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NWRM

Natural Water Retention Measures

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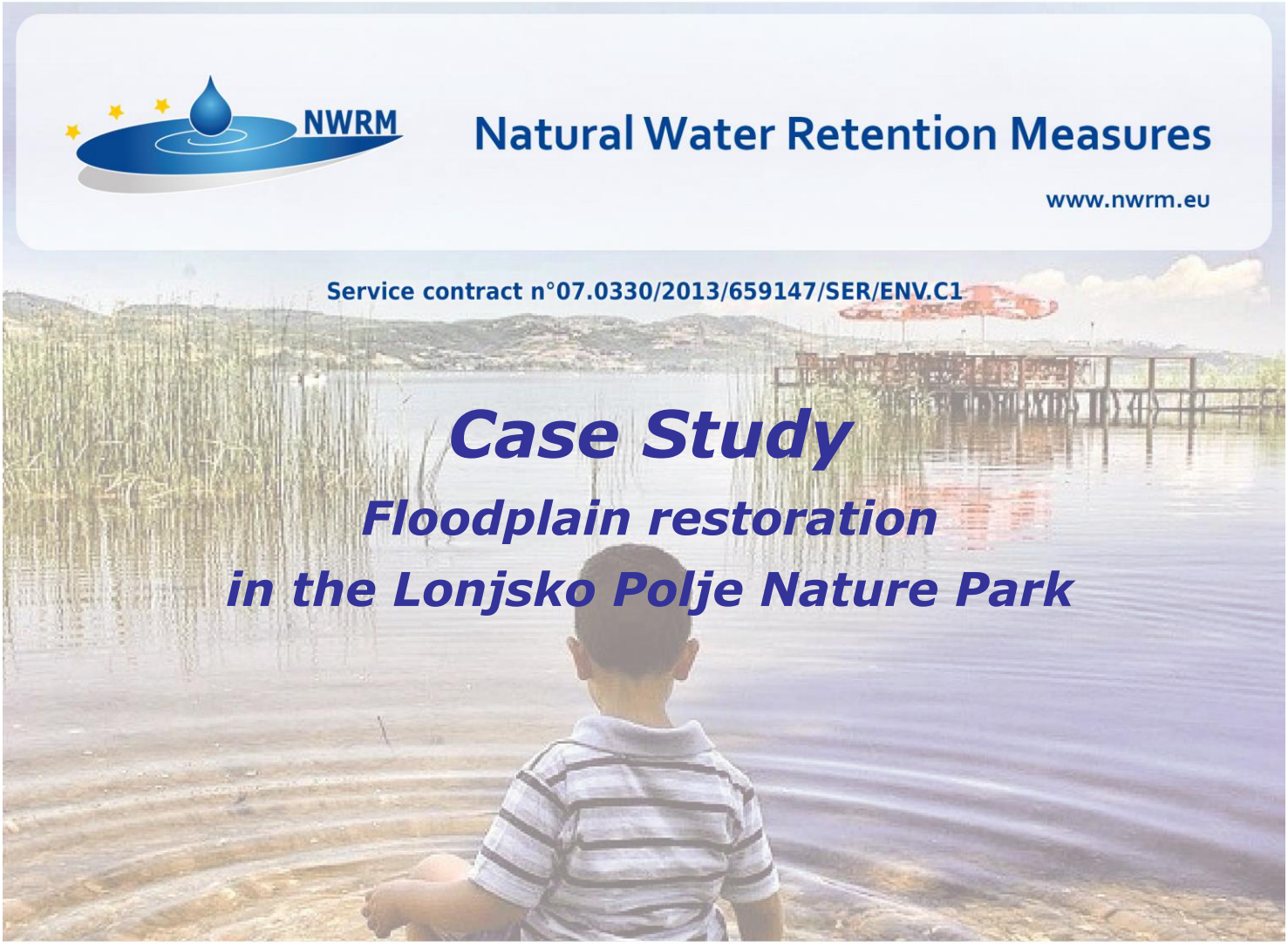
Case Study

Floodplain restoration in the Lonjsko Polje Nature Park



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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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I. Basic Information

