Modelling transpiration and plant growth of a South African agroforestry ecosystem

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In times of climate change, many regions of this world suffer from drought periods due to decreasing precipitation. As a consequence, irrigation gets increasingly important in agriculture.

A key issue is to exactly determine the water and nutrient demand of the plants to avoid waste of valuable water and other resources. Another way to use water more efficiently are wind protection hedges, whose effectiveness and design will be studied in the FarmImpact project "Devolpment of sustainable water and energy solutions for farms in South Africa".

With the modular model system Expert-N, it is possible to simultaneously simulate tree and crop/grassland growth of such agroforestry systems. Three different areas are differentiated in Expert-N: (I) grassland/crop area, (II) transition zone between the trees and the grass/crop and (III) tree strip. While area (I) and (III) are simulated independently, the influence of the trees on the grassland/crop are modelled in the transition zone. These impacts are among others shading, changed water availability due to water uptake or hydraulic lift of tree roots growing into the transition zone, and attenuation of the wind in the air layers close to the ground surface.

Expert-N is used to simulate the plant production and the water cycles at an agroforestry site in South Africa. Using input data from the cooperation partners preliminary parameterizations of the model system are generated and presented. First simulation results focusing on transpiration, the water cycle and plant growth are shown and discussed.