

Study of Landcover and Population Density Influences on Urban Heat Island in Tropical Cities by Using Remote Sensing and GIS: A Methodological Consideration

10°C

INTRODUCTION

- Urban Heat Island
- Population Density and Landcover
- Remote sensing and GIS
- The past studies and Recent studies
- The study of about the urban heat island phenomena over tropical environment could have been studying with the help of remote sensing and GIS
- Another more important thing is that it is less time consuming as well as effective

PROBLEMS

- ✓ Population density is one of the major problems for increasing city's temperature. An increasing amount of population concentration (growth pressure) in tropical cities are maximum, as a result temperature is increasing automatically. Whatever temperature is emitted from human body is abnormal rather than normal for the case of tropical cities.
- ✓ Land cover, which is increasing rapidly in urban tropical areas, a big problem for increasing urban temperature. Generally these cities are made of concrete materials, for example buildings are made of bricks, glasses and metals.

On the other hand roads are made of asphalt, cement and stones, vegetation is cut down due to urbanization, open water land area is become less as a result heat is automatically rising and reflection and absorption abilities of several object is different as compare with the rural object one.

OBJECTIVES

The main objective of this paper is to demonstrate the landcover and population density influences to develop urban heat island phenomena over tropical cities.

HYPOTHESIS

- Landcover and population density greatly influence to urban heat island have a positive relationship with urban heat island.
- The relationship among landcover, population density and urban temperature can be expressed with this formula:

$$T = f(Lc, Pd)$$

Where as, T = temperature, f = function
Lc = landcover, Pd = population density.

METHODOLOGY

MATERIALS AND TOOLS:

- Remote sensing imaginaries including thermal band
- Administrative map of given city (scale 1:10,000-25,0000)
- Population data of same city with same year.

NECESSARY TOOLS AND INSTRUMENT:

- Computer 1 unit with necessary instruments
- Necessary Software
- GPS for coordinates and field check.
- Infra-red thermometer for measuring surface temperature of different object.

RESEARCH PROCEDURE

- Geometric Correction and Radiometric Correction
Image Enhancement
- Colour Composite: True Colour Composite (TCC),
False Colour Composite (FCC)
- Supervised Classification
*Parallelepiped, Minimum Distance, Maximum
Likelihood*

RECLASSIFICATION

TEMPERATURE ESTIMATION

- Conversion of Digital Number (Dn) to Radiance (L λ).
- Conversion of Radiation to Temperature.
- Conversion Radiance Temperature To Kinetic
Temperature.
- Conversion of Temperature Kelvin to Celsius.

URBAN POPULATION DENSITY

- Urban population density based on administrative
areas.
- Urban population density based on morphological
areas.
- Urban population density based on housing areas.

TENTATIVE SURFACE TEMPERATURE MAP BASED ON SEVERAL FACTORS

- Raster to vector conversion.
- Vector to raster conversion.

FIELD SURVEY

Administrative map of a given city is divided into
grid system

Then temperature samples are to be taken
according to coordinate by GPS and Infra red
thermometer

Every samples will cover by several objects,
temperature will be collected but depend on
resolution

CALIBRATION METHOD

The average surface temperature of each
ground sample will be calibrated with
satellite temperature of the same coordinate.

$$\text{The equation is} \\ Y = aX$$

STATISTICAL ANALYSIS

Multivariate Regression Analysis

Hypothesis Test

- t - stats > t - table H_0 is rejected
- t - stats < t - table H_1 is accepted

URBAN HEAT ISLAND INFLUENCING BY SEVERAL FACTORS

DISCUSSION

Baumann (2001), used Landsat ETM+ with combination of bands 6,4,4. He Proved that Direct relationship to land use and vegetation coverage.



Fig. 1 Urban Heat Island by Using Composite band (6 red, 4 green, 4 blue) Baumann (2001)

Bekele (2000) used Landsat ETM+ and proved that downtown area high temperature

Nakamura et al (2002) also used ASTER/TIR
Absence of vegetation and water areas for the development of urban heat island.

Mitchell, 1961. The growing cities showed the the population number as the most representative factors for the urban contribution to the temperature change

Lo and Faber, 1997 in Clemonds. UHI is the effect of population density

TROPICAL CASE

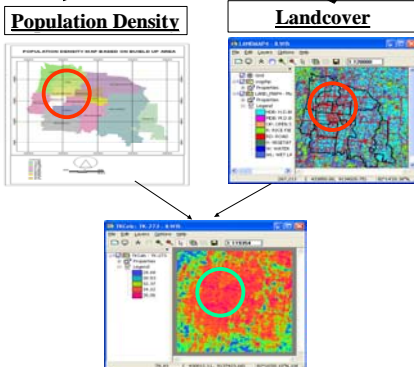


Fig.2. Factors Influencing for Increasing Temperature in Yogyakarta City

CONCLUSION

However population density and landcover is influencing on urban heat island and have co relationship. On the other hand it is hope that future R.S and GIS will search the new problems like air pollution for urban heat island specially in developing and under developing tropical countries.

THANK YOU