Usefulness and Application of Small Area Statistical Analysis

Dr. Atsushi OTOMO
Chief Adviser

Types of small area analysis

- Type 1: Single area analysis
- Type 2: Multiple area analysis

- Type 1: Analysis for one specific area only.
- Type 2: Analysis for more than one area.

Methods of small area analysis

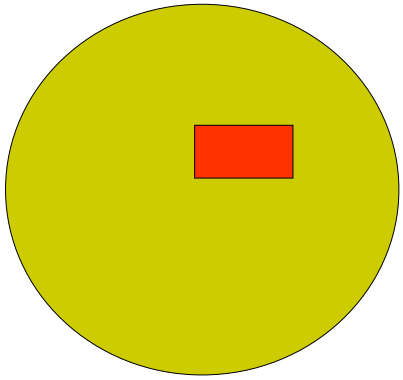
- For single area analysis, general method of statistical analysis is applied.
- For multiple area analysis, two types of methods can be applied:

  General statistical analysis and

  Spatial analysis

What Spatial Analysis Is (1)

- "Area" means a limited geographical surface on the glove.



What Spatial Analysis Is (2)

- "**Area**" can be divided into a certain number of *smaller areas*.
- "The smaller area" is called as a "**sub-area**".

What Spatial Analysis Is (3)

Kabupaten is a sub-area of *Propinsi* as well as that of the nation.

Kecamatan is a sub-area of *Kabupaten* as well as those of the nation.

Desa is a sub-area of *Kecamatan*. At the same time, it is a sub-area of *Kabupaten*, *Propinsi* or the Nation.

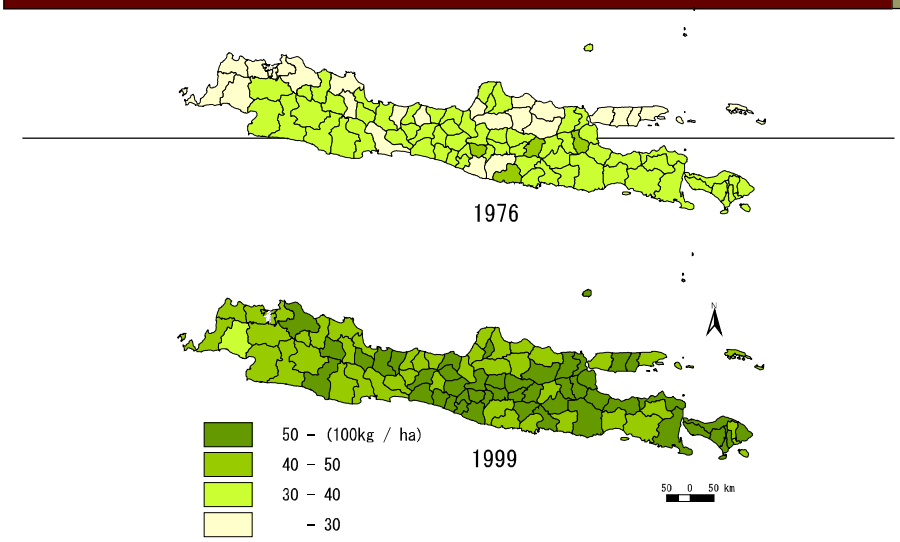
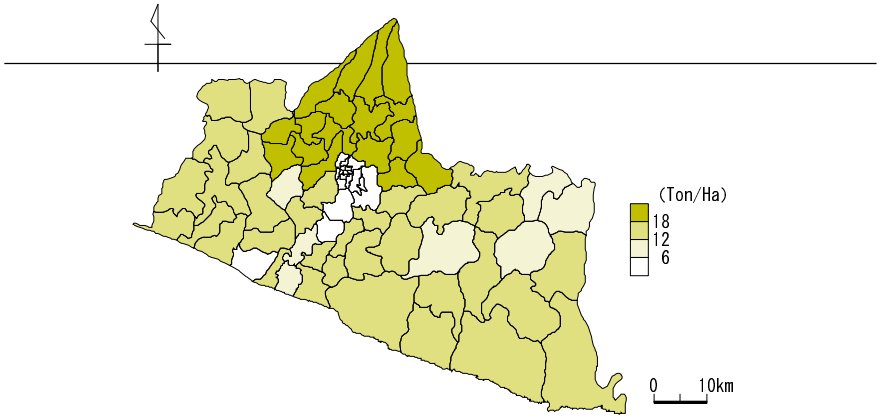
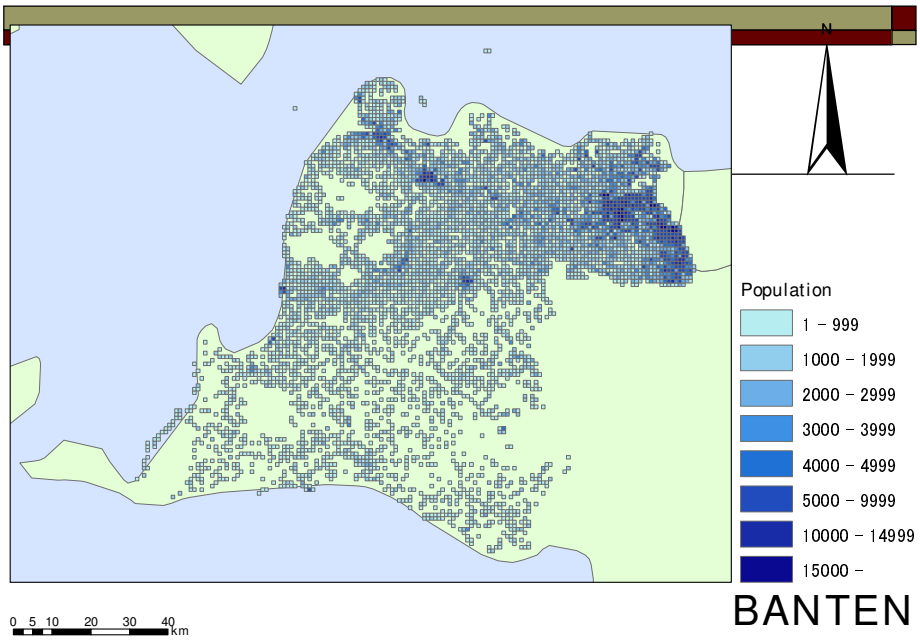


