International Course

ECOHYDROLOGICAL APPROACHES TO WISE USE, RESTORATION, MANAGEMENT AND CONSERVATION OF WETLANDS

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Retention potential in river headstream areas

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Abstract

Specific part of wide complex of flood protection measures and one of possible ways of prevention against floods and extreme droughts could be procedures realizing in river headstream areas. For water retention increase in catchment source areas the detailed analysis of peat bogs hydrological function based on comparison of hydrological regimes in catchments with different peat land proportion needs to be done. Very good conditions for realization of this research in present is related to an existence of several water level gauges and utilization of modern equipment and methods in selected model catchment of Otava River headstream area, representing the core zone of the extreme flood in August 2002 in Central Europe. In this catchment it is also possible to use first outcomes of bog pools detailed research made in recent years. Besides state profiles several automatic ultrasound water level gauges and precipitation gauges are installed in study area and bathymetric mapping of bog pools is being pursued. Another part of research is the detailed analysis of snow conditions as an important component of rainfall-runoff process in upper parts of catchments. The initiatory results made by exact analysis of runoff ascending and descending phases show higher discharge variability of streams draining peat land localities. In the direct relation to all partial outcomes varied measures leading to increase of retention capacity in river headstream areas will be assessed.

Keywords: retention potential, peat bogs hydrological function, flood protection, headstream area, ultrasound water level gauge, peak flow, drought

1. Introduction

In context of catastrophic floods and extreme droughts in recent years there is an urgent need of solving of flood protection issues and measures leading to discharge increase in dry periods, not using just classical engineering methods but also untraditional practices. There is a new strategy focusing on gradual increase of river catchment retention capacity including the realization of measures as runoff retardation and water retention increase in headstream areas.

Flood protection measures have their own specific characteristics in headstream, midstream and downstream areas. The main goal of our research is the realization of so called integrated flood protection which could be put into practise mainly in headstream and midstream parts of catchments where a number of procedures related to runoff retardation and water retention increase can take place. But a catchment needs to be considered always as a whole and neither local nor regional interests can be prefered. All sanitational measures, both in source areas of rivers and in floodplains on midstream or downstream parts, could be connected to each other (see Buček et al., 1998, Knapp, 2000). During their realization it is needed to take into account the fact that full flood protection is impossible, especially during extreme hydrological situations. Then we should suggest not full but advanced flood protection which could significantly contribute to partial decrease of flood damage.

To increase water retention in headstream areas the detailed analysis of peat bogs hydrological function needs to be done. The peat bogs influence on runoff conditions and other hydrographic and climatic characteristics is being assessed by detailed comparison of hydrological regimes in two subcatchments with very different peat land proportion. The solution is related to Otava River catchment representing a basin with frequent occurrence of flood events and with high heterogeneity in terms of physical-geographic and social and economic aspects. We can reason about the peat bogs influence on hydrological process also with respect to its affecting of water quality, respectively to ionic structure of water in periods of high or low discharges (Novák, 1955, 1959, Onderíková, Štěrbová, 1956, Oulehle, Janský, 2003).

Efforts focused on headstream retention capacity enhancement should take into account three factors. Besides consideration of renovation or torrent control of original drainage channels and focusing on recovery of vegetation health state having a positive influence on retention capability in the catchment we should consider possibilities of renovation of former accumulation reservoirs that could play the role of dry (green) polders, reduce flood wave peaks and catch transported wood (Janský, 2006). By implementation of these unforceable measures we could contribute to reduction of flood wave peaks and to increase of water resources during extreme droughts in future.

The problem of peat bogs hydrological function has not been so far fully solved despite a number of domestic and foreign projects and broad debates among experts. Opinions on such issues vary as it is evident in literature that has been dealing with these questions already in the second half of the 19th century. A detailed analysis of various approaches was made by Ferda (1960). The so called "theory of fungi", which was in domestic and foreign literature acknowledged approximately from last 60s, supposed the importance of peat land for its significant water retention and discharge regulating capability during high rainfall totals and its discharge heightening and runoff balancing in dry periods. From last 70s studies that infirm the peat bogs retention function appear. They assert that only possible way to increase their retention capacity is to lower groundwater level by means of drainage. Then these ameliorative hits were realized in a number of mountainous areas in Czechia.

Results of studies dealing with this research subject proved that water courses draining peat land areas show significant discharge variability and that the peat land influence on runoff regime balance had been overestimated in past. It was found out that winter snow precipitations have a relatively low influence on discharge increase in summer period while summer rainstorms play a very significant role in this sense. While filling peat bogs up, runoff values increase rapidly. As well, during longer droughts, peat lands don't play any positive role in hydrological terms, i.e. they don't feed water courses draining them. On the contrary, the past research projects state the hydrological regime improvement after peat bogs drainage and ameliorating.

Peat land influence on water quality in water courses is assessed as unambiguously negative while intensity of affection is related to its area and volume in catchments. The problem of pollution is further intensified in water reservoirs located in former peat land and moor areas, as it is in present in the case of Fláje reservoir.

2. Material and Methods

In order to increase retention potential in Otava River headstream area a qualified reference of measures being implemented at present by the Bohemian Forest National Park Management in connection with former ameliorative channels (made during communist regime) dyking needs to be done. The influence of peat bog localities on runoff process is assessed by detailed

comparison of Vydra River and Křemelná River runoff regimes (27%, resp. 5% peat land proportion in their catchments).
More than 30 years ago the first results related to peat bogs hydrological function were presented within the study of Czech Hydrometeorological Institute in Prague (CHMI) (Ferda, Hladný, Bubeníčková, Pešek, 1971). In this project drainage and ameliorating of peat bog beds is recommended with regard to improvement of their hydrological function. According to results from domestic and foreign literature it is stated that maximum discharges could be markedly reduced this way as a result of groundwater level decrease and consequently extension the depth of peat bog surface layer for capturing causal rainfall totals. It is hereat adverted to other positive effects as increase of forest stand accretion on drained areas (Vidal, Schuch, 1963, Huikari, 1963, Robertson, Nicholsen, Hughes, 1963). This study is so far the last paper dealing with hydrological regime and water chemism in upper Otava River catchment focused on peat bog habitation.
In recent years Otava River headstream area became a study catchment of the research consisting partly in bathymetric mapping of organogenous lakes (bog pools) incl. specification of their main physical parameters and chemical composition, but especially in the initiation of thorough monitoring of Vydra River and Křemelná River runoff regimes inclusive of assessment of various measures leading to their source areas retention potential increase.
Very favourable conditions for realization of this project currently bear on better accessability to the study area, lengthening data time series but also using quite modern equipment and methods. This project can also go upon first results of detailed research of local organogenous lakes (Bohemian Forest moors) carried out by the Czech Science Foundation under the project „Atlas of Lakes in the Czech Republic“. Our research outcomes should be used for realization of specific effective flood protection measures in cooperation with all concerned institutions.
Six water level laths were installed in chosen profiles (Roklanský Brook, Modravský Brook, Filipohuťský Brook, Vchynicko-tetovský Floating Channel - Rechle, Křemelná River above Prášilský Brook, Prášilský Brook above Křemelná River, fig. 1) in order to initiate hydrological observations. Since summer period 2006 seven automatic ultrasound water level gauges with dataloggers for continual monitoring of water level fluctuation (4 in Vydra River catchment, 3 in Křemelná River catchment; fig. 1, 2 and 3) were subsequently installed beyond these profiles. Furthermore 4 limnigraphic stations within the CHMI limnigraphic stations network (Otava River-Rejštejn, Křemelná River-Stodůlky, Vydra River-Modrava, Hamerský Brook-Antigel) and two profiles controlled by CEZ group (Vchynicko-tetovský Floating Channel-Rechle and Mechov) became parts of our research network system.
Measuring set from Fiedler-Mágr Company including registering and controlling unit of M4016 type, ultrasound sensor and GSM module for data transmission by means of GPRS network is used for continual water level monitoring in 10 minutes step and 1 mm accuracy. Data transmission in one day interval or shorter depending on the course of hydrological situation allows its operative solution and also regular control of whole measuring set function.
In February 2007 analyses of snow conditions, being a very significant element of rainfall-runoff process in czech headstream areas, were carried out. Snow cover height and snow water equivalent (SWE) monitoring is done by point measurements with specific spatial distribution considering altitude, exposition, slope and vegetation cover. Acquired data are then digitalized and interpolated using suitable methods in GIS software so spatial distribution of snow reserves could be assessed. Information about accumulation dynamic is logged on the base of several measurements during winter period. Snow cover height and SWE measurement is carried out by means of snow hydrometer SM 150-50 and exact position and altitude of measurement points is determined using GPS60, GPS60CS a GPS Leica.

