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University of Gadjah Mada

Explaining The Urban Heat Island Cases with The Demographic Dividend Phenomenon In Yogyakarta Special Region, Indonesia : (Linking Spatial Data with Population Data)

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Introduction

1. Yogyakarta Special Region (Yogyakarta), Indonesia has been thought a demographic transition since 1990 until now. Yogyakarta will achieve **demographic dividend** period in the year 2000 to 2015 (BKKBN, 2010).

2. In addition to experiencing the of demographic dividend, Yogyakarta also identified suffering **Urban Heat Island** phenomenon

Demographic Dividend

The concept of the Demographic dividend is its main advantage because of economic terminology is in the field of economics

Urban Heat Island

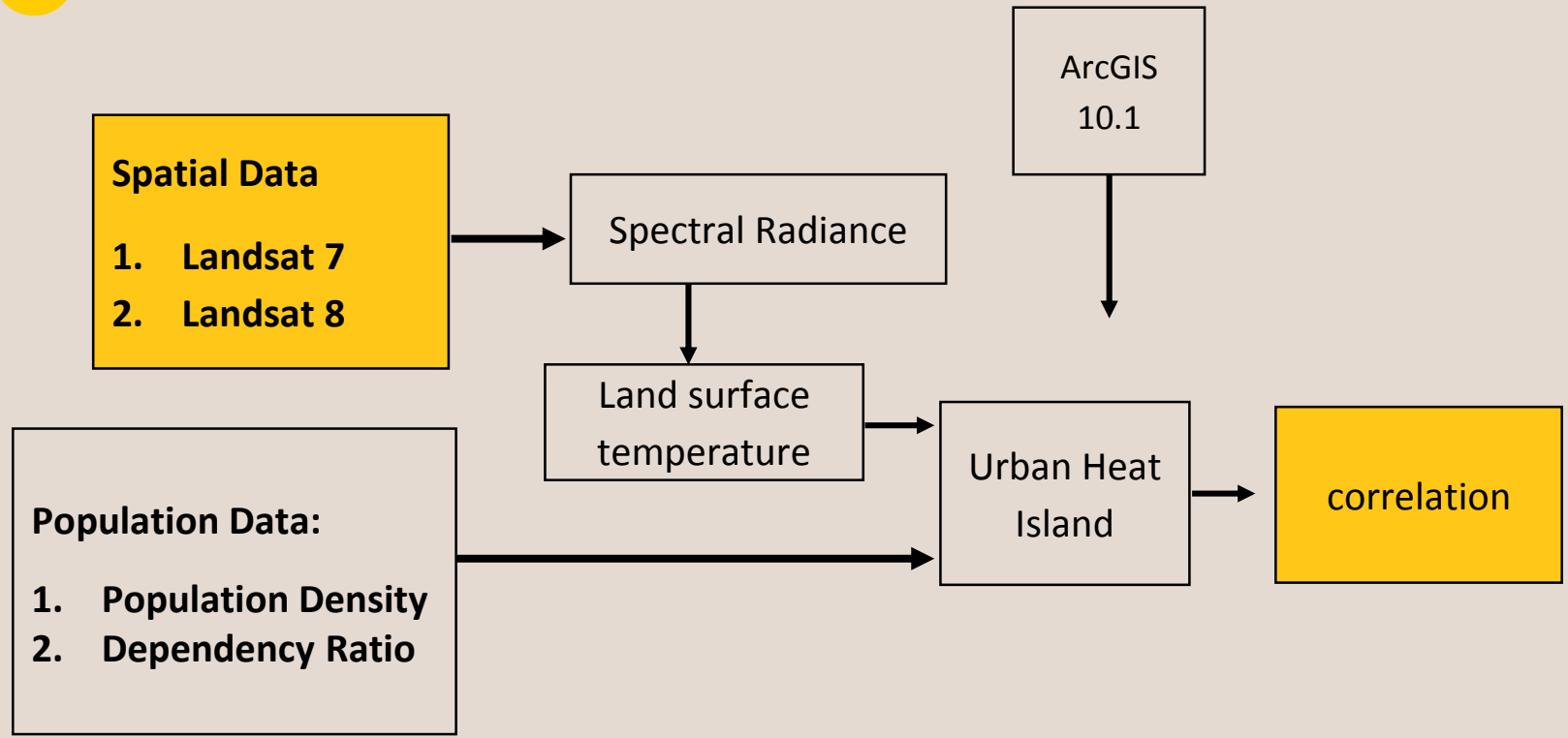
The urban heat island is an enclosed area that shows isotherme surface relatively warmer as a warmer temperature in urban areas compared to the surrounding rural environment (United States Environmental Protection Agency, 2008).

