TRANSBOUNDARY INTEGRATED WATER MANAGEMENT

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ABSTRACT

Water management is a very broad, sustainable and complex process. It is not an easy task to be implemented even inside national borders. The integrated approach of water management has different aspects. We could try to find solutions integrated in space, time, hydrologic cycle, professional disciplines, administration, services, stakeholders etc.

For a more transparent implementation we should divide the decision-making to the strategic, action-based and operational levels. The strategic decisions comprise the overall interests and its derivatives in the international governmental institutions. Actions can be performed at a lower level with a small number of actors with common interests; at the operational level we just need the direct involvement of stakeholders.

Integration in space means: basin wide analysis and watershed as modeling unit. The water basin master planning have been fundamentals of water management from the beginning. We cannot analyse a solution for the downstream impact of upstream structures, for the allocation of financial resources from downstream urban areas to soil conservation and torrential control in an upstream rural part of the watershed or flooding rural upstream areas for the protection of a downstream town.. The GIS is most useful tool for space integration in water management. That s also reason for us of GIS as fundamentals of water information systems.

Integration in time is open well-known bat unpredictable problem in water management. To day optimal solution will not be to morrow. How can we integrate paleohydrological data with historical flood, climatic change, landscape and riverbed dynamics in time. We cover only a small part of time with hydrologic measurement, not enough for estimations of hydrological processes with long return period. Paleohydrology and the study of historical flood can help us to extend our period of observation, but unpredictable climatic change and landscape development will tell whether we can extend information from the past in future. Society also changes over time, more than hydrology. The economy, legislation and population density change water management.

Surface water flow and ground water flow, including atmosphere processes and erosion processes on land surface are part of the integrated hydrologic cycle that we simulate or analyze separately very often. To day we have a problem how to integrate climate change prediction in the hydrological cycle. There is also problem of down scaling of modeling results or up scaling impact of variability of water regime.

Hydrology, hydraulics, surveys, geology, sociology, economy, psychology, political science, etc. are professional disciplines involved in complex action of the flood management. There is a lack in the research that incorporate technical and human scientist; misunderstanding, different methodologies and concepts impede common research activities. We urgently need interdisciplinary research on water management.

Structural and non-structural measures alone do not give us optimal water management. Optimal integrated water management needs the integrated policy of stockholders, insurance, the administration, the community, the province, state agencies, and the ministries. There is a lack of responsibility, willingness and trust for common action. The question is literacy and misunderstanding in communication between responsible services that lack on time decision and implementation.

When we deal with trans-boundary water management problems, than it is integrated in interstate relations finalized very often with no action as result or unilateral solutions. Such kind of situations leading in, more or less, in lose-lose or in no win-lose solutions. Importance of water as irreplaceable substance essentially for life and different economical activity put the water in high rank in relations between countries. Also country borders differentiate from watershed contour lines, even worse, rivers natural borders and official border lines are in the middle of the stream, very often.

Water flows more or less in one direction inside hydrological circle and impact on those flows including pollution dissolved in water transfer also in same directions. That very often means that the country with upstream part of watershed is in the better position than country situated downstream. This is not always through; for example if in stream is under impact of backwater than upstream country could suffer due the event from downstream. The ice jam on the Danube stream on border between Serbia and Croatia caused serious floods on Hungarian part of the Danube stream. Similar could be impact of dam construction close downstream of the border. Similar situation we have with ground waters, but there flow is not so straight forward lake in surface water flow and ground water flow could change flow direction under impact of water use. Ground waters also out of our prospect like water on the surface and than we could recognise impact only by special monitoring.

In water use development upstream country is also not always in better position. Navigation, with connection on sea, is better developed in down stream country. In the up stream country, rivers has less discharge, flow is faster and connection with open sea is through stream of down stream country. Hydropower development by dam constructed near border give down stream country control on surface water and also ground water level near stream aquifer. Use of water for water supply, irrigation, pollution, environmental protection and recreation give the upstream country beneficial position.

The trans boundary water management is negotiation between countries with specific protocols that also take a time. Preparation process is thereof essential. Hydrological processes on the watershed should be monitored and well documented. Unknown should be diminishing up to the possible knowledge and also country team should consist from relevant experts. Possible scenarios in development should be well-known in team and also weakness and straitening. Main goals and possible deviation should be recognised before the process, otherwise negotiation could be overloaded with not so important details and finalised without decision.