3. Present Outcomes

In given profiles with installed water level gauges periodical discharge measurements using hydrometric propeller are carried out in order to construct consumption curves. Till recent years water level values had been read constantly by local observers in one day step (during melting process in spring period twice a day) in six profiles with water level laths. These laths were subsequently substituted by above mentioned ultrasound water level gauges.
Furthermore two shuttle precipitation gauges mesuring in 10 minutes step the amount of precipitation (fig. 1 and 3) were installed in the upper part of Vydra River catchment (Rokytka Brook; measures since September 18, 2006 excepting two months in winter period) and Křemelná River catchment (Zhůřecký Brook; measures since March 29, 2007). From technical reasons the amount of snowfall during winter period cannot be measured in mentioned profiles.
In consequence of present short period of water level fluctuation monitoring using automatic water level gauges we keep at disposition only partial results. Preview of one of our outcomes from ultrasound water level gauge and shuttle precipitation gauge is presented in the fig. 3. It shows the discharge fluctuation of Rokytka Brook (Vydra River headstream area) in relation to the amount of precipitation in October 1, 2006 - May 20, 2007 period. Significant discharge increase during spring period as a result of snow melting process in the catchment is very distinct. Nevertheless striking runoff fluctuation (between 0,2 and 0,5 m^3/s) was registered also within the day. In order to assess peat bog localities influence on runoff regime variability two subcatchments within the upper Otava River study catchment with very different peat land proportion were chosen. In the upper part of Rokytka Brook catchment closed by the profile with installed water level gauge a large complex of so called „Rokytecké Moors“ is situated. Much more sporadic occurrence of peat bog beds is fixed to the Zhůřecký Brook catchment in the Křemelná River headstream area (fig. 1). Slightly higher runoff variability in the case of Rokytka Brook is quite distinct from fig. 2. In doing so, discharge variability is besides absolute value of culmination defined especially by peak flow frequency. Different rate of discharge of both water courses in monitored profiles is taken into account using Q/Q_p ratio, where Q is actual 10-minutes discharge and Q_p is mean discharge from the serie of all 10-minutes discharges from the whole monitoring period.
Through the exact study of runoff ascending and descending phases, concretely through the analysis of runoff reaction on causal rainfall (interval between maximum 10-minutes amount of precipitation and corresponding peak flow) during several rainfall situations within the monitoring period, more significant peak flow retardation in Zhůřecký Brook profile (about 4:40 hours) compared to Rokytka Brook profile (about 3:20 hours) was determined. It signifies higher water retention potency in the catchment with distinctively lower peat land proportion. Mentioned claims necessarily demand stronger reliance in terms of longer data time series and detailed analyses of a larger number of namely extreme rainfall situations. Continuously much more detailed studies of hydrological and climatic data time series need to be done, especially reaction analyses of runoff from several peat bog localities in relation to rainfall duration, intensity and spatial distribution in monitored catchments by means of thorough study of its ascending and descending phases. Assessment of peat bogs revitalizing measures influence of chosen localities on its hydrological regime change is also one of the project goals. Every single element of rainfall-runoff process, especially snow conditions in the study area, needs to be completely studied.
Even snow conditions of catchment, as it was already mentioned, are very important phenomenon in our mountainous river headstream areas. Their detailed analysis represents a necessary basis for correct assessment of runoff formation in these areas and for truthful integration of this intricately quantificating element into hydrological processes modelling.

In February 2007 the detailed field survey in chosen representative catchments in the upper part of Vydra River catchment was carried out. The first processed outcomes show the distribution of snow cover height and SWE in the case of Ptačí Brook (fig. 4). Measured data indicate high variability of snow reserves depending on altitude. While the snow cover height in the lowest part of the catchment (about 1100 m a. s. l.) reached up to about 30 centimetres, values in the highest parts of the catchment (1330 m a. s. l.) were moving around 90 centimetres. CHMI station Churáňov (1118 m a. s. l.) was measuring in the time of field survey around 30 centimetres of snow cover. Mentioned situation was very characteristic for winter period 2006/2007, bottom bound of snow cover was fluctuating between 800 and 900 m a. s. l. (very low values in this area). In the altitude of approximately 1100 m a. s. l. and higher thaws were not happening and snow was continually accumulating.
Analogously and very in detail, even if meanwhile in rather smaller regional extent, this issue is studied also in top part of central Ore mountains. One automatic water level gauge with pressure sensor was installed in the upper Chomutovka River catchment so far, another device and climatic station is about to be situated in adjacent area.

4. Conclusion

All of the issues related to various possibilities and measures leading to river headstream areas retention capacity increase should be discussed by experts in various fields taking into account objectives and priorities of a regional and local significance (Buček, 1998, Knapp, 2000, Kolejka, 2003). Such a discussion could result for example in introduction of suitable landscape elements or gradual modification of land use in areas playing various roles in flood control (Kovář, Sklenička a Křovák, 2002). However, this cannot be applied to national nature reserves that should be left free of any human interventions.
Enhancement of water retention in whole catchment areas will help building territorial systems of ecological stability, biocenters, and biocorridors. However, the Nature Conservation Act, no. 114/92 Coll. doesn't define the role of territorial systems of ecological stability in terms of flood control and doesn't specify responsibilities of state nature conservancy authorities (Macoun, 1997).
Present outcomes from automatic ultrasound water level gauges installed in the study catchment of upper Otava River persuade us of the fact that data measured this way make it possible to assess peat bogs hydrological function very in detail. Especially comparison of those parts of catchment where revitalizing measures of Bohemian Forest National Park Management took place, respectively other parts where ameliorative adjustments of mountainous peat bogs were implemented in last 70s, needs to be carried out. Continual records of water level and corresponding discharge values offer an extraordinary database for detailed analyses of flood waves ascending and descending phases, respectively for assessment of peat bogs influence on runoff process during dry periods. Qualified conclusions from field survey can be formulated after analyses of data from at least one hydrological year. Nevertheless, partial outcomes from present studies quite conclusively present more distinct runoff variability in profile closing catchment with very significant peat land proportion. Negative effect of peat bog localities on river headstream area hydrological regime was confirmed by thorough study and comparison of runoff reaction on causal rainfall total in both experimental catchments as well. Longer reaction interval adverting to more significant causal rainfall amount retention in the catchment was determined in the case of the catchment with less peat land proportion. Partial results were also carried out from analyses of snow conditions in representative catchments chosen within the study area. Acquired data in the form of graphic outcomes show quite high snow reserves variability in relation to the altitude. More detailed field survey in term of snow analyses will be realized in the next winter period 2007/2008.

