

Urbanization and Land Utilization of Tainan Region of Southern Taiwan with GIS Approach

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Abstract: Rapid urbanization of Tainan city has given rise to significant land use change in the past 100 years. This change is a dynamic process between land use and some socio-economic factors, which should be comprehended by a long-term analysis in both historical and spatial dimensions. For spatial analysis, a geographic information system (GIS) is a powerful tool for data visualization and analysis in geographic space to understand relationships and patterns. The temporal datasets on land use applied in this study cover 1904 to 2007, and include old topographic maps, aerial images, and economic planning and development topographic maps. After image registration and rectification, the quantification of land use changes can be determined by digitization on the historical maps. Then, a transition matrix is utilized to conjecture on and explain the land use changes with reference to available historical records. With the GIS approach, we also explore the socio-economic meaning of spatial transformations in the scope of old Tainan city. The results reveal that these changes of land utilization reflect the process of urbanization, which is mainly influenced by human activities, and the major driving forces toward accelerated urbanization are public policies.

Keywords: Urbanization, Land use, GIS

1. Introduction

Rapid urbanization of Tainan city has given rise to significant land use change in the past 100 years. In particular, fish ponds and agricultural land use have drastically decreased, while built-up land and industrial areas have increased since the 1970s (Chiang 2014). This change is a dynamic process between land use and some socio-economic factors, which should be comprehended by a long-term analysis in both historical and spatial dimensions (Cheng et al. 2013, Wu 2013). For spatial analysis, a geographic information system (GIS) is a powerful tool for data visualization and analysis in geographic space to understand relationships and patterns that would be difficult to identify if the information were only presented solely in historical literature or statistical data sets.

2. Data and Method

The temporal datasets on land use used in this study cover 1904 to 2007, and include old topographic maps, aerial images, and economic planning and development topographic maps. After image registration and rectification (Chiang 2013), the spatial information from the historical images is retrieved. Then, quantification of land use changes can be determined by digitization on the temporal datasets. To evaluate the changes of different types of land use across different time periods (Fig. 1), we classified the land use into 9 categories for comparison. A transition matrix (Burnham 1973, Bell 1974) is utilized to conjecture on and explain the land use changes with reference to available historical records. With the GIS approach, we also

explore the socio-economic meaning of spatial transformations in the scope of old Tainan city.

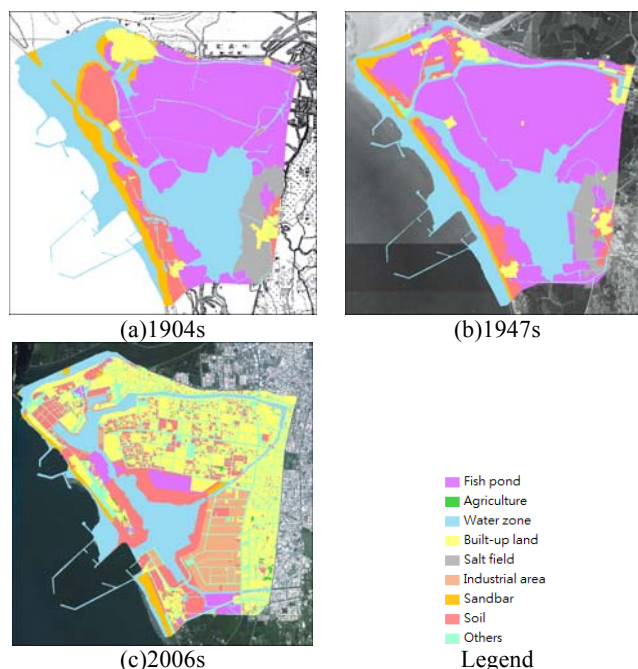


Fig. 1 The difference of land use types across different time periods.

3. Results and Discussion

In this study, because the timeline spanned over a hundred years, we divided it into three periods including the Japanese colonial

period, early Taiwan Restoration, and the period from 1980 to the present. The results reveal that the formation of land use policies was mostly based on the socio-economic activities in the Japanese colonial period. Policies were used to strategically promote economic development such as harbors, canals, public markets, etc. For rapid industrialization in the period of Taiwan Restoration, numerous policies were actively planned by the government and affected the spatial transformation of human settlements. These changes of land utilization reflect the process of urbanization, which is mainly influenced by human activities, and the major driving forces toward accelerated urbanization are public policies.

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