Integrated water quality management model for rural cross-border river basin: The case of Sotla/Sutla river

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1. CASE STUDY SUTLA RIVER BASIN

The Sutla river basin covers an area of 990.6 km², of which 78% is in Slovenia and the rest in Croatia. River Sutla makes the border between Slovenia and Croatia. (Picture 1). In its upper course there is a large longitudinal slope and basin incline, while in the medium run the longitudinal slope decreases and crosses the lowland flow with meanders. The most important regulatory building is the reservoir Vonarje (Picture 2, Picture 3 and Picture 4), which was created by using a natural retention with the construction of a dam, and was intended to retain a large water wave of Sutla, water supply, irrigation of agricultural land, fishing and tourist purposes. Due to the poor quality of water and seafood, the accumulation was discharged in 1988 and is currently operating as a retention. The whole area of retention and reeds of the Sutla River has been proclaimed as the NATURA 2000 area, which significantly influences the quality management of Sutla River water quality. Initiatives to re-establish lakes encourage the need to draw up a water quality management model because rural river basins represent a major source of nutrients and pollution, and the threat to the 2000 ES is not included in the basic measures of European water policy but needs to be addressed through a national implementation program.

2. PROPOSED METHODOLOGY

The implementation of the integrated water quality management “tailor-made” river basin model (Picture 4), includes six different methodologies:

1. The DPSIR conceptual model was used in a data set and / or indicator and by creating a spatial analysis using the ArcGIS and as the causes are identified untreated municipal wastewater and excess nitrogen from agricultural land.
2. The rural character of the river basin puts emphasis on research on modeling land use and quantification of pollution for the purpose of water quality management and the SWAT model is most suitable.
3. By using the SWAT mathematical model, the greatest influence on water inputs from river basin nutrition and sediment has been demonstrated, the risk of not achieving good water status and water eutrophication. Measures have been analyzed, water use, the historical flow, the longitudinal profile of the Sutla river and the volume of the Vonarje reservoir is a prerequisite for maintaining the river ecosystem upstream and downstream, and a proposal for the definition of an environmentally acceptable stream downstream of the dam taken into account the bioindicator - the swamp (hrv-potočna mrena) (Picture 7), water eutrophication emerged and for the future state scenarios (with and without reservoir) with respect to population and agricultural measures. In particular, scenarios will be considered for future climate change cycles, according to 6 characteristic climate models. (Picture 6)
4. The possibility of applying basic and complementary measures, the ecosystem service as an equivalent measure, will be analyzed and the most acceptable measures will be tested in the model to optimize a set of “tailor-made” measures.
5. The preparation of the monitoring proposal for the status of water the effectiveness of implementing an optimal set of water quality management “tailor-made” measures for the river basin.

3. RESULTS AND CONCLUSION

The scientific contribution, related to the aim of this research, will include:

1. development of an innovative integrated water quality management model for the rural cross-border river basin,
2. development of the scenario analysis methodology, including the impact of climate change, and the implementation of measures to avoid the risk of non-achievement of environmental objectives and water eutrophication,
3. development of the methodology for implementation of rural cross-border river basin tailor-made measure,
4. development of the methodology for implementation of ecosystem services and human well-being in the model.

Holistic, integrated water quality management model of the cross-border rural river basin, more reliable water impact assessment, and the implementation of an optimal set of measures based on selected scenarios, will have a significant impact on achieving environmental goals. Impact of the population and agriculture, the restructuring of Sutlanarko/Vonarje reservoir, and the impact of climate change, with the optimal set of tailor-made measurements will not have a negative impact on water quality and eutrophication of water.