5. Literature

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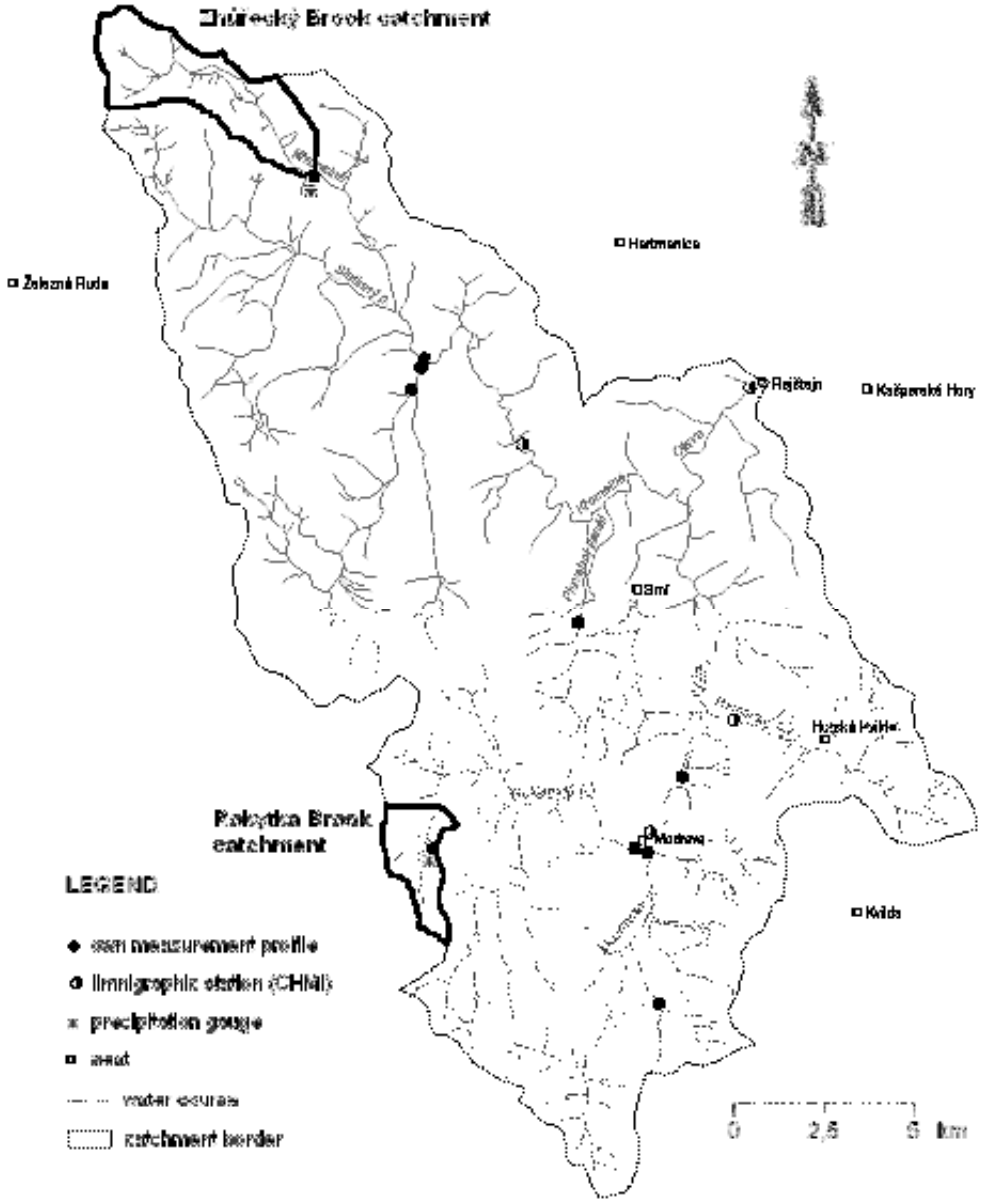


Fig. 1. Localization of own measurement profiles (automatic ultrasound water level gauges, water level laths), own shuttle precipitation gauges and CHMI limnigraphic stations in Otava River headstream area.

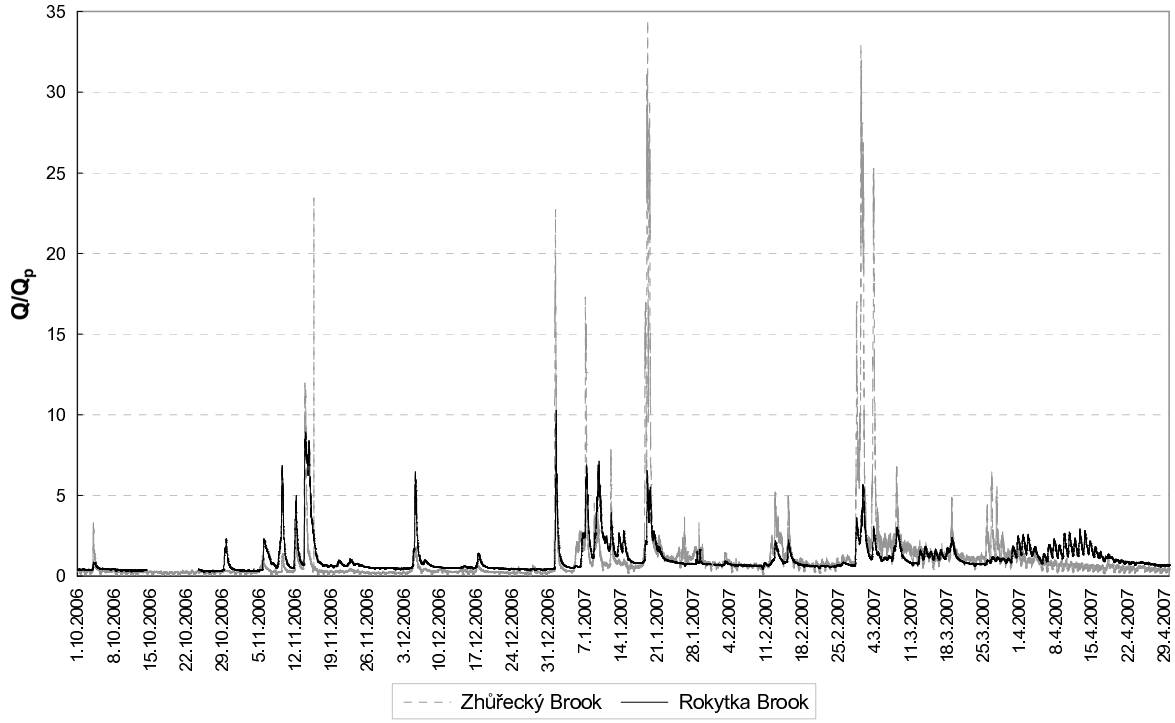


Fig. 2. Comparison of runoff variability in two catchments with different peat land proportion (Rokytka Brook, Zhůřecký Brook) in October 1, 2006 – April 30, 2007 period.

