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DATA DRIVEN DEVELOPMENT OF PREDICTIVE ECOLOGICAL MODELS FOR BENTHIC MACROINVERTEBRATES IN RIVERS

GEGEVENSGEBASEERDE ONTWIKKELING VAN PREDICTIEVE ECOLOGISCHE MODELLEN VOOR BENTHISCHE MACRO-INVERTEBRATEN IN RIVIEREN

door

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The European Water Framework Directive (WFD) 2000/60/EC aims at a good ecological status for all water bodies in the member states of the European Community by 2015. A major part of these water bodies can be classified as running waters or rivers. According to the WFD, rivers are to be assessed by comparing the actual status to a reference status. To this end, reference communities must be described that represent a good ecological status. Additionally, for the development of a representative set of metrics for ecological river assessment, one needs to gain insight in the relation between the aquatic communities and the human activities affecting these water systems. Insights in these relations will also be valuable for detection of causes of particular river conditions (environmental impact assessment) as well as for decision-making in river restoration and protection management to meet and sustain the requirements set by the WFD.

Until now, ecological models have rarely been used to support river management and water policy. Models have however several interesting applications in this context. First of all, through these models a better interpretation of the river status can be possible, the causes of the status of a river can be detected and assessment methods can be optimised. Secondly, these models can allow for calculating the effect of future river restoration actions on aquatic ecosystems and supporting the selection of the most sustainable options. Thirdly, these models can help to find the major gaps in our knowledge of river systems and help to set-up cost effective monitoring programmes.

The present thesis aimed at determining the appropriate variables and ecosystem processes by using classification trees as well as artificial neural networks to predict biological communities present in rivers. The research focused on macroinvertebrates in brooks and small rivers in Flanders (Belgium). The applied modelling techniques in this research are all data driven approaches. In this manner, an *a priori* and often biased knowledge of ecological experts has not been used during the model development process. However, when discussing the results, the outcome of the data driven models has been compared to expert rules from literature. This approach allows for deriving rules that contribute to a better understanding of river ecosystems and support of their management.

The developed models have been applied to support decision-making in water management. In this way, a crucial validation step, often lacking in many model development and assessment studies has been made and this can probably also help to pursue river managers of the added value of such ecological models. These models can in this manner support the appropriate selection of sustainable management options and help to convince stakeholders to make the necessary investments and/or activity changes as desired by society.