Trans-border water management in Slovenia is under umbrella of the Danube River Basin Commission on the Danube River watershed and on the Adriatic Sea watershed under the umbrella of the Barcelona convention. Both organisations provide with strategic documents and provide information system for monitoring and good practice. The Danube River Basin is an international basin covering nineteen countries, which is unique in the world. It is hardly possible to organise actions at such a large and broad scale. Common body on basin wide level with so much independent parties could produce only strategic document that declare very broad common interests. Because negotiation for actions should be managed on lower subbasin level including less participants that could also negotiate much easily about common interests, that was also reason to establish commission for the Sava River Basin. Countries on the Tisa River watershed also design to make a common water management plan. However, no proper results can be achieved without decisions made at the operational level, involving bilateral commissions with a long history in negotiation and execute of operation. Actions are derived from bilateral agreement driven by interests of parties from both sides.

The intention of the authors will be to show the historical changes of the ways of co-operation and conflict solving and the need of capacity building, training and multidisciplinary approach. A special point of importance of the long relationship on the common waters will be added at the end of the article.

In the paper the tradition of the joint Water Commissions in Slovenia and those of neighbouring countries on the tributaries of the Danube River: Sava River, Drava River, Mura River, will be presented. Also the presentation of the Water Commissions on the Soča River Basin and other small water basins with direct flow into the Adriatic Sea will be added. Special attention will be given to different cases of good practice in the co-operation on the subjects of water scarcity, border issues of flood protection and surface and ground water use.

Kobilje stream or Kebele stream (in Hungarian) flood protection project presents a good practice in bilateral co-operation of water management authorities from Hungary and Slovenia. Headwater part of the stream is in Slovenia, than the stream flow through Hungary and again passes on Slovene territory and than inflow in the Ledava River. The shared watershed has 296 km^2. There is high flood risk on the downstream part where several villages from both side of the border suffer of flood risk, figure 1.

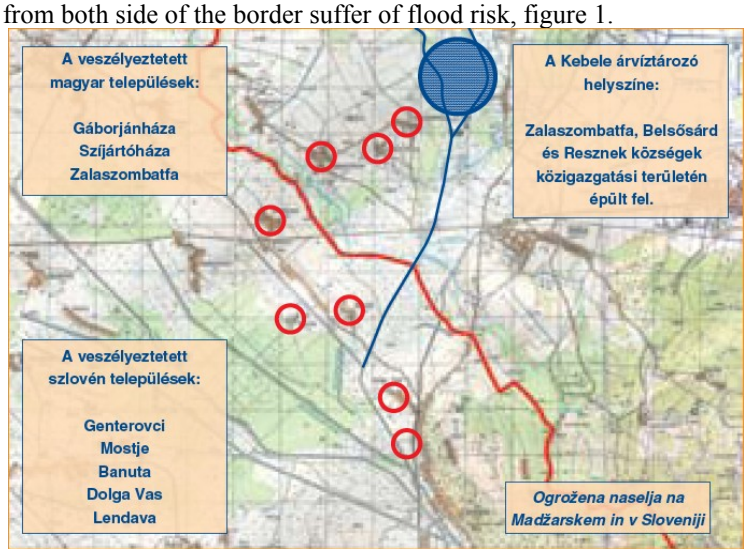

Figure 1. Map of the Kobilje stream with villages in risk and detention pond

Project were derived behalf long tradition in co-operation in water management between Hungary and Slovenia. Co-operation had been very well developed and in 1994 special agreement between Hungary and Slovenia was signed for development of common objectives and tasks in water management. The flood risk of Kobilje stream have been well known and river training works has been develop since 1908, but flood risk still exists and in years 1998 and 2005 8 villages were flooded on both sides of border. Common study of flood risk derived by engineers from both sides suggest as the best solution storage of floodwater in dry detention pond on Hungarian territory. The dry detention pond take 272 hectares with storage of 2,84 $10^6 m^3$, and maximum depth of water is 2,5 m. Flood peak will drop down from 94 m^3/s to 38 m^3/s. The project cost shared by both sides depends on:

- Ratio of watershed area of stream
- Ratio of diminished damage cost by project
- Ratio in validation of previous constructions done to prevent flood on both sides and in benefit of both sides.

According to analysis of interests from both side ratios in sharing cost estimated 56% of cost for Slovenia and 44% of cost for Hungary. Cost of the project is 2,5 million ECU and it was supported by Inrerreg III fund with 900.000 ECU, also. The project was recently finished and cost of project will return in 30 years by diminishing damage.