

## **PROBE: an eco-hydrological model to predict vegetation biodiversity in the coastal dunes of the Netherlands**

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We present a novel ecosystem model that is able to predict a spatial picture of vegetation types and to identify hotspots of biodiversity, as a result of water management, atmospheric deposition of N and P, and vegetation management (Witte et al., 2007a). Predictions are carried out in two steps. In the first step simple process-based relationships are used to compute how changes in e.g. water management affect soil factors that are important to plant life (such as the availability to plants of water, oxygen and nutrients). In the second step it is statistically computed how these habitat factors, in their turn, influence the species composition of the vegetation. We applied a mixture density fitting technique to estimate the occurrence probabilities of vegetation types (Witte et al., 2007b) and to compute the accumulated effect on the output of uncertainties in modeled relationships and input data. The model was validated on known vegetation patterns in a dune area that was ecologically restored by raising groundwater levels.

The model has a strong integrative character, attuning results and new questions from scientific disciplines such as hydrology, soil chemistry, mathematics and vegetation science. Thus, the model serves as a framework for a number of PhD-students who will try to incorporate succession and effects of climate change. Moreover, the applicable character of the model is strong; it can be used for policy analyses and environmental impact assessment studies. Since the new Habitat Directive requires the 'significance' of ecological effects to be quantified, predicting in terms of occurrence probabilities and including uncertainties will probably become a prerequisite for this European legislative.