Dynamic phosphorus expert system with QoS support algorithms

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Abstract— **In this paper we present conceptual model for ecological management system with data acquisition module, combine with telecommunication-routing algorithms for data processing which help to deliver the data to processing station; fast and accurate. Then as a part of this system, the data will be used to build mathematical model for the total phosphorus concentration for short-term period. The total phosphorus (TP) component plays an important role in the functioning of aquatic ecosystem, affecting the whole food web chain that this element is participating. This is why; the protection of the lake must be direction in controlling this kind of ecological hazards. In our case study of the Lake Prespa we used data collected for 16 months period using old style-techniques, we build mathematical model of the total phosphorus component. Presented conceptual system starts with data acquisition with wireless sensors networks using advanced routing algorithms with high-level of QoS provisioning. Later the data is inputted into the model to give reliable information about the ecological status of the lake ecosystem for short period. After the processing the results are available to the decision-maker and environmental management engineers. In future we plan to develop more precision ecological models and telecommunication modules and combine with GIS techniques for better spatial view of the ecosystem.**

***Index Terms*— Lake Prespa, QoS routing algorithm, Phosphorus concentration**

I. INTRODUCTION

THE ecological state of the aquatic ecosystems is very unstable value because the system has own dynamic equilibrium and always changes. With this effect the lake ecological status is hard to determinate and it needs constant monitoring and analysis of the data. In best cases, the collected measurements are used to forecast the future state of the lake. Building an ecological model for the given lake ecosystem in non-trivial task, due to the complex interaction that living organisms and the environment have. The model depends from many factors, both the most important is the quality and quantity of the measured data. Keeping this on mind, the presented paper introduces a conceptual diagram of such model, taking into account one of the three largest lakes in Macedonia, Lake Prespa. This lake has own geographical specification that we have embedded into the presented model and we will show, later in the paper that state of the lake is corresponding with our results gain from the model [3, 5].

Acquiring data have been proven to be more robust and fast if we use more advance QoS algorithms in the data delivering process.

The formal definition for the dynamic phosphorus model of the lake ecosystems is presented in section 2. The inside look of the TP model – mathematical equations for Lake Prespa, together with the experimental results gain from the model are given in section 3. In section 4 is presented a possible implementation of sensor networks for collecting the needed parameters with QoS algorithm which can be used, while section 5 concludes the paper and gives direction of further research.

II. PHOSPHORUS COMPONENT IN LAKE ECOSYSTEMS

The main source in our model, are the inflow rivers from the Prespa catchment. These sources of phosphorus are mainly from the agricultural activity in that area, human activity, and industrial waste [4]. In this model the flow rate and the TP concentration of the three main rivers are taken. Then the phosphorus cycle continues into the main lake basin, where takes part into the sedimentation process. This process is very hard to modeled, cause complex interaction between the abiotic and the living organisms are taking into place. This process depends from many factors, but the model takes into account only the temperature and the rate of sedimentation. A value of the sedimentation coefficient is calibrated using the measured data for the lake measuring stations. The calibrated value does not extend out of the normal values for lakes. Into the sedimentation the fluxes of material play an important role. They influence transport, bio-uptake and ecological effects of most toxins and nutrients. Complex nutrient and biological variables must be taken in order to describe the real picture of this process inside of the lake Due to missing of data such TP

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