Prospect food demand and supply in 2020 with economic model and land use change model

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1. Introduction

Recent years, the concern has risen to an increase food demand by pressure of population increase and economic growth. On the other hand, growth of harvested area and crop productivity are stagnated last decade. For these reasons, the food scanty is feared in the future and some researchers and institutions are forecasting future food demand and supply. The purpose of this study is to prospect food demand and supply in the future with multi-scale model, which contain an ecological model and socio-economic model.

2. Integrated Model

In this study, we use the integrated model. This model is based on crop price model, crop yield model and crop choice decision model. Crop price model, IFPSIM (International Food Policy Simulation model) is a partial equilibrium model and treats 32 countries/ regions and 14 commodities (Ohga and Yanagishima, 1995). An interactive in that it allows for the simultaneous determination of supply, demand, trade, stock changes and prices for all the commodities covered.

Crop productivity model, EPIC (Erosion/Productivity Impact Calculator) is developed by USDA to operates on a dairy step and includes components for whether simulation, hydrology, nutrient cycling, plant growth, tillage and crop management (Williams, 1995). Tan and Shibasaki (2003) proposed a methodology GIS-based EPIC, integrating EPIC, GIS and IE (Inference Engine), and it can estimate crop productivity at global level.

Crop choice decision model is based on a multinomial logistic function, which is assumed that a decision-maker chooses an alternative with the highest utility from the set of alternatives. The land use is a mechanism that crops with earnings most are selected in consideration of the price and the productivity of grain.

3. Simulation

3.1. Scenario Setting

Due to IFPSIM treats only agricultural sector, we use variables such as population and GDP growth from other models. Population increase and GDP growth is quoted form IPCC SRES; A1b, A2, B1, B2(CIESIN, 2005). About agricultural policies, we don’t modify these variables, producer subsidy equivalent, consumer subsidy equivalent and set-aside.

3.2. Simulation Results

Assumption in the foregoing paragraph adjusted and was simulated. We’ve compared comparison with simulated results and actual data from FAOSTAT (FAO, 20007). There are not so many differences compared with the reality, it was shown an accuracy of integrated model.

World price in all commodities would rise between 1995 and 2020. Multiple-cropping system is also taken into account. Though there are differences in each scenario, until year 2020, all scenarios have increasing population and economic development more or less. The width of price rise applied valuing economic growth scenarios (A1 and B1) is comparatively large. It is thought that this is because demand expanded by economic growth and increase of population.

This article shows an agricultural modeling with integrated economic and spatial models. The simulation result indicates that crop price in the future will rise. But, we have also some uncertainties. At first, in the USA maize demand for biofuel is increasing dramatically in recent years. Now, price of wheat and soybeans is soars and we need to take into demand for fuel.

References

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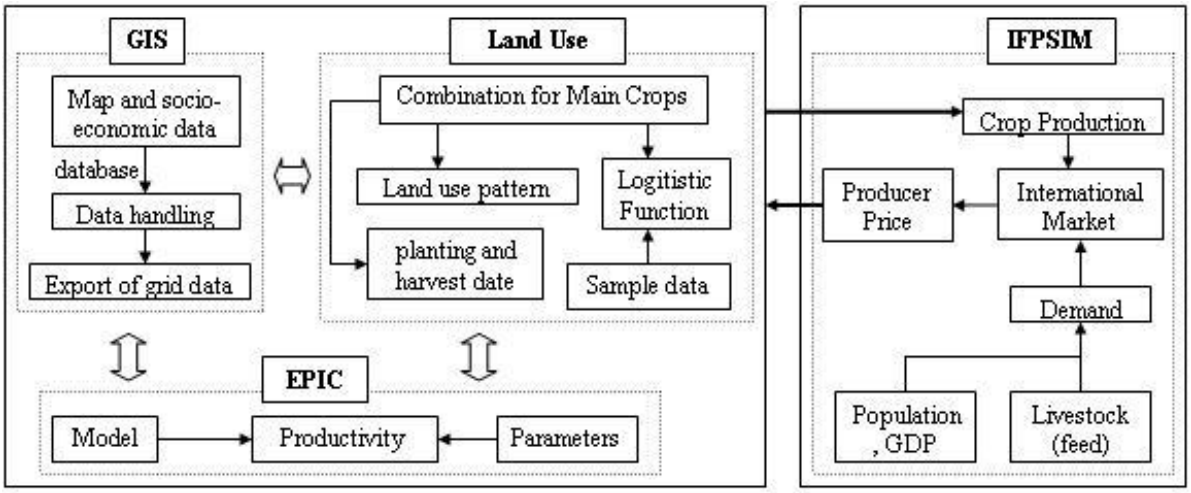

Framework of the model