, has a regional effect and comprehensive goals in terms of land, but does not involve outright rural development.
- Enforced land consolidation with full scale solutions. Although this version also accepts the voluntary principle, it also assumes legal provisions which enforces land owners and users to cooperate. It can only be implemented with strong participation by the government, assuming most of the related costs and the tasks of organisation and administration, and providing a complex rural development scheme covering the entire agricultural area of communities in coordination with the neighbouring settlements and in line with the national and regional spatial planning objectives (Ripka 2005).

Obviously, from the perspective of a regional level ILD scheme the third option would be ideal. In this case the priorities for the Tisza valley could be interwoven in the land consolidation procedures. Needless to say, there is no real chance to obtain public level acceptance of such a dramatic change within the foreseeable future and no funding is available to cover the significant costs entailed. Therefore, the opportunity exists only in principle, in spite of the well meaning river basin management plan and progressive design schemes of the water directorate at Szolnok. In addition, on the longer term proprietary rights themselves should be limited or restricted to a certain extent again as they were in historical times and the notion of the commons introduced in public awareness in the case of such assets and properties which require management for the common good (such as operation of the ILD system). There are examples in history and in other parts of the world where community managed water steering and management systems have been operated successfully up to quite recently (Tongdeeleert and Lohman 1991, Badenoch 2006).

5.2.2.2. Slow changes

Some promising initial developments seem to have happened in this respect in the legislative side as well. The regulation in place so far applicable to local food producers and sellers[55] promised little help to self-reliant lifestyles and local economy. Recently the Ministry of Agriculture and Rural Development amended the decree, providing a little bit more opportunity to small scale food distribution and trade. Primary producers are now allowed to sell their own produces including some raw meat and their own meat products, including farm-based slaughter of younger animals and processing of produces. Sales conditions were

[55] Joint Decree No 14/2006. (II. 16.) FVM-EüM-ICSSZEM on the conditions of food production, processing and marketing by small producers

also facilitated by providing the opportunity for producers to sell directly from house or to intermediaries such as merchants and hospitality industry facilities at least within their respective regions. Licenses for sale became family based, they do not need to obtain selling permits for each person dealing with the goods and administration of business was also simplified to some extent.[56] The new Hungarian government also promised to relieve some of the administrative burdens on the primary producers. For instance, distillation of Hungarian brandy brands ('pálinka') would be allowed for them and they can be suppliers to public catering institutions (Kelemen 2010/2). This way there is more opportunity for local land users along the river valley to earn a decent living on their own once the necessary changes in the land use patterns and methods have been implemented.

5.2.2.3. The legal framework of water management

The legal framework of water management needs complete re-engineeering before any ILD concept can be realised. Just as it happened with the VTT, where a separate piece of legislation had to be put in place before the concept could be started, ILD also requires a separate law, and much more than that. The complete legal structure of water management needs refurbishment.

As a first step, the dichotomy of water management responsibilities has to be eliminated and flood control, water stagnation, drinking water supply and drought measures put into the hands of a comprehensive, but not too complicated, area based water administration structure. The most handy solution would be a polder based approach, where all functions and tasks of a sub-basin or regional catchment area could be united in an all encompassing, but local organisation with the appropriate powers. Even this is not enough however, without the establishment of proper and effective interfaces between the legislation governing land use and agriculture, rural development and the legislation on water. Here, the key principle should be integration of land and water uses, restriction of land ownership rights to accommodate the interests of water management and the regulation of compensations, damages and other relationships between arable land and water cover.

Similar recommendations could be made for fishing laws. Fishing is considered to be an agricultural activity, although it takes place in surface waters. As mentioned in Chapter 2.2.2.2.3 Rules of fishing, local communities and individuals are entirely excluded from the rights to the fish in living waters of their own land. Therefore, fishing rights should be linked to land proprietorship just as it is done with hunting rights. It would also be necessary to make a strong distinction between natural fishing conducted in nature and in industrial undertakings with intensive aquaculture management. Also, local communities should be given pre-emptive rights for fishing on living waters within their administrative boundaries. Flood plain management and small scale fisheries should be coupled and relieved from the payment of fishing related fees, provided they take care of the spawning grounds, making sure that the natural resources of fisheries are replenished. The reason why this topic is discussed here is that fishing and fisheries are not agricultural activities. They are much more related to proper and integrated water management practices. Yet, current legislation focuses intensive aquaculture schemes only.

[56] Decree No 52/2010 (IV. 30.) FVM on the conditions of food production, processing and marketing by small producers

At the time of writing, no signs are present in Hungarian government to rearrange the water administration. It would be a positive outcome of the ILD project to prepare a Hungarian language position paper providing recommendations to the re-organisation of the institutional setup and for the drafting of a new legislation with a fresh approach to water management and land use needs.

5.2.3. Financial framework

As a minimum, an interdepartmental committee with authority to appropriate funding to various sectors as the need dictates. Allocation of resources with structured involvement of the local stakeholders. Financing should be based on a complex and comprehensive participatory planning and resource allocation instead of lobby interests and tendering.

On the other side of the coin, the economic profitability of the land used according to the ILD concept should be made less vulnerable to world market conditions. Current practices aim at large volume commodity production used to prepare staple food items such as wheat or corn. However, prices on the commodity market are extremely volatile as the changes in the past few years have demonstrated. In addition, single crop systems are also exposed to speculators on a worldwide basis. According to analysts and observers after the real estate crisis of 2009 large American brokerage agencies and investment banks started transform commodity markets and wheat and other grain contracts to derivatives and to trade with them among each other. This does not only make market movements erratic but also contribute to high commodity prices and hence, to growing risk of famine in developing countries (Nagy 2010). With a diverse production structure based on a mixture of multiple cash crops and other produces produced for the local market or for self consumption ILD based land use would not contribute to these adverse world market trends.

5.2.4. The logic of mind

The historical examples described in Chapter 3.2 highlight an important aspect of any comprehensive and larger scale implementation of ILD and that is the mindset of stakeholders affected by or people participating in it. A completely different attitude and approach is needed if you are ever to succeed.

5.2.4.1. Landscape as a functional unit

A new, comprehensive landscape strategy should be based on both vertical and horizontal cooperation in terms of physical geography just as well as in terms of institutional and legal backgrounds. On one hand, planning should be made for whole watersheds, irrespective of national or other boundaries which are not respected by natural processes anyway. Downstream and upstream sections of river basins should be given equal opportunities and power in planning, design and management of the ILD activities. Type one errors like the one described in Chapter 6.2.2 on the example of the Tiszaroff reservoir which had to be opened just to discharge water pumped into the river's floodway by extensive excess water drainage canal network head stations upstream have to be avoided.

This requires that design schemes be complex and comprehensive, encompassing all river functions and the situations now perceived as emergency cases. Not separate flood control, irrigation and excess water drainage schemes need to be set up but a single holistic ILD scheme which can be easily adapted to all the different needs simultaneously as the case may be.

5.2.4.2. The bottom up approach

Changing attitudes and awareness is an overwhelming task. Long established beliefs and perceived interests can only be diverted when there is a good foundation laid for the arguments and the people whose mindset is about the change can actually understand and feel the outcome of such a different approach. Therefore, such attempts must be made from the bottom up and by persons whose credibility was not yet challenged in face of the local population. First, the educational barriers described above in this study have to be overcome to possess a full range of such experts with accurate knowledge base and proper competence in local matters.

Once the conditions in terms of material, financial and human resources are available, a thoroughly thought over participatory planning procedure may be started in which all the necessary aspects are covered as follows:

- The potential benefits of the new approach are to be assessed in conjunction with all the stakeholders
- Total economic values related to or associated with the proposed solutions must be identified
- Once the benefits and values are in place, development of the locally most appropriate solutions may take place. In this, the ideas and concepts raised by locals are of paramount importance
- The developed solutions need to be visualised as long as all stakeholders have a perception of what is going to happen
- Implementation can be then made in joined management with key organizations (including the intermediary players as stated below)

Certainly, success depends on many terms and conditions as well as other factors. The only possibility to implement ILD is on local levels because the necessary flexibility and variability is much more easy to apply and the integrated concept can be realised here. Of course, the actual execution depends on many other factors, a different view has to be taken in the relationship between the city and the country, urban and rural population and institutional system, cooperative efforts are to be made, mediation, handling and abolishing of most barriers identified in the first part of this paper and in particular the financing premises and assumptions have to be changed entirely.

5.2.4.3. Intermediary players

Intermediary players are key contributors to eventual success. Organisations like regional or local branches of nationwide institutional networks such as the Chamber of Agriculture, Water Management Directorates, or Water Boards, and self-induced grassroots movements and non-governmental organisations such as – in the case of the Hungarian Tisza – SZÖVET, Alliance for the Living Tisza are natural candidates to such a role. They can be trained to play the part of mediators and facilitators in managing the system along the target function, that is to develop the most appropriate methods provided by the ILD concept for any given location or specific condition. Local experts may be instrumental in the development and application of the target oriented specific programmes. The economic crisis, the high level of unemployment and the socially backward regions may also turn for the better when their problems are not handled in the usual way by trying to attract working capital in the region or providing customary workplaces and jobs for untrained individuals. Instead, raising environmental awareness and locally relevant expertise and competence in ILD matters may be of use on the longer term when such people can either join a local initiative along the ILD approach or set up their own small business.

The ecological movement may prove to be an interesting and important incentive in the promotion of a more self reliant economy along the riparian zones where integrated land management and development should take place. Ecological movements and changing customer preference may provide a shift from industrial agriculture produced mass food items and junk food towards the demand for a more whole value healthy food supply produced in an environmentally sound manner. The same applies to local crafts and cottage industry which is getting to be more competitive with mass industrial products provided the appropriate legislation is in place. Such produces and products also imply a more ethical farming of animals which provide a large part of the respective raw materials. Animal welfare concerns may push consumer demand towards an integrated farming structure of smaller scale farms and community supported agriculture (CSA) schemes also encourage family farming with a diversity of products more easily fitted into the integrated land management and development concept.

The same approach can be applied to a series of other activities related to land use and agricultural production. Basic needs of supply for day-to-day living such as staple food items and heating facilities can be satisfied by local production. A farmer at Tiszabura is envisaging to set up a local biomass facility producing briquettes from agricultural by-products or wooden pellets for the purposes of heating. There are multiple benefits of such an approach. The farmer himself can make some money and at the same time is able to take advantage of materials otherwise lost economically. People on the more unfortunate walks of life can get access to high value fuel at a fairly moderate price, without adding transporting costs and may be relieved from the urge to fell trees themselves illegally. In other words: people need to switch to an entirely different strategy in terms of all aspects of life.

Reluctant stakeholders with arguments about unprofitability of extensive farming and alternative land use forms can be countered with the following case study[57]:

[57] Sources: The Barcelona Reporter News Source 2009, José Javier Rodríguez Núñez Commercial & Communications Director, Don Barber

THE RIO FRIO FISH FARM

Near the mouth of the Guadalquivir river in Southern Spain, a dogged company called Rio Frio (the name of the local river in the Sierra Nevada) turned aquaculture mantras upside down by turning the tide: instead of drawing an intricate network of canals in the estuary dry, they literally flooded them again, switching from the formerly practised beef farming to ecological farming.

The natural marshland thus created constitutes of „pools" where the native sturgeon species of the Mediterranean is grown. The 98,000 fish raised here are Adriatic sturgeons (*Acipenser naccarii*). The company has time: some of the fish harvested these days are 18 to 20 years old, i.e. they live in the river mouth almost since the company was converted to fully organic and environmentally friendly: no fertilisers, no hormones, no external inputs, manual handling of the animals and careful monitoring of their health status. The self-conscious business strategy in a structural trap situation has its price: 70% of their customers were lost initially and 20% of all their young fish and spawned eggs are eaten by the thriving bird populations of several hundred species which find it worth flying hundreds of kilometres each day to feast on the rich diet the sturgeons offer. Yet, the farm did not go out of business somehow, after all. In the neighbouring little town of Riofrio with a permanent population of 300 there are 14 forbiddingly expensive restaurants full of guests each night taking advantage of the closeness of the only certified ecological fish farm in Spain.

5.2.4.4. Threats

There is no reason to deny that with or without a radical shift towards integrated land management and development a number of threats have to be faced by the inhabitants of the Tisza valley. Such threats are however all-pervasive in all societies and in all parts of the world, albeit in a different manner. Below, only a few of such chronic ills and some new types of risk are listed to provoke further thought.

<u>Turning away from truth</u>
The eminent climatologist Stephen Schneider pointed out in his book *The Patient from Hell* that during the development of the IPCC Working Group II report of 2001 good science presented at the session was manipulated until it satisfied all of the national representatives present. The words used to express the consequences of global heating were blurred until they were acceptable to representatives of all oil –producing nations, who saw their national interests threatened by the scientific truth. This incident underlines the importance of the chiasm between reality, facts and science on one side and beliefs, manipulation, policy and politics on the other. Any measure or programmes is only that good as much of it is implemented. According to James Lovelock (2009) global climate fans divert interest entirely from real observation towards model scenarios and focus on carbon dioxide emission reduction instead of adaptation strategies. With integrated land management and development in the valleys of large low stage rivers, adaptation to more extreme weather and climate may be better suited if designed well and with the natural conditions taken as a priority.

Solidarity or sovereignty?

The Tisza River Basin Analysis of 2007 of the ICPDR (Sheperd 2007) emphasised the importance of *solidarity*: the belief, that one region should not pass on water management problems to another. Albeit this is a very honourable proposition, the fact is that human communities are usually organised in groups and societies which distinguish themselves from other groups and societies by their degree of relative independence. Over the 19th and 20th century and in case of nation states this went up to the extreme of the so-called *national sovereignty*, the notion that each nation state was an independent actor in the international political arena and had some unalienable rights on its own. In situations where ecological and physical geographic conditions of an area give themselves to a different type of division and segmentation than those defined by national boundaries such a notion may prove to be harmful.

The Carpathian Basin is a well defined and clearly delineated morphological unit with an independent set of river basins – including that of the Tisza – which ultimately all feed into the Danube catchment. Yet, it is divided up into several nation states the national territory of which was drawn up and re-drawn in times of war and political debate with political, economic or military considerations in mind. On top of that, nation states have their own development curve which depends on their history, the date of their national independence and the international circumstances. The nation states of the Carpathians are in different stages of their respective development curves, some of them are young and others more mature. The double constraint of – from the ecological perspective – arbitrary borderlines and varied attitudes of riparian countries towards cooperation and collaboration in the sense of solidarity led to a situation where perceived interests differ substantially and may lead to unfriendly moves or as a minimum passive complacency from one nation with regard to others.

In terms of the ILD approach along the Tisza, such attitudes may play an adverse role for several reasons: upstream countries are not interested in retaining water on their land as long as they think they need it. Downstream countries are exposed to enhanced levels of risk if upstream countries continue the business as usual scenario and try to discharge, drain floods across their land and territory the sooner the better, not minding what will happen to their downstream neighbours. Building up the dikes as high as possible in one country has an effect of aggravating flood risk situations in another. (The same applies to regions. However, clever governance of a national government may avoid the emergence of such situations).

Even though there is a transboundary water management agreement in place between Ukraine and Hungary, and even though due negotiations were conducted with regard to the Bereg boundary region of the river Tisza, the actual measures taken by Ukraine provide an excellent example to the problems derived from national sovereignty. The negotiated plan included the building of the Bereg reservoir in Hungarian territory and two types of measures in the upstream section in Ukraine: raising the height of the dikes and reinforcing them – there were several bursts in the past, relieving Hungary from even more serious and disastrous floods than those which actually happened – and the construction of a series of emergency detention reservoirs in the upper catchment to slow down runoff and mitigate the peak of the flood wave.

Obviously, the primary interest for Ukraine was to protect human life and asset on their national territory by raising the dikes, while Hungary was the beneficiary of the poorly built dikes and her primary interest would have been the detention reservoirs which would have mitigated the height of the floods. However, Ukraine had no money to build both, therefore they obviously chose to build the dikes. This has an effect of rising the peak level of the flood wave entering the Hungary at Tiszabecs by 120-140 cm (!) according to the model calculations. Before the completion of the Bereg reservoir – which was a non-governmental initiative not included in the original VTT anyway – such a flood would have devastating effect on the northern parts of the Hungarian Tisza valley (Illés 2010).

6. A comprehensive guide to practical implementation – an ideal case

We have seen that manipulation of the original functional landscape did not result in a sustainable situation and even the success of the most recent attempt called the further development of the Vásárhelyi plan –discussed in Chapter 5.1 is more than questionable. Economic drivers laid and still lay behind water management efforts. However, while the functional landscape along the Tisza originates from the shear forces of nature, not to be influenced by man at will, economy is an entirely man made construction and, therefore, subject to change by clever design.

A logical conclusion is that the landscape should be managed and developed in line with the functional needs of the land and not according to whimsical market trends.

The goal is, therefore, to restore the original dynamic equilibrium of the landscape by

1. letting out *just as much* water from behind the dykes which is needed in order to attain safe flood control and the replenishment of the missing precipitation;
2. convert just *as much cropland* to grassland which is necessary to accommodate this amount of water and which would be needed to put to other use for economic and ecological reasons anyway;
3. due to these changes in the land use pattern for reasons of flood control, replacement of missing rainfall and economic profitability consideration, *just the type of land use* will be formed which suits perfectly to maintain a healthy landscape and appropriate husbandry.

The multiple use of such a system includes various agricultural practices like horticulture, orchards, livestock management and cropland production supplemented with a variety of other activities related to land use, conventionally not qualified as part of modern agriculture. Such activities include fisheries, forest management, industrial crops like hemp or reed, hunting, apiculture, alternative transportation means (rafting), energy generation facilities (water mills) and direct water use for drinking, washing, watering, cooking, other domestic water needs, and so on. Needless to say, such a complex land use system would strive to self sufficiency as much as possible at least in terms of functions which can be met by local resources.

6.1. The solution: landscape management in the floodplain

The very first condition to be met before any large scale ILD works can be commenced is the assessment of the current Tisza valley from a geomorphologic point of view in order to determine those areas which can be flooded when taking the natural movement of water into consideration. As a key design principle, it is always the first priority to help nature to do its job for the benefit of humans and not trying to do something which is against the natural processes. How you can do this, is the second condition: a practical toolkit, a number of methods and concepts need to be developed for testing along the river at various locations. As the historical examples demonstrated – see Chapter 3 – and as was seen from the overview of the functional landscape features, these tools and methods may differ from location to location as the local conditions do differ. Here again, the approach of vertical design methods and vertical cooperation techniques described in Chapter 5.2.4.1 is justified.

The first condition can be best accomplished with the help of modelling and computer aided simulation techniques, while the second is provided by a landscape management methodology which consists of very radical design principles and implementation practices.

6.1.1. Modelling

The most comprehensive modelling work completed so far has been made by a team of experts on the Water Utilities and Environmental Engineering Department of the Budapest Technical University (BME) led by a professor László Koncsos. The material compiled from the results of the model simulation with the title '*Flood control and regulation of the river Tisza in the Carpathian basin*' was published by the Hungarian Association of Nature Conservationists in 2006. The whole programme was funded by the Regional Environmental Centre's (REC, Szentendre, Hungary) Danube Aid Programme which in turn is a part of the UNDP/GEF Danube Regional Project (Koncsos 2006).

The work provided a comprehensive analysis of the problem. In the first part a database was compiled based on remote sensing and areal information with subsystems such as ecological and nature conservation subsystem, hydrometeorological and hydrological subsystem, soil, land use, morphological and design subsystem, which in turn were unified in an integrated database. Next, design scenarios for hydrometeorological alterations were assessed with special attention paid to expected local impacts of the global climate change in the Carpathian basin.

The data obtained from the database were used to set up various models for the hydrological catchment area, including the precipitation runoff model, the hydrodynamic model of water flows in the river bed, and a two-dimensional hydrodynamic model of areal inundation (flooding).

The model simulations were used to create a flood control decision making support system and to outline a number of flood control options which then were evaluated for feasibility, costs and benefits and following this a simulation hybrid method was developed. Finally, the paper made an attempt to outline a sustainable flood control concept based on the periodical flooding of the deep lying flood plain. The paper stated the following research topics:

Using a detailed research methodology the potential 'environmentally sound' places suitable for inundation were explored in the entire Tisza valley – not including the tributaries. Both the left and the right bank of the Tisza were systematically surveyed for morphologically feasible sites. A total of 19 such deep flood plains – polders – were identified the inundation of which could result in significant reduction of the water level. Only deep flood plains with a retention capacity of at least 50 million m^3 were considered, while the storage capacity of the largest area measured exceeded 200 million m^3. Total storage capacity of the deep polders assessed exceeds 2 billion m^3. The water level reduction impact of the retention in the deep lying areas was calculated for historical flood incidents with the use of a 1D hydrodynamic model based on the Saint-Venant equation. Designing flooding of deep lying flood plain areas is not a simple job. Quantitative and temporal conditions of water replenishment, the impact of local water steering canal system, the alternatives of water steering must all be investigated (Koncsos 2006).

The paper arrived to the following conclusions:

Refurbishment of the current flood control system is necessary for economic reasons and making resources available to investment projects is a rational decision to be made. In fact, the costs of the current system – including the disaster relief operations in times of floods – far exceed the value of the assets which might by protected by them.

Considering the siltation of the floodway and impacts arising from the global climate change, if the system of levees was only to be built up to the height of the design flood level (DFL+0), significant costs would be incurred during their lifetime because of the necessary flood control activities even if no extra investment is made. This exceeds the lowest cost flood control systems' entire lifetime costs including investment, maintenance and operation.

It was clear from the model scenarios that current methods – that is, increasing the height of the crest for all the embankments along the Tisza and tributaries is not a tenable solution any more because in spite of the very expensive works the damage caused by the floods is still so high which does not justify the investment from the economic perspective. However, increasing the current levees by another half metre makes sense when accompanied by a full scale alternative solution, either by all the 11 reservoirs envisaged by the original VTT, or by a systematic flood reduction scheme on the deep lying flood plain areas. The former is very expensive but provides substantial damage prevention, while the second does not entail any high cost investment works, whilst the damages which may be incurred are also negligible.