Data and Method

Theory

1. This study uses two different types of data, spatial data and population data. Spatial data used is Landsat satellite data in August 2002 and 2014. The 2002 data using satellite Landsat 7 ETM + data, while the 2014 either using Landsat 8 OLI/TIRS .

2. Applications that are commonly used to detect the urban heat island phenomenon is the temperature changes and difference with other areas (United States Environmental Protection Agency, 2008).


Spatial Data
1. Landsat 7
2. Landsat 8
Spectral Radiance
ArcGIS 10.1
Land surface temperature
Population Data:
1. Population Density
2. Dependency Ratio
Urban Heat Island
correlation

Landsat 7 Enhanced Thematic Mapper Plus (ETM+)

- Spectral radiance formula used for Landsat 7 ETM + using the formula (NASA, 2008):
- $$L_\lambda = \left[\frac{(LMAX_\lambda - LMIN_\lambda)}{(QCALMAX - QCALMIN)}\right] \times (QCAL - QCALMIN) + LMIN_\lambda$$

Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS)

- Landsat 8 OLI/TIRS using formulas (USGS, 1999):
- $L_\lambda = M_L \times Q_{cal} + A_L$

Table 1.1 Population Data

Kabupaten	KECAMATAN	Dependency Ratio		Population Density	
		2002	2014	2002	2014
Kota Yogyakarta	Tegalrejo	36.61	38.5	11975	12418
	Jetis	36.3	37.54	13962	13724
	Gondokusuman	37.97	27.03	11828	11453
	Danurejan	36.48	38.16	16834	16776
	Gedongtengen	37.09	38.87	18052	18280
	Ngampilan	37.26	39.67	21412	20035
	Wirobrajan	39.63	40.31	14960	14277
	Mantrijeron	37.64	40.93	12540	12233
	Kraton	39.29	43.34	13691	12298
	Gondomanan	37.17	35.01	12738	11760
	Pakualaman	39.37	35.66	15454	14546
	Mergangsan	38.15	35.99	13027	12787
	Umbulharjo	35.62	30.57	8790	10225
	Kotagede	35.28	40.69	9563	11013
Kabupaten Sleman	Gamping	37.23	43.19	2408	3608
	Mlati	39.68	36.77	2469	3867
	Depok	32.69	24.2	3238	5244
	Berbah	37.08	49.06	1808	2443
	Kalasan	38.15	49.2	1568	2326
	Ngemplak	41.93	44.03	1307	1785
	Ngaglik	38.15	42.19	1819	2950
	Sleman	41.36	50.17	1841	2122
Kabupaten Bantul	Kasihan	35.17	43.05	2410	3683
	Banguntapan	34.7	42.48	2722	4620
	Sewon	39.62	52.67	1166	1603