Application ID	*Croatia_01*			
Application Name	**Floodplain restoration in the Lonjsko Polje Nature Park**			
Application Location	Country:	Croatia	Country 2:	
	NUTS2 Code		*HR04*	
	River Basin District Code			
	WFD Water Body Code			
	Description		The Central Sava Basin (CSB), located in Croatia, is an area that combines natural values with the function of storage of floodwaters of the Sava River. One of the most important areas is the Lonjsko Polje area. About 23 706 ha of this Nature Park, which has an area of approximately 50 600 ha, is used as the largest detention area in the Central Sava Basin.	
Application Site Coordinates *(in ETRS89 or WGS84 the coordinate system)*	Latitude: 16° 50´ 02´´ W		Longitude: 45° 21´ 43´´ N	
Target Sector(s)	Primary:	Hydromorphology		
	Secondary:			
Implemented NWRM(s)	Measure #1:	N3 – Floodplain restoration and management		
Application short description	The purpose of the Life project "Central Posavina – Wading toward Integrated Basin Management" (2006 -2008) was to develop and improve an integrated river basin management approach in Lonjsko Polje Nature Park and at least on a Central Posavina scale. This has been done by in particular developing consultative processes and appropriate structures which involve the various stakeholders for the conservation, utilisation and management of the water resources by ensuring non-structural flood control methods which take advantage of the natural functions of wetlands to supplement or replace existing flood control infrastructure.			

II. Policy context and design targets

Brief description of the problem to be tackled	After severe flooding of the river Sava (Zagreb 1964, Sisak and Karlovac 1965 and 1966) a flood prevention scheme, "Sava 2000" was set up and approved in 1972, with the aim not only to prevent flooding, but also to develop the agriculture. The project was a combination of the construction of large storage areas to retain excess flood water which the Sava cannot discharge, and conventional works (construction of dikes and regulation of the river canal). About 40% of the plan was completed when the region was plunged into conflict in 1990 and Yugoslavia fell apart, leaving large alluvial wetlands unregulated. In the meantime, the vision on ecological values changed. In 2000 the World Bank recommended to adjust the 1972 plan to a flood protection scheme that takes into consideration the ecological and landscape diversity values of the floodplains. This 'World Bankplan' proposed measures to mitigate the detrimental impacts on the biodiversity caused by the implementation of the first phase of the 1972 plan. Additional objectives of this new approach were to stimulate the preservation and development of the natural and cultural heritage of the Sava area. The Life project "Central Posavina – Wading toward Integrated Basin Management" fits in this context in particular by promoting an Integrated Sava Basin Management Plan that meets the requirements of the Water Framework Directive.		
What were the primary & secondary targets when designing this application?	Primary target #1:	Biodiversity and gene-pool conservation in riparian areas	
	Primary target #2:		
	Secondary target #1:	Flood control and flood risk mitigation	
	Secondary target #2:		
	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
	Pressure #2:	WFD identified pressure	4.2.2 Dams, barriers and locks for flood protection
	Pressure #3:	Other non EU-Directive (specify)	Croatia's Nature Protection Act
	Pressure #4:	Other non EU-Directive (specify)	Ramsar's Frameworks for managing Wetlands of International Importance
	Remarks		
Which specific types of adverse impacts did you aim	Impact #1:	WFD identified impact	Altered habitats due to morphological changes

at mitigating?	Remarks		
Which EU requirements and EU Directives were aimed at being addressed?	Requirement #1:	WFD-achievement of good ecological status	
	Requirement #2:	Choose an item.	
	Requirement #3:	Choose an item.	
	Remarks		
Which national and/or regional policy challenges and/or requirements aimed to be addressed?			

III. Site characteristics

Dominant Land Use type(s)	Dominant land use	511
	Secondary land use	313
	Other important land use	321
	Remarks	
Climate zone	cool temperate moist	
Soil type	*Information not found.*	
Average Slope	gentle (2-5%)	
Mean Annual Rainfall	600 - 900 mm	
Mean Annual Runoff	600 - 750 mm	
Average Runoff coefficient (or % imperviousness on site)		
	Information not found.	
Characterization of water quality status (prior to the implementation of the NWRMs)	There is pollution from cities such as Zagreb, Kutina, Bjelovar and Sisak. There are municipal sewage treatment plants upstream the river. There is a gypsymphoshor dump of the fertilizer factory near Kutina; Sisak is Croatia's biggest river port and the center of river shipping industry. In Sisak there is an atrazine (herbicide) plant and an oil refinery.	
Comment on any specific site characteristic that influences the effectiveness of the applied NWRM(s) in a positive or negative way	Text *Positive way:*	
	Text *Negative way:*	

