Chapter 35 Application of Fuzzy Logic for Mapping the Agro-Ecological Zones

Bistok Hasiholan Simanjuntak Satya Wacana Christian University, Indonesia Kristoko Dwi Hartomo Satya Wacana Christian University, Indonesia

Sri Yulianto Joko Prasetyo Satya Wacana Christian University, Indonesia Hindriyanto Dwi Purnomo Satya Wacana Christian University, Indonesia

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

DOI: 10.4018/978-1-5225-1908-9.ch035

Application of Fuzzy Logic for Mapping the Agro-Ecological Zones



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.

In order to improve the sustainability on the development of food commodities, there is a need to assess land suitability classification through AEZ. AEZ characterized lands by similar climate, ecology and agricultural activities (Chikodzi and Mutowo, 2012). In this paper, we discuss the application of fuzzy logic to map the agro-ecological zone in Boyolali, Central Java, Indonesia.

23 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage: www.igi-global.com/chapter/application-of-fuzzy-logic-for-mapping-the-agroecological-zones/178422

Related Content

Ambient Assisted Living and Care in The Netherlands: The Voice of the User

J. van Hoof, E. J. M. Wouters, H. R. Marston, B. Vanrumsteand R. A. Overdiep (2013). *Pervasive and Ubiquitous Technology Innovations for Ambient Intelligence Environments (pp. 205-221).* www.irma-international.org/chapter/ambient-assisted-living-care-netherlands/68938

Role of Distance Metric in Goal Geometric Programming Problem (G² P²) Under Imprecise Environment

Payel Ghoshand Tapan Kumar Roy (2019). International Journal of Fuzzy System Applications (pp. 65-82). www.irma-international.org/article/role-of-distance-metric-in-goal-geometric-programming-problem-g2-p2-underimprecise-environment/214940

Writer Identification in Old Handwritten Music Scores

Alicia Fornés, Josep Lladós, Gemma Sánchezand Horst Bunke (2012). *Pattern Recognition and Signal Processing in Archaeometry: Mathematical and Computational Solutions for Archaeology (pp. 27-63).* www.irma-international.org/chapter/writer-identification-old-handwritten-music/60872

Applying Digital Storytelling to Business Planning

Yoko Takeda (2016). *Computational and Cognitive Approaches to Narratology (pp. 140-163).* www.irma-international.org/chapter/applying-digital-storytelling-to-business-planning/159623

Genetic Programming for Robust Text Independent Speaker Verification

Peter Dayand Asoke K. Nandi (2012). International Journal of Signs and Semiotic Systems (pp. 1-22). www.irma-international.org/article/genetic-programming-for-robust-text-independent-speaker-verification/101249