



Deutscher Tropentag, October 11-13, 2005, Hohenheim

“The Global Food & Product Chain—
Dynamics, Innovations, Conflicts, Strategies”

Integrated Farm-Scale Modelling of Land, Water and Resource Allocation in the Khorezm Region of Uzbekistan

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Abstract

Irrigated agriculture in the Khorezm region, situated in the Aral Sea Basin of Uzbekistan, is characterised by excessive and unsustainable use of water, land and resources, such as fertiliser and pesticides. It is assumed that this is a consequence of the current post-Soviet economical and institutional framework conditions, for instance by the state-imposed production of cotton. In detail however, the picture is not clear. The resource use efficiency of the land use system as such still remains to be quantified and clearly described. There is also a basic need to seize the complex institutional, economic and agronomic interdependencies. Based on a thorough system understanding, recommendations have to be developed for an ecologically and economically improved resource use and for the institutional and legal setup needed to support it. As system dynamics are highly complex in nature, computer modelling provides the only viable option for tackling these issues.

As a first step to reach this goal, in the framework of the multidisciplinary, German-Uzbek research project “Economic and Ecological Restructuring of Land- and Water Use in the Khorezm Region (Uzbekistan)” — a pilot project in development research¹ (www.uni-bonn.de/khorezm) — a farm-level scenario-analysis and optimisation tool is being developed. This integrated model will allow for the analysis and/or optimisation of the status quo and simulation of different scenarios of farm-level land and resource allocation. The model will integrate four different components: a crop-soil-simulation model, a hydrological model, a linear programming/optimisation tool and a GIS/database component for spatial analysis and to account for data storage and visualisation. The integration of these components will be realised within the so-called COBIDS (component-based integration of data and services) framework.

The poster describes the setup of the model and how the interactions between the components are accomplished. The usefulness of applying the Unified Modelling Language (UML) in the development process of the model is briefly discussed.

Keywords: Central Asia, crop-modelling, farm optimisation, interdisciplinary research, linear programming, sustainability