The findings of the analysis demonstrated that it would be an economically rational decision on behalf of the stakeholders to make deep lying flood plain areas available for the purposes of ebbing the tide, mainly in the form of changing agricultural land use practices in the depressions. Alternative flood control options allow the use of land in the now inactive floodplain, thus providing services to the flood control system – assets and people to be protected. The paper also identifies the lack of a unified land use regime as the main problem of the process which has to be based on a coordinated agreement of all land users (including those operating the various infrastructure installations). An important statement of the analysis is that barriers to reconciliation of interests and to set up a system of internal compensations lies mainly in the culture, as from the shear financial perspective implementation of the changes would result in saving expenditures instead of spending – provided all costs are properly accounted for. Finally, the authors also concluded that if the best solution for the society as a whole is ever to be implemented, it was necessary to clarify the cornerstones of government involvement, to establish a framework for intersectoral coordination and the development of a long term adaptation strategy for the exposed areas which takes into account the various processes of the water regime – in other words, a strategy which adapts human operations to the processes identified in the environment.

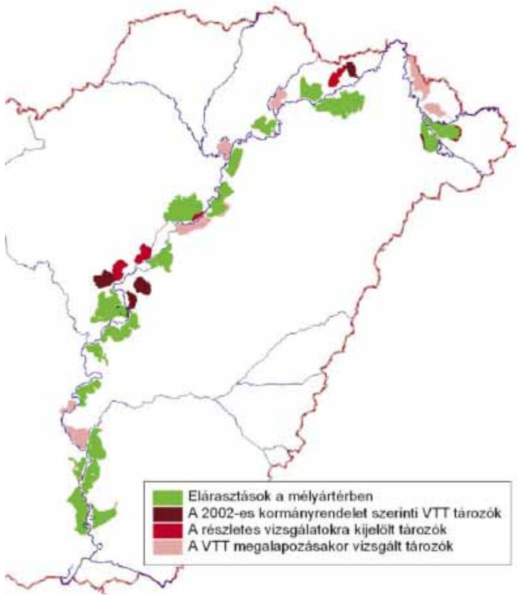


Figure 27: Alternative options for water retention
Legend: flooding of the deep flood plain (green), VTT reservoirs provided for by the 2002 Government Decree (dark brown), reservoirs assigned for detailed assessment studies (red) and potential reservoir sites surveyed at the time the VTT was drafted (pink)

It can be seen that the size of the area shown by the model as potential candidate for flood control is several times larger than the area of the reservoirs finally approved for construction. It is to be noted that flooding in the deep flood plain does not entail any major construction works, yet only for the areas included in the study a retention potential (2 bin m^3) twice as much as envisaged for the entire current VTT plan (1 bin m^3) can be foreseen. Furthermore, the study considered only the Hungarian reach of the Tisza, without the tributaries and without additional measures in the catchment area of the watershed. Since the study was completed and the paper published in 2006, the flash floods caused by torrent rains in Spring and early Summer in both Slovakia and Hungary had proven that the catchment area and the tributary are just as important factors in the integrated river basin management efforts as the main river itself. Without intensive and effective international cooperation efforts the complex basin management plans can not be properly implemented.

6.1.2. The methodology of floodplain landscape management

At this point merely a strategic methodology can be suggested for any approaches which may want to implement a sustainable landscape management strategy. Such a methodology shall build on the lessons learnt from traditional floodplain husbandry just as much as on modern scientific achievement of water and land management, data collection and processing, remote sensing, GIS, topographic surveys and precisions earthworks. It consists of the following elements:

1. Carefully controlled water discharge onto the riverine floodplain
2. The key feature for water discharge is the primary notch (‘fok’) and a set of secondary notches which allow communication with the floodplain lying behind the levees bordering the river banks. In this respect, it is irrelevant whether they are human made

or natural formations as long as they contribute to the even and reversible distribution of excess river water on the lowland.

3. A necessarily human made structure is the lock at the mouth of the notch, the key to regulate water levels on the plain as a function of time, water volumes and discharge as well as drainage operations.
4. A key component is careful design with due observance of natural contour lines in order to allow for both discharge and return gravitationally, thus avoiding the need for external energy use. In fact, water would rise on the plains in parallel with the main river bed as long as the locks are open.
5. Careful design also includes a gradual rising bottom of the notch and the brooklets so that water would not spill over the natural levees, much rather pour along the bed of notches and fill up the floodplain from below like a bowl
6. Well thought over design also allows manipulation of areal inundation by actuating the lock at the main outlet site on one hand and by raising low embankments along the channels and brooklets on the other, to be used to govern water
7. Geographic locations need to be defined for water uses of different purposes. Wherever land is to be put to productive use, water should move all the time: towards the distant edge of the meander belt while rising and towards the main bed when being drained. On the other hand, where stagnant water bodies are intended to be formed, water is to be retained for further use such as fish ponds, reservoir for irrigation or recreation. In such locations the ecological equilibrium of the aquatic system is to be preserved until the next inundation/replenishment.
8. Internal locks on brooklets and secondary notches can be used for water management within the plains to assist infiltration where water is needed or drying out where ploughing is intended to be done. Such manipulations can influence the water regime of really huge areas beneficially when done properly. Excess water is drained back to the main bed when the water level in the mean stage river bed dropped to a lower relative elevation than that on the plains.
9. Water governance can be achieved by locks as well as bottom sills at strategic points of the water transportation network. Locks are more expensive but can be used to proactively retain the water on either side, wherever it happens to be higher, while bottom sills lead water gravitationally when it reaches their design height.
10. Water thus can be managed wisely without forced hydromorphological alterations made in the riverine system. It has to be noted that such a management practice easily complies with the ICPDR objective of creating an integrated function of the riverine systems to ensure the development of self-sustaining aquatic populations, flood protection and reduction of pollution in the TRB. It is not simply a reconnection of the floodplains but a method preserving the original functions of the landscape to a great extent.

6.1.3. Design principles

The strategy requires a serious ‘paradigm shift’ in current water and landscape management principles and practices. It has to be acknowledged that:

- flood is not a risk to get rid of, it is rather an opportunity to take advantage of
- the Tisza valley as a whole has no ‘excess water’. On the contrary, it is a naturally arid landscape where missing water was supplemented under pristine conditions by periodic floods of its river.

- if you want to design a landscape management strategy which is sustainable on the long term and is able to provide high quality of human life it is necessary to design *with* nature and *not against*; therefore, you have to understand the landscape properly;
- the proper ground for design is to take the natural differences in elevations into consideration and to do your planning with the contours and various levels of the terrain according to the land relief; land use and hence, the water supply of the land should be adjusted to the relief and not the other way round;
- the flood control reservoir concept of the New Vásárhelyi Plan is very much in line with the strategy discussed here and the reservoir sites can be easily adapted to accommodate controlled discharge of the river. This would meet flood control, ecological and economic considerations alike. However, the implemented reservoirs so far do not meet the conditions for ILD as discussed in Chapter 6.2.2 on the example of the newly opened Tiszaroff reservoir.

Pending on the local conditions and morphology, inundation of the flooded areas in the floodplain can either be natural or managed by human interventions.

- <u>Natural flooding</u> means a system where water is only led by the native depressions and brooklets of the landscape formed by the dynamics of the river and its floodplain.
- <u>Assisted flooding:</u> water movements can be governed by bottom sills at the strategically important locations and some man made infrastructure needs to be protected by dykes.
- <u>Artificial water steering</u>: in situations where flooding is restricted, water is led between low levees along wide channels (currently deeply dredged excess water drainage structures which need to be reversed in a sustainable land development process) and flooding of the surrounded areas is controlled by side locks.

In a sustainable and functional landscape management and development system the water management system ensures replenishment of water bodies in the land and – in times of need – careful drainage of excess inland water and waterlogged fields. It should be set up as a complex whole of natural beds, bottoms and depressions, combined with man made system components – existing channels and road networks – as well as freshly built structures constructed for the purpose of water governance.

A key component is the outlet or discharge structure at the main flood control line, i.e. the lock closing the notch cutting through the embankments along the main river bed. Existing excess inland water drainage channel networks can be used but their slope has to be reversed so that they could transport water surplus as far inland as possible. Also, deeper lying areas currently used as excess water reservoirs can be converted into permanent ponds for a variety of use. An additional possibility would be to take advantage of natural depressions currently ploughed over. These land formations offer themselves readily for water retention purposes.

6.1.4. Functional landscape management

6.1.4.1. Method and possibility for flooding

Flooding of the plains can be started by opening the main lock at the flood control line when water levels in the main river bed reached the desirable height, i.e. the elevation of the lock bottom. The natural hydrostatic pressure of the rising tide would drive water from the river through the freshly established notches to the former excess water drainage canals. While the primary locks along the system's main branches are open to assist flooding, secondary or side locks can be manipulated in accordance with the water needs of the surrounding areas. As soon as water penetrated up to the farthermost point of the system and the landscape, the main lock and the primary locks in the canals are closed. This way no overspill will occur and upon subsiding water levels in the main river bed the water discharged onto the plains could be retained as applicable and necessary. In short, the following steps are to be followed:

- open main lock gate and primary locks
- let water penetrate as far as possible
- close main gate and primary locks
- manipulate side locks as appropriate

The possibility of gravitational reverse flooding – that is, inundation of an area started from relatively lower elevations along the river course and filling the floodplain upwards – will be given along the mid-Tisza reach once mean-stage highs occur, which is quite frequently. For the purposes of design the historical water flow patterns need to be consulted and the bottom sill of the main lock gate established at a level which allows to take advantage of relatively low water stages. Penetration and infiltration rates need to be taken into account so that the amount of water discharged accounted for such an extra need. In this manner, replenishment of soil moisture and groundwater tables can be secured. Historical figures will also provide an insight into the temporal patterns of flooding possibilities which in turn would help agricultural production planning.

6.1.4.2. Drainage of the plain

Upon retreating water levels in the mean stage river bed the main gate lock has to be opened as soon as possible to drain water from the main canals where it stands above the level of the surrounding terrain. Any other locks need to be opened afterwards where water is intended to be drained. For most purposes, a couple of weeks of inundation at a time is the maximum length of time which can be tolerated by the vegetation, land and field crops without damages or deformation.

Draining is theoretically possible up to the level of the bottom sill at the main gate lock, but it is advisable to retain some more water in the land for the purposes of infiltration and to make up for losses through evaporation. At the same time, this level ought to be low enough to allow for drainage of the fields. If the system is properly designed, drainage is possible gravitationally, without the need for any pumping. Again, consulting historical figures of pulse floods may help. You have to judge the length of the high water stand in the main bed so that the time between opening the locks and subsidence of the flood in the main bed below the bottom sill be not longer than the anticipated submergence tolerance period of the land. Also, some conditions are to be met for gravitational drainage:

- a fine structure of micro canals and micro depressions on the fields and the land under water cover needs to be developed so that upon retreat the water could be collected in them like the veins of the body to the side locks
- the bottom sill of these side locks must be lower than the lowest point of the field which is to be drained naturally
- yet, the bottom sill of the side locks must be above the bottom of the main lock gate.

The dynamic system of the aforementioned 'fok management' based flood control solution compared to the conventional dykes and levees is illustrated on the following series of figures.

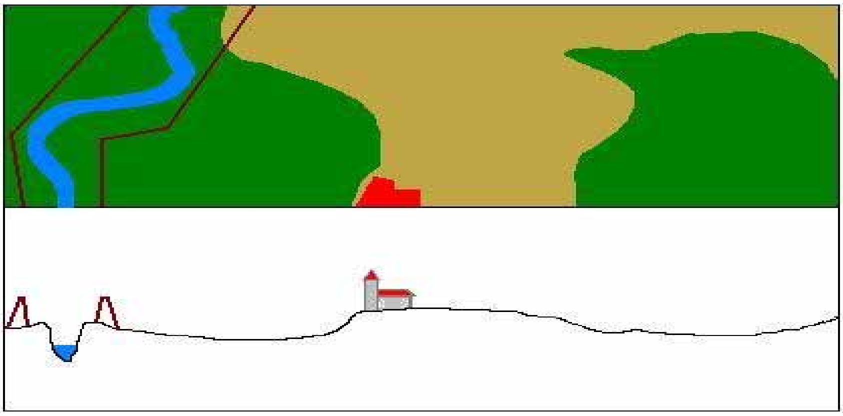


Figure 28:Trained river on the flood plains at low water stage

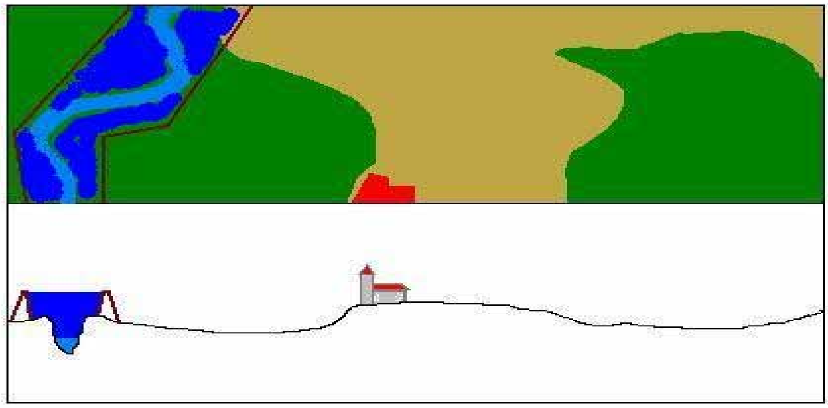


Figure 29: Trained river in the flood plains at high water stage

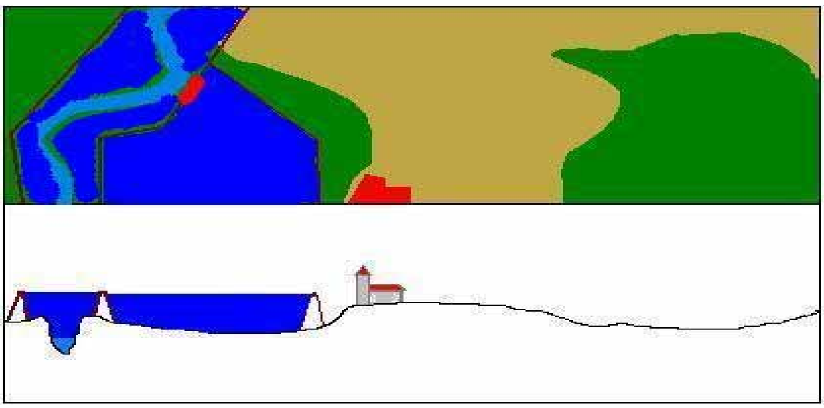


Figure 30: The theoretical concept of the VTT based on detention reservoirs to be used at high floods

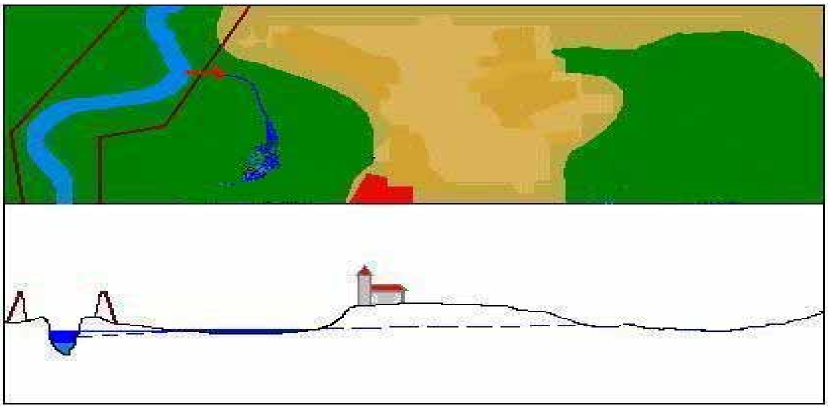


Figure 31: The theoretical concept of ILD: controlled discharge of water starts at mean water level from the mean-stage river bed

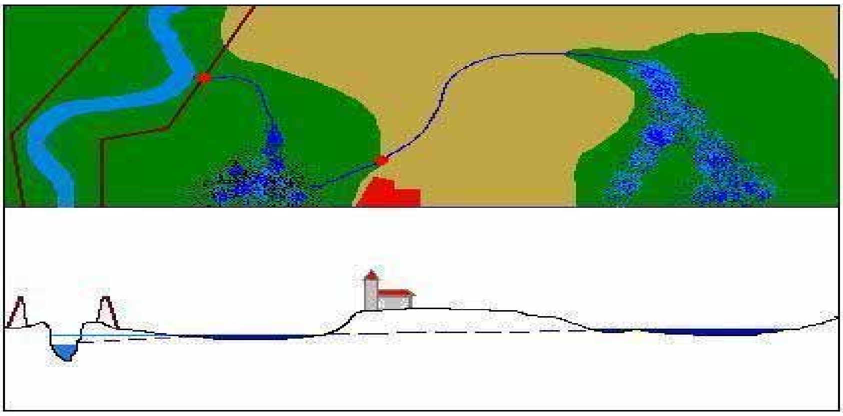


Figure 32: The theoretical concept of ILD 2
Controlled discharge of water allows filling up of large areas in the deep flood plain and low flood plain before water level in the main river bed and the floodway could rise to high to threaten the surrounding settlements. It can be seen from the cross section view that water levels never rise too high and therefore the damage they can make is negligible

6.1.4.3. Water balance in a landscape

The balance of the water regime in a landscape along the Tisza valley is determined by climatic factors and by the connections of the landscape with the river. Rainfall range, average rainfall (precipitation) levels, water level decline, climatic water scarcity (differential between natural precipitation and loss through evapotranspiration) as well as the missing water volumes for any design area should be determined. The water balance is also influenced by temporary excess inland water which in the new concept can be either used for making up to the flooding operation or to be led back to the main bed gravitationally when experienced in times of water surplus. Infiltration and water extraction for irrigation also add up to the total balance. The system would also capitalise on semi-natural wetland ponds which will function as natural buffers for seasonal water level fluctuations providing appropriate habitats for aquatic life.

6.1.4.4. Water quality

The quality of river water is a sensitive component of a landscape management strategy. In case of a surface water pollution incident the main gate lock needs to be open as long as possible before the migrating contamination plume arrives, then closed off to prevent polluted water from entering the landscape. It is to be noted however that such risks apply mainly to inorganic pollutants such as heavy metals or toxic synthetic organic substances, because nutrients and other contamination such as nitrogen or phosphorus can be easily handled by a diverse wetland community in the floodplain. Therefore, it has to be achieved that no heavy contamination could make its way to the river and hence, to the landscape of the lowland plains.

6.1.4.5. Infrastructure

Fixed line installations such as gas pipelines and electric transmission lines are not necessarily a problem. Since water cover is only temporary, most of these utilities such as the pylons of high voltage transmission lines and the control accessories of underground pipeline systems can be relatively easily protected. It is more of a question of flexible legal provisions and approach then finances. Current legislation deny the possibility for instance to flood the concrete foundations of large transmission pylons which carry high voltage electricity lines. It is easy to see that such provisions can not be complied with in times of high floods, when the pylons which run in the floodway are flooded anyway. Yet, no disaster happened for instance in June 2010 when such a situation occurred in the Nagykörü region. It seems to be quite clear that sometimes short sighted and rigid legislation create the greatest impediments to a different approach.

Figure 33: Electric transmission pylon under water (Photo by Péter Balogh)

A somewhat different problem is represented by railways and roads which function as man made embankments for most part. Careful survey, assessment and impartial, flexible multifunctional design is needed to overcome these problems. The regional infrastructure in the Tisza valley has to be refurbished anyway. It is an upfront cost which is predictable and does not entail unexpected contingency expenditures on flood control and flood relief operations. If infrastructure projects are carried out with a view to the new land development objectives, damage to structures in the future can be minimised and hence, high maintenance and restoration costs avoided. For this to happen, components like roads, public utilities and other piping or wired installations must be routed with due observance of flooded areas, preferably using their structural elements (for instance the banks and slopes of paved roads) in a double function to water steering purposes.

Traditional settlement patterns usually follow the high banks of polders. Unfortunately however, more recent development produced encroachment on lower lying areas where houses and other infrastructure are exposed to enhanced level of risks and hazard. In the riparian city of Szentes for instance the demographic pressure caused inhabitants to leave the historical core of the city and to build houses on lower lying areas which were chronically prone to floods and waterlogging (Filep 2009). For a large scale implementation of ILD careful consideration must be given to the relocation, replacement of certain infrastructure elements or, alternatively, the options of flood control measures – which in the case of a systematic and slow flooding process do not need to be too extensive – have to be assessed such as an encircling dam or ring dyke around threatened parts of settlements.

6.1.4.6. Land use changes

Current land use patterns in much of the Tisza lowland reflect a basically homogenous structure with large scale farming plots cultivated in monoculture cropping methods intended to produce grain, corn, alfalfa and other cash crops. Biological diversity in the area is very low and local ecosystems are infested with invasive exotic species such as desert false indigo (*Amorpha fruticosa*). A key element for the success of the ILD will be the implementation of dramatic changes in land use.

With the introduction of a floodplain husbandry scheme, more mosaic like and harmonic landscape would emerge, highlighting the original morphological diversity of the terrain. The various land uses will depend mainly on the relative height of the individual areas. Such relative levels include the following:

Relative height	Water cover	Land utilisation scheme
flood free area	definitely free	settlements, autumn grain, forest
high flood plain	seldom, short term	orchards, gardens, cropland, forest, grazing
low flood plain	regularly, seasonal	meadow, pasture, forest, grazing land
deep flood plain	permanent (with water refreshment)	fisheries, reed, other aquatic species, birds

For the purposes of land use changes, primarily not the cultivation method, much rather the landscape type should be used as a guiding principle. Possibilities are as follows:

Type	Pond	Reeds	Grass	Cropland	Orchards
flood free area	–	–	X	XXX	XX

high flood plain	–	X	XX	XX	XXX
low flood plain	XX	XX	XX	X	–
deep flood plain	XXX	–	–	–	–

Land use patterns and the necessary changes are determined by the following correlations:

1. Potential water steering systems are specified by the natural network of lower lying regions.
2. Potential land use types are determined by the relative height of the fields in question.
3. The water steering system is to be divided up into sub units which have to be operated in a uniform and integrated manner.
4. The sub units include all fields and land parcels affected by them which all have to be managed in accordance with the selected water management type.
5. For practical purposes, both water and land management can be more conveniently implemented when existing current parcels are split to accommodate the changes and cultivation methods changed according to the new needs.