Source : Population Census and Government Population Report 2000- 2014

Urban Heat Island

Different of Temperature

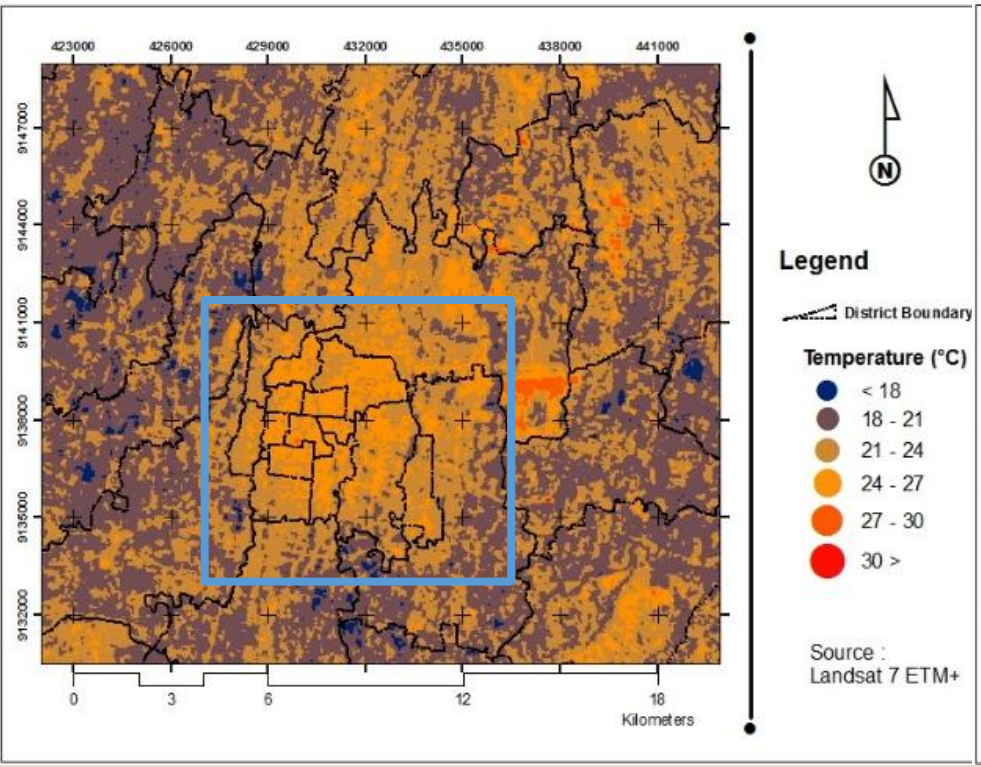


Figure 2. Surface Temperature Distribution 2002.
Source : Landsat 7 ETM+ processing

