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A Multi-agent Model Simulating Agronomic Income Sources in the North China Plain

ANDREAS ROTH, REINER DOLUSCHITZ

University of Hohenheim, Computer Applications and Business Management in Agriculture, Germany

Abstract

Farmer incomes in the North China Plain are highly variable considering the agronomic situation each agricultural year. However environmental and economic side-factors influence the actual yield situation and the upcoming growing season. Budget calculations of farmers, e.g. for fertiliser are annually highly variable, too. These together affects the frame conditions of cultivated land in the North China Plain tremendously. Additionally the recently socio-economic innovations by Chinese government change the public anticipation of agriculture and propagates, e.g. the probability of “off-farm” income. This together with a growing urbanisation rate is believed to aggravate the aerial features of Hebei province agricultural landscapes.

In order to investigate the spatial features of agricultural activities we identified the farmer decision to generate income as the key research variable. Factorial impact on income is achieved by the rate of urbanisation or percentage of off-farm income and specific data e.g. on household structure. Further more the size and crop composition of arable land is an important issue to consider.

We designed a local version of the agent model NetLogo a cross-platform computing environment written in Java. Primarily geo-referenced data with a map of soils and infra-structural data at county level are included. These data sets provide a unique geo-data basis on which simulations will be conducted. Secondly agents are introduced acting at the residential areas found in the research area. These agents are individually configured by household and agronomic variables and have pre-defined radii of activity. Variables considered to primarily affect income and yield are labour, household size, crop area, percentage of “off-farm”, leased and under-leased land. Our approach accounts for zones of interactivity between agents. These areas are of special interest as representatives of competition and convergence fields in the inter-agent-relationship. The multi-agent spatial approach was chosen to simulate inter-farmer decision making with diverse constitution of households and external driving factors, e.g. the off-farm income. Expected outcomes of this study will be predicted yield and income and the identification of pathways and interconnected relationships of agent decisions generating these two.

Keywords: Agent decision, agent interaction, agronomic income, multi agent modelling, North China Plain