6.1.4.7. Finances

The financial feasibility of the new concept is established by the adaptation of the funding schemes both nationally and at the EU level. Agricultural aid structures are refurbished by the EU anyway, and the new system can take advantage of the rural development pillar of the agricultural system as follows:

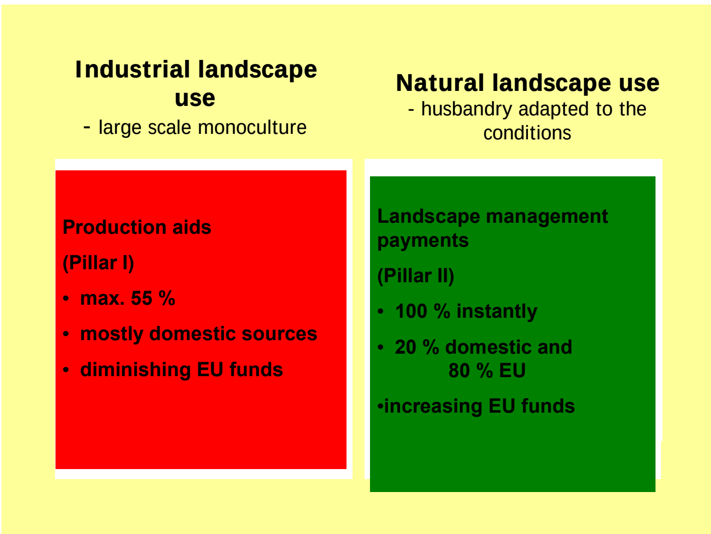


Figure 34: Financial opportunities of ILD

6.1.4.8. Expected results

- The burden on Nature would be diminished – as a minimum, the imminent ecological disaster is mitigated at the local level. Long term sustenance of living conditions can be achieved.
- Beside the reduced loads the income generating capacity of the very same landscape will be enhanced due to the new and state-of-the-art husbandry methods, consequently the country stops to be a burden on the government budget.

- Since the accession to the European Union the land farmed as ploughland had to be diminished. This necessity can be turned into a benefit when low value, waterlogged areas are given back to Nature.
- Unprofitable agricultural production structure based on grains and meat production, which is restricted by EU quotas could be replaced by high quality and labour intensive Hungarian specialities and organic production.
- Self-sustaining and subsistence generating capacity of the country could be increased. Higher levels of job offers could ensure local livelihood for the population. Due to the nature of the new possibilities members of the Gypsy population might also find ways of living better suited to their special needs.
- The hazard and risk of excess surface water (inland water) would be eliminated as waterlogged areas could be better utilised as wetland habitats. (Simultaneous ecological and economic usefulness.)
- In the event the concept is used to its full extent, flood risks would be reduced as the controlled discharge of higher tides could reduce the height of the water level.
- The serious water scarcity of the vegetation period could be off set by the retention of the high waters, which also appear mostly during the vegetation period – as it happened under natural conditions.
- Ecological destruction potential of pollution incidents carried by the river bed could be reduced by shutting the flood-plain off.
- Conditions for the former legendary fisheries in the Tisza river system can be restored.
- Such a land use pattern also represents the reclamation of the functional landscape. Substantial increase in the size of semi-natural habitats would position the Tisza region as an example of European importance. Such a mosaic like natural landscape may also provide ample opportunities to boost landscape and agro- and village tourism (based on Balogh 2002).

Ecosystem services

Benefits of a complex land development system are manifold, yet a number of factors can be listed as imminent and essential services which are provided by a revitalised ecosystem and rehabilitated landscape:

- deflation (wind erosion) and water erosion caused by current inappropriate land use methods are mitigated by permanent vegetation cover;
- nutrient leaching out of the soil also for the same reasons are replenished by seasonal inundation and sediment deposits;
- constant danger arising from exposure to high level floods is instantly and permanently diminished by lower levels of inundations;
- enhanced biodiversity provides a lot of additional and indirect services even to the very same crop-oriented agroecosystem: for instance, birds contribute to pest control and bees and other pollinators help pollinate crops;
- clean-up services of wetlands can not be underestimated. It has been repeatedly demonstrated that aquatic communities have strong self-purification capacities and the biodegradation of sediments deposited mitigates adverse environmental contamination loads of the system.

In a complex approach like this society's need for security could be met in all important aspects, as seen on the figure below. In addition to mitigated flood risks, people could find a proper and decent livelihood within their respective bioregion and in the process even the ecological security of that region could be secured.

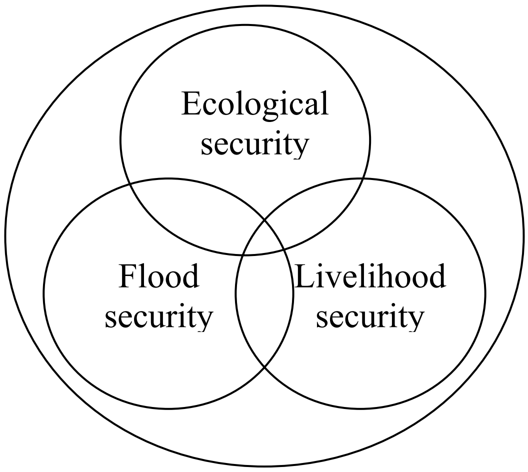


Figure 35: Security considerations: floods, ecology, livelihood (adapted from Péter Balogh)

6.1.5. Nagykörű polder

The Nagykörű Reservoir area

Below, a sample site is shown which – not at all incidentally – coincides with the proposed (but later on cancelled) Nagykörű Reservoir area. With the application of an integrated land development strategy the reservoir could be managed in a more sophisticated manner using the structures described above. The community of Nagykörű is built on the highest bank in the polder, thus minimising flood risk in a natural state where floods are lower and spread over and around the settlement.

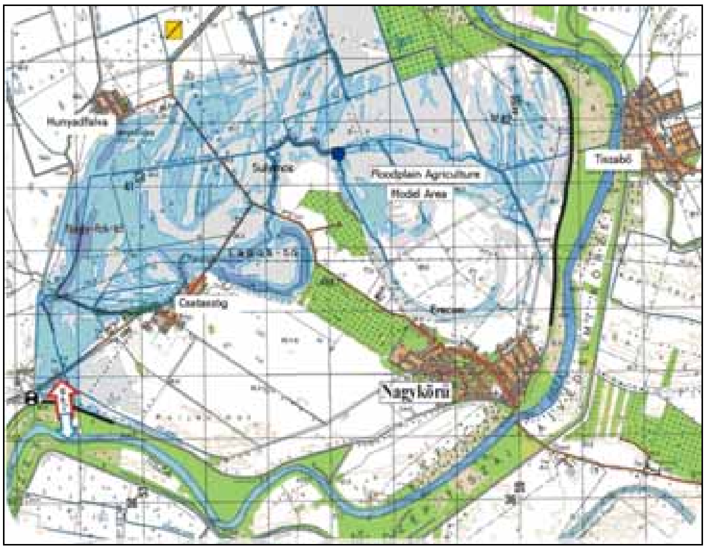


Figure 36: The Nagykörű polder and its proposed use under the ILD project

In the series of figures below, the process of an ILD based flood control and water management solution is illustrated on the example of the Nagykörű polder. Phase 0 shows the contour map of the polder without human made infrastructure. This is the functional landscape where former meandering river beds, scroll bars, depressions, brooklets can still be clearly seen. Two of the former bends are easily distinguished on the right hand side in green and in dark blue colour, while the current trained river is depicted in light blue.

Phase 1 demonstrates the first stage of inundation when the freshly cleared notch (red dot indicating the sluice on the fok) is opened and rising water fills up the landscape through the carefully constructed canal system which duly follows the lines of former temporary water courses. Historical names still indicate the role and function of certain parts of the now agricultural land: Nagy-fok tó means the lake behind the great notch, which was used to fill up the polder and Sulymos tó is the reminiscence of another permanent water body meaning Water Chestnut Lake.

Phase 2 – through a number of intermediate steps – shows the system in full scale when the third major water retention ‘structure’, Lapos tó (Flat Lake) on the deep floodplain part is also filled and the low floodplain areas – ‘lapos’, meaning shallow depressions in the land – are inundated with the excess water to irrigate meadows, gallery forests, pasture forests and other water resistant land use forms and to replenish groundwater tables for better coping with the subsequent dry summer season. Light yellow and darker brownish shades indicate high banks where orchards and ploughland can be retained and settlements built.

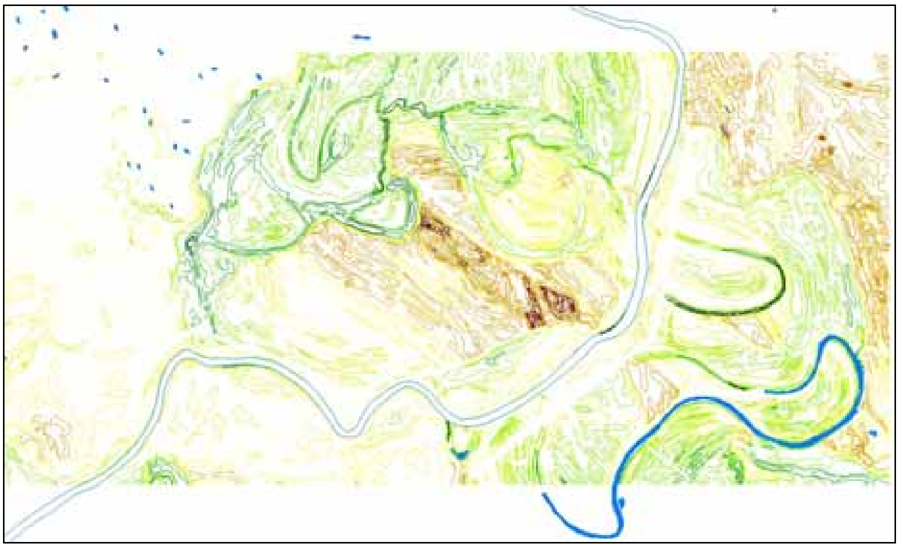


Figure 37: ILD in action Phase 0

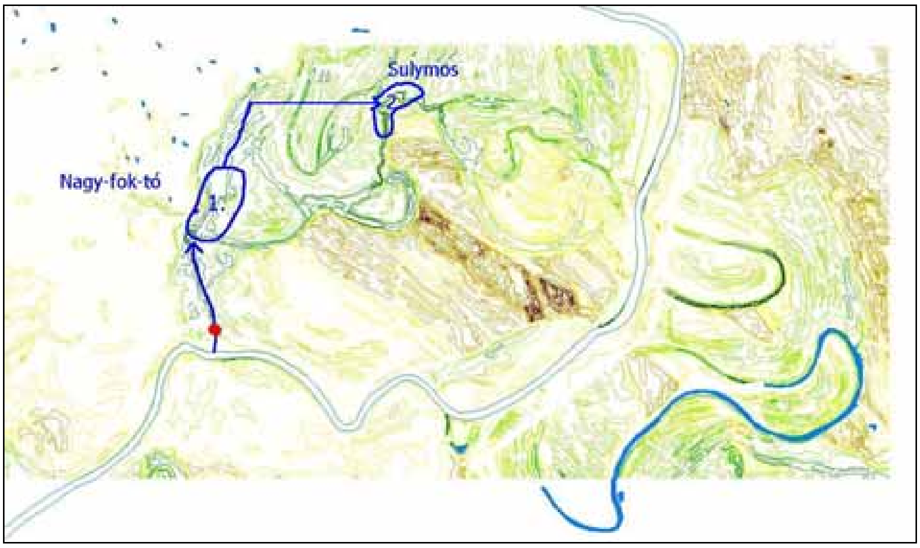


Figure 38: ILD in action Phase 1

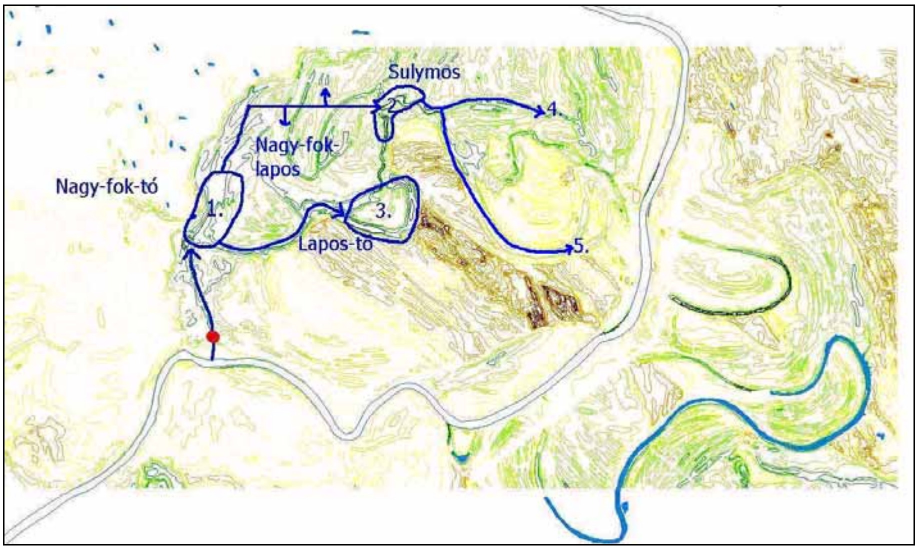


Figure 39: ILD in action Phase 2

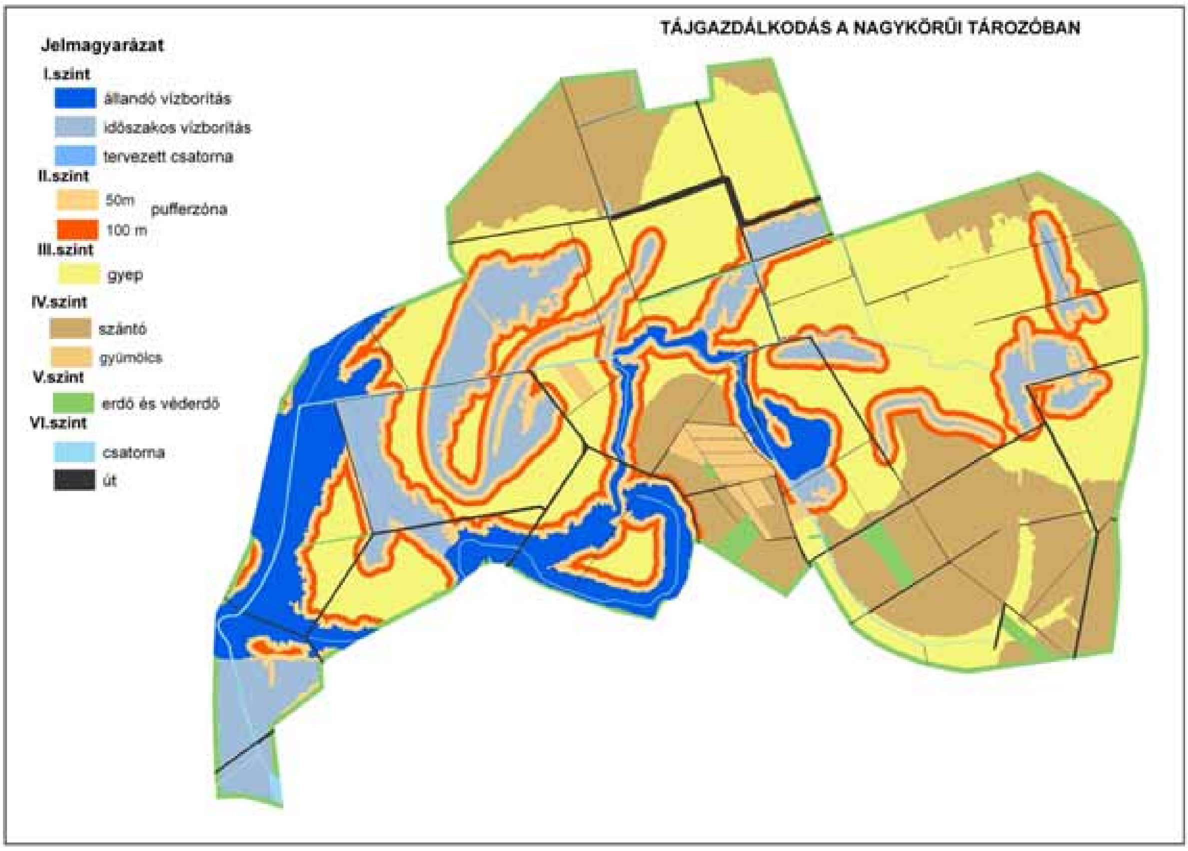


Figure 40: Landscape management in the Nagykörű reservoir

Legend: Level I (permanent water cover: deep blue, temporary water cover: greyish blue, proposed canal: lighter blue), Level II: Buffer zones (50 metres and 100 metres, respectively), Level III: grassland (yellow), Level IV: ploughland (darker brown) orchard (lighter brown) Level V: forest and protective forest, Level VI: canal (light blue), road (black)

6.2. Case studies

As it has been discussed extensively in this manual, the practical implementation of the integrated land development and management approach is not an easy job for a variety of reasons. Nevertheless, the project is geared up to make a serious attempt to overcome the barriers and take advantage of the opportunities identified. That is, to make ILD water management and land use changes reality for at least some pilot demonstration sites. Below, these attempts are outlined for the demonstration sites in Hungary, Serbia and Romania. Please note, that none of the pilot projects are finished at the time of writing (September 2010) and therefore no final conclusions can be drawn at this stage. Lessons learnt from the attempts of practical implementation will be discussed more in details in the final report of the ILD project. On the other hand, there are some other examples – both good and bad – of alternative water management efforts along the Tisza. Three of them are presented here, one of them reflects the current official central approach, the other two are beautiful examples of the existing possibilities – driven by both some water engineers and nature conservation officials.

6.2.1. ILD in Nagykörű

The Lead Partner, Szövet is based in Nagykörü, a relatively small community in the seemingly dangerous hug of the river Tisza in the middle reach of the Hungarian Tisza section.

The area centred round Nagykörű is
- a flat land with the typical morphological features of the Great Plain: former river beds, tills, high banks, with differences less then 10 metres
- water could arrive from the Tisza into the closed floodplain sub-basins and sub-catchments and would be returned to the Tisza – with the help of the rediscovered fok/'notch'-system
- 90 % of the area is now under crop, fully drained but prone to excess surface water with parcels of potential wetland, while the forested active floodplain is full of invasive species
- the riverbed is canalized but not dammed yet, with natural(-like) processes (both hydrological and morphological)
- industrialized agriculture and society, open market economy
- typical middle section of the catchment

6.2.1.1. Pilot demonstration sites

If you are to achieve any changes or shift in the approaches and attitudes of political decision makers, first you have to assess the problems and barriers and demonstrate that it was possible to solve them on the local level in the form of a pilot project and that the concept was viable and feasible. ILD intends to provide a solution to this.

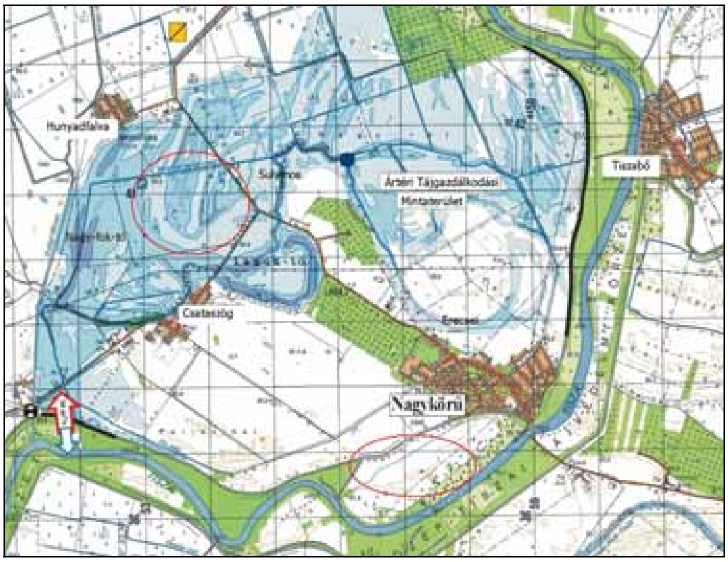


Figure 41: Situation of the pilot sites in the active and inactive floodplain within the Nagykörű polder

6.2.1.1.1. Demonstration site in the floodway

The project aimed at two kinds of demonstration sites, one within the floodway, that is on the active floodplain, and one outside the levees on the 'protected side', on the inactive floodway. The site in the active floodplain was an area formerly known as Lake Anyita (the name speaks for itself) and the surrounding fields known as Tóalja (currently agricultural land). The number of parcels coloured on the aerial photograph below show the proposed demonstration site. Current type of cultivation for all the plots is officially ploughland. In reality however, most plots are farmed as wooded pastures. There is only one farmer (marked light blue) who stubbornly puts his land to till each year. The point in this case would be land consolidation and a request from the owner to the land registry concerning the change of the land use type. Unfortunately, the farmer in the middle refused to swap his land with another parcel on the protected side and insisted on ploughing. (Agricultural aids available for ploughland are much higher than those to be granted for pastureland.) Since the area is covered by Natura 2000, the nature conservation authority has to endorse it first.

The concept was somewhat supported by nature itself, as during the Summer 1999 flood the so called summer dyke protecting the area from the lesser floods was burst and the land inundated. Summer dykes are structures built in the floodway close to the low and middle stage river bed to control lesser floods from entering the high stage river bed, that is the surface between the two primary levees constituting the floodway proper. In fact, in most cases the floodway is put to plough just as intensively as any other areas in the river valley and hence the need for the summer dykes. However, the new water management concept – supported by the administration – does not intend to retain summer dykes in order to increase the flood absorption capacity of the floodway and in this case the intention met with the endorsement of the project and part of the local land users. The ILD project capitalised namely on the outcomes of the former Tisza biodiversity project by putting grey cattle onto these areas to create the wooded pasture and to squeeze out invasive weeds. Therefore, it was a welcomed decision not to restore the burst summer dyke: pastures in an arid land need seasonal inundation, as opposed to cropland.

