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SESSION 08 RESTORING HYDRO-MORPHOLOGICAL PROCESSES

THE METHOD OF SIMULATING THE EFFECTS OF RIVER RESTORATION ON THE EXAMPLE OF LOWLAND RIVERS IN POLAND

Krzysztof Szoszkiewicz (Poznan University of Life Sciences, Poland, kszoszk@up.poznan.pl)
Karol Pietruczuk (Viievodship Innspectorate for Environmental Protection, Poland)
Tomasz Kaluza (Poznan University of Life Sciences, Poland)

Aim of study

To propose approach supporting decision-making process which allows to choose an optimal restoration strategy, considering cost-effectiveness, environmental benefits and hydrological safety

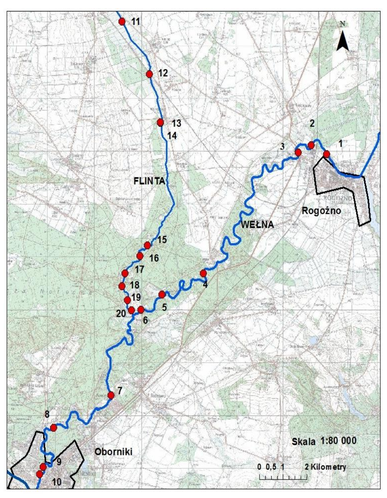
Methods

The method has been tested on two river ecosystems. In the first stage a hydromorphological survey was completed (in the summer 2013) using the British River Habitat Survey (RHS). The range of restoration technical and biological measures was proposed and their ecological effects were simulated using the RHS system, basing on two numerical parameters - HQA (Habitat Quality Assessment) and HMS (Habitat Modification Score). Basing on the HQA and HMS the class of hydromorphological quality was estimated for each of the river sites at different restoration variants. Moreover the hydraulic consequences of the restoration concept was analysed.

Study area

The concept of restoration was tested on two rivers located in central Poland - Welna River (30 km long) and Flinta River (17 km). Both rivers are relatively strongly meandering lowland watercourses with sandy and stony substrates. Altitude differences are relatively large as for the lowlands and river flow is partly fairly rapid. The valuable aquatic vegetation is growing in the rivers and rich fish fauna typical of fluvial ecosystems is developed. For this reason, valuable fluvial vegetation and fish fauna is developing there. Unfortunately the water quality is spoiled by advanced eutrophication and hydromorphological modifications.

Study area



Programe of comprehensive restoration

No	Measures	River		Unite
		Wełna	Flinta	
1.	Wooden deflector	2	4	Piece
2.	Wood-stone deflector	18	40	Piece
3.	Wooden weir	4	7	Piece
4.	Willow faggots	4	2	Distance
5.	Timber crip wall	2	0	Secion
6.	Brushwood mattresses	3	2	Piece
7.	Tree planting	60	180	Seedling
8.	Spawning gravel insert	4	4	Surface
10.	Fish bypass	1	1	Piece
11.	Tree trunk	11	14	Piece
12.	Wooden poles	1	1	Distance
13.	Concrete weir removal	0	1	Piece
14.	Rip-rap on willow mattress	5	4	Piece
15.	Tree removal	2	0	Distance
16.	Rocky Island on willow mattress	16	13	Piece

Results

The survey showed that two tested rivers were differentiated according to several parameters, as size of the catchment, channel dimensions, flow parameters and land use on banks. However, the several similarities were detected as for instance comparable modifications as impoundments, channel deepening, bank profiling and reinforcements.

Basing of the undertaken hydromorphological survey the restoration concept was prepared. It was found that the comprehensive restoration requires a large scale efforts - sixteen various technical and biological measures were proposed to stimulate fluvial processes and to improve habitat for development of living aquatic organisms in rivers. Studies have shown that in some places the restoration effects can be exceptionally ecologically effective whereas in some other sites we can expect limited benefits.

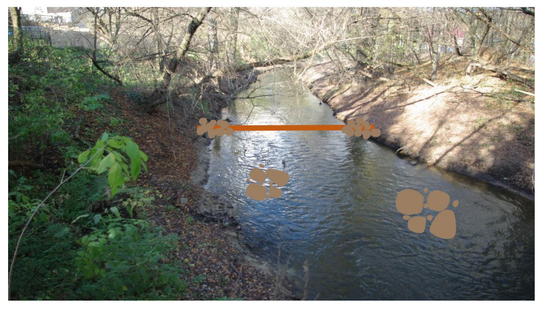
The performed simulations showed that the proposed measures enable to achieve variable hydromorphological improvements of both rivers. We were able to select sites where the restoration significantly influence the hydromorphological status. Hydraulic measurements proved that the proposed activities not significantly deteriorate high water flow and is not increasing the flood risk.

Simulations of the restoration effects of three river sites

No	Variant	HQA	HMS	Class	Roughness coefficient	Q 1% m a.s.l.	SWQ m a.s.l.	SSQ m a.s.l.
A	Current situation	28	43	V	0,033	71,77	71,32	70,78
B	Reconstruction of the part of bank reinforcements and limiting river bed deepening and profiling	28	24	V	0,040	71,82	71,42	70,80
C	Tree planting – distance of 200 m of the bank	38	43	V	0,040	71,82	71,42	70,80
D	Introduction of veir, artificial islands, deflectors and trunks	36	43	V	0,050	71,83	71,55	70,85
E	B+C+D	46	24	IV	0,060	71,85	71,67	70,89

No	Variant	HQA	HMS	Class	Roughness coefficient	Q 1% m a.s.l.	SWQ m a.s.l.	SSQ m a.s.l.
A	Curent situation	33	9	IV	0,033	67.72	66.91	66.28
B	Reconstruction of the part of bank reinforcements and limiting river bed deepening and profiling	33	3	III	0,040	67.76	67.02	66.32
C	Tree planting - distance of 100 m of the bank	37	9	III	0,040	67.76	67.02	66.32
D	The introduction of veir, artificial islands, deflectors and trunks	49	9	III	0,050	67.89	67.15	66.38
E	B+C+D	53	3	II	0,060	67.92	67.27	66.43

No	Variant	HQA	HMS	Class	Roughness coefficient	Q 1% m a.s.l.	SWQ m a.s.l.	SSQ m a.s.l.
A	Curent situation	53	9	III	0,033	60,58	59.96	59.55
B	Reconstruction of the part of bank reinforcements	53	5	II	0,040	60,59	59.97	59.57
C	Introduction of veir, artificial islands, deflectors and trunks	64	9	III	0,045	60,59	59.97	59.57
D	B+C	64	5	II	0,050	60,61	59.99	59.60
E	D+Impoundment removal	66	2	I	0,050	59.63	58.88	58.51



Conclusions

- **Using our approach you can predict the environmental effects and hydraulic consequences of the planned restoration.**
- **The proposed approach can support the decision-making process to select an optimal restoration strategy, taking into account cost-effectiveness, environmental benefits and hydrological safety.**

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