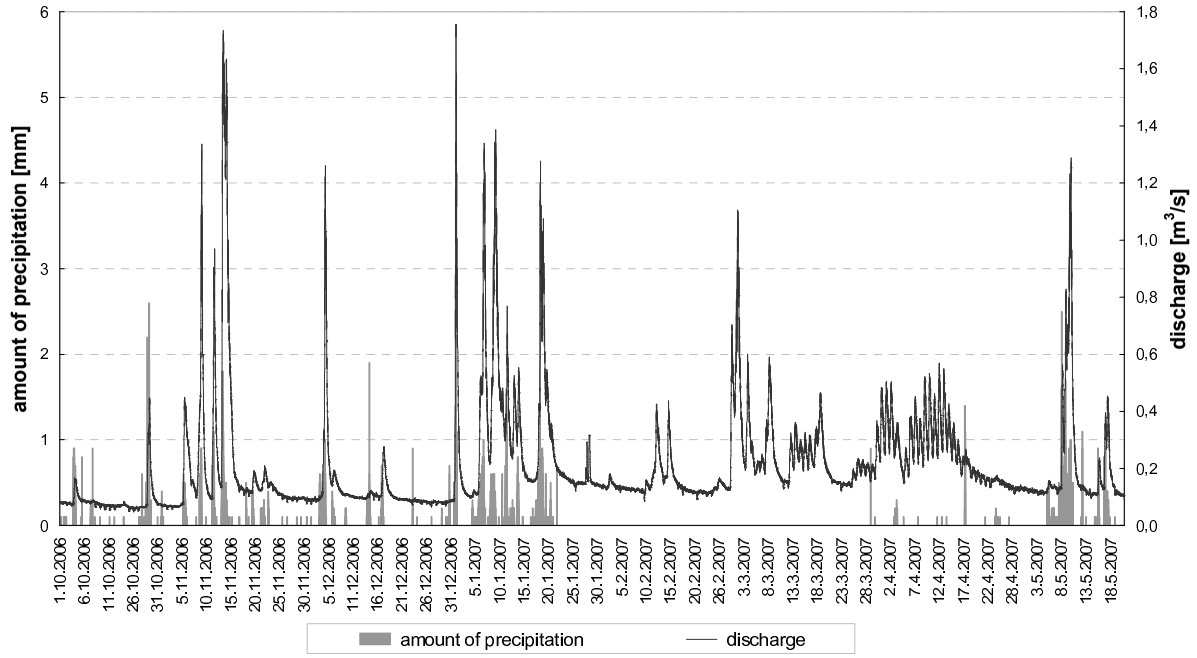


Fig. 3. Partial outcome from automatic ultrasound water level gauge and shuttle precipitation gauge – runoff reaction on causal amount of precipitation in Rokytka Brook profile (Vydra River headstream area) in October 1, 2006 – May 20, 2007 period (in January 1, 2007 – March 28, 2007 period precipitation gauge was out of service).

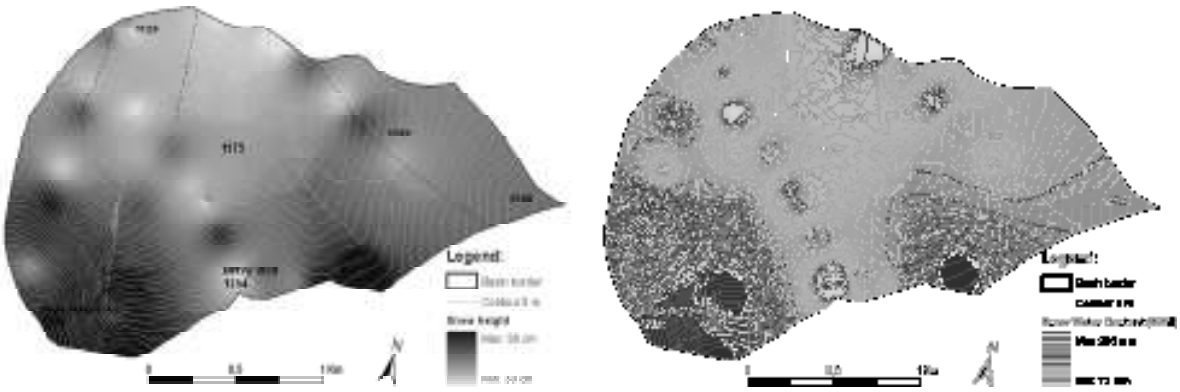


Fig. 4. Snow cover height (on the left) and snow water equivalent (SWE) in Ptačí Brook catchment (Vydra River headstream area).

Wetlands conservation activity
Expertness and approaches of Ecological Movement BIOM, Kyrgyzstan

Domashov Ilia,
Ecological Movement "BIOM

Profile of BIOM

- A public non-profit voluntary organization (created in 1993) unifying young specialists, scientists and leaders that participates in addressing environmental problems of the Kyrgyz Republic and Central-Asian region.
- Mission of BIOM is - involving diverse public groups in solving ecological problems and realizing the ideals of Sustainable Development.

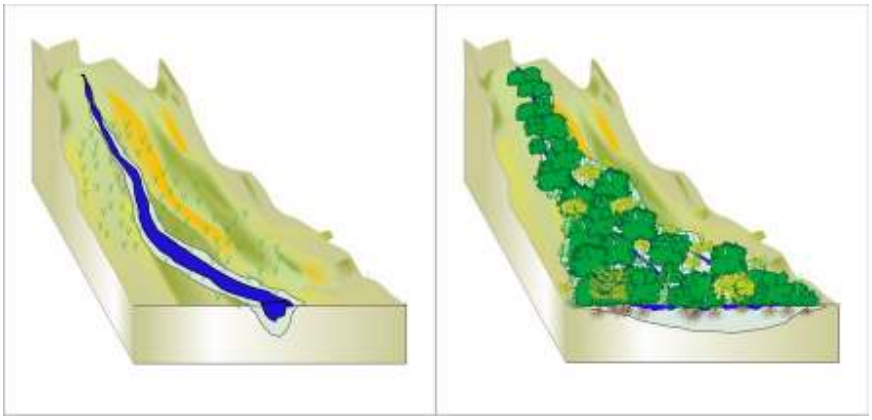
Priority programs of BIOM's activity:

- Sustainable Development
  - Sub-programme: environmental education for sustainable development
  - Sub-programme: Alternative power
- Biodiversity Conservation
- Ecological security
- Environmental Management

Activity

- Conservation of mountain wetlands in Kyrgyzstan
- Conservation of bogs around Issyk-kul lake

Concept of mountain wetlands conservation in Kyrgyzstan



Benefits

- Flow is concentrated in one place

Risks

- High level of destruction, quick flow (erosion, mudflows and floods);
- High level of water haziness;
- Siccation of territories around;

Benefits

- High level of soil moistening;
- Sustainable micro climate;
- High level of moistening of territories around

Risks

- Complicated access directly to the river.

