European Commission

NWRM

Natural Water Retention Measures

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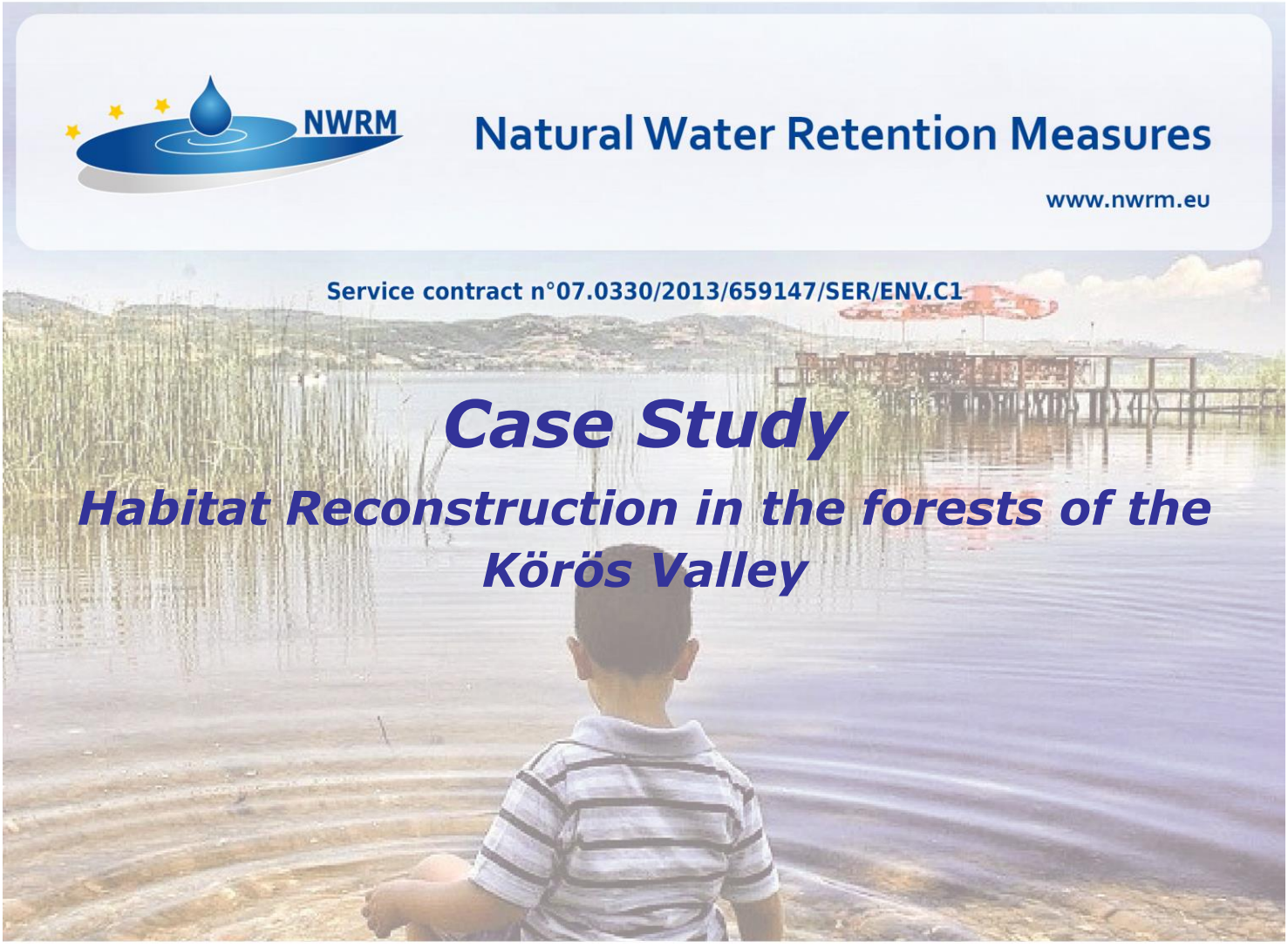
Service contract n°07.0330/2013/659147/SER/ENV.C1

