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## Sustainability Assessment by Fuzzy Evaluation: Case Study in Urban Vegetable Cultivation Systems in Red River Delta, Vietnam

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### Abstract

Fuzzy logic is a scientific tool that permits the simulation of system dynamics without a detailed mathematical description by using “if-then” linguistic rules. These rules describe the logical evolution of the system according to the linguistic values of its principal characters that we call linguistic variables. This paper presents the results of the sustainability assessment by fuzzy evaluation of urban vegetable cultivation systems in Red River Delta, Vietnam. The case studies were conducted in three selected communes in urban areas of Ha Dong district in Hanoi in Red River Delta, Vietnam. The farms in those communes are small-scale vegetable and/or mixed vegetable-rice farms. Vegetables grown in the study area included cabbage, bean, cucumber, leafy cabbage, cauliflower, tomato, kohlrabi, and cauliflower. Average farm size was 0.107 ha in which 0.089 ha was used for vegetable production, the number of plots was 4.52 and plot size was 0.025 hectares. A workshop was carried out in February 2010, total 476 rules were gathered based on twelve indicators by using farmers’ perceptions as well as their preferences into the decision making process. The fuzzification and defuzzification processes have been done by using Fuzzy Logic Toolbox in MATLAB software. The results showed that the value for environmental sustainability indicators was 0.33, the social sustainability indicator was lowest (0.25), and economic sustainability was highest (0.50). The overall sustainability index of vegetable cultivation systems in the study area was very low (0.31). The results of this study indicate that urban vegetable cultivation systems in Red River Delta, Vietnam were unsustainable.

**Keywords:** Fuzzy evaluation, Red River Delta Vietnam, sustainability assessment, vegetable