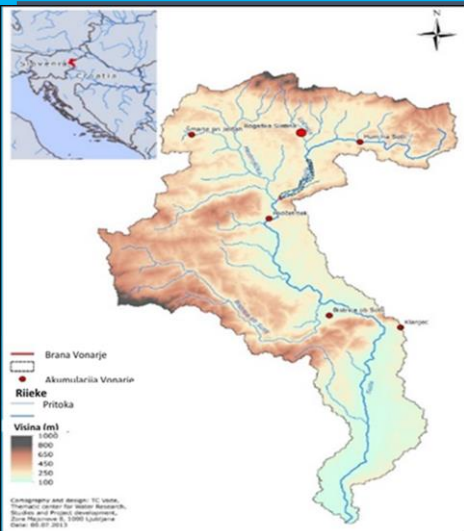




Integrated water quality management model for rural cross-border river basin: The case of Sotla/Sutla river

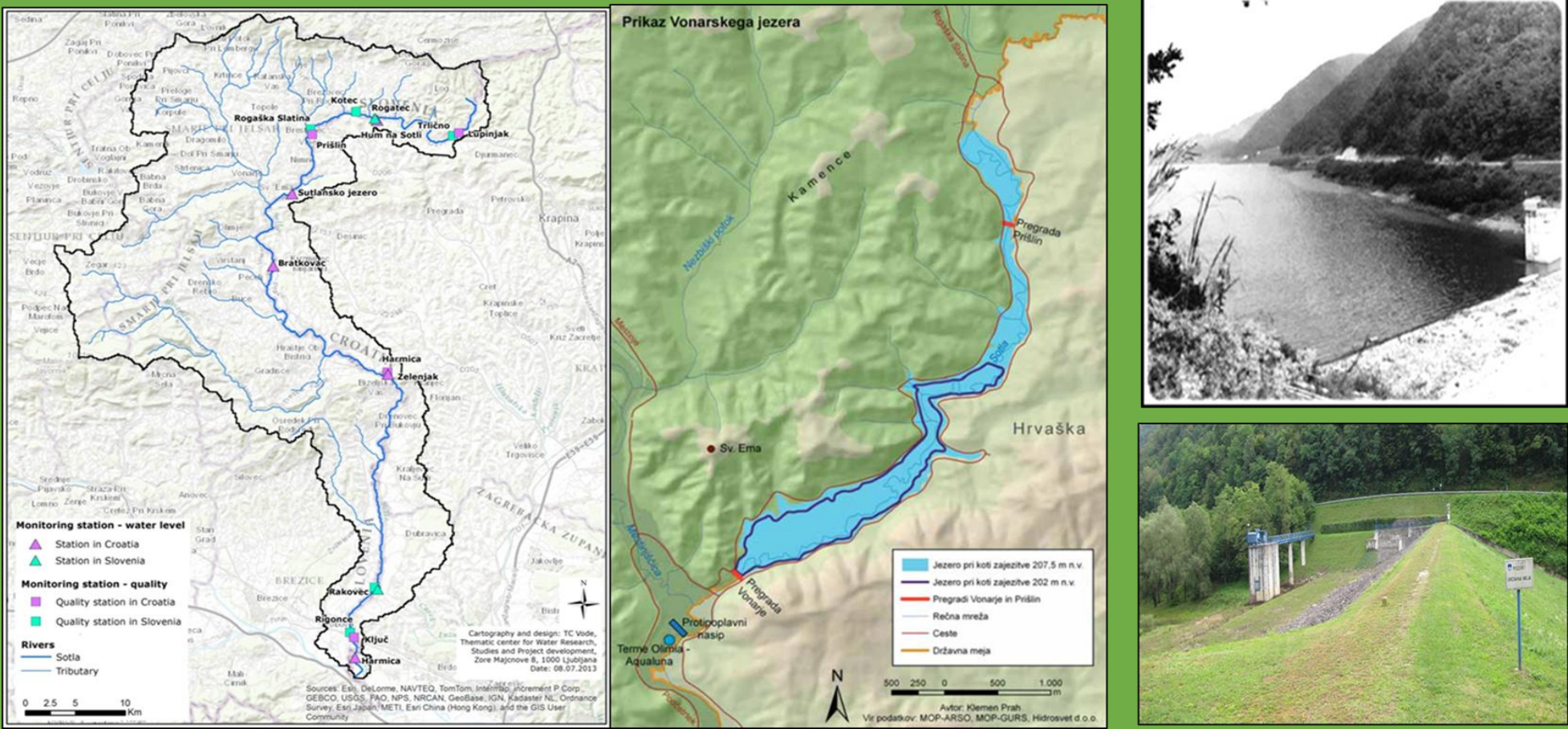
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ABSTRACT

The intensive use of soil and water of the river basin results in the need to achieve balance between the environmental and developmental objectives of the river basin by using a water quality management model for the risk of eutrophication, especially downstream of dam/reservoir such as in the case of the Slovenian-Croatian cross-border Sotla/Sutla river basin. **The aim study is to develop a water quality management model of the rural cross-border river basin within integrated water management to achieve the environmental objectives of the river basin.** The selected model is based on the selection of the optimal water quality management scenario on the Sotla/Sotla river basin implements on the use of the Driving Forces, Pressures, State, Impact, Response (hereinafter: DPSIR) approach, climate change models and the Soil and Water Assessment Tool (SWAT model), and the „tailor-made“ measures of the river basin including ecosystem services and human well-being.