Case Study

Habitat Reconstruction in the forests of the Körös Valley



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This report was prepared by the NWRM project, led by Office International de l'Eau (OIEau), in consortium with Actéon Environment (France), AMEC Foster Wheeler (United Kingdom), BEF (Baltic States), ENVECO (Sweden), IACO (Cyprus/Greece), IMDEA Water (Spain), REC (Hungary/Central & Eastern Europe), REKK inc. (Hungary), SLU (Sweden) and SRUC (UK) under contract 07.0330/2013/659147/SER/ENV.C1 for the Directorate-General for Environment of the European Commission. The information and views set out in this report represent NWRM project's views on the subject matter and do not necessarily reflect the official opinion of the Commission. The Commission does not guarantee the accuracy of the data included in this report. Neither the Commission nor any person acting on the Commission's behalf may be held Key words: Biophysical impact, runoff, water retention, effectiveness - Please consult the NWRM glossary for more information.

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Table of content

I. Basic Information

Application ID	*Hungary_01*			
Application Name	**Habitat Reconstruction in the forests of the Körös Valley**			
Application Location	Country:	Hungary	Country 2:	
	NUTS2 Code		HU33	
	River Basin District Code		HU1000	
	WFD Water Body Code			
	Description		*Former floodplain of the River Körös near the Town Gyula, County Békés*	
Application Site Coordinates *(in ETRS89 or WGS84 the coordinate system)*	Latitude: *- ETRS89 or WGS84? Specify:* 46.698664 46°41'55.2"N		Longitude: *- ETRS89 or WGS84? Specify:* 21.389736 21°23'23.1"E	
Target Sector(s)	Primary:	Forest		
	Secondary:	Hydromorphology		
Implemented NWRM(s)	Measure #1:	*N3 Floodplain*		
	Measure #2:	*F5 Land use conversion*		
Application short description	The fragments of floodplain forests (Fraxino - pannonicae - Ulmetum) along the River Körös were cut from the river by dykes during the river regulation works in the 19th century. The deteriorated groundwater conditions were worsened in a drought period during the 1980-1990's that triggered action of the forestry service. Restoration of the river connection and the floodplain watercourse network provide surface water supply from the backwater of flood waves to the 2000 ha forest. The result of the habitat reconstruction work is a 38.8 km long water-flow and a water surface of 15.7 hectares, cc 400 hectares of the forest has a direct positive ecological impact. The water supply of the floodplain channel network has another source as well. A smaller volume comes from a fishery. In case of this second source the nutrient overload of the fishery is assimilated in the forest as an additional service. Previously this load were let back into the river directly.			

II. Policy context and design targets

Brief description of the problem to be tackled	*River regulation works of the 19th and 20th century resulted in degraded living conditions for the river valley forests (declining groundwater levels, lack of inundations). A 12 year long dry period in the 1980-1990 pushed the remaining forests into critical status. The insufficient available water quantity had to increase.*	
What were the primary & secondary targets when designing this application?	Primary target #1:	Regulation of hydrological cycle and water flow
	Secondary target #1:	Self-regulation of water by filtration / storage / accumulation by ecosystems
	Remarks	

Which specific types of pressures did you aim at mitigating?	Pressure #1:	WFD identified pressure	**4.1.1 Physical alteration of channel/bed/riparian area/shore of water body for flood protection**
	Remarks		
Which specific types of adverse impacts did you aim at mitigating?	Impact #1:	WFD identified impact	**Damage to groundwater dependent terrestrial ecosystems for chemical / quantitative reasons**
	Remarks		
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:	WFD-mitigation of significant pressure	*Adverse effects of hydromorphological changes on groundwater and riparian ecosystems*
	The measures were made before Hungary joined the EU, so the specifications are backward induction of the recent classification.		
Which national and/or regional policy challenges and/or requirements aimed to be addressed?	The droughts challenge, but this development wasn't induced along national policies. It was a local initiative to tackle the site specific problems that originates in a more general, regional scale effect.		