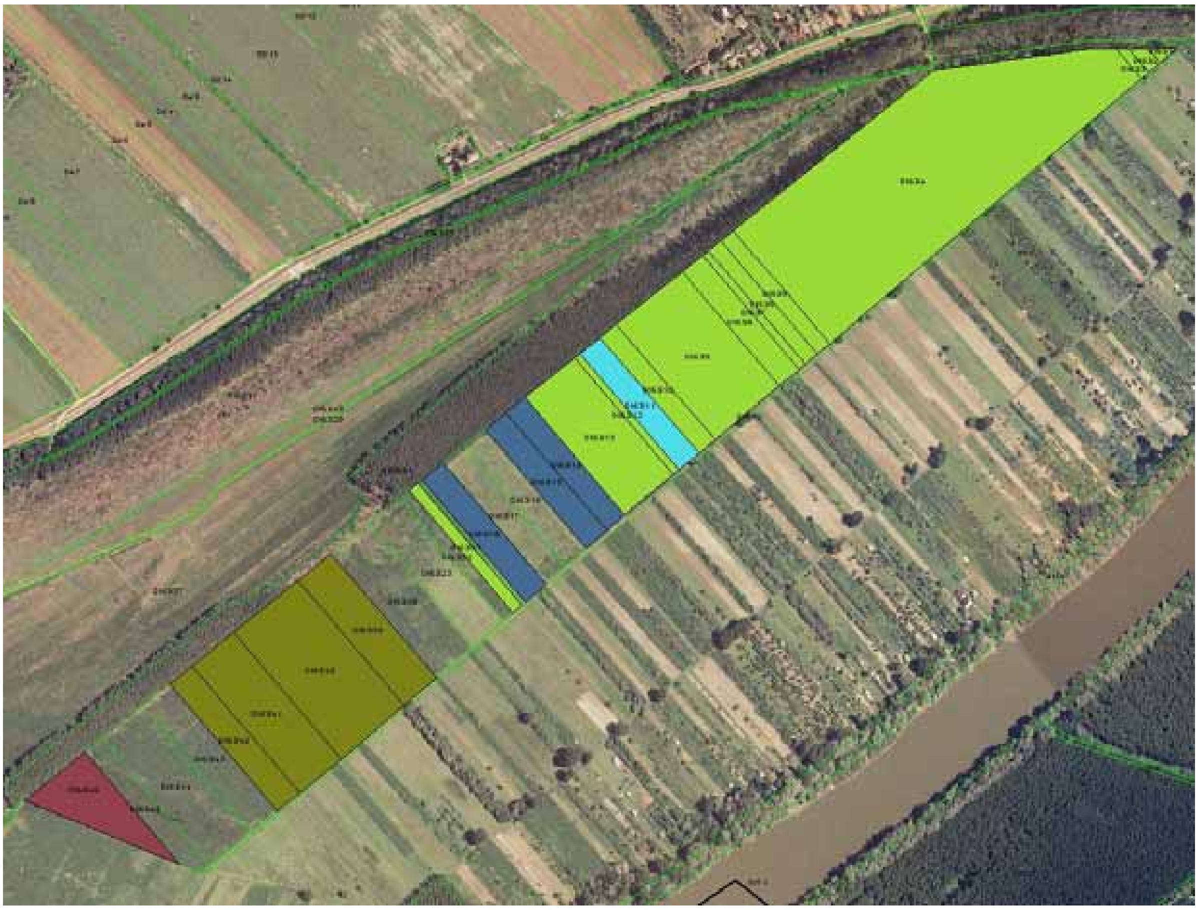


Figure 42: Tóalja, the project's pilot demonstration site on the active floodplain in the floodway

Classification of farmers according to their willingness to participate or cooperate with the ILD project in the example of the Tóalja site

Farmer 'types'	Characteristics	Solution
Rational	- can be convinced by rational arguments	- land swap agreement
	- money dominates	- compensation (single or long term)
		- purchase
Emotional	- emotional drivers behind decisions	- swap land associated with the region (Nagykörű, Tisza-valley)
	- string ties to Nagykörű	- land use change by retaining the original owner
	- strong ties to the Tisza	
Irrational	- faith, strong imprinting	difficult to handle
	- 'it has always been family land'	
	- 'tidy, more appropriate'	

Negotiations with the last farmer – influenced by his mother – proved to be an insurmountable task. The counter argument against land swap was that the exchange land offered was not 'tidy and appropriately cleared'. Cleared land is understood by locals as a barren ploughland. However, being on the floodway, exposed to annual floods, 1-40 cm sediment is deposited on these lands each year, bringing weed seeds. Any ploughland here has to be cleared each year. Desert false indigo is the most aggressive invasive species and farmers mostly struggle against it in vain. Grazing is an excellent habitat management tool because cattle clear the land without any herbicides and after a number of years a typical wooded pasture can be grown on the plot concerned.

According to the current state of the negotiations, some 90 per cent of the project objective will be met by changing the type of cultivation and establishing wooded pastures, except one plot in the middle.

6.2.1.1.2. Selection of the sites and from the sites

The activities carried out at the demonstration site on the protected side (inactive floodplain) of the ILD project in Nagykörű aim at a practical presentation of how tillage of arable land can be adapted to the natural conditions, in other word how you can set up a type of landscape utilisation which is effective in terms of the long term ecological and economic sustainability of the area.

Sustainability in this respect would mean the increase of the water buffer capacity in the landscape, including the mosaic like structure of geological, biological and utilisation diversity in line with the opportunities offered by the landscape. With an increased buffer capacity the landscape will possess higher level of tolerance and its vulnerability to surplus water and water scarcity will be reduced not only for ecological but land use and economic purposes alike. Since the landscape conditions are determined by the morphological features, water cover and hence, the economic function varies with the levels and forms of the relief. The modes of land use discussed in Chapter 6.1.4.6. apply to the Nagykörű area with the following elevations:

Modes of land use

Relative level	Height	Water cover	Type of utilisation
flood free area	85 m	definitely free	settlements, autumn grain, forest, animal shelter during floods
high flood plain	84 m	seldom, short term	orchards, gardens, cropland, forest, grazing
low flood plain	83 m	regularly, seasonal	meadow, pasture, forest, grazing land, fishing on meadows
deep flood plain	lower	permanent (with water refreshment)	fisheries, reed, other aquatic species, birds, water reservoir

The following two figures show the relative position of the demonstration sites within the Nagykörű polder. The axis of the site is a branching off river bed remain in the middle of the flood plain polder, cut into four pieces by the public road and Inland Water Canal No 19. The area features all the characteristic properties of flood plain parts in the protected side, in particular with regard to husbandry methods and ownership relations. Particularly interesting is the fact that the morphologically identical area belongs to the administrative boundaries of four different settlements, and hence, local councils.

The polder has a relative height typical for the low lying floodplain areas with the corresponding natural landscape functions, with former river bed depressions in it in the form of deep lying floodplain areas. The photograph below shows clearly a former river bend in the middle. Yet, the area is put under crop and tilled in its entirety, including the depressions, which are naturally prone to inundation by excess water, interpreted under the present conditions as a natural disaster.

The selection process between the four preliminary sites identified was mainly driven by the ownership structure of each of the sites. Consolidation of arable land and forest parcels even on a relatively small scale like the pilot demonstration site of the project at Nagykörű seems to be a tremendous task. Of the four options identified on the basis of physical geographic properties and infrastructure (relief, existing drainage ditches, settlements, roads, transmission lines and elevations in relation to the current course of the Tisza) none had only one owner or tenant. In fact, a relatively large piece of land within the public administration area of Csataszög community (topographic number 087/6 Csataszög, size of the lot: 196.1148 hectares, in the ILD project Site No 4) has 62 different owners listed in a single parcel, including the Republic of Hungary through its dedicated organisation, the Hungarian National Asset Manager Private Limited Company. On top of all that, the whole parcel is registered as undivided common, i.e. any changes in ownership, land use patterns or types of cultivation can only be carried out in agreement with a quorum of the owners.

Figure 43: The former river bend is still a river bed: excess surface water cover shown on an aerial photograph of the project demonstration sites

Figure 44: Delineation of the four pilot demonstration sites investigated on the inactive floodplain

The difficulty of the task can be imagined from the reaction of an information letter of the project which has been sent to all the 62 lawful owners. First of all, not all of them are still alive, the probate is an extremely lengthy procedure with a number of administrative procedures, while the majority of the natural person proprietors are absentee owners, who have only a vague idea of where their land lies and how does it look like. For the procedure of any consolidation or pooling to be completed, not only the owner, but the current land user – usually a large farmer, a cooperative or a business entity – has to provide his consent. Therefore, even if all the 62 owners could have been convinced of the benefits of ILD, the tenants and leaseholders are still in the position to bar the process.

Of the 62 owners, two expressed their willingness to cooperate and promised to approve of the project's objectives. Two others asked for more information. The rest did not even answer, except for the Head of Office at Hungarian National Asset Manager Private Limited Company. He denied any consent to subdivision of the property and to change its type of cultivation outright on the grounds that the Agency – which has the principal mission to manage land given to its possession on behalf of the state – has concluded an indenture of lease for the area under consideration, the unilateral termination of which was not possible (sic!). In addition, the Agency wished to increase the amount of land managed by it through the life annuity programme, in which disinterested proprietors can offer their piece of land to the state in return of a lifelong annuity payment.

Two other sites were also abandoned due to such administrative reasons. One of them had too many topographical numbers and title deeds to deal with, while the other could have been only managed when a land exchange is effectuated, which was not possible due to the resistance of one of the owners. The following table summarises the pros and cons of the selection process.

Summary table of the four sites assessed

Site No	Location	Current state	Benefits	Barriers
1	Hunyadfalva	• 97 ha, 27 to be flooded • currently ploughland • undivided common with 26 proprietary ratios	• one of the users is willing to cooperate and divide up the area • he intends to put grass on higher parts to graze goats • large area could be flooded • predictable, long term increase in biomass production	• the other user tills the deeper parts • land consolidation • ILD project only as an advisor
2	Kőtelek	• 75 ha, 9 ha to be flooded • currently ploughland	• excellent river bed formation • with a depression included, relatively large area can be flooded • predictable, long term increase in biomass production	• too many owners • suspended proprietorship • litigation
3	Nagykörű	• 22 ha, 11 to be flooded • currently ploughland and orchard	• least number of owners • clear ownership • known owners • predictable, long term increase in biomass production	• not identified in the selection process
4	Csataszög	• 195 ha, 75 to be flooded • currently ploughland • undivided common with 62 proprietary ratios	• excellent river bed formation • with a depression included, relatively large area can be flooded • a single user, willing to cooperate • ecologically valuable wetland habitat could be created • predictable, long term increase in biomass production	• land consolidation difficulties

Therefore, due to the ownership properties the least marked section of the former river bed system (red circle below) was chosen for implementation, where an approximately 400 metres long and 50 metres wide, 1 metre deep section of the river bed and its riparian areas are the subject of the land use change process (Project Site No 3).

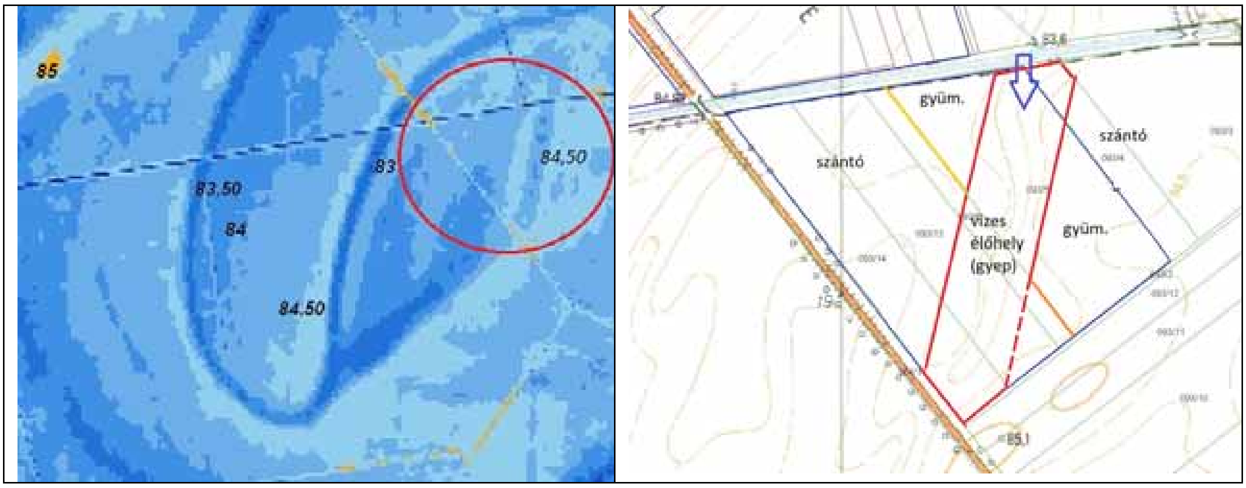


Figure 45: Site No 3 and the proposed new sub-parcel

The section of the depression has a ground area of approximately 2 hectares, but is cut into pieces administratively by five parcels with a total are of approximately 16 hectares, each holding separate topographical numbers. The northern border of the site is formed by Inland Canal No 19 which is now used to drain the pilot site, and can be envisaged as a water supply source for the proposed project (blue arrow). The areal photograph of the site shows the natural conditions with the title deeds overlapping the picture.

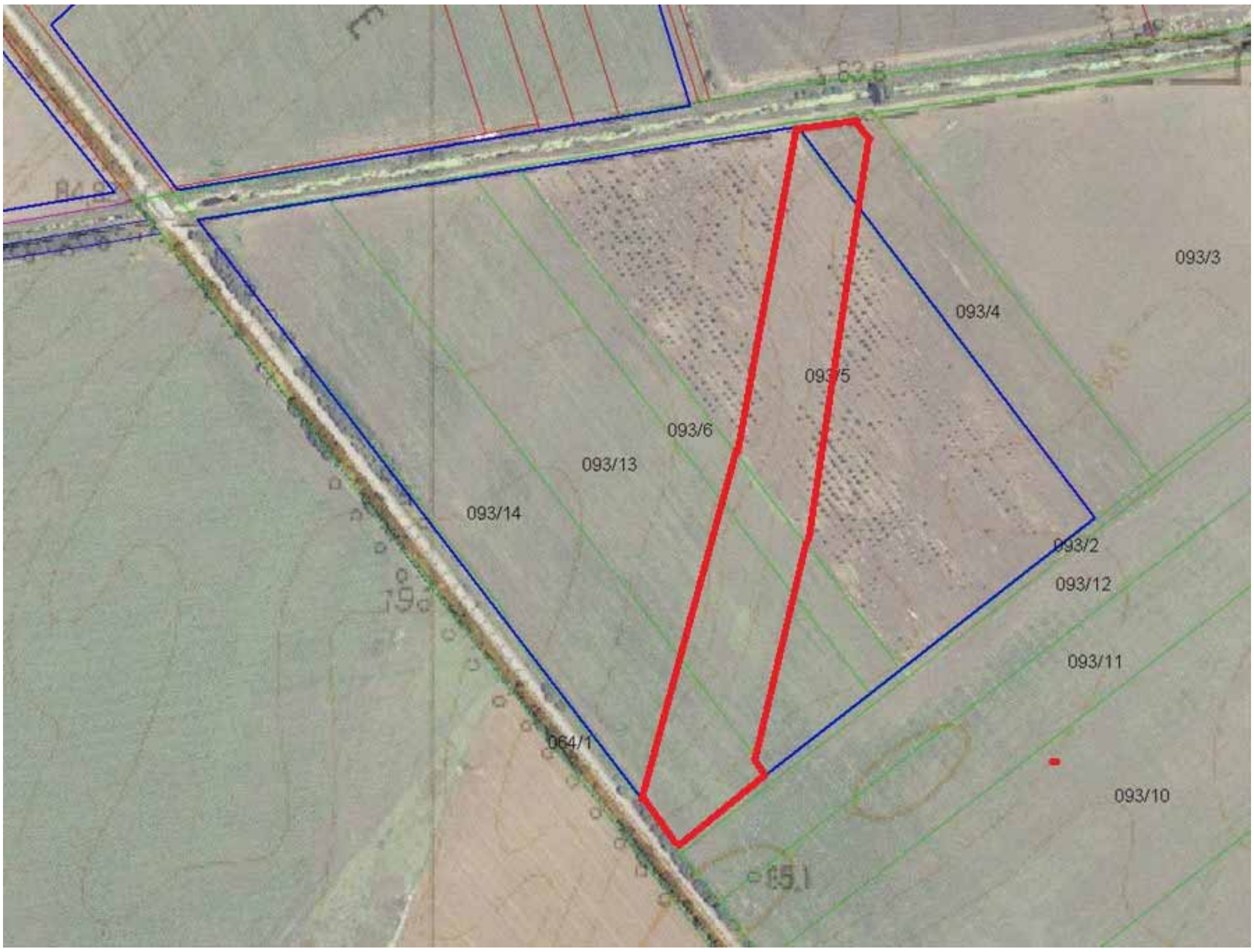


Figure 46: The proposed site with contour map and topographical numbers of title deeds (N-plum orchard)

The main objective of the practical work was to change the subdivisions and sub-parcels of the parcels concerned as well as their respective types of cultivation along the red line to convert ploughland and orchards into another type of land use which allows the application of a semi-naturally operated land management method. First it was seen as grassland, then a gallery forest, finally due to the owners' objections in the last stage (Summer 2010) it is intended to be converted into a fish pond with riparian buffer areas, together a wetland-woodlot habitat which has to be established in compliance with the current legal requirements.

The use of the newly formed site will be two fold: to retain locally generated/collected waters in the area and land use accommodated water cover, and to fill it up from the canal to supplement local water supply. When designing the water supply structure, it should be taken into account that it was more important to operate the sluice gravitationally than to provide water supply any time and under any conditions. Low cost execution and operation, least interference into the landscape and the use of natural materials and solutions are all high priority considerations.

6.2.1.1.3. Steps of flooding in the N plum orchard (Site 3)

Step 1: Description of the area, schematic diagram

The site to be subjected to periodical, seasonal flooding was selected for reasons of convenience: the process of implementation seemed to be most feasible here because ownership structure was relatively simple and all the owners and users known. The map below shows the position of the site (in dark blue) and indicates the topographical registration numbers (in light blue) which all have their registered owner(s) and user(s). It can be seen that even in the simplest case it was four different owners to be dealt with and one of the owners had a leaseholder who used the land. Under Hungarian law starting any kind of procedures (such as changing the type of cultivation, breaking up of undivided common, swap of parcels, etc.) can only be launched by the owner and not the user or any third party.

As the map indicates, surveying and allotment was done in accordance with the most convenient straight lines aligned to the nearby road, entirely disregarding any contours of the relief and the natural drainage system of the surface. Each of the owners had their ideas how to take advantage of the land they got hold of in the compensation process, consequently three strips of the four within the dark blue delineation area are put under plough with various crops, while the fourth strip was planted with plum trees (hence the name) a few years ago.

On site observation easily confirmed the suspected situation: first of all, the plum trees perished in an oblongated shape from the middle of the parcel numbered 093/5 which shape diligently followed the contour of a depression. In the springtime, this part of the area which stretched to the neighbouring ploughland as well was duly under water: snow melt and rainfall could not be infiltrated into the thick clayey soil and had to be artificially drained by the owners/users of the parcel. The photograph taken on 31st March 2010 shows the drainage ditch excavated by the farmer to lead the excess surface water away from the fields to the inland water drainage canal marked light bluish here, just as he was required to do under the current law. At the end of ditch where it joined the canal it was hip high, crossing the dirt road running along the canal. On the other side of the canal, you can still see the rusty old sluices fallen in disrepair which were used earlier on to solve these situations but which were neglected after the political transition of the nineties.

Figure 47: Draining ditch on the N-plum orchard site in Spring 2010

Step 2: Identification of the owners

Using the files of the cognisant land registry office, the key parameters of the topographical numbers concerned can be collected, including the title deeds and the respective owner's official permanent address. This information then can be used to track down the owners one by one. In the case of the demonstration site, one of the users – the one planting trees – happened to be the Mayor of Nagykörű, an enthusiastic supporter of the ILD project. To make things more complicated, the land title was not granted to him but his mother. Two other owners were also from Nagykörű and one of them also the mother of the man who actually farmed the plot. The old ladies received the land as compensation in the mid nineties, but being unable to farm it, leased to their respective sons. The fourth plot belonged to an absentee owner living in the nearby city Szolnok, having no relation to agriculture and leasing his land to a large agricultural holding. One of the plots were put in mortgage which makes any administration procedure more complicated. The ownership relations can be summarised as follows:

Ownership structure of Site 3

No.	Size (ha)	No.	Owner	User	Share	Cultivation type	Note
1	6.0371	093/5	Mother 1	Farmer 1	1	orchard	mortgage
2	1.1319	093/6	Mother 2 Farmer 3	Farmer 2 Farmer 3	1/2 1/2	ploughland	
3	3.8864	093/13	Absentee owner	Holding	1	ploughland	
4	3.8377	093/14	Absentee owner	Holding	1	ploughland	

Step 3: Information dissemination and negotiations

As a first move, both the owners and the users have to be informed about the goal, methods and objectives of the project, trying to explain the benefits it may help to them such as enrichment of the soil with nutrients, saving the costs of excess water drainage (excavation of ditches, payment to the water management boards), replenishment of groundwater tables, reduction of drought related damages and so on. Once they are convinced, a statement of intention should be signed by them concerning the proposed land use change and an authorisation letter which would allow project participants to handle the administrative issues instead of them. It would be silly to think that even if owners, users can be convinced, they are willing to take the extreme burden of struggling with bureaucracy.

Step 4: Surveying and administration

Once the willingness of the stakeholders is won, a surveyor is to be commissioned to prepare the division layout diagrammatic drawing. The surveyor also has to mark-out the physical boundaries of all the newly formed subdivisions or sub-parcels. As found out by research supported by the project, division can be effectuated in alignment with the contours of the land, only surveyors are not really eager to do it: it is much more complicated for them.

The division layout diagrammatic drawing then should be submitted to the building authority for approval. The building authority *ex officio* contacts the various other agencies soliciting their opinion. Following endorsement of the layout diagram by the so-called technical authorities (environmental agency, soil protection, etc.) the regulator issues the permit for the division.

Then the proponents may go to a lawyer to get the appropriate dividing document prepared. The document can be submitted to the land registry for registration and assigning a new topographical number. All these steps are associated with various costs and expenditures in the form of fees and duties.