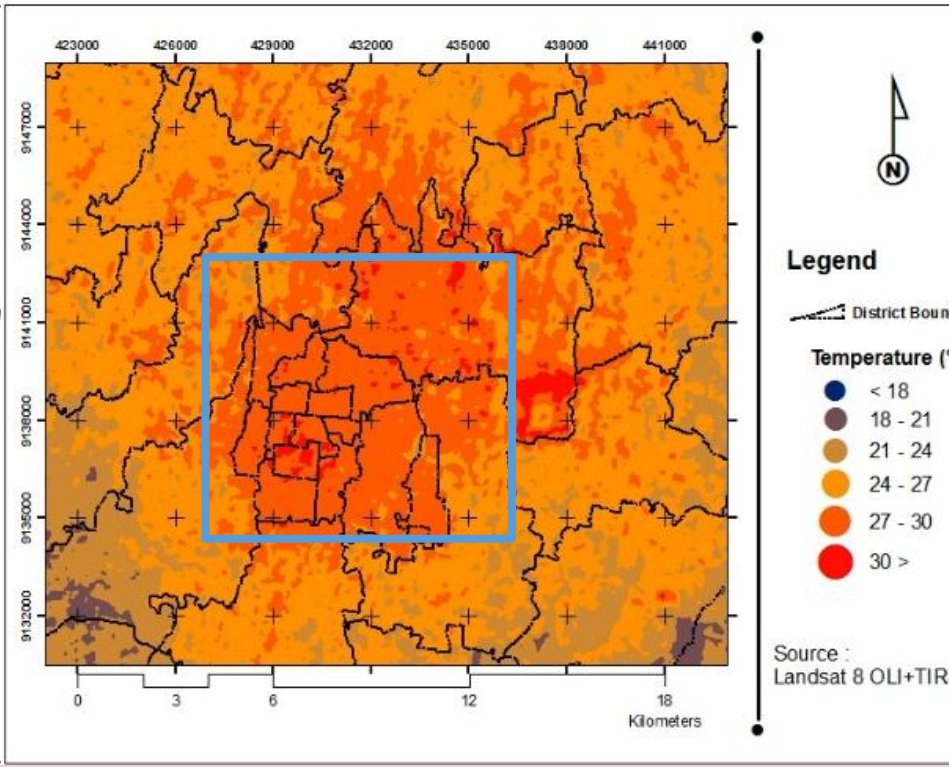
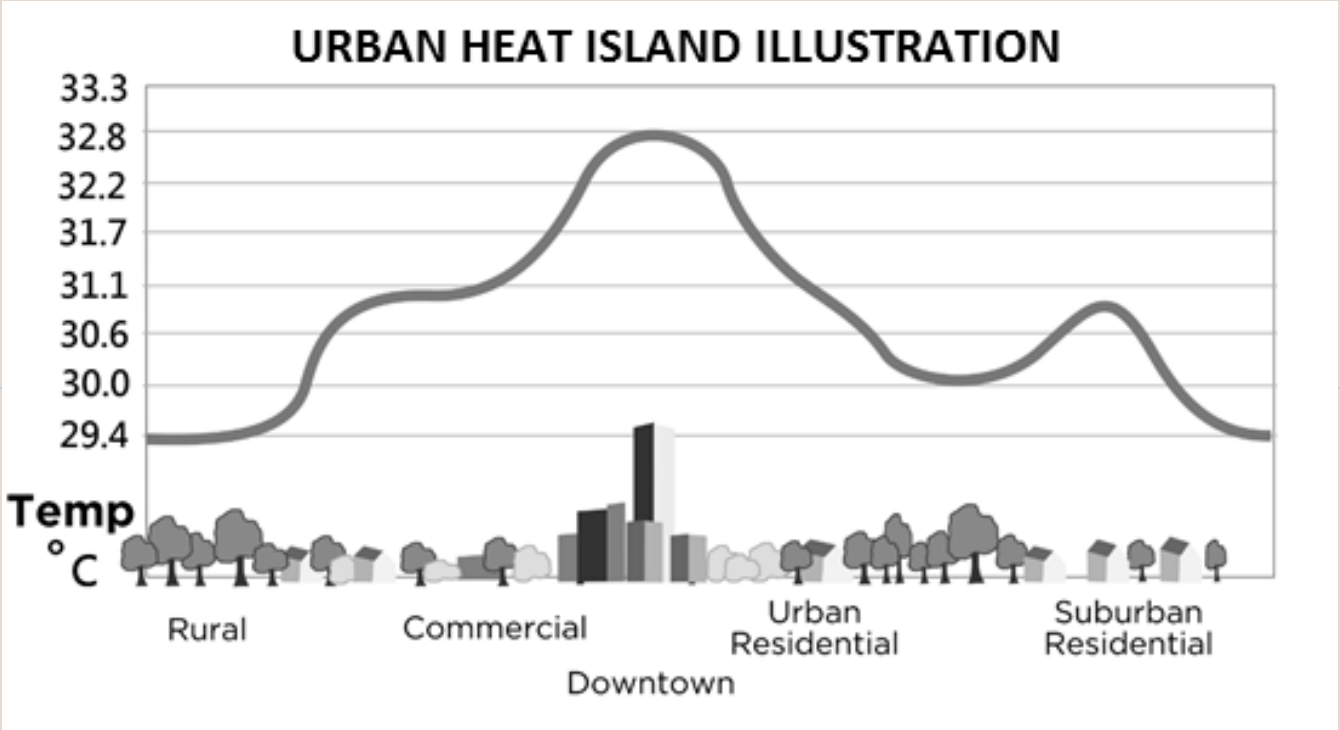


Figure 3. Surface Temperature Distribution 2014.
Source : Landsat 8 OLI/TIRS processing


URBAN HEAT ISLAND ILLUSTRATION
33.3
32.8
32.2
31.7
31.1
30.6
30.0
29.4
Temp
°C
Rural
Commercial
Downtown
Urban
Residential
Suburban
Residential

