THE FUTURE GROUNDWATER RECHARGE: EVAPOTRANSPIRATION RESPONSE OF NATURAL VEGETATION TO CLIMATE CHANGE

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In The Netherlands, climate change is likely to cause longer periods of drought, wetter winters and high intensity rain showers. These changes will affect the water balance, freshwater availability and the spatial distribution and type of vegetation. Vegetation characteristics that determine evapotranspiration, like vegetation coverage, biomass and water use efficiency, may alter due to climate change and may subsequently affect groundwater recharge. Future groundwater recharge can only be assessed if we understand how vegetation responds to changing climatic conditions.

Our study focuses on coastal and inland sand dunes of The Netherlands. We hypothesize that in these regions prolonged periods of drought will lead to a larger cover fraction of non-rooting plants (mosses and lichens) and bare soil. This vegetation feedback will reduce the effects of meteorological drought on groundwater recharge by reducing transpiration. Our simulations show that groundwater recharge may even increase in the future climate due to this vegetation response.

We pursue a modeling approach to simulate dynamically the response of vegetation to climate change and the impact on groundwater recharge. Hereto, we will first determine evapotranspiration characteristics for different plant species. Special attention will be paid to the interception evaporation of mosses which may occupy large areas in coastal an inland sand dunes. Secondly, field experiments will be used to relate water stress to cover fractions of different plant functional types. Thirdly, we will assess the significance of vegetation patchiness on soil moisture contents, as the vegetation structure or patchiness may cause radial unsaturated flow from barren surfaces to rooting plants. Fourthly, we will analyze climate change effects on soil organic matter contents. Finally, this will lead to a robust, dynamic model that takes account of climate change effects on vegetation and soil physical characteristics, required to estimate future groundwater recharge.