Step 5: Changing the type of cultivation

Since the project intends to demonstrate how the type of cultivation can be changed (land use change, LUC), these areas are to be converted from ploughland and orchard to grassland. This means in the case of the orchard that the trees in the affected new parcel or sub parcel have to be cut in order to comply with the requirements of an eventual site visit and official inspection. The changing of the cultivation type must be proposed by the owner – and not the user – of the parcel concerned and the reasons for doing so provided. The Nagykörű area belongs to the District Land Registry Office in Szolnok.

Step 6: Design, licensing and construction of the water steering structure

Once a decision is arrived at, the land has to be surveyed according to the new sub-parcels which were agreed on, and the sub-parcels registered in the land registry office. Once the topographical mapping procedure is completed, the water management design needs to be drawn up, licensed and implemented. In practical terms this would mean in the case of the pilot site a small sluice and bottom sill which could streer the water level in Canal No 19 into and from the new plot put to ILD use. In the next step, the necessary changes in the land use can now be done (excavation of the fish pond, removal of dried out plum trees, sowing the area intended to convert into grassland, planting trees, pending on the solution agreed upon).

Step 7: Operation and maintenance

An appropriate structure must be found to operate the system. With the involvement of all the farmers, owners and users, a negotiation process has to be conducted as to which form of management seems to be most appropriate to the stakeholders. Overhead costs need to be estimated and a proper business plan for the new plot developed.

6.2.1.2. Difficulties of practical implementation

6.2.1.2.1. Arrangements with farmers

Benefits of land use change

For most part, this argumentation is not very convincing to a current farmer. They are compensated for draught and flood damages just as well as for losses due to the very high excess water on their fields and they hoped for to receive production aid under the single area payment scheme to be introduced in Hungary in 2010. Indeed, it is very difficult to offer real incentives to a change which does not secure any perceived benefits but is unkown and uncertain.

In spite of what was said above, ILD implementation opportunities locally have a number of options. These include convincing of the farmers:

- to manage their land according to the ILD requirements,
- to lease or
- to agree to be compensated for or
- to sell their piece of land affected, or
- to shape the physical structures of the pilot site according to the farmers' willingness to cooperate.

There is also a possibility to combine the options described above.

At the N plum orchard pilot demonstration site in Nagykörű, there were only four owners to negotiate with. One of them was the absentee owner living in the nearby county seat Szolnok. While first inclined to endorse the project's objectives and willing to provide approval to the proposed land use changes and amendment of plot boundaries, later on he changed his mind with the following rationale: 'this land was given to me, I want to leave it as it is and have it cultivated in a single parcel' (19 April, 2010). Somewhat later, when approached by another team member, he again changed his mind and agreed.

Another owner has a self-confident and suspicious attitude: 'You won't tell me what to do. I was born here'.

In the next round, the project team offered money to the owners for agreeing to the subdivision of their respective parcels in accordance with the proposed ILD site running along the contour of the land. This could be seen as a single payment for redeeming the Golden Crown valuation. In this scenario, the land would remain the clear title of the current owner who agrees to change the type of cultivation. The new category would be pasture land, with trees and woodlots scattered on it. The proposed site now looked as follows:

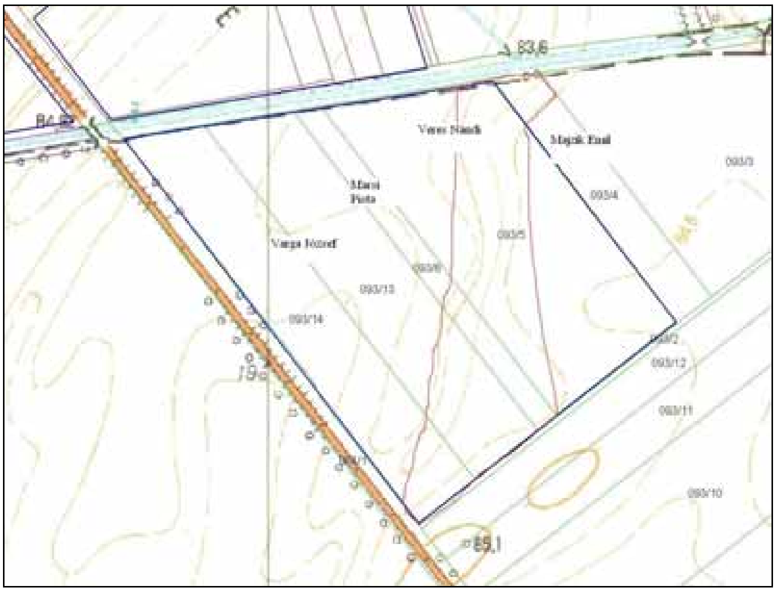


Figure 48: The proposed sub parcel, somewhat modified

The picture changed again when one of the owners insisted that he will only agree when it will not be pasture but a fish pond. Following some additional negotiations, verbal consent was obtained from all owners. On this basis, the surveyor started to peg out the new sub parcel and carry out the administrative tasks. The marked out areas – the deepest parts of the fields – would be withdrawn from cultivation for the purposes of setting up a fish pond of about 4 to 4 hectares. In order to provide a more comprehensive outlook for the landscape design, two addition parcels were also included in the scope of the designs with the approval of the owners (093/3 and 093/4, both croplands).

<u>Four versions:</u>

This was the point when project management felt the need to involve professional landscape designers into the scheme. In order to be able to visualise the various options raised during the negotiations, a landscape architecture firm was commissioned to prepare four different versions of land use patterns in terms of a layout diagram and the bird's view illustration thereof.

The fours versions were, respectively:

1. Version 1: Current pattern with the intensive cropping of all the fields, except the failed plum orchard in the middle.
2. Version 2: Grassland and pasture, where most of the lower lying land was converted into grass as the cultivation type and covered by water seasonally.
3. Version 3: Semi-natural land use patterns, where various different uses comprise a mosaic like diverse structure including different types of cultivation with woodlots, wetland areas and grassland, leaving some of the cropland intact on the higher elevations.
4. Version 4: Intensive use adapted to the geomorphologic conditions. In fact, this version contains a state-of-the-art fish pond.

The respective options including their schematic layout diagrams are presented in Annex 9.2: Maps and graphic representations. Below, the ideal solution Version 3 is shown. However, the practical constraints allow for the implementation of Version 2 only.

Figure 49: Artist's rendering of Version 3: Semi-natural land use method

Then another problem was raised. According to the land registry office there is no such type of agricultural land as 'wetland'. The closest thing to it is 'water cover'. Any land qualified as water cover however, if converted from a proper cropland, has to be paid for in the form of a 'conversion fee' which is euphemistically called the land conservation contribution. The size of these fees is enormous because they are designed to prevent productive land be put to development unnecessarily. Therefore, the fee payable in the event Version 3 is to be adopted, would range up to millions of HUF even for the small pilot site. Somewhat better financial conditions exist for Version 2, that is when the land is not withdrawn from cultivation, only converted from cropland to grassland. Even in this case, administrative costs would be a burden in the range of several hundred thousand Hungarian forints. For Version 4, financial and administrative implications would be enormous. The setting up of a fish pond involves the establishment of a plot, as opposed to a parcel. Several permits should be obtained from the various expert authorities of water, environment and land. Having obtained the necessary permits, an expensive investment project should be made by which the pond is constructed. This would be a permanent water body and hence, subject to water rights permit and registration with the land registry. In a preliminary position letter the cognisant agency did not raise any substantial objection against the proposed scheme, the land registry office did not respond.

Due to the reasons outlined above, the negotiations with the owners and users as well as with the contributing professionals and advisors took a more intense turn in September 2010. For the remaining project period the following activities are envisaged by the project team:

1. Adoption of Version 2 by the stakeholders. This should be done through personal conversations with each of the stakeholders and in several steps. Owners and users are two different cohorts, to be dealt with separately. Decision should be made as to the future user of parcels 093/13 and 093/14 where tenants are about to change in the near future. The new tenant should be aware of the proposed changes in land use and has to assume the associated obligations.
2. The landscape design is to be finalised with the bird's view illustrations and the layout maps. This design shall be the basis for any future interventions.

3. The surveyor shall finish his work on site and in the bureaucracy. This way, the proposed new sub-parcels will have been officially established.
4. The new sub parcels have to be grassed. The necessary seeds are available and the work can be done by the end of October 2010.
5. Dead fruit trees in the orchard should be cut out and afforestation started in small lots according to the landscape design. The work can be done by taking advantage of the local public workers' programme.
6. The design of the water management structure (a bottom sill, governing water levels gravitationally, without the need for any extra energy) should be finished, licensed and implemented.
7. As an incentive to decision makers, an application for the amendment of the respective applicable legislation should be submitted to the newly formed Ministry of Rural Development to trigger the change of the current legal framework. Legal provisions currently in place do not allow for setting up the condition precedents for a mosaic-like diverse land use pattern exploiting the ecosystem services offered by the landscape and capitalising on the local agro-ecological potential of the land. These regulations need to be reframed and re-drawn in order support flexible land use (for instance, to acknowledge wetland and woody or bushy patches as agriculturally productive land) and may be to introduce the new concept of semi-natural cultivation type (or abolish the mandatory types of cultivation altogether)

It can be argued that ecological benefits on a national or even international level from a shift into this direction will be much higher than those currently drawn from the area as proposed in Chapter 6.1.4.8 Expected results.

6.2.1.2.2. Struggling with laws and regulations

Even if the N plum orchard is to be a success, there are still reasons to believe that in the case of other sites practical implementation will be more lengthy and sophisticated.

Some of the difficulties encountered with land consolidation, ownership and tenure are best explained through local examples in the Nagykörű region. The ominous undivided common parcel Csataszög 087/6 had 126 owners according to the attested land title sheet (certificate of title) dated on 22 January, 2001. Since calculations are made in natural proprietary shares, the 126 owners were divided up into 308 677 pieces of proprietary ratio, some of them as low as 10 Golden Crowns (remember: Golden Crowns were sold at HUF 500 (2.5 USD) at the time). According to one document related to this parcel, one of the owners initiated a voluntary land consolidation process back in 2001. He had to assume the task of a very complicated procedure. Pursuant to the relevant law[58], division of undivided common parcels (the so-called proportional property) shall be subject to the decision by a General Assembly of all owners under specified rules of procedure. The General Assembly can be proposed by any of the lawful owners and attended by the owners or their duly authorised proxy. Decision can be arrived at when the necessary quorum is present, which is represented by two thirds of the proprietary ratios, irrespective of the number of owners turning up. Thus, in principle, the administration of such a procedure becomes easier with less and less owners as the parcels become concentrated. Obviously, the process did not arrive to a successful climax, as there

[58] Article 11 of Act No XLIX of 1999 on the amendment of Act No II of 1993 on the Land Consolidation and Land Restitution Committees

are still 62 titles recorded in the land registry. The preferential price of land survey at the time was merely HUF 15 000 as opposed to HUF 60 000 in 2010. The difference is to be attributed to the state subsidy. However, disinterested owners must have found even this amount a burden.

While costs of consolidation is passed on to the owners, resources available for land registration and administration are sometimes used quite inefficiently. Another document from the same parcel in 2005 informed the owners that the cognisant land registry office has the right to amend the base map and the associated territorial data any time when there is an error detected in land surveying, mapping or areal calculations[59]. Given this opportunity, the bureau diligently amended the type of cultivation, quality classification and Golden Crown value of the said parcel as follows (Changes are highlighted in yellow):

Decision delivered by the district Land Registry Office

Before the changes						After the changes				
Top. No	Sub parcel	Cultivation type	Quality class	Area (ha)	Golden Crown	Sub parcel	Cultivation type	Quality class	Area (ha)	Golden Crown
087/6	a	plough land	3	0.7954	20.04	a	plough land	3	0.7954	20.04
			4	31.2933	654.03			4	31.2933	653.89
			5	131.6971	2054.47			5	131.6971	2054.57
			6	32.3290	336.22			6	32.3290	336.23
	b	ditch	-	0.5126	0	b	ditch	-	0.5126	0
	c	forest	3	0.9130	9.50	c	forest	3	0.9130	9.50
Total				197.5404	3074.26				197.5404	3074.23

It can be clearly seen, that the 62 owners had to be informed, the administrative procedure conducted and the registration amended because of a three-hundredth part Golden Crown was mistakenly assessed. Mind you, Golden Crown itself is contested by many as a typological feature of land assessment because of its unsuitability for the purpose. One tends to think that if there are resources available to correct such minor mistakes sparing neither trouble nor expense, why was it impossible to harmonise and divide up undivided commons on 1.5 million hectares for 16 years.

6.2.2. Tiszaroff – the bad example

The second completed structure of the VTT, the Tiszaroff reservoir was inaugurated in 2009 with the expectation that it will be used in every 30 or 40 years once. In early summer 2010 it had to be put to use because the flood of the century arrived. The 'emergency reservoir' was obviously not designed in accordance with the ILD concept, much rather in the spirit of 'Man conquering Nature'.

A glance on the contour map of the reservoir area is sufficient to convince any professional geographer that the planning concept had not much to do with the exploitation of the functional landscape features. First of all, it is seen that the floodway lies already higher than the flood plain itself because of the years long siltation. Embankments in the past were not built at the natural boundaries of the higher banks but arbitrarily, to increase the size of land put under crops. Yet, for the purposes of a flood detention reservoir, you can take advantage

[59] Article 11 paragraph (7) of Act No LXXVI of 1996 on land surveying and cartographic operations

of the terrain stairs which are still there behind the dykes. In fact, there is a ready made basin suitable to store water at no cost. On the picture below it is shaded green and deep green to the right hand side of the river which can be distinguished as a darker strip from the left upper corner to the middle in the bottom.

Instead, designers delineated an area utterly inapt for the purpose. First of all, it is much larger than the natural depression of the former floodplain. High banks are also involved, which would be able to contain water without any construction needs. Huge locks with a discharge capacity of three to four times the low water flow of the river itself were installed. At one place the embankment runs several hundred metres on the bottom of a former river bed, actually following the depression in a length. There are hidden and overt reasons for such a design feature. The overt pretext is that the law requires not to build embankments within 60 metres from any public roads. Certainly the road concerned was built at the time of its construction on the high bank which served as a natural boundary. Hidden causes involve vested interests, because the more the construction costs are, the better construction companies are off. When the design procedure was well in progress, a landscape architect was duly assigned to assess the design concept from the landscape management perspective. He wrote a paper stating that it was ill-designed and that high banks ought to be followed. The study was accepted, paid for and forgotten (Péter Balogh, personal communication).

The dimensions of the construction live up to the 'man conquer nature' principle. The area which has become the reservoir covers 22 km^2 and is capable of storing 97 million m^3 water in times of high water, that is 4 to 5 metres average height of water. However, distribution of the water depth is quite uneven, while the middle of it (the real basin) stores several metres of water, both extreme sides on the north and the south remain entirely dry. In Summer 2010 the reservoir lock was opened at 90.04 mB Tisza water level and storage level was measured as 88.18 mB. The lock gates of the inlet structure are 166 cm high, which made them able to tap a 300 m^3/sec inlet flow of the 5200 m^3/sec flood in the main river. This corresponds to 15% of the total flow and indeed, the highest water stage downstream of the Kisköre dam, a few kilometres upstream from the reservoir lock, was halved within hours. The inlet structure was closed later on because further rain was forecasted. Therefore, the reservoir could be filled up to two third of its capacity with about 60 million m^3 of water. This amount was stored almost entirely in the natural basin in the middle and about a third of the reservoir site was not even watered.

Another sad aspect of the VTT concept is that the reservoirs are not seen as opportunities, rather as barriers to agricultural production. The entire system is compensation and damage oriented, which again cost a lot of money. Instead of effectuating land use changes or expropriating the area once and for all (the preferred solution by water management professionals) only the narrow strip of the embankments is expropriated, the rest is put to inadequate use by the farmers just as before, who receive compensation for their land because of the diminished value (within the reservoir) and again when their crop is damaged by the water. Certainly, no crop could withstand four metres high water. But another type of use with another type of design concept would never expose crops to such a stress. Thinking of damages instead of benefits by inundation is an erroneous approach. If you grow wheat in the river bed, it is not the river bed to blame. Ploughland is to blame. In our case 3-4000 thousand straw bales floated on an inland ocean in June. A huge amount of water was let onto autumn wheat: water was let out which could have been otherwise retained without any levees constructed. The high intensity flow at the inlet structure devastated totally the sowed crop. The whole concept of emergency reservoirs is a questionable practice. Reservoirs at one point may cause shortages in water supply downstream. This is the case with the Zagyva, a tributary of the Tisza and with the Körös rivers in Romania: proposed or implemented reservoir structures deprive the downstream communities of their surface water supplies.

If this wasn't enough, the completely paradoxical nature of the system can be easily demonstrated on the recent example of the Tiszaroff reservoir operation. As mentioned, 300 m^3/sec was the flow discharged onto the fields of the unhappy farmers who happened to live in the Middle Tisza region. At the same time water officials – director of KÖTI VIZIG – reported that according to his information along the upstream section of the Tisza, only within Hungarian territory, the other regional water authorities pumped excess surface water covering the fields of the farmers there into the river at a rate of 400 m^3/sec. In other words, more water was transferred into the river during the flood than actually discharged from it under the hailed VTT concept. It was transferred first and discharged later. This situation can really be called a Type one error, or, in other words, a structural trap. Discussions with officials convinced project team members that people in the establishment also feel the awkwardness of the situation but they – being part of the establishment – are caught in the same structural trap, bound by rules of the trade, rigid technical installations and counter productive legislation.

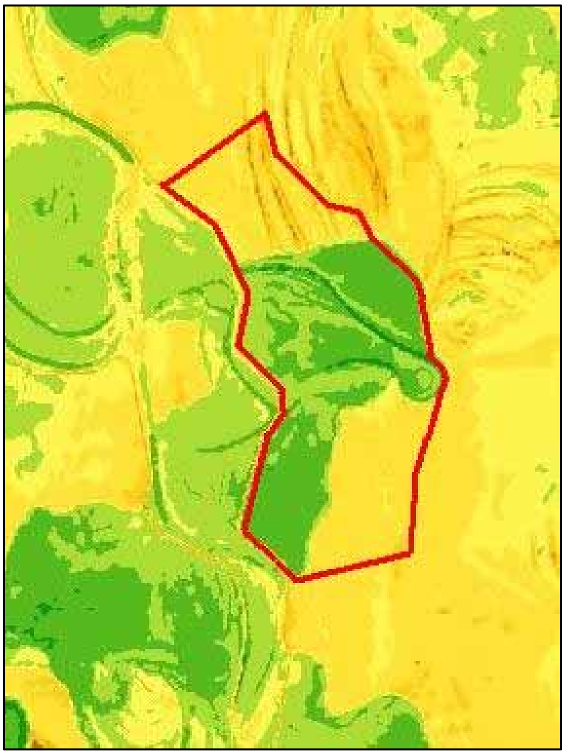


Figure 50: The ground area of the Tiszaroff reservoir on a contour map. Green is deep floodplain, yellow is higher banks

Figure 51: Open locks of the Tiszaroff inlet structure on 14th June, 2010

6.2.3. Dobai polder – the (almost) good example

As it has been stated earlier on, extensive excess surface water cover ('inland water') has been described and ardently studied by the Hungarian water scientists first and such problems are not known or termed by most foreign references. This fact confirms the assumption that the problem is a relatively new phenomenon related and specific to the regulation works on the Tisza and tributaries. Whilst technocratic solutions proposed for solving the situation earlier on included the establishment of an extensive inland water canal network and many technical structures to get rid of the non wanted 'surplus' water, there are signs of a changing perception and attitude on behalf of the sector and the water management specialists.

On the other hand, river basin management plans provide a future scenario for the respective catchment areas. Their main goal is to arrive at a mutually accepted, long term, environmentally sound and hydrologically well founded agreement amongst the users of that watershed. To outline such a 'river basin scenario' you need a multi-stakeholder approach where the water sector plays more of an integrating and coordination role instead of imposing engineering solutions without reconciliation with other sectors of society.

The regionally competent Water Directorate (KÖTIVIZIG) prepared an alternative water management concept for tackling the double sided problem of drought and excess water in this spirit several years ago. They made up a new system of water steering and tested it in a series of model simulations. The approach was named 'Inland water reform: a coordinated effort to carry out excess water management and landscape management. Semi natural water steering in the Doba inland water polder: a watershed analysis'.

The concept basically recognised the same opportunity which is also a key element of the ILD approach. That is, the existing system of various canal networks – excess water drainage, waste water transportation, irrigation canals and other water management structures such as transfer pump stations, sluices, locks, embankments and bottom sills – could be easily used to actually store excess water instead of trying to get rid of it as soon as possible. Since surface water on the fields usually appears at times of high water in the rivers, it can not be drained gravitationally, if your aim is to carry it away instantly. Therefore, huge pumping stations are operated at the inland water canal networks which transfer the excess water from the canals into the floodway, thus aggravating the flood risk of downstream sections by further increasing the water flow between the main dykes.

The engineers at KÖTIVIZIG realised that they can save a lot of money on operational costs, reduce flood risks in the river and make excess water available for later times if they managed to store it somewhere within the inactive floodplain with relatively little costs.

The area investigated by them was the Doba inland water polder, a 130.7 km^2 size area, which is the supersystem of the Nagykörű polder. It follows the lines of the natural embankments and high banks built by the river in historical times but is now deprived of its natural connections with the living water. Consequently, it is prone to excess water, because on most part it consists of poorly absorbing, very poor infiltration rate soils. Typical elevations in the polder vary between 84.50 and 85.50 mB (metres above Baltic Sea level). The fundamental source of information for the model experiment was the investigation of the detailed morphology of the terrain, the use of existing hydrological and hydraulics data as well as runoff calculations.

These latter however give no point of orientation in times of floods: as discussed in the theoretical sections, the elevated levees cause the water of the flood wave infiltrate and seep through underneath the earthen embankments, which then appears as excess surface water and puts an additional load onto the inland water canal network. In fact, the experts at the Directorate could demonstrate that if there was a longer flood wave flowing through the region, the amount of seepage water which had to be transferred from the protected side into the river exceeded several times the volume of calculated annual runoff from the entire polder. This is the reverse side of the very same Type one error described in the previous section with regard to the VTT reservoir at Tiszaroff.