Result

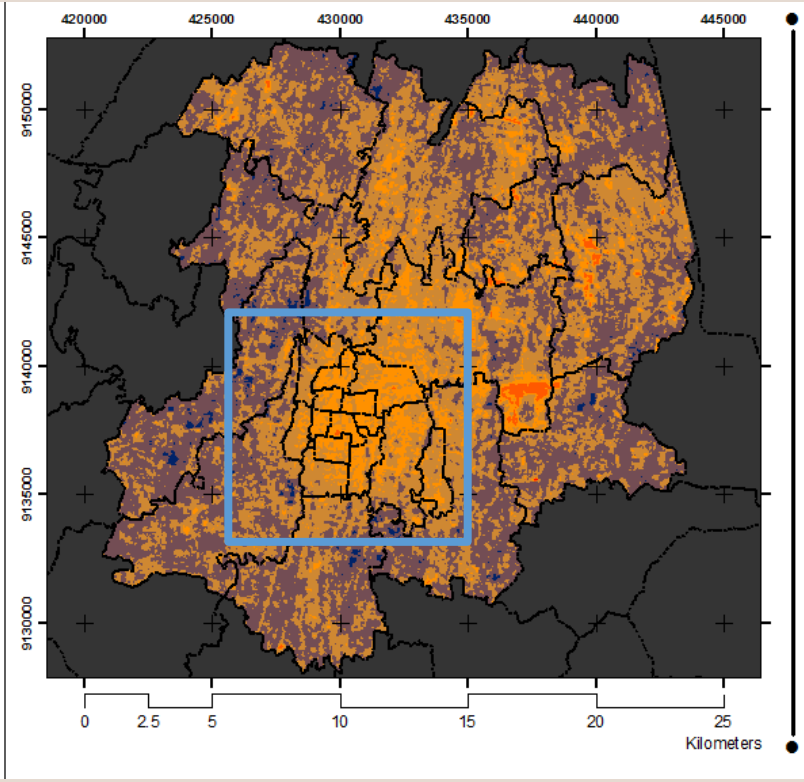


Figure 4. Surface Temperature Distribution 2002.
Source : Landsat 7 ETM+ processing