Fig.1 Yield Rate of wetland paddy by Kabupaten in Jawa

Source: Agricultural Survey by BPS-Statistics Indonesia





What Spatial Analysis Is (4)

Not only ***Propinsi***, ***Kabupaten***, ***Kecamatan***, and ***Desa***,

but also **Grid Squares** and **Census Blocks** are called sometimes as **Sub-national Areas**.

What Spatial Analysis Is (5)

Accordingly, Spatial Analysis is called sometimes as **Sub-area Analysis**, or **Sub-national Area Analysis**.

In spatial analysis, after deciding the Area for the analysis, all of the sub-areas within the Area become the target of the analysis.

What Spatial Analysis Is (6)

In spatial analysis, the data of the position or location play very important role together with social and economic data derived from small area statistics, and with environmental data.

What Spatial Analysis Is (7)

In this context, the Grid Square data containing information on things, events or phenomena observed on it together with that of its position or location are most useful for spatial analysis among small area data.

What Spatial Analysis Is (8)

Also, by using the Grid Square data applied to the computer software of Excel used widely, spatial analysis can be done without using the computer software of Geographic Information System (GIS).

What spatial analysis is (9)

- Thus, spatial analysis can be said as "small area statistical analysis" relevant to spatial elements such as distance, accessibility, agglomeration, migration, diffusion, distribution, etc.

What Spatial Analysis Is (10)

However, other small area data such as the data for ***Kecamatan*** **or** ***Desa*** carrying the information on location by digitizing, can be used for spatial analysis by means of GIS software.

Methods of Spatial analysis (1)

- In spatial analysis most important tool is “map”.
- In this context, “statistical map” is very useful for small area statistical analysis relevant to spatial elements such as distance, accessibility, agglomeration, migration, diffusion, distribution, etc.

Methods of Spatial analysis (2)

- At the same time, spatial analysis applying spatial models is useful for obtaining various types of estimates those which are helpful for decision making in various fields.

Methods of Spatial analysis (3)

- Examples of Spatial Models by using small area statistics applied to spatial analysis will be introduced.

Methods of Spatial analysis (4)

- Center of Population for deciding the location of public facilities such as public school, hospital, city hall, etc.
- Clark model on urban population density for estimating substantive urban population.

Methods of Spatial analysis (5)

- Reiley model for delineating a market area for marketing in retail sale indusriy.
- Huff model for delineating theoretical market areas and estimating market population, purchasing potential, provability of purchasing, etc.

Application of Clark model (1)

- Clark model on population density within an urban area :

  Population density decreases in proportion to the distance from the city center where it presents the highest within an urban area.

Application of Clark model (2)

- Clark model

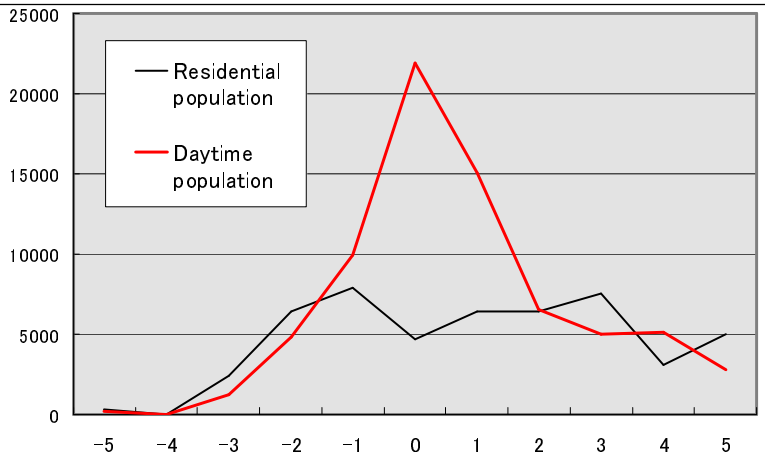
$$D_x = D_0 e^{-bx}$$

$$\ln D_x = \ln D_0 - bx$$

D_x: Density at x from city center

D_0 : Density at 0 or the city center

Population density by distance from city center, Kofu City, 1995



Application of Clark Model