III. Site characteristics

Dominant Land Use type(s) *Select from the drop-down menu with the CORINE LU types and codes.*	Dominant land use	*311*
	Secondary land use	
	Other important land use	
	Remarks	
Climate zone	warm temperate dry	
Soil type	*Type in the relevant soil type (FAO class) from the list in Annex 3*	
Average Slope	nearly level (0-1%)	
Mean Annual Rainfall	300 - 600 mm	
Mean Annual Runoff	0 - 150 mm	
Average Runoff coefficient (or % imperviousness on site)		
	No runoff from the area, the inflow water infiltrates into the soil.	
Characterization of water quality status (prior to the implementation of the NWRMs)	The complex WFD status of the River Fekete Körös (the source of water to the site) is medium. The water quality is good, the low classification is due to the hydromorphological problems. The area of the measure had no water supply before the measure, so it had no water quality status/information.	

Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	*Positive way:* This is a state owned forest that consists of one forest body. Also it is inside a temporary flood storage reservoir in a band of the River Fekete-Körös. The isolation of the area and lack of the risk of flooding nearby areas made it an easy case from the water directorate's point of view. The landscape relief contains the former river branches in the territory this gave the basic network of the rehabilitated water supply network.

IV. Design & implementation parameters

Project scale	Medium (eg. public park, new development district)	*The forest site is cc 2000 ha*
Time frame	Date of installation/construction (MM.YYYY)	*1996*
	Expected average lifespan (life expectancy) of the application in years	*Forever*
Responsible authority and other stakeholders involved	*Name of responsible authority/ stakeholder*	*Role, responsibilities*
	1. DALERD Rt (South-Alföld Forestry Ltd.	Lead Planner, implementer of the development
	2.Állami Erdészeti Szolgálat Kecskeméti Igazgatóság, National Forestry Service – Kecskemét	Advise on planning
	3.ÁPV Rt (National Privatization and Asset management Ltd, state owned)	Owner of the regional forestry management organization, Dalerd – financial sources for the development
	4.Körösvidéki Vízügy Igazgatóság (Körös River Water Directorate	Co-planner
	5.	
The application was initiated and financed by	The application was the own initiative of the forestry, Dalerd. It was financed during the recapitalization of the state owned forestry management organizations by ÁPV Rt. Other financial sources came from the (that time functioning) forest regeneration fund of the Treasury	
What were specific principles that were followed in the design of this application?	The basic restoration principle was to simulate the environmental conditions for the forest it had before the river regulation works as much as possible. Some design principle: Use the existing infrastructure and former river beds, channels as much as possible in a landscape friendly manner. Minimize future operation and maintenance costs. Do not create conflicts with the other water uses of the area. The functioning of the system must be agreed with the other land users and owners of the area.	

<table>
<tr><td rowspan="2">Area (ha)</td><td>Number of hectares treated by the NWRM(s).
e.g. It could be the upstream drainage area in case of retention ponds</td><td>15.7</td></tr>
<tr><td></td><td>15.7 hectares new water surface in lakes and channels. The total length of the rehabilitated arms is 38.8 km. It is estimated that 400 hectares of the forest has improved conditions</td></tr>
<tr><td>Design capacity</td><td colspan="2">Maximum quantity of water derived from the river depends on the water level. During a year there is cc 180 days for water supply. During this period cc 2 million m3 water arrives into the area</td></tr>
<tr><td rowspan="6">Reference to existing engineering standards, guidelines and manuals that have been used during the design phase</td><td colspan="2">Reference</td><td>URL</td></tr>
<tr><td>1.</td><td></td><td></td></tr>
<tr><td>2.</td><td></td><td></td></tr>
<tr><td>3.</td><td></td><td></td></tr>
<tr><td>4.</td><td></td><td></td></tr>
<tr><td>5.</td><td></td><td></td></tr>
<tr><td>Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?</td><td colspan="2">The high cost of a previous attempt to pump water for the area proved prohibitively expensive and made it clear that only gravitational supply can provide sustainable solution.</td></tr>
</table>

