

## Analysis of Population and Land Use Dynamics in Tsukuba City using Grid Square Statistics Data

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### 1. Introduction

Currently, Tsukuba city is fully modernized with the necessary facilities establishment which is well known as science city in Japan. In the last decade, the population trend of the city shows promising results against the depopulation problems by adding more than 10,000 every census year. Does the trend appear spatial? How about the spatial patterns of land use and population changes in such small city? We would like to address these issues with the aid of GIS tool and the Grid Square Statistics (GSS) data. This study aims to explore the population and land use dynamics in Tsukuba city of Tokyo metropolitan fringe using the GSS data.

### 2. Database and method

In this study, we used the city boundary based on 2000. GSS data with 1 kilometer resolution of population for the year 1990, 1995 and 2000 were processed to identify the spatial patterns of population change in Tsukuba city. Population change patterns are classified into five categories. Five categories are classified by index: a) 'Pop. To NoPop', b) 'Decreased Pop.', c) 'No change', d) 'Increased Pop' and e) 'No Pop to Pop'. Land use change patterns were explored using 10m Grid Land Use data for the year 1984, 1989 and 1994. The locations of land use change between the years 1984 and 1989, and 1989 and 1994 were compared with population change between the years 1990 and 1995, and 1995 and 2000.

### 3. Results and discussion

The GSS data shows that the population in Tsukuba city was increased by 23,000 during 1990 to 2000. Majority of the study area have low population density i.e. less than 1000 per square kilometers. City core area shows more than 5000 inhabitants in one square but the numbers of such square are nominal.

The spatio-temporal patterns of land use and population change in the city between the year 1990-1995, 1995-2000 shows very few countable squares with no population change in the decade but the situation is not same every year. Positive population change is observed in the city core area that concentrated mostly within the closed boundary of science city. Depopulations seem more clustered mostly located in rural agricultural areas.

The result of land use analysis therein the decade shows the trends 70% of lands in an average occupied by dry farm land (26.4%), paddy field (21.9%), and forest (20.1%).

The forth majority is found low-story residence (11.4%). The ratio of the land use change was observed at lower rate. But still we can see some trends of changing spatial pattern. During 1989 to 1994, the 95% of preparation area changed to other land uses. Total 73% of the preparation land in 1984 changed to forest, paddy land, farmland and vacant in 1989. 60.0% of preparation and 46.6% of vacant land in 1989 were come from other categories in 1984. 'Pop to No Pop' area changed from paddy field, forest, and farm land to vacant, commercial area and water uses. The land occupied by the increased pop category, was changed from vacant to low story residence.

### 4. Conclusions

The land use changes in Tsukuba city mostly occurred in vacant or preparation land. The combined analysis of both land use and population provided a great insight in socio-economic dynamics of the study area. For example, transition of vacant land to low story residence during 1984 to 1989 caused increasing patterns in 'Increased pop' category. Interestingly, the land having transition between the public institutions and low residential area during 1989 to 1994 did not have any effect to the population change in 2000. Hence we can observe the socio-economic characteristics through the combination dataset.

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