- Concept is developed together with Kyrgyz professor Emil Shukurov, on the base of Theory of biotic regulation of the environment
- http://www.biotic-regulation.pl.ru

Summary

- Only through assistance of local population it is possible to guarantee sustainable future of water and wetlands in the landscape;
- Not disturbed wetlands increase level of moistening of territory, promote attraction of precipitation, cleaning of water from diverse pollutants, etc.
- Direct benefits for local population from wetlands could come from creation of coastal nursery forests

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Basics on Wetlands /Power Point Presentation/

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Sustainable future of water and wetlands in the landscape?

- Decreasing funds
- Public Awareness not raised enough
- Converting wetlands into agriculture areas

Services provided by wetlands

- The present valleys and river beds were formed in the aftermath of the last glacial periods (erosion, deposits of sand and gravel), followed by a return to the present climate (deposits of fine organic or mineral alluvial silt and ongoing erosion).
- Different types of features can be distinguished : from the river bed carved out of the rock to alluvial valleys formed from a succession of deposits of gravel, fine sand and peat
- Wetlands play
  - an essential part in the regulation of river flow,
  -filter pollutants and fertilizers,
  -spawning zones for some species of fish (pike in particular).
  -habitat for plants, insects, batrachians and birds…
- The expanse of groundwater in these deposits when they are well developed can constitute a large reserve which absorbs the variations of water flow. Alluvial deposits act rather like sponges which absorb surplus water before releasing it later. In these alluvial areas part of the water follows the course of the river: this drainage can represent a large volume. This water has been filtered, has a more constant temperature and constitutes a reserve of good quality water.
- When the flow of water from the river basin has to cross these alluvial formations before joining rivers significant quantities of nitrates or pesticides contained in the water are eliminated by the action of bacteria trapped in the soil or by the vegetation.
- These two functions – regulation of flow and retention of diffused pollutants from the river basin –combined with the positive effects on the fauna such as providing a specific habitat for fish (a safe area for spawning for some species and pike in particular spawn in flooded grasslands) and bird life make these areas very important ecological zones.
- In traditional landscapes these wetlands have specific features: wet grasslands, rushes, willows, etc. but in some regions the systematic drainage of this water-logged soil has resulted in the disappearance of these buffer zones. Even worse corn culture which leaves the earth laid bare for long periods, and which needs large quantities of fertilizers and pesticides appears to be disastrous for rivers downstream: sudden rises in water level, low water levels, poor water quality. Sand and gravel extraction in large alluvial valleys has also transformed the landscape. The consequences of these industries are often negative : floodwater no longer spreads out naturally but flows rapidly into rivers which increases the rise in water level. This water is loaded with organic and mineral material causing erosion of the river basin and alluvial silt is deposited in the river bed.

- Wetlands which are vital to the balance of rivers and crucial for the diversity of animal and vegetable species can only be preserved through political resolve. They should not be merely abandoned but properly managed like other areas
- Agricultural and forestry activities cannot be profitable within the structure of current policies, consequently owners and those working the land must be helped within the framework of landscape and river basin management. The flow and quality of rivers will depend on this action.

Public Awareness Rising About Wetlands

- Lack of good will from the authorities
- Not enough money
- People are not willing to hear anything if they doesn't have economical interest
- More stress should be given to the importance of the food supply system
- More stress should be given to the promotion of the economic activities that could be done from the local people for the wetlands protection

Socio-economic aspects of ecohydrological management of wetlands

- Wise use of the drainage systems
- With some exceptions water may be considered to be abundant in the world and consequently the main factor limiting water availability in many areas is water quality rather than quantity.
- It will become apparent that the most widespread water quality problems are those that ecohydrological processes can effectively address provided that the self-purification
- capacity of rivers and wetlands is no t compromised by human alterations.

Socio-economic aspects of ecohydrological management of wetlands

Pathogens

- Inputs of organic wastes, which give rise to BOD may also introduce pathogens.
- Illnesses related to poor water quality are the number one health problem in many countries

Nutrients

- Eutrophication of surface waters has been reported in many parts of the world.
- Most problems are reported in lake and reservoir systems receiving significant inputs of raw sewage from nearby urban areas

Sediments

- Natural suspended sediment concentrations vary enormously in the river systems, mainly as a function of basin relief and climate.

Socio-economic aspects of ecohydrological management of wetlands

- Natural Attenuation in River and Wetland Systems
- The waste removal capacities of rivers and wetlands have been recognized from the very beginning of human civilization, and consequently these water bodies have forever been the receptacles of our wastes.
- The most immediate advantage of a river was its flow, which transported wastes from the dumping point, but dilution also quickly reduced liquid waste concentrations, ideally to levels that were harmless to aquatic organismsand downstream human communities.

Integrating Ecohydrological Principles into Management Plans

- The management of water resources is a complex subject that responds to and emerges from a number of international agreements and national and state laws.
- Specific management actions are generally divided between multiple governmental agencies, with varying levels of interaction with non-governmental organizations and citizen groups.

Natural reserve EZERANI

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Personal Background regarding wetlands

- *Local Programme Assistant*
- *Restoration of Golema Reka*
- *Integrated Ecosystem Management in the transboundary Lake of Prespa in Albania, Macedonia and Greece*
- *2 years experience within wetlands as an assistant manager (not much experienced, that's why want to learn*
- *-Included in one site survey regarding the wetlands*
- *Regarding wetlands until now experience only within the Strict Nature reserve Ezerani*

Strict natural reserve EZERANI

Location

- Almost all bird species existing in the Prespa Lake area are building nests, feeding, resting and finding shelter here.
  - It covers the northern coastal area of the Prespa Lake, at 855 m height above sea level. The protected area covers 2080 ha.

Strict Natural Reserve

The strict ornithological reserve "Ezerani" is situated on the northern shore of Lake Prespa, between the villages of Sir Han and Asamati. This part of the shoreline is low, muddy, covered with reeds and is flooded to a large extent during high water level. Numerous species of birds present around Lake Prespa build nests, feed, rest and look for a shelter within Ezerani. The widespread wet meadows of this area are also important trophic sourcesfor large numbers of transitory birds.

In the past, the natural sources of food were supplemented by artificial fish ponds near Asamati (141 ha), especially after the spawning period of the "belvica" in Lake Prespa.

These fish ponds are now abandoned and dry, however (see Chapter 3 of this report for details).

