Exploring Relationships Between Geomorphic Factors and Wheat Yield Using Fuzzy Inference Systems

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Abstract. Discovery of relationships between geomorphic factors and crop yield is a promising step toward spatial decision support of farming technology problems. A study of relationships between geomorphic factors and yield requires simulation of a non-linear system with poorly quantified uncertainties. Contrasted against conventional mathematics, a fuzzy inference system (FIS) employs fuzzy if-then rules to model the qualitative aspects of human knowledge and reasoning processes without employing precise quantitative analyses. In this paper, the utility of the FIS method for determining relationships between geomorphic factors (elevation, slope, aspect, curvature, and upslope contributing area) and yield is investigated. Parameters of FISs are identified using a dataset comprising over 6300 spatial points within 63 ha of an undulating farm field in Colorado. The single-input FISs designed in this study were used to identify several geomorphic dependencies of the spatial yield, which are presented graphically. Several two-input FISs were also developed to compute geomorphic yield dependencies. For practical application, these two-dimensional dependences are presented as 3D images and contour maps.

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