V. Biophysical impacts

Impact category (short name) Select from the **drop-down menu** below: ⇩	**Impact description** (Text, approx. 200 words)	**Impact quantification** (specifying units)	
		Parameter value; units *and/or*	% change in parameter value as compared to the state prior to the implementation of the NWRM(s)
Runoff attenuation / control	*Reduction of runoff*	2 million m3/year	it was zero
Peak flow rate reduction	*No water supply from the front water of flood waves*		
Impact on groundwater	*There is no reliable monitoring, but a 2,5 meter increase of ground water level was detected in a forest dwell 300 meters from the channel after the re-introduction of the water supply of the area.*		
Impact on soil moisture and soil storage capacity			
Restoring hydraulic connection	*Hydraulic connections are developed cc half of the year*	*180 days*	
Water quality Improvements	*No direct impact on the source river as no back-flow. Indirect positive impact. The forest assimilates the nutrient overloaded water from the near-by fishery that previously drained its used water directly into the river.*	*no.available data.*	
WFD Ecological Status and objectives	*The area is not part of the Fekete Körös River water body, while the connection of this former floodplain improves the river's hydromorphology status.*		
Reducing flood risks (Floods Directive)			
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	*Improved habitat for species. Increased diversity of plant and bird species. There are surveys and list of the species, but it is not quantitative.*		
Soil Quality Improvements			
Other			

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	The prevention of the loss of future timber production due to water shortage is the main benefit of the application. Potential increase of timber mass growth rate compared to other forest sites will be investigated next year (20 years, two forest planning cycles from the implementation). Cost reduction due to natural regeneration of some tree species (for example fraxinus ornus).		
Financial costs	***Total:***	*Value in €*	*Text / Specify*
	Capital:	*650.000 - 970.000 €*	*Planner's estimation of the development cost in 2014 prices of the same work volume, 200-300 million HUF*
	Land acquisition and value:		
	Operational:		*No need of additional operation costs. The eventual operation of the sluices can be covered in the basic operation.*
	Maintenance:		*No maintenance need for the next 2-3 decades.*
	Other:		
Were financial compensations required? What amount?	*No*		
	Total amount of money paid (in €):		
	Compensation schema:		
	Comments / Remarks:		
Economic costs	*Actual income loss: There is no loss*		
	Additional costs:		
	Other opportunity costs:		
	Comments / Remarks: The reason for the lack of costs and compensations: The measure was implemented where conflict free circumstances were given. Other potential sites were scaled down because of potential conflicts of interests in land use.		
Which link can be made to the ecosystem services approach? *Hint: The actual benefits of improving nature's water storage capacity are essentially linked to an*	Biomass production Amenities: This area is the Forest School of the nearby Gyula town, education and recreation facilities for school programs with regional importance. Total		

improved provision of some of the following ecosystem goods and services: - *Freshwater for drinking.* - *Water provision to deliver water services to the economy both for drinking and non-drinking purposes.* - *Water security (reliability of supply and resilience to drought).* - *Health security (control of waterborne diseases).* - *Flood security and protection.* - *Storm surge protection.* - *Biomass production.* - *Amenities (associated to habitat protection): fish and plants, tourism, recreation, and others.* - *Benefits of improved coastal water quality and ecological status for a sustainable commercial production of shellfish with human health and welfare values.*	education activity reaches 3-4 thousand education day per year (counted like workload in the person month) and 3-6 visitor nights. Wildlife management – the area provides higher animal carrying capacity Assimilation of nutrient load: it provides a mutually advantageous solution to "treat" the nutrient content of the discharged water from the fishery adjacent to the forest site. It can work instead of draining it back to the river.

VII. Monitoring & maintenance requirements

Monitoring requirements	There is no permanent monitoring about the changes what introduction of the measure generates, there are event-by event surveys that are conducted mostly from botanical approach.
Maintenance requirements	There is no extra maintenance required. There is no eutrophication process in the channel system due to the shadow that the forest provides. It means that there were no need to clear emerging vegetation (for example weed) or dredge the branches and by the expectation of the forestry this will remain the case in the future as well. The inlet sluices via the water arrives to the area are robust long term structures without real annual maintenance needs.
What are the administrative costs?	The cost of coordination between the water directorate (provider of water) and the forestry (manager of the area). During the first years of the operation there were significant attempts (workload) to create a formal co-ordination guidance between the two organizations. It was aimed to define strict guidelines for the directorate to be able to act independently on the opening and closure of the sluices, but now a simpler, direct communication based control method prevails without significant costs for them. Opening and closure of the inlets take place a few occasions per year.

