Chapter 11

Application of Fuzzy Logic for Mapping the Agro-Ecological Zones

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ABSTRACT

The mapping of agro-ecological zone, which is integrated with the suitability of land evaluation, will determine the ideal farming system. The ideal farming system including sustainable land management will support the food security scenario of a region. In this chapter, the implementation of fuzzy logic for mapping the agro-ecological zone is discussed. The agro-ecological zone in Boyolali is used as case study in which the mapping considers its physiographic characteristics and climate. Two physiographic characteristics are involved: slope of the land and elevation. Rainfall is used as representative of climate. The experiment results reveal that simple membership function with the Mamdani inferences system could help decision makers to classify the agricultural land in Boyolali.

INTRODUCTION

Food is a basic human need and the right to food is a basic human right. Efforts toward food tenacity are food security for all household, sufficient in quantity and quality, proper nutrition, equitability and affordable by every individual. According to the Food and Agriculture Organization, FAO, (2006) of the United Nation, there are four pillars of food security: availability, access, utilization and stability. They can be illustrated in Figure 1. Food availability refers to the availability of sufficient quantities of food with appropriate quality. Food availability is significantly influenced by food production and distribution. The food can be supplied through local production or importing food from other region. There are several factors that affected the food production such as climate, soil characteristics, rainfall, irrigation, components of agricultural production as well as farmer incentives. In some cases, disaster

Figure 1. Four pillars of food security according to FAO (2006)
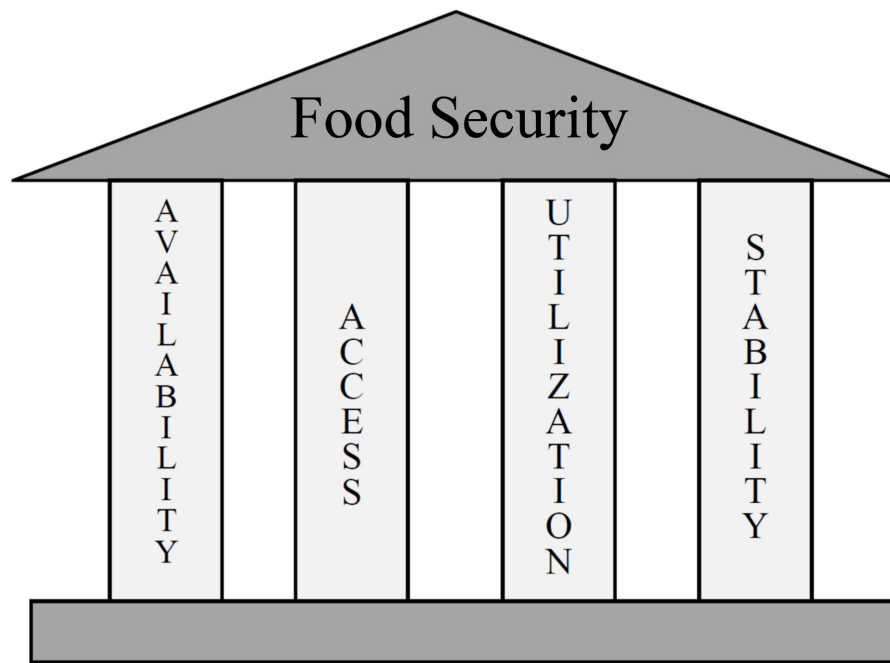
also influenced the food production, such as flood and landslides. Food access means individual could access to adequate resources of appropriate food with proper nutrition. Utilization is the non-food factors that support food security such as clean water, sanitation and heath care to reach the nutrition well-being that meets the physiological needs. Stability means the population, household or individual have access to adequate food at all times (FAO, 2006). Availability, access and stability may refer to the emphasis of ensuring and improving supply and price stability as well as its various trade and market relations. Stability may reflect the long term reliability. While utilization encompass a variety of issues that affecting the transformation of food resource into food consumption (Midgley, 2013).

Food insecurity may occur in an area when the local food resources depend only on one type of food commodities. When an area unable to produce food commodities, unable to import adequate food commodities or unable to distribute food commodities at an affordable price then food insecurity happen. In order to reduce the dependency to a specific food commodity, food divergence is needed. Food diversity can be interpreted as an attempt to strengthen one of the four pillars of food security. It increases the availability of food. The development of food diversity in a specific area is determined by biophysical conditions of the land, land management and the farming system used for that area.

In most area of Indonesia, the development of food commodities has not been carried out in an integrated manner between agro-ecological zone (AEZ), land suitability and capability, regional of food commodities as well as sustainable land management planning. This leads to the lack of ideal model for agricultural and food security development for a particular area. On the other hand, agricultural development is one of the bases for national development. It is not only important for economic but also for environment and society development.

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