# A TWO-STEP APPROACH TO PROPAGATE RATING CURVE UNCERTAINTY IN ELBE DECISION SUPPORT SYSTEM

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The relationships between water level and discharge along the river channel are vital for decision support systems in river basin management. Normally the reliability of the so-called rating curves along the main river channel depends greatly on the accuracy and duration of the measured discharge and water level data. In the Elbe Decision Support System (DSS), the rating curves are fitted based on the water level and discharge data computed from the hydraulic model —HEC-6. By this way, the effects of river engineering measures on the Elbe river system can be investigated. Under such situations, the uncertainty in the water levels computed from the HEC-6 model and the uncertainty involved in the fitting process are of great importance for the reliability of the rating curves.

This paper presents a two-step approach to analyze the uncertainty in the rating curves and then propagate this uncertainty into the vegetation model used in the Elbe DSS. The decision variables in this case are the frequencies of 11 dominant biotypes in the Elbe floodplains. The first step in this approach is to identify the uncertainty sources. One main uncertainty is the error in the computed water levels by the HEC-6 model, which is roughly estimated from the calibration process. An analytical method based on the error propagation equation by Bevington and Robinson (1992) is adopted to propagate these uncertainty sources into the final rating curves.

The second step in this approach is to propagate the uncertainties in the rating curves into the model outputs of the vegetation model. One of Monte Carlo methods — Latin Hypercube Simulation is used. By this two-step uncertainty analysis approach, the uncertainty in the rating curves is successfully propagated into the vegetation model in the Elbe DSS.

Fig.1 presents the error bars of the frequencies of 11 dominant biotypes in the floodplains. On the one hand, these final uncertainty results from Latin Hypercube Simulation show that there are high uncertainties in the model outputs of the vegetation model. As stated before, one important source of the uncertainty is from the error in the computed water levels by the HEC-model. The other important source is the high uncertainty involved in the process of fitting the rating curves. On the other hand, the results shown in this figure indicate that some biotypes are likely to disappear in the future because of their small numbers of frequencies. If more diverse biotypes in the floodplains are hoped, measures needed to be identified by relevant decision makers to increase the frequencies of these biotypes.

The results shown in this paper can provide useful insight of the uncertainty in the biotype diversity in the floodplains for the Elbe DSS. They can be used to assist decision makers with reliable information in making a sound decision when the effects of different river engineering measures are investigated.

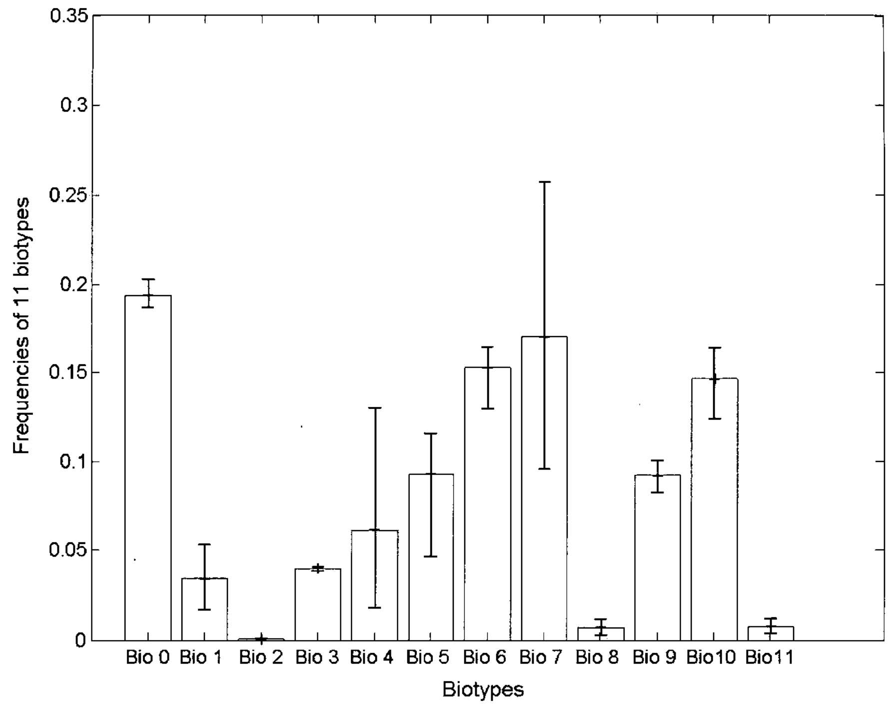


Fig. 1 Error bars for the frequencies of 11 dominant biotypes in the Elbe floodplains ('Bio 0' is the situation without data, 'Bio 1' ~ 'Bio 11' are the 11 dominant biotypes in the Elbe floodplains)

## REFERENCES

Bevington, P.R. and Robinson, D.K. (1992). *Data Reduction and Error Analysis for the Physical Sciences,* McGraw-Hill.