There are about 200 bird species, 104 of which are water birds. Of this number, 62 species are put on the List of Protected Species according to the Bern Convention, while three of them are on the European Red List of Globally Endangered Specie

In the European "Red List" of vertebrates issued by the European Environmental Agency and the Council of Europe, of the 30 threatened fish species known to exist within the country, six utilize the Ezerani wetland and are endemic species restricted to Lake Prespa:

- 1. Prespa Bleak - Alburnus belvica;
- Prespa Barbel - Barbus prespensis;
- 3. Prespa Nase - Chondrostoma prespense;
- 4. Prespa Loach - Cobitis meridionalis;
- 5. Prespa Minnow - Phoxinellus prespensis;
- 6. Prespa Roach - Rutilus prespensis

Protection status

- Within Macedonia, the main competent authority concerning the protection of nature is the Ministry of Environment and Physical Planning, which is also the National Focal Point for all related MEAs (CBD, CITES, Ramsar, Bonn and Bern Convention).
- In accordance with No. 10 International Convention on Bird Protection (Paris), the Law on Natural Rarities Protection ("Official Gazette of SRM" No. 41/73) and the Law on Ohrid,
- Prespa and Dojran Lake Protection ("Official Gazette Of SRM" No. 45/77), a Law on theProtection of the "Ezerani" Locality at Lake Prespa was adopted by the Parliament of Macedonia (Official Gazette No 37/1996), proclaiming Ezerani as a strict natural reserve.
- Lake Prespa (including the Ezerani reserve) is on both the list of the most important ornithological locations of Europe and the list of the most important wetlands in the world.

Current status

- The Ezerani Reserve covers an area of approximately 2,080 ha and includes a portion of the lake up to 10 m in depth; however, the vegetated emergent wetland area is much less, today covering approximately 325 ha due to Lake Prespa's fluctuating lake surface (Figure 6). Th last time the lake was at normal pool elevation (arbitrarily set at 849.5 m msl) was November 1972.

Since then, the water level has gradually fallen (normal seasonal variations notwithstanding) to its current level of 843.82 m msl (as of January 2006). Although the water level of Lake Prespa has decreased by more than 6 m in 33 years, based upon a review of historical maps, aerial photographs, and monthly water level fluctuation data, as well as several field investigations, it appears the decline was slow enough that the adjacent wetland was able to successfully migrate with the lowering water surface. According to Sherdenkovski (2000), the lake's long-term amplitude of fluctuation is 17 m, with the lake surface having plunged to 835 m msl at some time in the past

WET Evaluation

- The social significance rating for floodflow alteration is high due to the presence of features ofsocial concern or economic value (e.g., houses, buildings, etc.) within the 100-year floodplain of the wetland. Thus, the wetland is useful in absorbing flood waters and protecting valuable human structures. Sediment stabilization is high because these structures are also located within wave vulnerable areas.
- Sediment/toxicant retention and nutrient removal/transformation have high social significance because Lake Prespa is used for drinking water, a WWTP was considered a priority for the area, Ezerani includes almost all of the palustrine wetland system in the vicinity, and the wetland is the last chance to provide these services before contaminated water reaches the lake. Wildlife diversity/abundance is rated high due to the presence of a wetland-dependent threatened speciesand because the area is designated as a special-use reserve for waterfowl.
- Aquatic diversity/abundance is high because several rare fish species (including the endangered carp) utilize the wetland. Finally, uniqueness/heritage is high because the area is used for ongoing scientific study, it contains threatened/endangered species, it includes almost all of the20 palustrine wetland system in the area, and because Ezerani has been pronounced as a strict nature reserve, as well as a national monument and a RAMSAR site

- With respect to effectiveness, the Ezerani wetland also achieved a number of high ratings.
- For example, sediment stabilization is high because of the presence of erosive forces (winddriven waves formed from a large fetch [i.e., the open water distance unimpeded by intersecting islands, erect vegetation, or other obstructions]), which are countered by the wide fringe of erect vegetation in the Ezerani wetland. Sediment/toxicant retention and nutrient removal/transformation are rated high due to this same wide fringe of vegetation coupledwith generally low water velocity and an apparent lack of significant long-term erosion.
- Thus, the Ezerani wetland seems to be very effective at removing toxicants and nutrientsfrom inflowing waters.
- In addition to the WET analysis, on 7 August 2006 field investigations were made of the reported recent canalization activities within the Golema Reka delta. Based upon an inspection of the lower reach of the river (a 250 m section immediately north of the river mouth), as well as a spot check of the area around the collapsed bridge over Golema Reka between the two series of former fish ponds, no recent channel excavation/rectification works were observed (Figure 7).

Site survey and problems

- Regarding unauthorized sand excavation, a number of small areas where sand had been removed were noticed. For the most part, they were situated within the Ezerani Reserve but outside of the wetland. A few areas were documented near the edge of the wetland on theAsamati side of Golema Reka (Picture 2). In general, all of the observed sand excavation work was of a minor nature. If the level of Lake Prespa rises again in the future, the areaswill be naturally restored to their previous condition by wave and water action. If the lake level remains low, the habitat damage caused by the removal of sand should not be a concern if the amount of excavation does not increase considerably.
- Because the wetland is so large and the hydrologic regime of Lake Prespa so complex, only a few general observations can be made.
- First, the water regime of the lake and its fluctuating water surface directly affect the Ezerani wetland. A number of factors are responsible for the declining lake level, including climate change, normal variation in precipitation patterns, water usage for irrigation, drinking water use, evaporation, etc. (KfW, 2005). Some of these various factors can be moderated (for example, the use of drip irrigation instead of flood irrigation); however, others are beyond anyone's immediate control. Nevertheless, unless a future drastic and rapid change in the lake's water inputs occurs, the Ezerani wetland can be expected to continue moving with the lake, either higher or lower as in the past, and maintaining its same general areal extent. As a result, no specific restoration measures for the wetland should be attempted at the present time.
- This is not to say that nothing can be done to improve the habitat quality of the general area.
- On the contrary, the western cell (about 60 ha) of the former fish pond situated on the east side of Golema Reka was a very good wetland habitat until just a few years ago, when thewater control structure was opened and the levee breached (Picture 3 and 3a). Because some portion of the fish pond was likely originally constructed within the Ezerani wetland, restoring hydrology to the pond and recreating a wetland environment would be a type afforestoration, even though the water will have to be managed artificially.

- **Summary of Main Problems**
- Practically the strict natural reserve is not functionation
- he local citizens are resisting to the measures undertaken due to the unsolved property rights and relations
- Mass sand excavation
- No tourists present
- Agricultural and other business sector activities are undertaken

New Hope

- Nature Reserve Management Plan, that is to be expected to be launched in 2008, for which the funding is being provided and it expected positive changes to be made
- Revaluation plan for all the Strict Natural Reserves the Ministry of the Environment and Physical Planning as well as UNDP, expected to be done at the end of 2007

TABs

Project of detailed mires inventory in the Karkonosze National Park in Poland as the basis for the monitoring and protection of these ecosystems

Roksana Knapik'
Karkonosze National Park, Poland

Mires are the most valuable ecosystems of the Karkonosze National Park in Poland. They are places of rare and endangered plant and animal species occurrence, including glacial relics and endemic species.

In the Karkonosze National Park mires cover area of 400 ha. According to their location they are divided into two groups: mires of montane zone and of subalpine zone. The age of the oldest mires was determined at around 10 000 BP and most of them have developed through paludification. Mires of montane zone are located between 1000 and 1250 m a.s.l. Their surface texture is largely unvaried. The depth of peat does not reach more than 1 meter, just on the mire in the Łomnica valley the depth of the organic deposit is around 10 meters, but it is because of different origin of this place. They are strictly related to spring water seepages. Mires of subalpine zone are located between 1250 and 1450 m a.s.l. Their surface texture is diversified, with a large number of small pools, ridges and hollows. The peat thickness varies from 1.5 to 2 meters.