Selection of the potential reservoir sites was made on the basis of two considerations: sites exposed systematically to excess water over the years and sites which can be rendered suitable for storage due to their geomorphologic features. After the preliminary assessments four sites were chosen for more detailed investigation: a former rice paddy, a systematically inundated several hundred hectares depression ('lapos'), an area beside the flood control levees which can not be properly cultivated and an area chosen proactively by the engineers for its topographical features. This fourth – chosen for theoretical considerations – site has proven to be the best candidate for the model experiment. Surprise-surprise: the area – albeit much greater – is identical with Site No 1 and Site No 2 of the ILD project. In other words, these areas lend themselves readily for water cover. The KÖTIVIZIG team called it 'Csataszög reservoir' for the neighbouring community (see the Figure below).

Selection criteria also included the interests of the stakeholders, current methods of use, land value, existing topography, perceived level of acceptance, exposure to excess water risk, least cost price tag, security of inhabited areas, soil water regime properties and water quality of contamination sources.

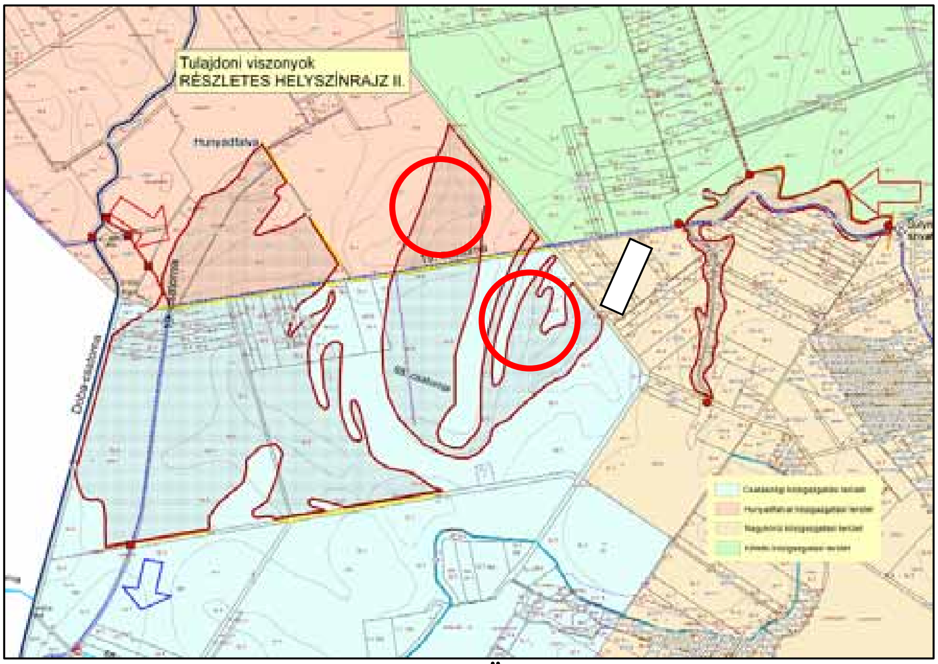


Figure 52: The reservoir site selected by the KÖTIVIZIG team in the Doba polder project
Legend: Deep purple contour: the Csataszög excess surface water reservoir, red circles: Site No 1 and Site No 2 of the ILD project, white area: the proposed LUC site in the N-plum orchard (Site No 3)

The size of the model area is 316 hectares and with a storage level at 84.00 mB it is capable of storing a maximum of 1.78 million m^3 water with a depth varying 0.2 to 2.00 metres. The area is crossed by canal No 19, the same structure which is instrumental in the ILD model site on the other side of the road.

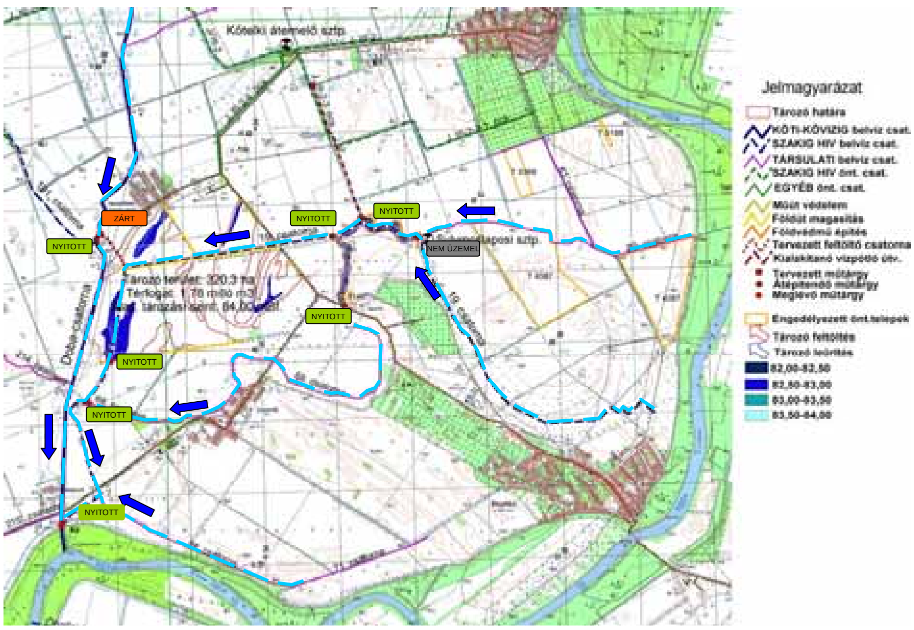


Figure 53: Initial state of the Doba inland water drainage system (courtesy by Béla Horváth)
All structures but one are open (green) and the water collected is drained towards the transfer station at the mouth of the canal system gravitationally. In case of high water stages it is pumped actively into the Tisza. The supplementary transfer pump station at the place called Sulymos is not operated. Water flows in a single direction

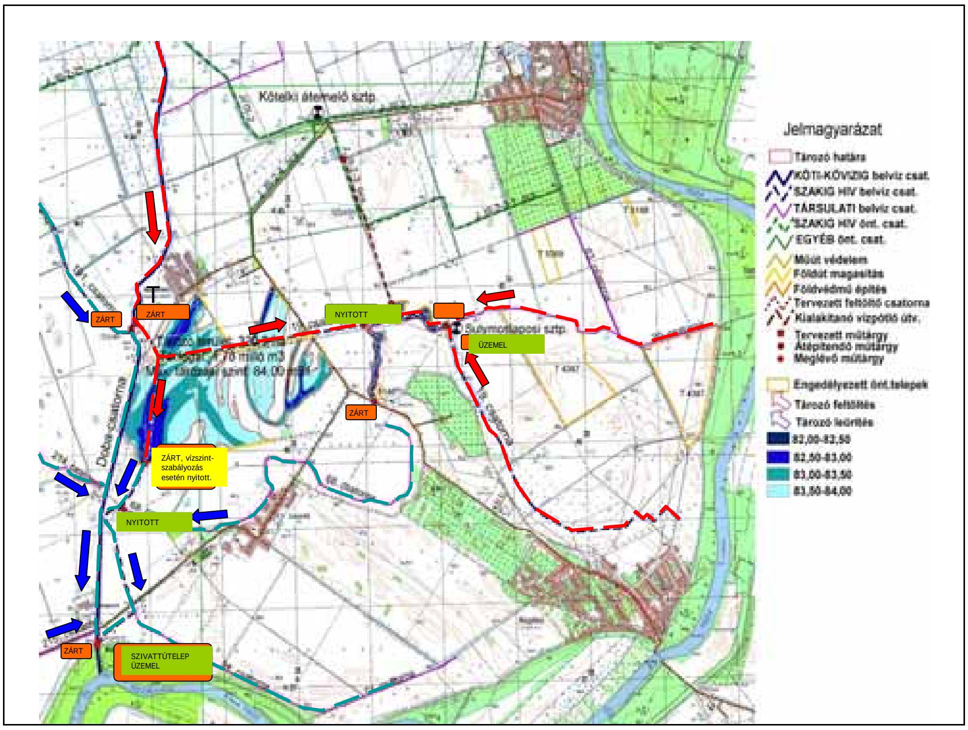


Figure 54: Proposed operation of the same system under the 'inland water reform' (courtesy by Béla Horváth)

Some of the structures are closed off (orange) and direct water into the reservoir (red arrows). The sluice at the bottom side of the reservoir is operated in accordance with the control needs in the storage (yellow). The drainage lock at the transfer station (red dot) is closed, but the station itself is operated to lift water which comes from other directions and not from the reservoir. Shades of blue in the reservoir indicate the depth of storage water

Direct and indirect benefits of the retained excess water at a special site are numerous. According to the model calculations, the total capacity of the proposed reservoir could have been exploited during half of the years between 1996 and 2006, therefore it should be an economically profitable development as storing excess water *in situ* means less operating costs at the transfer pump station and water can be drained gravitationally when not needed any more. It is difficult to quantify but definitely has a positive effect on excess water drainage from the fields whilst improving water supply during the dry season. Additional benefits include multiple use business opportunities such as fishing, irrigation water availability and tourism, enhanced biological diversity, carbon capture function and assimilation of nutrient loads. Even economists found that the solution was cost effective. And last but not least the reservoir could relieve the river from the need of transporting additional water volumes when there is a flood anyway.

Lessons learnt from the project indicate that while there is a possibility to set up a consistent content and set of criteria to explore the existing conditions for the purposes of a more sustainable water management approach, the very diverse local conditions, social and economic factors and expectations which have to be taken into account for practical implementation argue for individual solutions in each of the cases and no horizontal approach equally applicable everywhere can be found. This holds true for the technical implementation but legal and institutional barriers are more difficult to overcome locally. For instance, the water engineers proposing the aforementioned scheme had to stop when it turned out that the area to be dedicated for inland water retention has more than 500 owners. In the light of what was said about land consolidation, proprietary rights and legal frameworks, it would be illusory to think that this falls within the scope of the water administration. Do not forget: the law requires them to drain the fields as soon as possible but within 24 hours the latest. At the same time, it is very difficult to demonstrate the benefits of the system for the same reasons as mentioned in the case of the ILD site in Nagykörű. Owners are not interested at all.

6.2.4. Hortobágy – nature knows best

Hortobágy, the famous "puszta" is indeed a flat lowland of the Tisza floodplain where a number of forced land use methods were applied earlier on such as rice farming or wheat crops. Since the foundation of the Hortobágy National Park nature conservation professionals manage this approach was totally converted and now there are three environmentally sound utilisation modes in the area: livestock husbandry, reed cutting and fishponds. Additionally, the tourist industry provides livelihood to a number of people. Grazing still has a landscape forming role in this place, where the famous Grey Cattle roam free on the pastures. Floods have inundated parts of the puszta four times in the period between 1999 and 2010.

Figure 55: Pictures taken from the same hunting tower in Summer and Spring of 1999

However, most of these extreme events did not do much harm to the agriculture practices here. In fact, the place called Nagyiván could be easily used as a natural reservoir. National Park officials suggest a coordinated effort to re-establish the Nagyiván marshland as a permanent natural water retention possibility with the following measures:

- Providing appropriate amount of water replenishment from the river Tisza
- Reconnection of the Tisza with the Hortobágy-river (now used as a draining and water transport canal)
- Construction of the engineering structures (sluices, bottom sills) in and along the bed of the Hortobágy-river necessary for the operation of the "fok" system
- Arrangement of the dumping sites originated from the dredging of the Hortobágy
- Construction and installation of a proper water inlet and outlet structure on the "Nagyiván reservoir" (without the need to build extensive earthen embankments)
- Consolidation of the legal status of these new 'water retention areas'

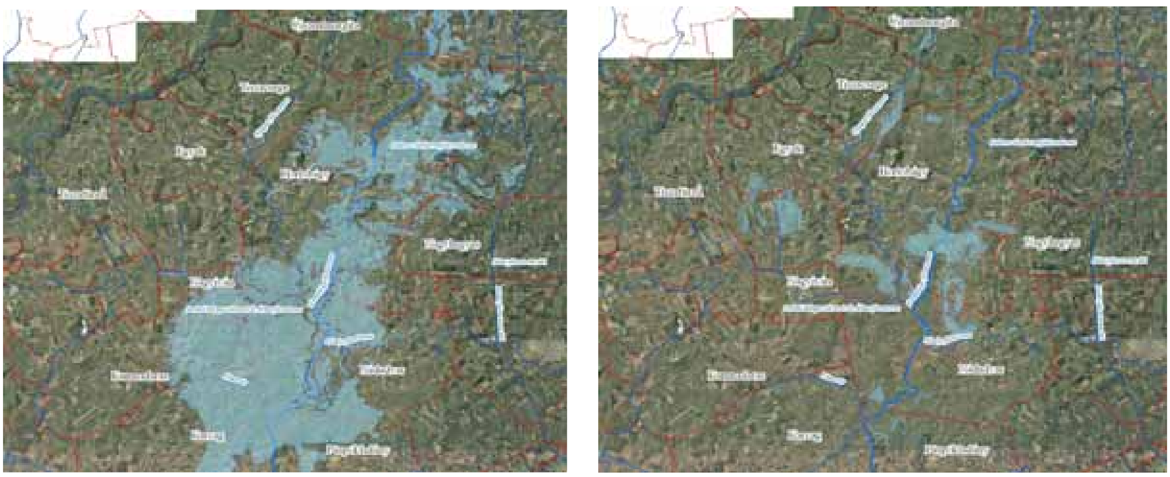


Figure 56: Model simulations of the inundation levels resulted from the current floods and the proposed controlled discharge (without the Nagyiván reservoir)

This way the floods could be managed under controlled conditions and would cause much more benefits than harm. Controlled discharge could be taken advantage of not only in emergency situations but in a recurrent seasonal inundation which follows the natural dynamics of the river system. Unlike in many other parts of the river valley, on the Hortobágy only minor installations would be needed to achieve this situation.

6.2.5. Senta-Zenta

One of the contributing partners to the international ILD project is Senta municipality. Senta is situated on the lower reaches of the Tisza in Serbia, the area called Vojvodina. According to the USDA Report for 2003., the areas most seriously affected by drought conditions in Serbia during 2003., are north and central Banat, all of Bačka, and east and central Srem. All these regions are in Vojvodina, the so-called "bread basket of Serbia". Instead of average rainfall of 40 litres per square meters during April and May 2003 those regions received only 12 litres per square meters in total.

The area centred around Zenta-Senta

- is a more dynamic landscape than that in the middle section: there is a loess-plateau, alluvial terraces, floodplain – difference in contour range up to 30 metres
- agriculture shows similarities with that of the Great Hungarian Plain, but being in a different country, circumstances are somewhat different
- natural conditions and ecosystems are seriously degraded, biodiversity and natural resources diminished
- from the hydromorphological point of view, this is a headwater section of the river which is impounded by the Óbecse-Becej dam since 1977
- groundwater reservoirs are overused causing a sinking ground-water table on the plateau, simultaneously increasing the water table on the floodplain and under the city
- the area is an intensive industrial region having oil tank-farm causing massive pollution incidents from time to time
- the Danube-Tisza-Danube canal, a major water management scheme provides the opportunity to wide-spread irrigation, thus combating lack of natural rainfall to some extent.
- the region is a typical low section of the catchment.

Conditions in terms of the legal and institutional framework keep on changing in Serbia just as well as in Hungary. However, there are some differences between the relevant effective legislation in the respective countries. In Serbia the water administration is covered by a single and very young Act on the waters, adopted in 2010. The organisational structure is much more simple, as there are public water utilities charged with the task of all aspects of water, both underground and surface waters, river training, flood control, irrigation and draining schemes and canal network. Like in many other countries, these activities are mainly financed by the government and by the contributions of the users of the respective services, such as water discharge, water use, drainage, use of water management structures and water collection systems. On the other hand, no provision exists on the possibility of controlled discharged onto agriculturally productive land and flood control measures are only allowed once the condition precedents defined in the operative plan for the river section concerned are met.

The state seems to play a much more important role in land ownership and land use than in most market oriented economies. The government is called the primary – symbolic – owner of agriculturally productive land and has pre-emptive rights on all changes in both ownership and use. Although land users are obliged to put their land to agriculturally productive use, there are no serious restrictions as to what they do with it. In other words, there is no obligation to cultivate the land in one of the rigid categories put up in Hungary. The only restriction is that other than Class 4 and 5 arable land can not be converted to grassland or pasture. Withdrawal from cultivation – whatever that means – is subject to the payment of a withdrawal fee. Substantially all land has now been consolidated in a long procedure which first started in 1878 and has been gradually extended. Although not finished yet, land consolidation is much more advanced in Serbia than it is in Hungary. The main purpose of land consolidation was to provide the opportunity for reasonable and effective agricultural production, create more sensible infrastructure layout, including the organised network of irrigation and draining canals and – importantly – to mitigate erosion of the topsoil. Forests are protected by the law, wherever there is a forest it must be maintained and should not be converted into ploughland. On the other hand, there is a possibility to graze in forests upon prior consent of the owner/user and except in fresh plantations.

Another substantial difference is that the privatisation process now finished, approximately 80% of all arable land is now in private ownership. Like in other parts of the plains, most agriculturally productive land (95%) is put to ploughland crops. The official agricultural policy in the country supports further intensification of the production, mainly through the development of irrigation schemes and better exploitation of available land. Also, boosting the development of small and medium enterprises should be a priority for the integration of the farmer holdings. Holdings are currently very fragmented and small in size. Beside the less than 10 hectares average holdings about a half of all arable land is found in the possession and use of family undertakings which are not purely agricultural businesses or farms and work usually on even smaller pieces of parcels. In a strikingly unsuitable land use pattern, of all the 26,000 hectares of arable land in the Senta municipality merely 200 hectares are grazing land and approximately 650 hectares meadows. Consequently, livestock husbandry is not a major sector in the region. Agribusiness ownership and land use is not dominant, 78% of all land is farmed by individual farmers.

Water management on the lower reaches of the Tisza is based on conventional flood control measures, mainly on heightening the crest of the levees. In 2006, when a concurrent flood wave on the Danube prevented discharge from the river, record water levels had to be combated (this time successfully). The reservoirs envisaged upstream in Hungary under the VTT promise a reduction of the incoming flood wave heights.

The proposed project is to revitalise a former river branch in the form of a pond. The area, called Zentai rét is a originally a 5000 hectares meadowland, which was cut from the river in the 19th century, put to agricultural use and drained from excess water by a canal network since the beginning of the 20th century: the same picture as everywhere else along the Tisza.

Figure 57: The 'meadow' in 1930

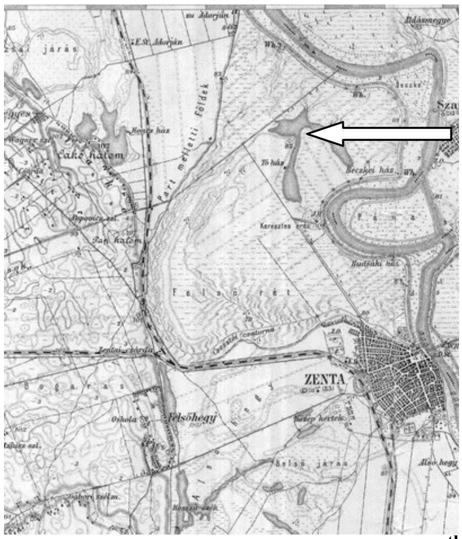


Figure 58: Military mapping survey No III (19th century)

As everywhere else in the plains, former river beds and active parts of the deep floodplain can still be distinguished on the maps and areal photographs. To the north of the city and a little bit upstream from a former bend, there is a horseshoe-shaped natural depression on the now cultivated land (see arrows) called the Csésztói-pond. In spite of the river regulations, this site was used as a fishpond up to the beginning of the 20th century. Later on one of the branches has been silted up and the other branch was used to dig out a drainage canal. During the 1980's plans were afoot to restore the eastern side of the pond in order to store irrigation water in the area from the high Spring water stages. The project renewed this concept and intends to take actions in that direction. It still remains to be seen how – under the legal and institutional framework discussed above – this work can be accomplished.

Figure 59: Aerial photograph of the site

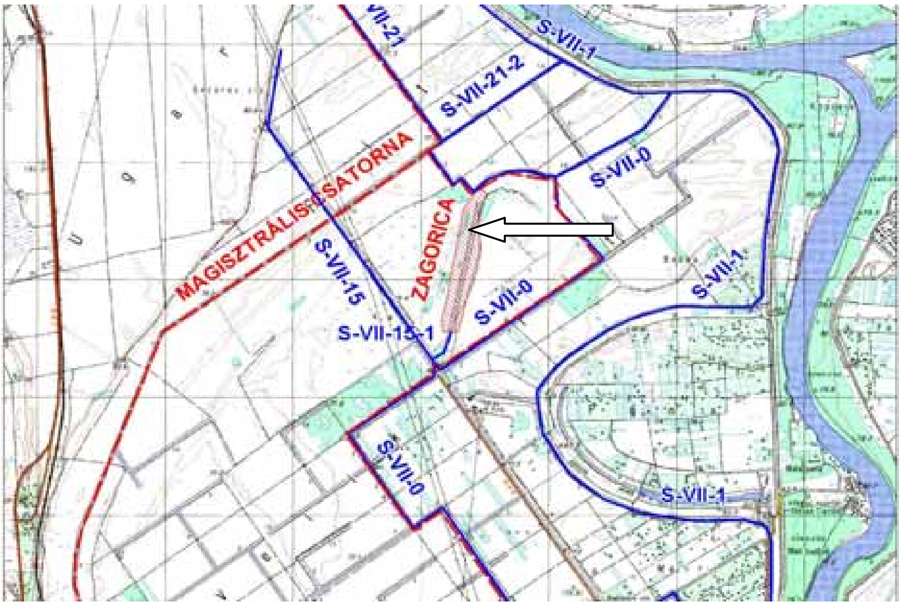


Figure 60: The current plans to revitalise the pond (renamed as Zagorica)

6.2.6. Székelyudvarhely-Odorheiu-Secuiesc

The third pilot demonstration project site is found in the upper catchment of the Tisza, in Romania. The area centred round Székelyudvarhely-Odorhei

- is a mountain range with the highest point at 1800 metres above sea level, with the Udvarhely-basin in the centre
- the western slopes face west winds, producing massive annual, in case rapid, rainfall (confluence caused huge flood damages along the Nyikó river in the summer of 2005)
- the area is mostly forested, with meadows and some arable land around villages on the alluvium in a mosaic pattern
- more traditional land use patterns and social forms survived until recently, when altered by modernization
- typical upper section of the catchment

Figure 61: The Nyikó river basin

Fehér-Nyikó – Feernic (see map) is a tributary of the Tisza. This small local watershed is merely 190 km^2 in size yet demonstrates clearly the dangers and risks of poor water management as well as the challenges to be faced as a result of the climate change. In 2005 a flash flood caused several million Euros worth damages and claimed more than a dozen (!) lives in this small catchment alone.

