

GIS and Agricultural Economics

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Introduction

This document provides a brief overview of the application of GIS in agriculture economics.

Relevancy

Location specific biophysical and socio-economic attributes affect the decisions regarding the allocation of land for specific crop cultivation, livestock production, inputs use, and even marketing of agricultural commodities. The importance of location has been increasingly realized in agricultural economics studies and econometric analyses. The importance of location in agricultural economics can be illustrated using the von Thunen model of farm price, land use, and rent. This model uses an agricultural market and shows how the resulting transportation costs affect the land use in different locations from the market centers and its consequential effect on land rent (Nelson, 2002).

The geographical data required for modeling land uses and econometric modeling are hard to find in developing countries and especially where locations of interest are sparsely distributed. The GIS, global positioning systems (GPS) and remote sensing (RS) provide tools and methods for gathering data. GIS provides powerful sets of tools for collecting, storing, retrieving, and displaying spatial data of interest from the field.

Application

There are numerous avenues where GIS can be integrated with agricultural economic studies. Changes in agricultural land use are one of the areas that agricultural economists are interested in. A decision on the land use for crop production depends on many spatially related factors such as, microclimate, vegetation, location specific attributes such as prices of inputs, outputs, household characteristics, ownership of land and a combination of these factors with a set of production technologies that relates inputs and outputs. For instance, Muller and Zeller (2002) investigate geo-physical, agro-ecological, and socio-economic determinants of land use change in Vietnam and assess the influence of rural development policies on land cover change.

Precision farming (PF) is another area where agricultural economists make use of GIS technology when producers have to deal with a large field for crop production. PF involves the study of spatial variability in productivity, infestation of insects and pests, weeds, distribution of soil nutrients, moisture status, and microclimate in order to manage and get crop production as uniform as possible. The uniformity of production is essential from the perspective of maintaining the quality of products, which has direct implications

in marketing and pricing of the products. GIS, GPS, and remote sensing techniques help gather and analyze site-specific information on such variability. As an example, McKinion et al (2001) have used these technologies to optimize resource use in cotton by altering the nutrient and water use. Similarly, Bullock et al (2002) and Florax et al (2002) examine the relevancy of precision farming technologies, input management and ensuring the profitability of new agricultural technologies.

Related GIS Resource Documents

GIS_RD_02-01 (Geographic Information System)

GIS_RD_02-30 (Global Positioning System)

GIS_RD_02-03 (GIS and Spatial Analysis)

GIS_RD_02-04 (Spatial Statistics)

Relevant web site at Penn State:

Land Analysis Lab: <http://lal.cas.psu.edu/index.htm>

Citations

Bullock, D. S., Lowenberg-Deboer, J. Swinton, S., 2002. Adding value to spatially managed inputs by understanding site-specific yield response, *Agric Econ.* 27: 233-245

Florax, R. Voortman, R., Brouwer, J. 2002. Spatial dimensions of precision agriculture: a spatial econometric analysis of millet yield in Sahelian coversand, *Agric Econ.* 27: 432-443

Nelson, G. C. 2002. Introduction to the special issue on spatial analysis for agricultural economists, *Agric Econ* 27:197-200.

McKinion, J. M., Jenkins, J. N., Akinns, D., Turner, S. B., Willers, J. L., Jallas, E., Whisler, F. D. 2001. Analysis of a precision agriculture approach to cotton production, *Comput-electron-agric.* 32: 213-228.

Muller, D. and Zeller, M. 2002. Land use dynamics in the central highlands of Vietnam: a spatial model combining village survey data with satellite imagery interpretation, *Agric. Econ.* 27: 333-354.

There are other relevant articles published in *Agricultural Economics* 27, issue 3, (2002).
<http://www.sciencedirect.com/science/journal/01695150>

Copies of the articles in *Agricultural Economics* are available to Penn State researchers through E-Journal Title Search at <http://apps.libraries.psu.edu/cf/fasttrack/search.cfm>