IV. Design & implementation parameters

Project scale	Large (e.g. watershed, city, entire water system)		The area of the Lonjsko Polje Nature Park is approximately 50 600 ha.
Time frame *NWRM(s) Installation date and lifespan*	Date of installation/construction		2006
	Expected average lifespan (life expectancy) of the application in years		*Information not found*
Responsible authority and other stakeholders involved	*Name of responsible authority/ stakeholder*		*Role, responsibilities*
	1. Lonsjko Polje Nature Park		Responsible of the implementation of the NWRM
	2. Croatian Water Agency		Financing
	3.		
	4.		
	5.		
The application was initiated and financed by	The application was initiated by the Londjko Polje Nature Park and financed by Croatian Waters.		
What were specific principles that were followed in the design of this application?	Integrative planning, integration of demands, acceptable costs, impact on public perception and acceptability, aesthetic benefic, functionality, adaptability.		
Area (ha)	Number of hectares treated by the NWRM(s). *e.g. It could be the upstream drainage area in case of retention ponds*		23 706 ha.
	Text to specify		
Design capacity	About 23 706 ha (237 km²) of this Nature Park is used as the largest detention area in the Central Sava Basin.		
Reference to existing engineering standards, guidelines and manuals that have been used during the design phase	*Reference*		*URL*
	1.	D. Brundic, D. Barbalic, V. Omerbegovic, M. Schneider-Jacoby, and Z. Tusic, 2001. Alluvial wetlands preservation in Croatia : the experience of the Central Sava Basin flood control system. In H. J. Nijland & M. J. R. Cals (Eds.), Proceedings of the Conference on river restoration, Wageningen 2000	
Main factors and/or constraints that influenced the selection and design of the NWRM(s) in this application?			

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	% change in parameter value as compared to the state prior to the implementation of the NWRM(s)
Runoff attenuation / control	*Improvement of the nutrient sink capacity.*		
Peak flow rate reduction	*Information not found*		
Impact on groundwater	*Information not found*		
Impact on soil moisture and soil storage capacity	The storage capacity would be increased from 634 billion cubic meters (BCM) to 733 BCM.	Billion cubic meters	16 %
Restoring hydraulic connection	A very important component of the programme is the improved connectivity of water bodies.		
Water quality Improvements	*Information not found*		
WFD Ecological Status and objectives	In some places the polders, which were built during the first phase of the flood control programme (1972 – 1990), would be restored. The area proposed for restoration extends to 1200 hectares, with a storage capacity of 20 million m3. The projects have also excellent potential for the creation of new habitats. To maintain the alluvial landscapes, 'ecological flooding' was proposed, this means that the areas cannot be restored by re-inclusion into the flood prone area, but their water levels would be maintained; if necessary, water could even be introduced during floods. Through such measures, the character and value of the riverine landscape would be maintained and their ecological importance, which is of an international standard, preserved. The proposed areas extend to some 15 400 hectares and their storage capacity is about 10 million m3. 27 oxbow lakes and floodplain areas, which were cut off from the 'live' river channel, would be preserved in addition.	Number of restoration projects: 26 Flooded oxbows (500 ha ; 2 BCM); 8 Restoration areas (1 200 ha; 20 BCM); 6 Ecologically flooded areas (15 400 ha ; 10 BCM)	-
Reducing flood risks	Long-term conservation of large		

(Floods Directive)	inundation areas for transboundary flood protection.		
Mitigation of other biophysical impacts in relation to other EU Directives (e.g. Habitats, UWWT, etc.)	*Information not found*		
Soil Quality Improvements	*Information not found*		
Other	Protection of the valuable cultural and natural heritage.		

VI. Socio-Economic Information

What are the benefits and co-benefits of NWRMs in this application?	The project saves considerable costs, by reducing the amount of water engineering construction: both the length of dikes and the number of distribution facilities are lessened. Accordingly maintenance costs are also reduced. Additional costs are incurred for designing the new facilities, for modelling the flood waves and for carrying out the risk assessment on the new system. Incremental costs are needed for important improvements to the system, which will secure the long term sustainable use of the floodplains. Restoration and rehabilitation projects are needed to achieve an integrated water management. Value added by the preservation and restoration plan results from the improvement of the nutrient sink capacity, protection of the valuable cultural and natural heritage, and the long-term conservation of large inundation areas for transboundary flood protection. The impact on the alluvial forest cannot been foreseen.		
Financial costs	***Total:***		*Information not found*
	Capital:		*Information not found*
	Land acquisition and value:		*Information not found*
	Operational:		*Information not found*
	Maintenance:		*Information not found*
	Other:		*Information not found*
Were financial compensations required? What amount?	*Information not found*		
	Information not found		
	Information not found		
	Information not found		
Economic costs	*Information not found*		
	Information not found		
	Information not found		
	Information not found		

Which link can be made to the ecosystem services approach?	- Water provision to deliver water services to the economy both for drinking and non-drinking purposes. - Flood security and protection. - Amenities (associated to habitat protection): fish and plants, tourism, recreation, and others.