The situation is not new. Farming encroached the mountainous areas from the lower parts of the valley as far back as in the 18th century. According to the historians between 1772 and 1897 4000 hectares of land was put under plough in the higher reaches, mostly by deforestation of the hillsides. As a result, water retention capacities of the landscape were impaired and ever more sudden and higher floods arrived. Additionally, as a result of the poor management practices during the Communist era, huge areas were left barren, prone to water erosion and allowing the shorten the water collection time to a fragment of the former values.

Relative water scarcity is now a main problem due to these processes in the area. According to anecdotic information, the water volumes and flows in the river are now one third of their former strength and sometimes in Summer the river drops dry altogether.

In response to these problems, AGORA, the project partner participated in a joint NGO effort to build a small water retention dam at a place called Malomfalva. The dam is situated on a small creeklet, a tributary of the Nyikó , to slow down runoff from the mountains. The project had multiple objectives:

- to retain some of the water and thus slow down seasonally forming flash floods by catching some of the runoff water in the tributary
- to replenish groundwater tables
- to provide a recreational opportunity by a new open water surface for much of the year.

Additional diversion dams and overfall weirs are also designed to prevent early siltation of the dam reservoir. As the erosion in the open land upstream is still very strong, there is a lot of beadload and suspended sediment which will be captured by the dam. The aim of the project proponents is to build several other small dams on the tributaries to improve the water regime in the region and to reduce the risks represented by flash floods. Certainly, in a consistent implementation of the ILD approach, the first and most important task to be done would be the re-establishment of the water retention capacities of the natural systems like the vegetation and the morphological features of the landscape.

Figure 62: Contruction of the small dam on the tributary creeklet

7. Summary and conclusions

Dynamic movements of rivers can be best understood with the approach applied by systems theory. Man made systems usually are not dynamic in the sense that they can not be adapted easily to changing boundary conditions, therefore complex adverse consequences follow and new investments are needed. The mechanism is known as the Type One error.

Historical river management bears all the characteristic features of Type one errors. A possibility to break the circle and arrive at a long term, adaptable strategy to live with and not against the processes taking place in a river valley is suggested under the UNDP/ICPDR project by the method called integrated land development (ILD). Current river regulation practices control floods by draining the water between artificial embankments which need to be raised every know and then due to siltation problems in the floodway. Thus, the water flows several metres above the surrounding terrain. This is a structural trap because in times of floods the river is unable to carry surplus water volumes without making problems, while riparian zones become more and more arid due to the missing water replenishment. Flood control works themselves create a risk to the surrounding settlements because high water may got stuck in the floodway and burst the dykes or find a way to ‘protected’ land.

Traditional multi purpose land use methods customary in the Tisza valley before the Ottoman conquer of the country may be applied again. The practice is called ‘fok’ management by researchers for the partly artificial, partly natural formations on the river banks which were used to spread excess water of floods in the entire Holocene floodplain so that it could be drained again once it was not necessary any more. ILD intends to follow the same principle assisted with modern design and implementation tools such as GIS, remote sensing, topographical and aerial surveys and photographs, sluices, locks, drainage canal systems and a structured change of land use patterns. According to the model experiments there are still 36 deep lying floodplain areas along the Hungarian reach of the Tisza which could accommodate 2 billion cubic metres of flood water quite easily and inexpensively from the technical point of view.

The main barriers are political, institutional, legal and social in their nature. A key to the new concept is to change the type of cultivation of farmland on some 500 thousand hectares so that ploughland be converted into grazing pastures or woodlots which resist to seasonal water cover much better and depressions become permanent ponds which could be a source of groundwater and soil moisture replenishment in times of drought. Such a mosaic like, consistent land use pattern adapted to the contours of the relief and the potential water cover could restore the ecological equilibrium of the landscape and bring back many ecological services provided by it earlier on.

The ILD project aims at the practical implementation of such a model site in the administrative area of Nagykörű community, a pioneering settlement with an impressive track record of such experiments. A demonstration site was identified and negotiations with owners and users are afloat to implement a small scale structure capable of regulating water cover on that site.

During the project, two levels of problems were outlined.

1. Theoretical level: Farmers and land users are not really interested in changing their land use patterns. There are no incentives for them to do so. On the contrary, in the past twenty years since the political transition all their assets, technology and know-how have been directed towards intensive cash crop production, using huge bank loans and setting up a structure which causes the formation of a structural trap. Authorities and state administration on the other hand are unresponsive to complex problems, are very rigid and bound by unnecessarily detailed regulations.

2. Practical level: Whoever wants to implement a flexible, mosaic like land use pattern, will run into troubles. Rationalisation of the land parcels is difficult, ownership relations complex, subsidies geared up to specific purposes, any attempt to make changes may easily entail payment obligations, controversies or even lawsuits.

The following key issues need to be tackled and solved with a view to the implementation of the ILD concept:

In terms of land use

- Flexibility in land uses: Allow land users to leave some of their land to other uses, water retention canals, forest patches, woodlots, grassland, permanent ponds or any other type of use which could boost biodiversity and improve the water regime on the lower lying areas. According to the pilot experiments some 5 to 7% of the fields could be put to such uses with sufficient results;
- Land use categories: Cultivation type categories currently used are focused on cash crop production and not on the agro-ecological potential of the fields. In Hungary, a nation-wide survey of agro-ecological potential of all agriculturally productive land has been completed years ago. This database could be used to re-define land use categories and cultivation types;
- The regulatory framework is both non-transparent, unnecessarily complicated and market oriented in both the European Union and domestically. Large farmers and agribusinesses are subsidised by unequal opportunities;
- Modern agriculture is based on purpose-built special machinery with huge price tags and – consequently – a strong pressure to be used in the most time efficient manner. Such an approach is completely unjustified in areas with extreme water regime and times of drought or excess water;
- The rigid system of obligation to cultivation prevents any flexible land use methods both in terms of space and time. It should be left to the discretion of the land owner or user what kind of benefit he or she may draw from his or her land and by which method – within certain limits, of course;
- Land management and land development does not seem to be an issue in modern agriculture. More thought should be given to long term visions of agricultural production, not only in terms of production and subsidies but also in terms of biodiversity, ecological systems services, natural resilience and prospective diverse uses.

In terms of land consolidation:

- As stressed many times elsewhere in this document, land ownership and tenure in Hungary needs to be consolidated and put to new footing. One of the first and most important step in this process should be the elimination of the undivided common ownership of parcels;
- In the next step, parcels and blocks need to be consolidated to eliminate partial ownership, strip-holding (shoe-lace patches of ground) and unreasonably positions parcels, but not only with a view to more efficient market operations, also with a view to accommodate the agro-ecological potential of the fields as well as geomorphologic features of the landscape;
- Land consolidation should also focus on a more sound and reasonable distribution of agribusiness undertakings and farmer holdings. Too big farms tend not to take into account the special features of a locality and represent unevenly positioned lobbying power in face of agricultural subsidies.

Livestock husbandry

- In Hungary, prior to the accession to the European Union, an organised deterioration of the livestock farming took place in the nineties. Politically the move was justified by the unjust requirements of the EU to secure markets to large agricultural producer countries but on the social level a necessary spin-off development was the disintegration of rural communities, soaring unemployment and social backwardness. In the course of this process, and reinforced by other 'developments' and 'progress', the following trends made the implementation of any diverse rural development approach very difficult:
  - deterioration and collapse of local markets, primary producers and handicrafts;
  - processing of local goods was made more and more difficult, mostly by unnecessary rules and obligations

Water management

- Although organised on a regional basis, water management administration is still not area based. Responsibilities are shared by many organisations and officers, making the enforcement of liabilities difficult. Sources available for the operation of the sector were repeatedly cut as the country under bad governance got more and more indebted and the deficit of the state budget grew;
- There are theoretical problems in the policies as well. Instead of a comprehensive approach to deal with the water regime of a specific area, the main objective is to fight extreme water management situations like floods or water stagnation. Renewable and non-renewable water reserves can not be separated with appropriate certainty. As a result, underground water extraction taps non-renewable sources in much of the Great Plain, while renewable surface waters are let to run off quickly;
- More recently, slackening regulation brought the danger of irresponsible use of thermal water. Up to date, any thermal water brought to the surface for energy generation reasons had to be re-injected under the surface. Now it is allowed to be discharged into living waters, causing much harm to the wildlife and the natural biogeochemical processes in the system, while depleting the underground reservoirs of thermal water.

However, the main conclusion is that without substantial changes in the institutional setup, the political interests and the legal framework any large scale implementation of the ILD concept is illusory. This manual makes an attempt to offer some recommendations on how these sectors need to be changed in order to become suitable for accommodating the objectives and goals of the new concept.

8. Acknowledgements

In addition to all project partners and participants, the author is deeply indebted to the following individuals for their contributions to this paper: Balázs Borsos, Deputy Director, Hungarian Academy of Sciences, Institute of Ethnography; Dénes Lóczy, Assistant Professor, University of Pécs, Institute of Geography and János Fehér of VITUKI, Budapest for their technical contributions; Béla Horváth, Head of Unit, KÖTIVIZIG Szolnok, for making the materials of the Doba polder design available, Tamás Bánvölgyi for some of the illustrations, Péter Kajner, Kriszta Matúz technical assistance, Professor Ferenc Schweitzer, Zoltán Keresztesy for authorising the use of some of the maps, István Sándor, Director of National

Park Hortobágy for the section on the Hortobágy 'fok' system, Izabella Suhajda from Senta, for the section on the Senta pilot site, Pál Péter for the section on the local watershed in the Odorheiu Secuiesc area, Ferenc Demjén for his advice on fishing rights001 .

9. Annexes

9.1. References

1. Alföldi, László (2005): A birodalmaktól az Európai Unióig. A Kárpát medence vízrendszereinek történei áttekintése, különös tekintettel a trianoni békeszerződésre. *Földrajzi Értesítő,* Vol LIV, No 1.-2, pp 5-28
2. Alföldi, László (2009): Hydrography In: Kocsis, Károly and Ferenc Schweitzer (eds.) Hungary in Maps, Geographical Research Institute, Hungarian Academy of Sciences, Budapest
3. Andrásfalvy, Bertalan (1973): A Sárköz és a környező Duna-menti területek ősi ártéri gazdálkodása és vízhasználatai a szabályozás előtt (Ancient floodplain economy and water utilisation schemes in the Sárköz and the neighbouring areas along the Danube river), in: Zsigmond, Károlyi (ed.): *Vízügyi Történeti Füzetek 6. (Historical Papers on Water Management)* Vízdok, Budapest
4. Andrásfalvy, Bertalan (2009): A gazdálkodás következtében végbement földfelszín változások vizsgálata a Kárpát medencében (Assessment of geomorphological changes in the Carpathian basin exerted by husbandry and farming) *In: In: Antropogén ökológiai változások a Kárpát-medencében (Anthropogenic ecological changes in the Carpathian basin),* edited by Bertalan Andrásfalvy and Lajos Vargyas, L'Harmattan, Budapest, pp 9-19
5. Badenoch, Nathan Augustus (2006): *Social Networks in Natural Resource Governance in a Multi-Ethnic Watershed of Northern Thailand*. A Thesis Submitted for the Degree of Doctor of Area Studies. Graduate School of Asian and African Area Studies. Kyoto University March 2006 242 p
6. Bajomi, Bálint (2004): A sokféleség és jelentősége (Diversity and its significance). *Kovász* Vol VIII. No 1-4, pp 7-14
7. Balogh, Péter (2002): Az ártéri tájgazdálkodás koncepciója (The concept of landscape management in the floodplains), in: *Élőtáj* 2, Válogatott írások természetről, térről, teremtésről (szerk.: Buka László és Gyarmathy István), Dél-Nyírség Bihari Tájvédelmi és Kulturális Értékőrző Egyesület, Debrecen, 2002, pp 192-202
8. Barta, János Junior (1996): Magyarország mezőgazdaságának regenerálódása, 1711-1790 (The regeneration of Hungarian agriculture, 1711-1790). In: Orosz, István – Für Lajos – Romány Pál (eds.): *Magyarország agrártörténete (Agrarian history of Hungary),* Mezőgazda, Budapest, pp 33-79
9. Bodnár, Gáspár (2009): *A Tiszába érkező vizekről. A Felső Tisza vízmegtartása (On Waters discharged into the Tisza River – Water retention in the Upper Tisza)* Conference presentation at the conference: The Future is in our Hands. All drop of water is a value, Budapest 7th May, 2009
10. Booth, William (2009): Beneath rivers, another realm, *Washington Post*, October 26, 1989, A1 o.
11. Borhidi, Attila (2009): Régebben még volt hová menni (Earlier on, you had a place to go), *Népszabadság*, 5th September, 2009, Weekend Supplement Page 1
12. Borsos, Balázs (2000): *Három folyó között. A bodrogközi gazdálkodás alkalmazkodása a*

természeti viszonyokhoz a folyószabályozási munkák idején (1840-1910) Akadémiai Kiadó, Budapest
13. Borsos, Balázs (in press): Rivers, Marshes and Farmlands. Research Perspectives on the Ecological History of Hungary through examples of Bodrogköz. *Hungarian Studies* (in press)
14. Borsos, Béla (2003): *Azok a bizonyos könnyű léptek I. Ökológia és rendszerelmélet* (Tread Lightly on Earth I. Ecology and Systems Theory) (Budapest: L'Harmattan, 251)
15. Borsos, Béla (2009): Systems theory and ecological settlement design: a pilot project in rural Hungary, *Hungarian Studies* (ed. Mihály Szegedy Maszák), Akadémiai Kiadó, Budapest, Volume 23 No 2 pp 175-194
16. Borsos, Béla (2010): Type One error and the impact of human societies on large rivers, manuscript
17. Deák, Antal András (2001): Fokok és délibábok, *Hidrológiai Közlöny* 2001/1, 39-41. o.
18. Dobos Endre – Jozef Kobza (2008): Jelenkori tájhasználat (Recent land use) In: Dobos Endre – Terek, Jozef (szerk.) *Élet a folyók között. A Bodrogköz tájhasználati monográfiája* (Life among the rivers. The monography of land use in Bodrogköz). H.n.: Miskolci Egyetem. pp 39-46.
19. Filep, Antal (2009): Víz a magasban. Megjegyzések az árvízmentes térszínek és a domb- illetve hegyvidékek hagyományos vízgazdálkodásához. In: *Antropogén ökológiai változások a Kárpát-medencében (Anthropogenic ecological changes in the Carpathian basin)*, edited by Bertalan Andrásfalvy and Lajos Vargyas, L'Harmattan, Budapest, pp 65-107
20. Fodor, Zoltán (2002): A Tisza-menti fokok tájhasznosítási szerepe az újkori folyószabályozások előtt (The role of 'fok' along the Tisza river before the river regulations in the new age), *Falu, Város, Régió, A vidékfejlesztés hírei*, 2002/4, 14-17. o.
21. Glatz, Ferenc (2009): *Water Management and Government Policy*. Executive Summary of the Conference held at the Hungarian Academy of Sciences, Budapest on 27 November 2008 and 16 June 2009.
22. Göncz, Benedek - Ákos Barabás (2009): *Árvizekről – Megelőzés és védelem (On floods – prevention and control)*. Conference presentation at the conference: The Future is in our Hands. All drop of water is a value, Budapest 7th May, 2009
23. Gowdy, John M (2004): A biodiverzitás értéke. *Kovász* Vol. VIII. No 1-4 pp 44-73
24. Grimm, Nancy et al. (1989): *Contribution of the hyprheic zone to stability of an arid land stream*, Arizona State University, Department of Zoology, Tempe, Arizona, 1989, 9. o.
25. Gulyás Katalin (2000): Ármentesítés és szabályozás a Tisza völgyében, in:*Ezer év a Tisza mentén*, szerk: Sári Zsolt, Jász-Nagykun-Szolnok megyei Múzeumok Igazgatósága, Szolnok, 2000, 215-240.o.
26. Gyarmathy, Magdolna et al. (2008): Növénytan (Botanics) In: Dobos Endre – Terek, Jozef (szerk.) *Élet a folyók között. A Bodrogköz tájhasználati monográfiája* (Life among the rivers. The monography of land use in Bodrogköz). H.n.: Miskolci Egyetem. pp 47-64.
27. Gyulai, Ferenc (2003): *A növénytermesztés emlékei a Kárpát medencében*. Doktori értekezés (PhD. dissertation), Környezettudományi Doktori Iskola, Szent István Egyetem, Gödöllő
28. Gyulai, Iván (2009): Fenntartani a fenntarthatatlant (To sustain the unsustainable) *in: Mária Kóródi (ed.): Az erőszak kultúrája. Fenntartható-e a fejlődés? (The Culture of Violence. Can Development be Sustained?)* Pallas, Budapest pp 135-159 (in Hungarian)
29. Hamar, József (2000): *Lesznek-e még folyóink*? in: Gadó György Pál (szerk.) *A természet romlása, a romlás természete: Magyarország*, Föld Napja Alapítvány, Budapest, 2000, 67-93 o.
30. Horváth, Benő (1993): Independence like Hybris. The Correlation of Man and Nature in the

Great Hungarian Plain (in Hungarian) *Tér és Társadalom* Vol 7, No 3-4, pp 105-114
31. Ihrig, Dénes (ed.) (1973): *A magyar vízszabályozás története* (History of Hungarian water regulations) Országos Vízügyi Hivatal, Budapest
32. Illés, Lajos (2010): A beregi ártér revitalizációja (Revitalisation of the Bereg floodplain), Conference presentation, *Vízkészletek jövője a Tisza vízgyűjtőjén (The future of water resources in the Tisza river basin)*, Hungarian Academy of Sciences, Budapest, 7 September, 2010
33. Kajner, Péter, István Fazekas, Zsuzsa Flachner, Géza Molnár and Péter Balogh (2009): *Szelídvízország. Kézikönyv a Tisza-menti ártéri gazdálkodás megalapozásához.* [Land of Calm Waters. A Handbook on the Basics of Floodplain Management Farming along the River Tisza.] 190 pp.
34. Kelemen, Zoltán (2010): Cheers, Hungarians! En extension of the land purchase moratorium. *Heti Világgazdaság* 23 April, 2010 pp 62-65
35. Kelemen, Zoltán (2010): Gazda szeme. Agrárpolitikai mérleg (The eyes of the master. Agropolicy in the balance.) *Heti Világgazdaság* Vol 32. No 32. 14 August, 2010 pp 6-9
36. Koncsos, László (2006): *A Tisza árvízi szabályozása a Kárpát-medencében (Flood control of the Tisza in the Carpathian basin)*, Magyar Természetvédők Szövetsége, 32 pages
37. Konkolyné, Gyuró Éva (1989): A területhasznositás optimalizása a Zempléni-hegység térségében (Optimalising land use in the area of Zemplén Mountains) *Gazdálkodás* XXXIII/11. 39-50.
38. Konkoly-Gyuró, Éva (1989): A területhasznositás optimalizása a Zempléni-hegység térségében (Optimalising land use in the area of Zemplén Mountains) *Gazdálkodás* XXXIII/11. pp 39-50.
39. Konkoly-Gyúró, Éva (2003): Tájkaraktert formáló történelem. Történeti tájalakítás és jelenkori konfliktusok a Fertő-Hanság vidékén, in: *A Dunántúl és a Kisalföld történeti földrajza*, szerk. Frisnyák Sándor és Tóth József, Pécsi Tudományegyetem Földrajzi Intézete és a Nyíregyházi Főiskola Földrajz Tanszéke, Nyíregyháza-Pécs, 2003, 95-108.o.
40. Kumar, P.; Babu, C. R.; Sharma, S. R; Love, A. and Prasad, L. (2001) *Valuation of Ecosystem Services: A Case Study of Yamuna Floodplain in the Corridors of Delhi*. Under the World bank Aided Environmental Management Capacity Building Programme. Mimeograph, IEG, Delhi.
41. Laki, Zoltán (2010): Viharzóna (Storm zone), *Heti Válasz*, Vol X, No 26. pp 27-29
42. Láng István (ed.) (2002): *Folyóinkkal való gazdálkodásról*, Folyógazdálkodási Tárcaközi Bizottság, Észak-Dunántúli Vízügyi Igazgatóság, Győr, 2002a
43. Lászlóffy, Woldemár (1982): *A Tisza. Vízi munkálatok és vízgazdálkodás a Tisza vízrendszerében*. Akadémiai Kiadó, Budapest
44. Legget, Jeremy (2005): *Half gone. Oil, Gas, Hot Air and the Global Enegy Crisis*, Portobello Books Ltd. London
45. Lovelock, James (2009): *The Vanishing Face of Gaia*, Penguin Books, London, 2009
46. Marten, Gerald G. (2001): *Human Ecology: Basic Concepts for Sustainable Development* (London – Sterling, VA: Earthscan, 238)
47. Molnár Géza (1991): Folyószabályozás régen és ma, *Öko*, II. évfolyam, 1. szám, 1991. március
48. Molnár, Géza (1992): Néhány megjegyzés Szigyártó Zoltán: A fokgazdálkodás és az ármentesítés címû cikkéhez, *Öko*, III. évfolyam, 1. szám, 1992, 15-31. oldal
49. Molnár, Géza (2002): A folyó, mint ökológiai rendszer (The river as an ecological system), in: *Élőtáj* 2, Válogatott írások természetről, térről, teremtésről (szerk.: Buka László és Gyarmathy István), Dél-Nyírség Bihari Tájvédelmi és Kulturális Értékőrző Egyesület, Debrecen, 2002, pp 182-190