Devising good methods of mires monitoring and protection in the Karkonosze National Park should be preceded by detailed inventory of all objects together with research on mires origin and development both from geological and historical points of view. Well planned monitoring is supposed to reflect changes in mires ecosystems and results of the detailed inventory should be the key for the monitoring data analysis. For example the knowledge about mires reactions to climate and humidity changes in the past can let us to predict reactions of these ecosystems now.

First stage of the mires inventory in the Karkonosze National Park will contain peat thickness measurement because the mire presence is conditioned by existence of 30 cm of peat depth. This analysis will make possible to count the area of all particular mires and the area of all mires together in the Karkonosze National Park. The next stage of the inventory will include making of the mires plant communities map and description of the mires morphological forms.

Profiles analysis will the most labour-intensive part of the inventory. It will include: lithological description, macrofossil analysis, pollen analysis, diatoms and cladocera analysis (if lake deposits are recorded), C and S stable isotopes ratios analysis and C 14 dating. The results will determine the age if the mires and reconstruct detailed development of every particular mire in the light of climate changes.

Variability of herbaceous floodland vegetation depending on water regime changes at Gemenc, Middle-Danube-valley

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Danube-Drava National Park Directorate, Pécs, Hungary

Between 2002 and 2004 vegetation mapping and descriptions were made four times at Nagy-Gyékényes – a 26 hectare grassland area of Gemenc. In 2002, after the first survey, a serious flood and a long, extraordinarily high-water period occurred, followed by a longer drought in 2003. The drastically different water regime states arow each other had strong effects on vegetation. For the analysis ecological indexes and social behaviour types of species, and vegetation maps were used. The collected data simply and cleanly show that the herbaceous vegetation of the floodland reacts fast and sensitively to changes of accessible water. At first, because of the constant water coverage the species richness of the relatively species-rich, dominantly alluvial meadow vegetation, patterned based on microrelief, reduced and the dominant role was assumed by higrofilous and aquatic elements. The less water adherent vegetation types persisted only at the highest levels. In the following drought period an open herb layer remained which was soon filled up by fast propagating, disturbance tolerant weed and invasive species, furthermore the pattern became much homogenous, that all signify the vulnerability of the habitat type.

Wetlands in Belarus: values, threats and key achievements

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Institute of Zoology, NAS of Belarus

The study of wetlands has recently been carried out in Belarus, which have enabled to identify Ramsar sites. This presentation demonstrates some achievements in sustainable wetland management in Belarus.

Types of wetlands in Belarus
There are several types of wetlands in Belarus such as bogs and fen mires, lakes, and meadows. The most valuable wetlands are recognized as Ramsar Sites.

Presently there are 7 Ramsar sites in Belarus
Belarus joined Ramsar Convention in 1999. **Now we have 7 Ramsar sites**, which have been designated from 1999 to 2002. There are Sporovski (1999), Mid-Pripyat (2001), Olmany mires (2001), Yelnia, Osveiski, Zvanets, Kotra.

All Ramsar sites have the national status of the **Natural Protected Areas (**National Reserves). All Ramsar sites will be also obliged to have Management Authorities and Management Plans.

Values of Ramsar sites
- unique biodiversity
- considerable number of rare and threatened species depends on wetlands

Main threats for Ramsar sites
Ramsar sites are represented by natural ecosystems that are negatively impacted by human activities at the adjacent areas. **Main threats** are as following:
- habitat degradation caused by changes in the hydrological regime;
- habitat changes as a result of floods;
- habitat changes as a result of fires;
- unsustainable economic activities.

Hydro regime
The main causes of changes of hydrological regime
Disruption of hydrological regime of wetlands is the main reason of many other problems. Causes of disruption of the hydrological regime are:
- rules of water resource use do not take into account the interests of wetland conservation in the sites;
- the old network of drainage canals is still in use;
- the drainage canals are located along the borders of many sites.

Floods
Means of prevention:
- **hydrological management;**
- **biodiversity-friendly regulations for use of water resources need to be elaborated**

During vegetation period floods is one more threat for wetlands. Regular floods are the reason for the vegetation succession. Floods are caused not only by increased precipitation, but also by the environmentally unfriendly patterns of water use in the region.

To prevent summer floods it is necessary to take the following measures:

- water level regulation facilities need to be built on drainage canals;
- new regulations for water resources use need to be elaborated.

Fires

One more threat is uncontrolled peat fires when the water level is low.

Economic activities

Continuously falling water level in wetlands reduces wetland productivity and causes shrub expansion and fires.

One of the global threats to biodiversity of wetlands is expansion of shrubs. Comparative analysis of aerial photos has indicated that the area of open fen mires decreases due to **encroachment with shrubs and trees**. The key factor behind extensive shrub encroachment is natural vegetation succession as a result of almost complete cessation of hand haymaking at the mire, once widely spread over its area in the past. Another cause is disruption of the hydrological regime.

Achievements

Management plans

- Management plans for three key fen mires (Zvanets, Sporovski, Yelnia) were elaborated and approved by the government in 1999-2002
- Restoration of hydrology of three Ramsar sites (Zvanets, Sporovski, and Yelnia) has been started. Scientific conclusions and technical designs are developed
- The preparation of the Management Plan for Ramsar site "Mid-Pripyat" is to be started within the framework of the project UNDP-GEF

Example of restoration of hydro regime in raised bog: Yelnia (Ramsar site, 1999-2002)

One example of wetland restoration is the implementation of the project initiated by the Ministry and supported by RSPB and Wetlands International. As a result, recommendations were developed for restoration of hydrological regime for one of the largest Belarusian raised bogs "Yelnia" (Ramsar site and IBA (232 sq.km). The project was implemented by BirdLife Belarus. The dams on 17 drainage canals, which were the principal cause of water level decrease, were built in the framework of the project. Dams were built in places inaccessible to any transport. Therefore a simple but effective enough dam design was developed. Rise of water level allowed to prevent peat fires ever since.

Example of restoration of hydro regime in fen mire - Zvanets Ramsar site (area – 15,873 ha)

>16% of world population of Aquatic Warbler

Suitable habitat area: 80 sq.km

Number of Aquatic Warbler: 4600-7600 males

Density of Aquatic Warbler: 91-137 males/sq.km

Ramsar site and IBA

Another example of the positive results of Ramsar sites management can be found in the mire "Zvanets".

Reserve "Zvanets" is the largest open fen mire in Europe. Its area is 15,000 hectares. It is recognized as IBA and a Ramsar Site. Open fen mire covers seventy percent (70%) of the site. Zvanets is bordered by drainage network, thus canals of these network would drain the natural mire as well. Decrease of underground water level caused rapid expansion of shrubs.

Implementation of management plan in Zvanets (2003)

In order to ensure optimal hydrological regime in Zvanets mire, engineering project was prepared. The management plan recommends:

• to construct a series of water regulating facilities on drainage canals across the mire;

• to elaborate new operational rules and regulations for the drainage facilities adjacent to the mires.