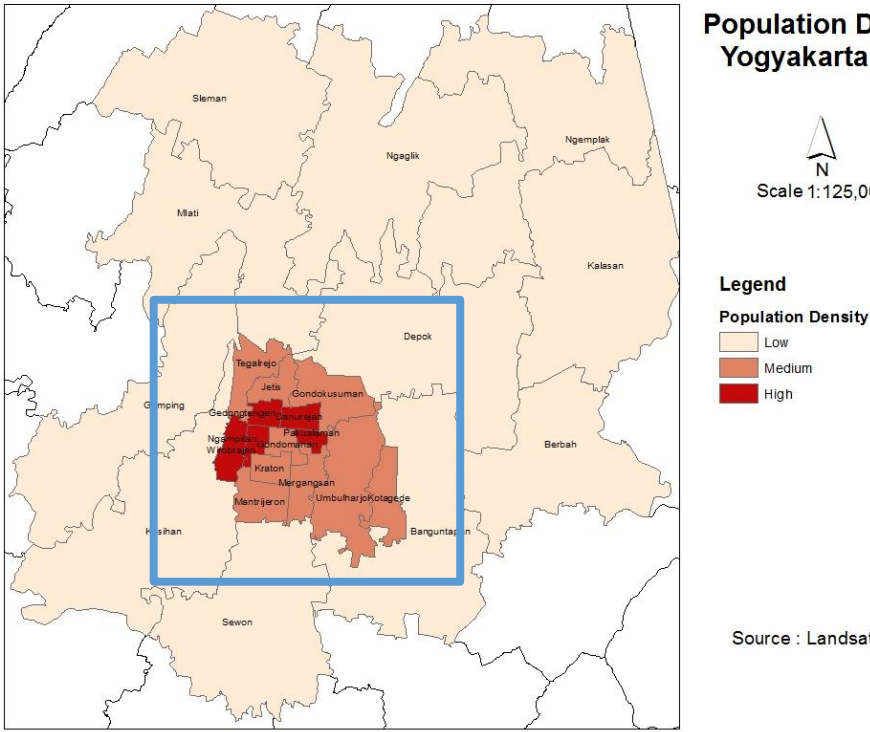


Figure 5. Population Density 2002.
Source : Population census and report

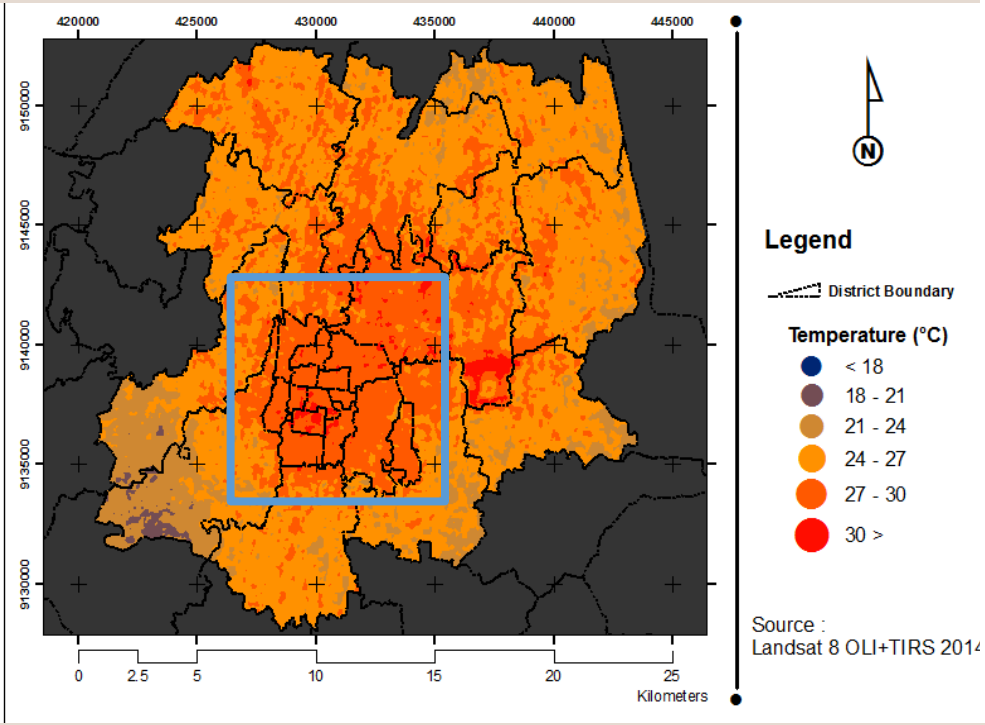


Figure 6. Surface Temperature Distribution 2014.
Source : Landsat 8 OLI/TIRS processing