1. CASE STUDY SUTLA RIVER BASIN

The Sutla river basin covers an area of 590.6 km², of which 78% is in Slovenia and the rest in Croatia. River Sutla makes the border between Slovenia and Croatia. (Picture1). In its upper course there is a large longitudinal slope and buoyancy flow, 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 reefs 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.

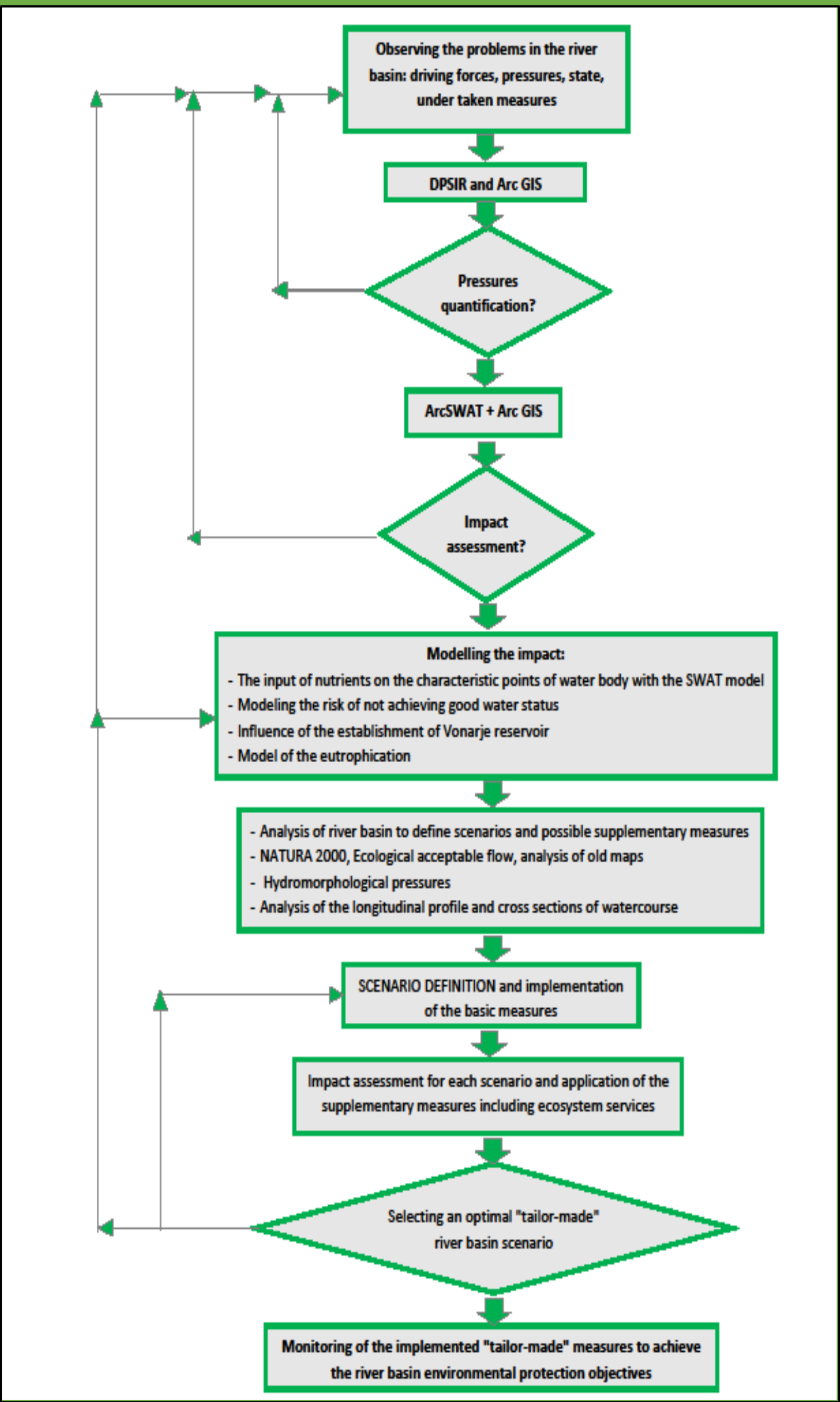


Picture1: Map of the Sotla river basin and monitoring stations
Picture 2: Location of the reservoir Vonarje
Picture 3: Reservoir Vonarje in the past
Picture 4: Retention Vonarje in the present time

2. PROPOSED METODOLOGY

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 using 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)
- 5) 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.
6. 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.



Picture 5: Flow chart of the integrated water quality management "tailor-made" river basin model