Expected results:

- **Water level in the mire will be stable from –5 to +10 cm during breeding season**
- **AW density will be stable at 90-110 males per km2**

The canals go along the edge of the mire and the water flowing out of it used to cause a considerable decries of the water level in the mire. Construction of 8 overflow dams on the key canals affecting the mire is being completed. **Even though the dams have just been completed they have already started to operate as planned by retaining water.**

Plans for the future

- identification of the valuable wetlands not included in the NPA system
- development and implementation of management plans for all Ramsar sites
- restoration of the disturbed wetlands

IUCN-SEE and conservation and management of wetlands in the South-Eastern Europe region

Lubomíra Vavrová

IUCN-Programme Office for South-Eastern Europe, Serbia

IUCN-The World Conservation Union is the world`s leading authority on nature conservation. The mission of IUCN is to influence, encourage and assists societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. The Union brings together more than 80 states, 111 governmental agencies, more than 800 NGOs, and some 10,000 scientists and experts from 181 countries in a unique worldwide partnership.
The IUCN Programme Office for South-Eastern Europe (IUCN-SEE) is one of the four offices in Europe coordinated by the IUCN Regional Office for Europe. IUCN-SEE is located in Belgrade (Serbia) and its main responsibility is to implement the "Strategy for Conservation without Frontiers" and to coordinate trans-boundary cooperation and integrated biodiversity conservation in the SEE region.
IUCN-SEE has been participated at the following projects focused also on wetlands conservation and management:

Sava River
Sava River springs in Slovenia, and flows through Croatia, Bosnia and Herzegovina, Serbia and Montenegro, where it discharges into the Danube River. Its total length is 950 km. With its largely unaltered natural river system, it carries high global importance in terms of ecological and landscape values. Being one of the largest tributaries of the Danube, the Sava hosts the largest complex of alluvial intact floodplain wetlands in the whole Danube basin, as well as the largest lowland forests.
Sava has been selected as the focal region in the Pan European Biological and Landscape Diversity Strategy (PEBLDS) of the Council of Europe. The river hosts two Ramsar sites – Lonjsko Polje & Mokro Polje in Croatia and Obedska Bara in Serbia.

1. Development of an Ecological Network along the Sava River (June 2005 – June 2006) – PIN-MATRA
Coordinators: Wageningen International (the Netherlands), IUCN-SEE
Partners: Institute for Nature Conservation of Serbia, State Institute for Nature Protection of Croatia, Faculty of Science-Centre for Ecology and Natural Resources of Bosnia and Herzegovina, Institute of the Republic of Slovenia for Nature Conservation

The overall objective of the project is to design and manage an ecological network along the Sava River through the identification and designation of protected areas, ecological corridors and buffer zones. The overall objective should be achieved through the following immediate objectives:

- Processing of existing biodiversity data into a harmonized database – Spatial Data Infrastructure (SDI).
- Harmonization of methodologies of data gathering and storage with the requirements of the EU Birds and Habitats Directives.
- Identification of areas valuable for nature conservation and for the development of an ecological network.
- Developing of preliminary ecological network.

- Increasing of knowledge and capacities of national experts on the Birds and Habitats Directives and the management of ecological corridors.

On activities and results of the PIN-MATRA Sava River project is based the following project:

2. Protection of Biodiversity of the Sava River Basin Floodplains (Nov 2006 – Dec 2009) - LIFE
Coordinator: IUCN-SEE
Partners: Wageningen International (the Netherlands), ORBICON (Denmark), State Institute for Nature Protection of CRO, Faculty of Science-Centre for Ecology and Natural Resources of Bosnia and Herzegovina, Agricultural Institute of Republic of Srpska, Institute of Nature Conservation of Serbia

The overall objective is to protect the unique ecosystems and biodiversity along the Sava River through supporting Croatia and Bosnia and Herzegovina to i) protect floodplain landscapes and biodiversity, ii) maintain retention functions of the floodplains, and iii) improve trans-boundary cooperation. In order to integrate protection of ecosystems with land use practices and flood retention measures, the immediate objectives are:

- Support transborder cooperation and agreement between the Sava countries to designate and manage an ecological network of protected areas, buffer zones and corridors for habitat types and species f European importance.
- Protect global significant biodiversity and support rural development through adjusting land use practices to the needs of the ecological network.
- Integrate the national flooding and retention capacities with protection and management of the floodplain landscape and biodiversity.

For more information on the projects, please contact: **Mr Jőrg Lohmann,** IUCN-SEE, joerg.lohmann@iucn.org

Danube River
In 2004, the IUCN and its partners launched the European Green Belt Initiative, focusing on creation of an ecological network along the former Iron Curtain route. The Initiative aims to foster trans-boundary cooperation and regional sustainable development within the region. The first site-based project coordinated by IUCN within the Initiative is

Integrating Local Communities and Nature Protection in the European Green Belt (Sep 2005 – Aug 2007) - LNV
Coordinator: IUCN-SEE
Partners: Institute for Nature Protection of Serbia, Drava League (Croatia)
The project is focusing on the Gornje Podunavlje Special Nature Reserve (SNR) in Serbia. It is a large wetland area located in the N-W Vojvodina Province along the left banks of the Danube River, borders the Danube-Drava National Park (Hungary) and the Kopacki rit Nature Park (Croatia), which was included in the list of Ramsar sites in Europe. This is a large marshy complex and one of the last remaining big floodplains in Europe.

The project foresees strengthening of trans-boundary cooperation in the middle course of the Danube River while carrying out activities in the Gornje Podunavlje SNR. The specific objectives are to:

- Strengthen trans-boundary cooperation between Serbia and Croatia.

- Raise awareness among local stakeholders and administrations.
- Build capacities of all stakeholders associated with the protected area.

The main sets of activities of the project are i) new inventory and habitat mapping of the area; ii) to conduct consultations among local stakeholders and administrations concerning the integration of biodiversity protection with sustainable rural development, and iii) to hold a workshop for all key stakeholders to discuss results of the project activities.

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HYDROLOGICAL REGULATION OF BIOLOGICAL PROCESSES IN THE VOLGA DELTA AND NORTH CASPIAN

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The wetlands ecosystems (deltas and estuaries) are subjected to outer impact, since their life activity is based on the through flows of substance and energy, unlike the majority of natural ecosystems with almost confined substance rotation. The role of human being in the outer management of deltas and estuaries is increasing. This may lead to the ecosystem crisis if the formula has not been found of differentiation between the «responsibilities», i.e. functions, of man or nature in delta and estuary management.

The definition of the «responsibilities» of Nature is a primary task, since it is only after it is solved that the limits to human interference in the management of deltas and estuaries could be set.

Seasonal and perennial fluctuations of water flows and substances passing through the Volga delta and estuary (i.e. the North Caspian) are specific feature of the wetlands ecosystems of the area. An important feature is also the so-called memory of the ecosystems due to which the hydrological changes accumulated in the previous years affect the current changes of water flows and substances. The elements of the «memory» are, in particular, the sea level and water and substances reserves in the eastern part of the North Caspian.

At the present, natural hydrological factors in controlling biological processes in the Volga delta and estuary are much higher than the anthropogenic factors. To increase the impact of anthropogenic control it is necessary to determine its priorities and develop mechanisms of their realization.