VII. Monitoring & maintenance requirements

Monitoring requirements	*Information not found*
Maintenance requirements	*Information not found*
What are the administrative costs?	*Information not found*

VIII. Performance metrics and assessment criteria

Which assessment methods and practices are used for assessing the biophysical impacts?	*Information not found*
Which methods are used to assess costs, benefits and cost-effectiveness of measures?	*Information not found*
How cost-effective are NWRM's compared to "traditional / structural" measures?	*Information not found*
How do (if applicable) specific basin characteristics influence the effectiveness of measures?	*Information not found*
What is the standard time delay for measuring the effects of the measures?	*Information not found*

IX. Main risks, implications, enabling factors and preconditions

What were the main implementation barriers?	*Information not found*
What were the main enabling and success factors?	*Information not found*
Financing	*Information not found*
Flexibility & Adaptability *Is the current implementation flexible and adaptable to changing baseline conditions? What does the adaptation of these measures requires? What costs could be foreseen?*	*Information not found*
Transferability *When and where can a similar application be proposed, assessed and selected? What are the necessary preconditions?*	*Information not found*

X. Lessons learned

Key lessons	*Information not found*

XI. References

Source Type	*Project Report*

Select from the drop-down menu			
Source Author(s) *Provide the Name of the author(s)*	D. Brundic, D. Barbalic, V. Omerbegovic, M. Schneider-Jacoby, and Z. Tusic		
Source Title *Provide the Tile of the reference*	Alluvial wetlands preservation in Croatia : the experience of the Central Sava Basin flood control system		
Year of publication *Provide the year in the format (YYYY)*	2001		
Editor/Publisher *e.g. Journal/Volume/Issue*	In H. J. Nijland & M. J. R. Cals (Eds.), Proceedings of the Conference on river restoration, Wageningen 2000		
Source Weblink *Direct weblink(s) of the reference*	Weblink		
Key People *List names, affiliation and contact details of key people who have communicated important information presented in this factsheet*		*Name / affiliation*	*Contact details*
	1.		
	2.		
	3.		
	4.		

Source Type	*Book*		
Source Author(s)	Goran Gugic		
Source Title	Managing sustainability in conditions of change and unpredictability - The living landscape and floodplain ecosystem of the Central Sava River Basin		
Year of publication	2009		
Editor/Publisher	Lonjsko Polje Nature Park Public Service, Krapje, Croatia		
Source Weblink	Weblink		
Key People		*Name / affiliation*	*Contact details*
	1.		
	2.		
	3.		
	4.		

Source Type	*Project Report*		
Source Author(s)	Guido Van der Wedden		
Source Title	Flood management in Lonjsko Polje - Setup of the Lonsjko Polje computer model in the Sobek modelling environment		
Year of publication	2004		
Editor/Publisher	Delft University of Technology		
Source Weblink *Direct weblink(s) of the reference*	Weblink		
Key People		*Name / affiliation*	*Contact details*
	1.		
	2.		
	3.		
	4.		

XII. Photos Gallery

Figure 1 Lonjsko Polje Nature Park - wetland landscape

Source : Boris Krstinic,
http://www.pp-lonjsko-polje.hr/new/fotogalerija_en/mocvarni_krajobraz/content/mocvarni_krajobraz_74_large.html

Figure 2 Lonjsko Polje Nature Park - wetland landscape

Source : Boris Krstinic,
http://www.pp-lonjsko-polje.hr/new/fotogalerija_en/mocvarni_krajobraz/content/mocvarni_krajobraz_52_large.html

Figure 3 Lonjsko Polje Nature Park - wetland landscape

Source : Boris Krstinic,
http://www.pp-lonjsko-polje.hr/new/fotogalerija_en/mocvarni_krajobraz/content/mocvarni_krajobraz_46_large.html