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Monika von Haaren

*Institute for Environmental Planning, Gottfried Wilhelm Leibniz University Hannover, vonhaaren@ymail.com*

Sylvia Herrmann

*Institute for Environmental Planning, Gottfried Wilhelm Leibniz University Hannover, herrmann@umwelt.uni-hannover.de*

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# Using System-Dynamics for advanced decision making and sustainable water-use for farm irrigation

**Monika von Haaren<sup>1</sup> and Sylvia Herrmann<sup>2</sup>**

*Institute for Environmental Planning, Gottfried Wilhelm Leibniz University Hannover, Germany,*

1) [vonhaaren@ymail.com](mailto:vonhaaren@ymail.com) 2) [herrmann@umwelt.uni-hannover.de](mailto:herrmann@umwelt.uni-hannover.de)

Under the conditions of climate change, an efficient use of water is crucial for sustainable resource management. There is a need of user-friendly systems to evaluate the complex system of water use in agriculture. In this scientific research, the factors that have a significant effect on irrigation and the assessment of water consumption were determined by a system-dynamics approach. The developed model includes selected components of irrigation farming and shows interactions of these elements. The model was defined based on expert inputs and a participatory stakeholder process to analyse the interactions within the system "water extraction for irrigation" and derive the most influential factors for the evaluation of water consumption. The farmers' decision to use irrigation is mainly influenced by economic factors such as investment costs, operating costs and revenue. But, purely economic assessment of water extraction is not sustainable because any change in water supply for irrigation has an effect on other factors in the farm system (income, biodiversity, labour). The agricultural operation is a complex, cross-linked system including various economic, ecological and social factors as basis for the farmers' decisions. Due to a mutual influence on each other, it is not always apparent at first glance how relevant a single factor is. The System-Dynamics model was used to determine the relations between water extraction for irrigation, the farmers' means of adaptation to climate change and the impact on water resources. From the acquired results, the most influential factors for the assessment of water consumption were deduced. The results were used to develop a water-tool in the existing management software MANUELA. The water-module is available as a new plug-in and can be used by farmers and consultants. The module is applicable to different types of farms and regions, no matter whether groundwater or surface water is used for irrigation. It's applicability was tested by farmers and students.

**Keywords:** irrigation; agriculture; system-dynamics; water management; decision support