Regional Assessment of Agricultural Cropping Systems in the North China Plain: A Modelling Approach Towards Sustainable Resource Use

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Abstract

The North China Plain (NCP) covers an area of around 328,000 km^2 and is one of the most important regions of cereal crop production in China. Wheat and maize rotations and one season cotton are the most common planting systems. The region contributes at an amount of about 50 % to the countries wheat production and about one third of maize yields. Crop production in the NCP was focused in the last decades on increasing yields to meet the growing food demand accompanied by the limitation of arable land as a result of urbanisation rate i.e. of the Beijing District. Food production needs can nowadays only be achieved by the optimisation of agricultural management, i.e. fertiliser input, irrigation, improved crop rotations. The focus on increasing yields raised serious environmental problems, like water shortage and pollution, air pollution and soil contamination. Hence the development of future land use system approaches improving these conditions is essentially. This may provide both a high production level as well as a protection of resources. The multidisciplinary collaborative International Research Training Group project (IRTG) "Modelling Material Flows and Production Systems for Sustainable Resource Use in Intensified Crop Production in the North China Plain", funded by the Deutsche Forschungsgemeinschaft (DFG) and the Chinese Ministry of Education, was launched to detect the potential of adjustments in cropping systems and develop management practices for sustainable resource use and protection of environmental conditions while assuring a high yield level. Our work concentrates on the simulation of different spatial-temporal scales in order to detect the effects of changing land use patterns within scenarios. To fulfil this task we locally adapted the concept of cellular automata (CA). Simulations i.e. of fertiliser input levels are obtained by transition rules for different cell stages. The possibility to create cells in hierarchical order, so called hierarchical automatic cellular automata (HA-CA) proposes the opportunity for regionalisation. Secondly we use the crop model DSSAT (Decision Support System for Agricultural Transfer) to predict and regionalise water use efficiency, fertiliser efficiency and yield under iterative management scenarios.

Keywords: Agriculture, cellular automata, China, crop modelling, China, regionalisation

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