Geophysical Research Abstracts,
Vol. 11, EGU2009-3186, 2009
EGU General Assembly 2009

Agriculture and natural resources in a changing world – the role of irrigation

T. Sauer (1,2,3), P. Havlík (4), U. A. Schneider (1,2,4), G. Kindermann (4), and M. Obersteiner (4)

(1) Hamburg University, Research Unit Sustainability and Global Change (FNU), Hamburg, Germany (timm.sauer@zmaw.de), (2) Centre of Marine and Atmospheric Sciences (ZMAW), Hamburg, Germany, (3) International Max Planck Research School on Earth System Modelling (IMPRS-ESM), (4) International Institute for Applied Systems Analysis (IIASA), Forestry Program, Laxenburg, Austria

Fertile land and fresh water constitute two of the most fundamental resources for food production. These resources are affected by environmental, political, economic, and technical developments. Regional impacts may transmit to the world through increased trade. With a global forest and agricultural sector model, we quantify the impacts of increased demand for food due to population growth and economic development on potential land and water use. In particular, we investigate producer adaptation regarding crop and irrigation choice, agricultural market adjustments, and changes in the values of land and water.

Against the background of resource sustainability and food security topics, this study integrates the spatial and operational heterogeneity of irrigation management into a global land use model. It represents a first large scale assessment of agricultural water use under explicit consideration of alternative irrigation options in their particular biophysical, economic, and technical context, accounting for international trade, motivation-based farming, and quantified aggregated impacts on land scarcity, water scarcity, and food supply.

The inclusion of technical and economic aspects of irrigation choice into an integrated land use modeling framework provides new insights into the interdisciplinary trade-offs between determinants of global land use change. Agricultural responses to population and economic growth include considerable increases in irrigated area and agricultural water use, but reductions in the average water intensity. Different irrigation systems are preferred under different exogenous biophysical and socioeconomic conditions. Negligence of these adaptations would bias the burden of development on land and water scarcity. Without technical progress in agriculture, predicted population and income levels for 2030 would require substantial price adjustments for land, water, and food to equilibrate supply and demand.