Suitability Analysis of Convenience Stores based on Spatial Characteristics

Tamba Sahr Dauda (Masters Program in Geosciences)

1. Motivation

Convenience Stores are playing a very important role in the lives of its market shares. Their twenty-four hour operation has served as a ready stock supply security while it also provides fast food, beverages and other necessary commodities. Its spatial distribution and characteristics is therefore very important for its densification.

2. Introduction

The location of convenience stores can be based on several factors springing from the sales performance; however a much more intuitive way is to study the spatial characteristics of dispersions of existing stores in relation to the natural factors which is the aim of this study. The field work shows some correlation to varied levels between their locations and the spatial features. These features will be analyzed to determine the criteria and their weights in the present pattern shown by their distribution. A weighted suitability model is used in ArcGIS to locate possible sites for future localization of convenience stores in the University of Tsukuba area.

3. Study Area

The University of Tsukuba area has been identified with an external buffer of 200 meters. This was determined by sampling all convenience stores within this area. The external buffer was considered because 90 percent of the stores fall outside the University boundary and within this buffer.

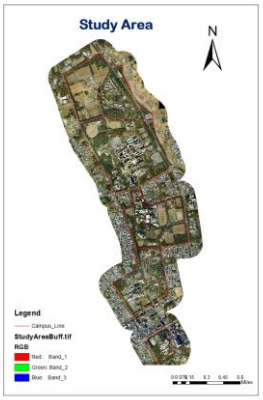

Fig.1 Study Area

4. Methodology

A survey 123 was used to capture series of data attributed to the location of the existing stores using a smart phone. The surrounding land use was also recorded for each store. The University boundary shapefile, the campus bus route and bus stations were extracted from the CampusGIS database. It was evident from the survey that 100 percent of all the surveyed stores had a very strong attraction to residential concentrations while 46 percent to recreation. However, other criteria such as distances to the bus route and the nearest bus station to each store were also calculated. These distances were also used to set the buffers for restricted and most suitable sites. The 10m DEM was also used to create a slope which was clipped with the stores shapefile to determine the maximum slope. These criteria were used in the following model:

$$S = \sum_{i=1}^{n} w_i C_i \prod_{j=1}^{m} r_j$$

Where S is the suitability for site location, w_i is the weight of a criterion, C_i is the criterion and r_j are the restrictions. In the Restriction model, the university building footprints and the convenience stores were buffered as follows;

Restriction Source	Min. Distance (m)	Max. Distance (m)	Analysis Distance (m)
Store	125	1400	125
Buildings	20		20

$$S = \sum_{i=1}^{n} w_i C_i \left(r_{stores} \cdot r_{Buildings}\right)$$

Suitability Source	Min. Distance (m)	Max. Distance (m)	Range (m)	Rating	Weights (%)
Bus Route	0	200	200	5	15
Bus Station	45	400	365	3	15
Boundary	0	210	210	5	25
Slope%	**0%**	**17%**	**<=1%**	**5**	30
Landuse Variations	**Residential**	**100%**	**100%**	**5**	20
	Recreation	**40%**	**40%**	**2**	

$$S = \sum_{i=1}^{n} (w_{br} C_{br} \cdot (w_{bs} C_{bs} \cdot (w_b C_b \cdot (w_{sl} C_{sl} \cdot (w_{lu} C_{lu}) \prod_{j=1}^{m} r_j$$

5. Results and Discussion

The result shows that the suitable sites are having similar characteristics with the existing stores location. The general suitability map presents suitable locations on a scale of 5 with 5 being the most suitable. The Restriction map is an indication of forbidden areas. These areas share less or no characteristics with the existing ones. The final suitability map shows the most suitable sites without any restrictions. These areas have maintained similar spatial distribution characteristics as the existing ones.

Fig.2 Restrictions

Fig.3 Suitability

Fig.4 Suitable Sites

Fig.5 Convenience Stores

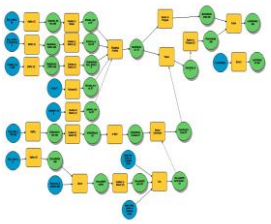

Fig.6 Model Diagram