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	Comparison to the previous status: Groundwater - water level in wells situated in the forest. Biomass – not yet assessed, it will take place next year in the context of the decadal forestry plan supervision
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	
How cost-effective are NWRM's compared to "traditional / structural" measures?	Additional water supply to the area had no alternative only from the river. The question was the technical solution, how water can cross the flood dykes that goes along the river. The applied sluices for this purpose are very robust, low-tech solutions. There were no other solution that provides control of the inflow for lower price.
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	The relief of the area – the former river channel and side arm residues - provided a natural basis for the new water supply network. A key point of providing water from the river for previously cut floodplains is the duration of suitable water level in the river. In this case a downstream dam on the River Körös provides this sufficiently high water level. In spite of the irrigation purpose of the damming there is no conflicts of interest because forests can receive surplus water outside the irrigation season
What is the standard time delay for measuring the effects of the measures?	Forestry – 20 years. The next round of timber volume estimation will take place 20 years after the introduction of the measure. It will give information that makes the biomass growth comparable to other territories' results where there were no water supply for the forest. Ecosystem, biodiversity. The effect of improved floodplain dynamics could be identified next year, but it does not show a trend but constant adaptation to the actual year's water abundance. Groundwater recharge weeks. (Groundwater levels in wells in the forest increased in one-two weeks-time after the water supply started.

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	Implementation required the reconciliation of forestry and water management interests. The main issues were: - Should the forestry pay for the water (resource)? It was resolved as ecological water supply - No water inlet at the front side of the flood waves because of flood safety reasons. - The forestry resign to demand compensation for damages that the water that remains out in its territory can cause.
What were the main enabling and success factors?	The main success factor was the forestry management's unequivocal understanding of the structural problem that threatens the sustainable operation: the lack of inundations. They grasped the first occasion to finance and negotiate such a development. The financial consolidation/restructuring process of the state forestry organizations provided financial sources that were used to improve fundamental production conditions.
Financing	Reorganization subsidy came from the owner the (state owned) National Privatization and Asset Management Ltd. (Regional Forestry Organizations were formed into state owned joint stock companies). Transfer from the (that time existed) national Forest Regeneration Fund
Flexibility & Adaptability	The application depends on the sufficiently lasting high water level in the river that now a downstream dam provides. It solves the most pressing predictability issue. On the other hand the forest can play an equalizer role. The area could absorb more water, if technical flood risk concerns were solved. It means the area can adapt to different regimes to receive water. On the other side, because of the forest's ability to store water it can adapt by decreasing intake in case of growing competing water demands during water shortage periods in the summer.
Transferability	There were no such applications proposed elsewhere in the country. The application could be used all around the country. The necessary precondition is the complex problem identification and task definition at the responsible/acting institutions. The missing key element of transferability is the conflict resolution in order to create the necessary conditions of land conversion.

X. Lessons learned

Key lessons	Surface water supply is an effective way of recharging groundwater storage capacity of forest soil in order to reduce droughts risk by enhancing the natural inter-seasonal allocation of water. The key difference of this application compared to an area with generally the same problems is the possibility to sort out the transaction costs that emerge in an area with multi-party ownership.

	If the suitable complex knowledge happens to be at the right place, no further incentive is needed to take advantage of an upcoming possibility. – It highlights the fundamental need for education about the complex nature of the water-land use-ecosystem nexus.