50. Molnár, Géza (ed.) (2008): Tájhasználati potenciál (Land use potential) In: Dobos, Endre and Jozef Terek (ed): *Élet a folyók között. A Bodrogköz tájhasználati monográfiája* Life between the rivers. The landscape utilisation monograph of the Bodrogköz, (in Hungarian). University of Miskolc, Miskolc 2008, 198 pp.
51. Molnár, Géza and Pásztor Attila (n.d.): *Ártéri tájgazdálkodás a Bodrogközben. Egy mintaprogram tanulságai dióhéjban (Floodplain landscape economy in the Bodrgoköz. Lessons from a pilot project in a nutshell)*, Bokartisz Környezetgazdálkodási és Tájrehabilitációs Közhasznú Társaság (Bokartisz Environmental Management and Landscape Rehabilitation Non Profit Company), Karcsa
52. Nagy, Gábor (2010): Drágulás bőség idején (High prices in times of adundance), *Heti Világgazdaság*, Vol 32 No 32 14 August 2010 p 7
53. Odum, Eugene P 1997.: *Ecology: A Bridge Between Science and Society*, Sinauer Associates Inc., Sunderland, USA
54. Pusztai, László and Gábor Szabó (2010): Hullámverés (Wave action) *Heti Világgazdaság*, Vol 32 No 25, 26 June 2010 p 13-15
55. Rácz, Lajos (2008): *Magyarország környezettörténete az újkorig (Environmental History of Hungary up to the New Age)*. MTA Institute for Historical Sciences, Budapest 261 pp
56. Rappaport, Roy: Maladaptation, in social systems. In.: *The evolution of social systems* (ed.Friedland J. – Rowlands MJ.) London 1977, 49-71. o.
57. Ripka, János (2005): *Birtokszerkezet, nemzeti birtokrendezési stratégia és a földügyi igazgatás (Land holding structure, national land consolidation strategy and land administration)*. Edited version of a conference lecture presented at the MFTTT assembly organised in Győr, Hungary between 30 June and 2 July 2005
58. Roberts, Paul (2004): *End of Oil: on the edge of a perilous new world*, Boston: Houghton Mifflin
59. Schabuss, Michael and Fritz Schiemer (2009): The Integrated River Engineering Project (IREP) *The Scientific Scope to find Mutual Solutions in Large River Management and Restoration. Workshop*. University of Vienna, Vienna Ecology Centre, Vienna, Austria, 2009 September 7-10
60. Schneider, Stephen H. (2005): *The Patient from Hell*, Da Capo Press, Cambridge, Mass. 2005
61. Schweitzer, Ferenc (2002): Szempontok a Tisza vízgyűjtőjének vizsgálatához a földrajztudományok szempontjából. A Földrajzi Közleményekben megjelent tanulmány rövidített változata, *A Duna Kör hírei*, 2002 november, 1-6. o.
62. Sheperd, Kirstie and Paul Csagoly (eds.)(2007): *ICPDR: Tisza River Basin Analysis 2007. Summary Report*. A Call for Action, Vienna International Centre
63. Silverton, Jonathan (ed.) (2010): *Fragile web*. Natural History Museum, London 192 pp
64. Somodi, István (2006): A föld népe (People of the earth) In: Szijártó, István (ed.): *Sodródás helyett. A százak tanácsának ajánlásai a politikának (Instead of drifting. Recommendations from the Council of the Hundred to politics)* Százak Tanács, Budapest
65. Somogyi, Sándor (1967): Az ármentesítések és a folyószabályozások (vázlatos) földrajzi hatásai hazánkban, *Földrajzi Közlemények*, 1967 XV(XCI)/2, 145-158
66. Szabó, Gábor (2010): Térhatás (Plastic effect) *Heti Világgazdaság*, Vol 32 No 32 14 August 2010 p 49-51
67. Szabó, Péter (2009): Hagyományos erdőgazdálkodás a Kárpát-medencében (Traditional forestry management in the Carpathian basin) In: *Antropogén ökológiai változások a Kárpát-medencében (Anthropogenic ecological changes in the Carpathian basin)*, edited by Bertalan Andrásfalvy and Lajos Vargyas, L'Harmattan, Budapest, pp 129-144
68. Szentiványi, Árpád (2006): *Flood management in Hungary and the 2006 flood*, National Water Centre and Public Archives, Budapest, Hungary. Retrieved on 9 September 2010

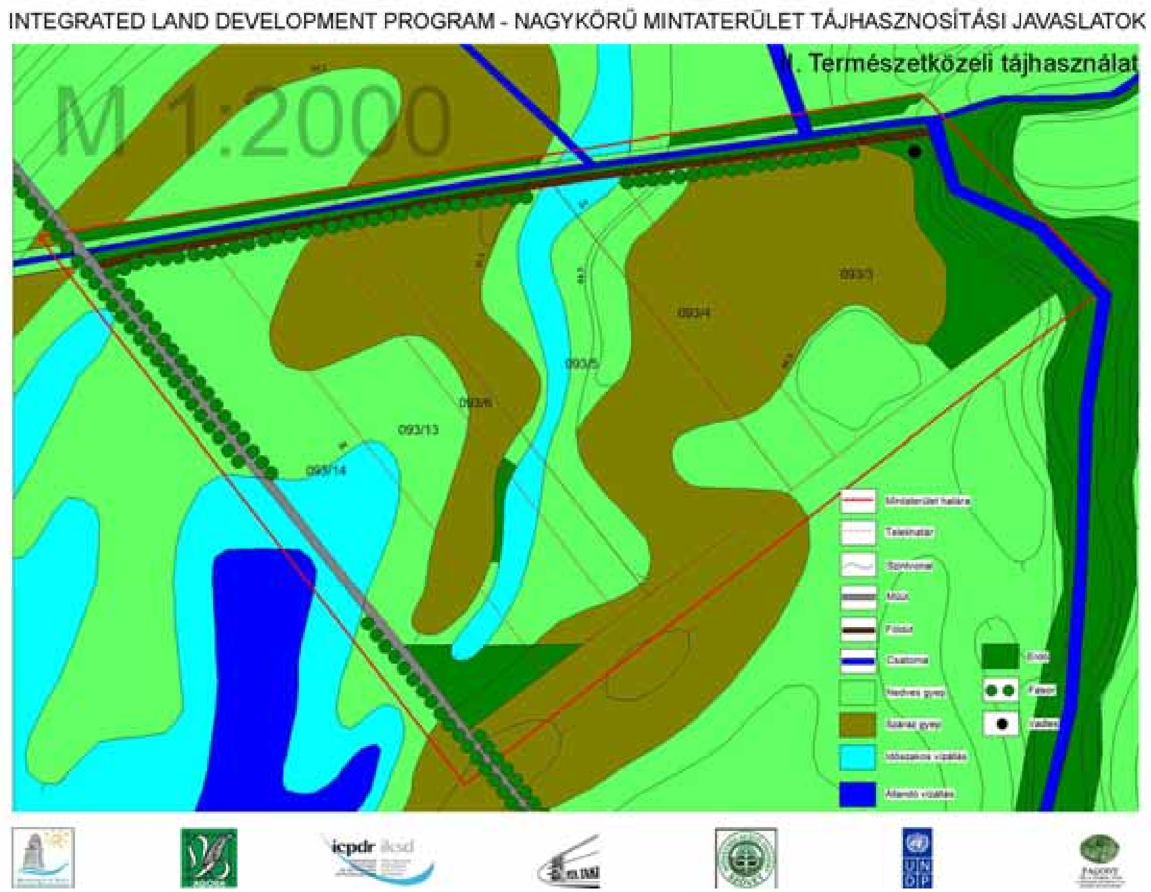
from: http://www.chmu.cz/katastrofy/ceudip06a6.pdf
69. Szigyártó, Zoltán (1991): A fok-gazdálkodás és az ármentesítés, *Öko*, II. évfolyam, 2. szám, 1991, 15-21. oldal
70. Szilasi, Ildikó, Eszter Péntek and Anton Takač (2008): Néprajz (Ethnography) In: *Élet a folyók között. A Bodrogköz tájhasználati monográfiája* University of Miskolc, Miskolc pp 121-132
71. Takács, Károly – György Füleky (2003): Középkori csatornarendszerek nyomai a Kisalföldön, in: *A Dunántúl és a Kisalföld történeti földrajza*, szerk. Frisnyák Sándor és Tóth József, Pécsi Tudományegyetem Földrajzi Intézete és a Nyíregyházi Főiskola Földrajz Tanszéke, Nyíregyháza-Pécs, 2003, 127-134.o.
72. Takács, Károly (2000): Árpád kori csatornarendszerek kutatásáról (On research of canal systems in the Arpadian era) In: R. Várkonyi, Ágnes (ed.): *Táj és történelem. Tanulmányok a történeti ökológia világából (Landscape and History. Studies from the World of Historical Ecology)*. Budapest 2000 pp 73-106
73. Takács, Károly (2003): *Medieval Hydraulic Systems in Hungary: Written Sources, Archeaology and Interpreation*. In: József Laszlovszky - Péter Szabó (eds.): People and Nature in Historical Perspective. Budapest 2003, pp 289-313
74. Tenner, Edward (1996): *Why things bite back. Technology and the revenge of unintended consequences*, Vintage Books, New York
75. Teszárné Nagy Mariann et al.: 30 éves a Kiskörei tározó (Kisköre reservoir is 30 years old) *Hidrológiai Közlöny*, 2009. 89. évf. 6. sz., pp 68-71.
76. Tongdeelert, Chatchawan and Larry Lohman (1991): The *muang faai* irrigation sytem of Northern Thailand *The Ecologist*, Vol. 21, No 2, March/April 1991, pp 101-106
77. Varga, Árpád (2010): Így tervezi a kormány a vízitársulati törvény módosítását (This is how the government intends to amend the Water Management Boards Act) *Társulati Informatikai Rendszer*, Vízgazdálkodási Társulatok Országos Szövetsége, 2 July 2010. http://www.tir.hu/index.php?option=com_content&view=article&id=160:igy-tervezi-a-kormany-a-vizitarsulati-toerveny-modositasat&catid=40:szoevetseg-hirei&Itemid=59 Retrieved on 1st September 2010
78. Vágás, István (2007): Vízügyeink az elmúlt évszázadoktól napjainkig (Water issues from the past centuries up to date), *Földrajzi Értesítő* Vol LVI, No 1-2, pp 105-110
79. Vida, Gábor (2000): A természetvédelem kettős arca (Double faced nature conservation), in: Gadó, György (ed.): *A természet romlása, a romlás természete (Deterioration of nature, the nature of deterioration)*, Föld Napja Alapítvány, Budapest pp 7-14

9.2. Maps and graphical representations

The four versions of the Nagykörű pilot demonstration sites:

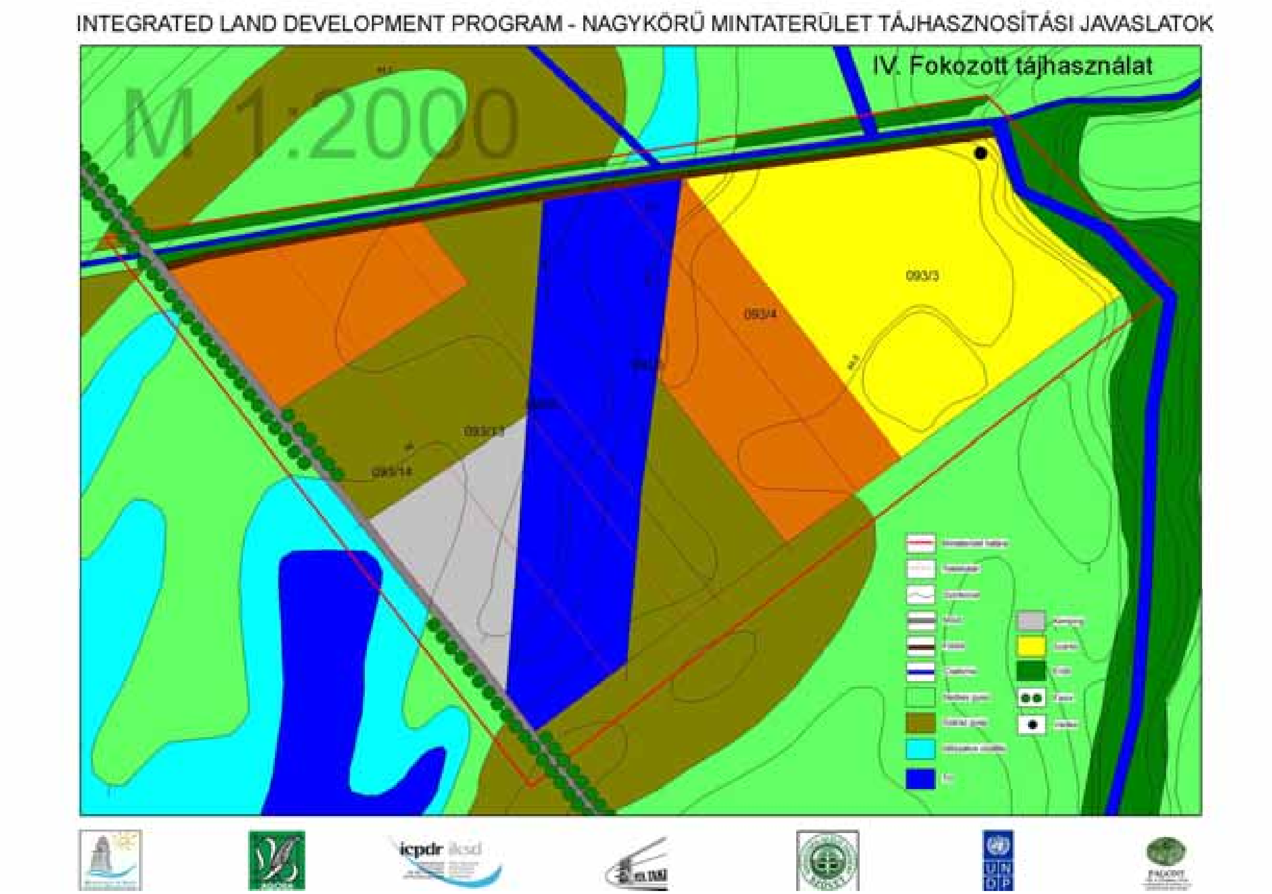
Version 1: Existing state

Version 2: Restoration of natural wetland areas

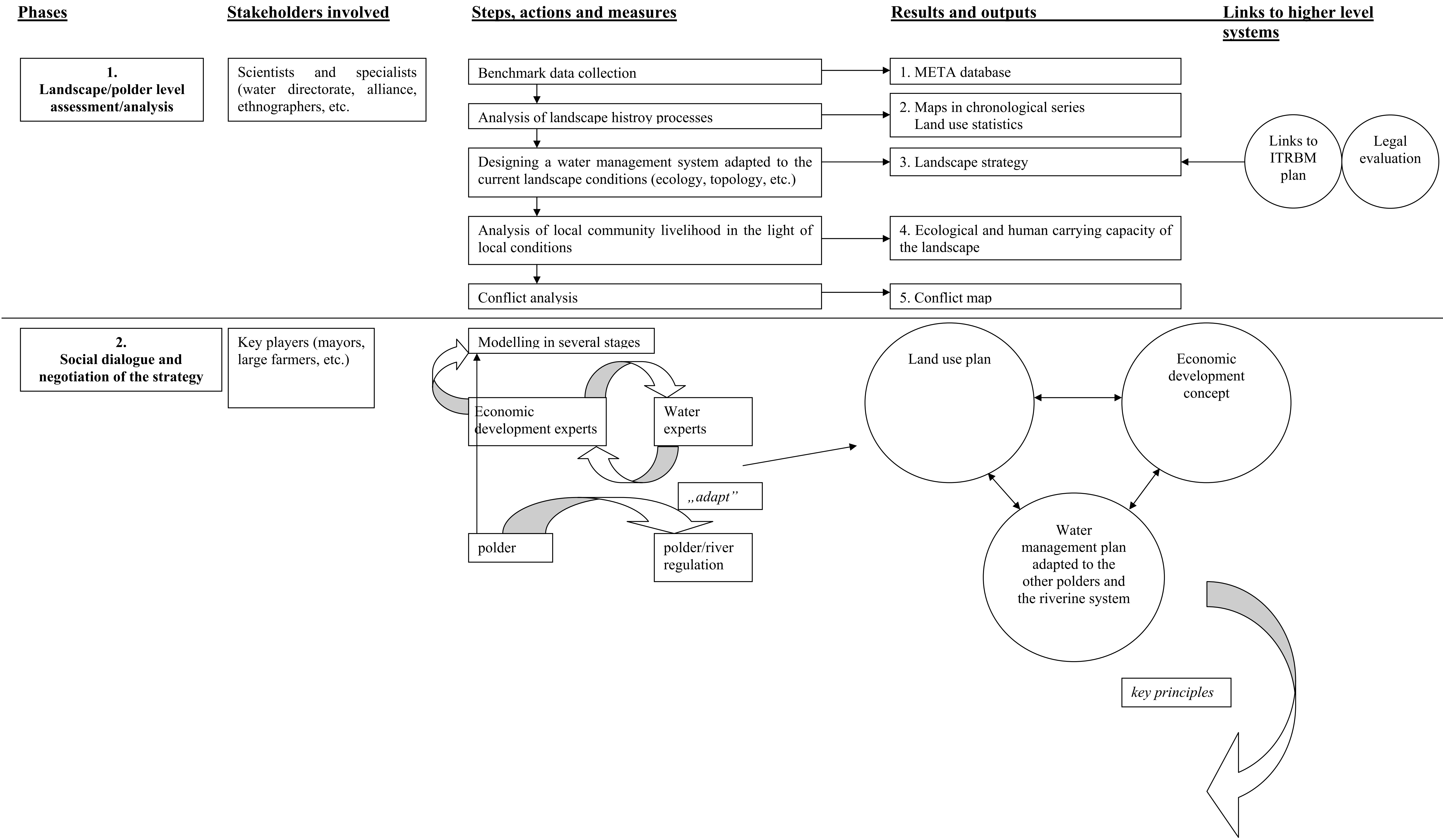


Version 3: Ideal state with grassland and diverse, mosaic land use pattern

Version 4: Intensive fish pond installation



9.3. *Project architecture and flowchart*



Phases | **Stakeholders involved** | **Steps, actions and measures** | **Results and outputs** | **Links to higher level systems**

3. ILD implementation

Land owners and land users concerned, heirs, competent authorities

Selection of potential locations for water retention

Formulation and development of alternatives and interventions

Conducting analyses and calculations

Owners

Water system operators

supporters

Designer programme office (ILD)

1. Set of criteria

2. Data sets for the selected area

3. Methodology guide

3. 1. Temporary flooding / steps for land division

a) Obtaining title deeds or copies thereof from Nagykörű and Kőtelek local governments

b) Getting into contact with the owners

c) Owners to sign a Letter of Understanding and Authorisation statement

d) Surveyor to prepare a parcel division scheme along the contours and to peg out in the field the area to be divided up

e) Obtaining approval for the division scheme from the stakeholders
Minutes

f) Obtaining approval from building authorities = licensing procedure

g) Drawing up a parcel division instrument by a lawyer pursuant to the permit issued

h) Submission of the division scheme to the cognisant land registry office = registration of new topographical numbers

3. 2. Temporary flooding /Change of cultivation type

a) Application for changing the land use method (converting cropland to grassland) with the District Land Registry Office in Szolnok including a short rationale

4. Presentation and dissemination of the process internationally, evaluation, recommendations

Presenting a proposal for amending legal provisions

9.4. Summary table: Barriers and opportunities

Barriers	Opportunities
International	
• Fragmented legislation in water	• Water Framework Directive and River Basin Management plans
• Fragmented and market oriented legislation in agriculture	• CAP reform
• No integrated rural development legislation	• Agro-environmental, set-aside schemes
Conceptual and institutional	
• stakeholder relations	• the bioregional concept
• organisation of institutions	• local autonomy
• no interdisciplinarity	• dynamic arrangements
• no interdepartmental coordination	• new government
Legal barriers related to land use	Institutional opportunities
• reprivatisation and compensation	• land consolidation on a large scale
• ownership structure and land consolidation difficulties	• champions of change (ICPDR)
• undivided common	• green budgeting and accounting
• land ownership and purchase moratorium	• research in possible land use changes
• pre-emptive rights	• the flexibility of the bottom up local) approach
• obligation of cultivation and types of cultivation	• the role of intermediary players
Legal barriers to water management	• best examples
• partitioned water management structure and operation	
• disaster approach in mitigation and defence	
• complicated legislation	
Finances	Threats
• difficulties with tenders	• science, politics and truth
• problems of redistribution	• solidarity vs. sovereignty
• political and geographic divisions	• climate change scenarios, torrent rain and sudden flood
• the power of lobbies	
• water use fees	
Awareness	
• overcoming stakeholder resistance	
• mindset of absentee owners	
• vanishing indigenous knowledge	
• dominant paradigm, value preferences	
Structural	
• technology versus nature	• free flowing river
• horizontal integration bureaucracy	• geomorphologic opportunities
• inappropriate land use	• existing canal networks

9.5. List of abbreviations

ILD	Integrated land development
GIS	geographical information system
LU	land use
LUC	land use change
NGO	Non-governmental organization
SH	stakeholder
EU	Common Agricultural Policy
HU	Hungary
Ro	Romania
RS	Serbia
VTT	New Vásárhelyi Plan for integrated flood, rural development and nature development in Hungary
SZÖVET	The Alliance for the Living Tisza Association (ALT)
MTA	Hungarian Academy of Sciences
KÖTIVIZIG	Middle Tisza Water Management Directorate
mB	metres above Baltic Sea level
BME	Budapest Technical University
RISSAC	Research Institute for Soil Science and Agricultural Chemistry (MTA TAKI)
TÉSZ	Production and Trading Organisation
VKKI	Water Management and Environmental Central Directorate
NPHMOS	National Public Health and Medical Officer Service
MARD	Ministry of Agriculture and Rural Development (-2010)
MRD	Ministry of Rural Development (2010-)
CAP	Common Agricultural Policy
TEEB	The Economic of Ecosystem and Biodiversity
CSA	community supported agriculture
DFL (MÁSZ)	Design flood level
LNV	Highest water stage
TRB	Tisza River Basin
ICPDR	International Commission for the Protection of the Danube River
UNDP	United Nations Development Programme
GEF	Global Environmental Facility
LFA	Least favoured areas
NDM	National Development Ministry
NAEP	National Agro-Environmental Programme