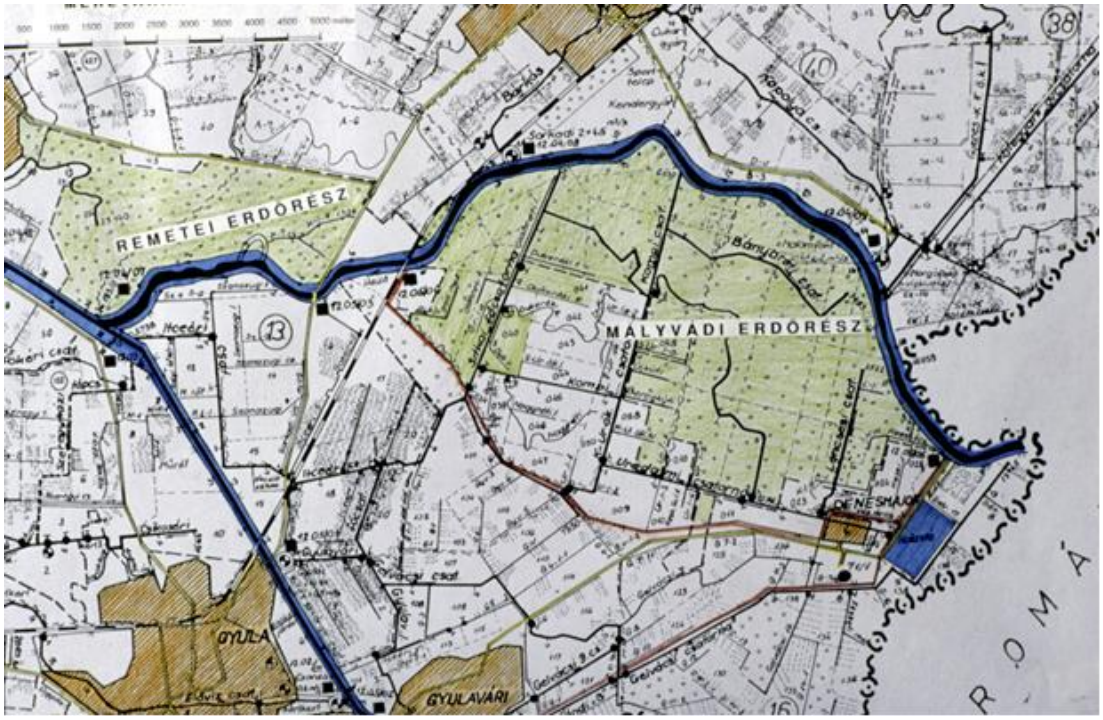
XI. References

Source Type	*Other (specify)*
Source Author(s)	Puskás, Lajos
Source Title	A FEKETE-KÖRÖS ERDEINEK VÍZPÓTLÁSA ÉS 15 ÉVES ÖKOLÓGIAI EREDMÉNYEI The water supply of the forests of the Fekete Körös and the ecological results of the first 15 years.
Year of publication	2010
Editor/Publisher	
Source Weblink *Direct weblink(s) of the reference*	http://evgi.emk.nyme.hu/fileadmin/dokumentumok/emk/evgi/Erdopedagogia/pl1.doc

Source Type	*Scientific Article*
Editor/Publisher	Crisicum 3. pp.217-224.
Source Title	Élőhelyrekonstrukció a Körös-völgyi erdőkben Habitat reconstruction in the Körös valley forests
Year of publication	2000
Source Weblink *Direct weblink(s) of the reference*	http://kmnp.nemzetipark.gov.hu/_user/browser/File/CRISICUM_III_HU/III_217_224_Puskas.pdf

Source Type *Select from the drop-down menu*	*Interview*		
Key People		*Name / affiliation*	*Contact details*
	1.	*Puskás, Lajos – Director of Education Dalerd Zrt*	*erdeiiskola@dalerd.hu*

XII. Photo Gallery



Map of the Mályávádi flood storage reservoir. Blue line - River Körös, red line – boundary of the flood storage reservoir, green area – forest, brown areas – settlements. The blue rectangle in the bottom right corner is the fishery that is referred to in the text.

Source: Puskás 2010, A Fekete-Körös erdeinek vízpótlása és 15 éves ökológiai eredményei, (The water supply of forest along the river Fekete-Körös and its ecological results) Figure 1