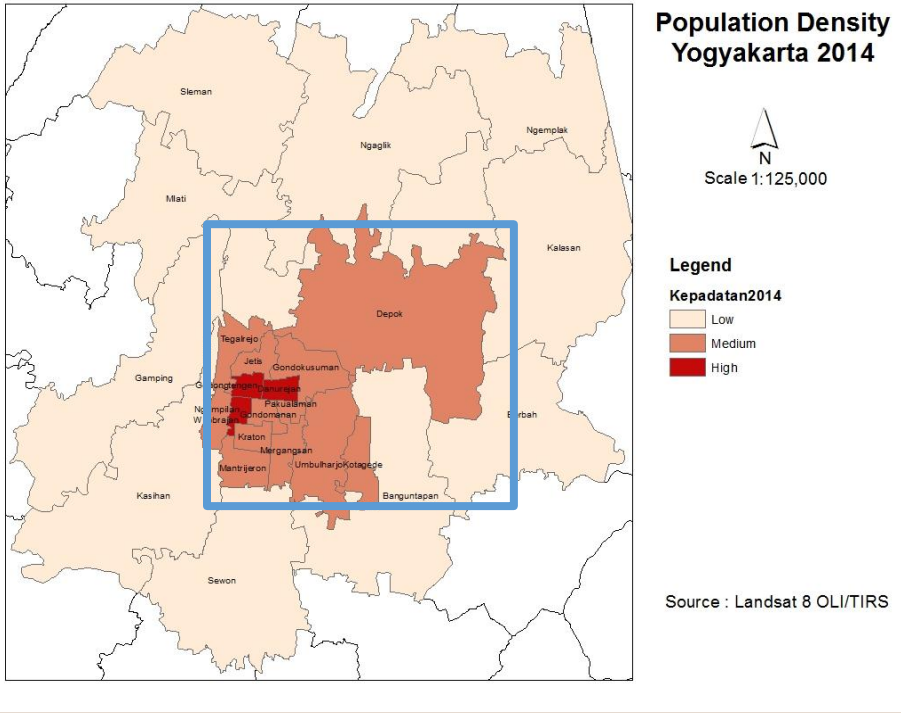


Figure 7. Population Density 2014.
Source : Population census and report

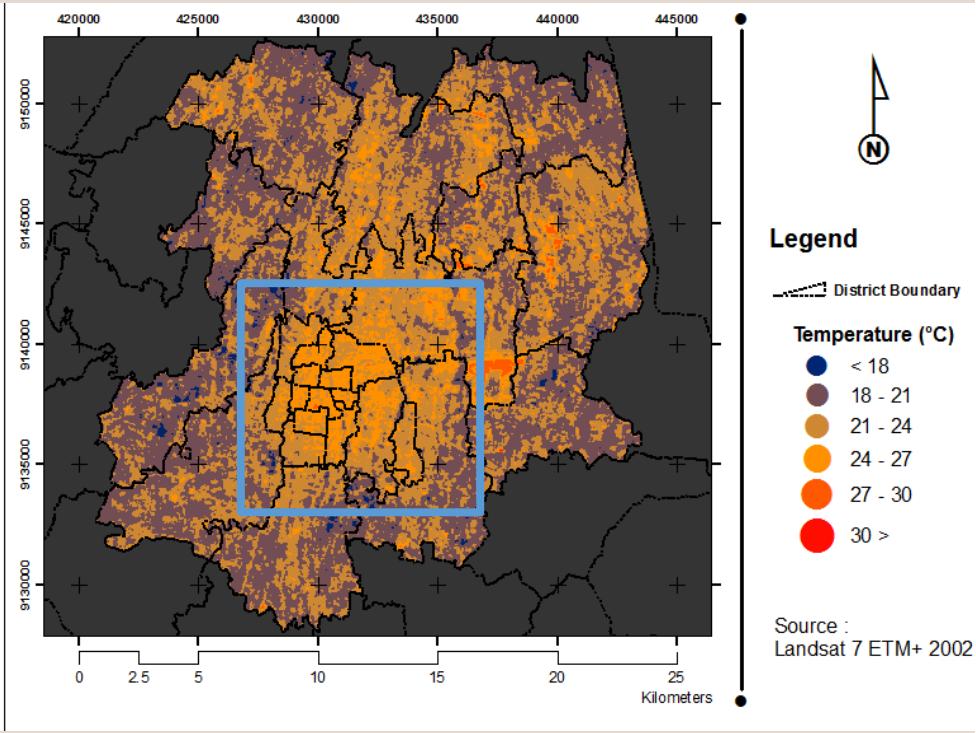


Figure 8. Surface Temperature Distribution 2002.
Source : Landsat 7 ETM+ processing

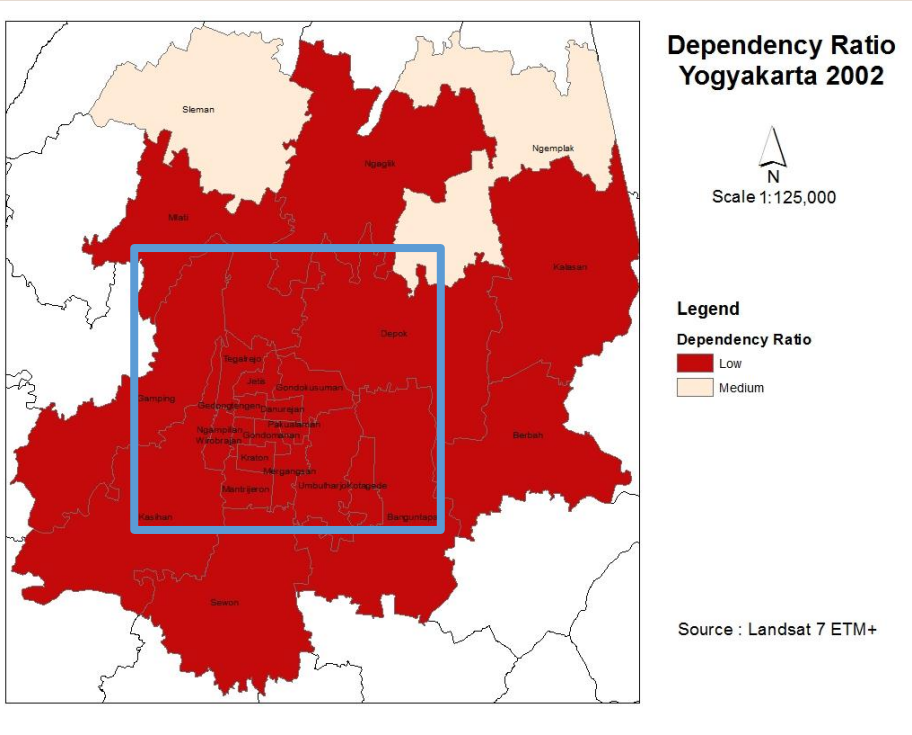
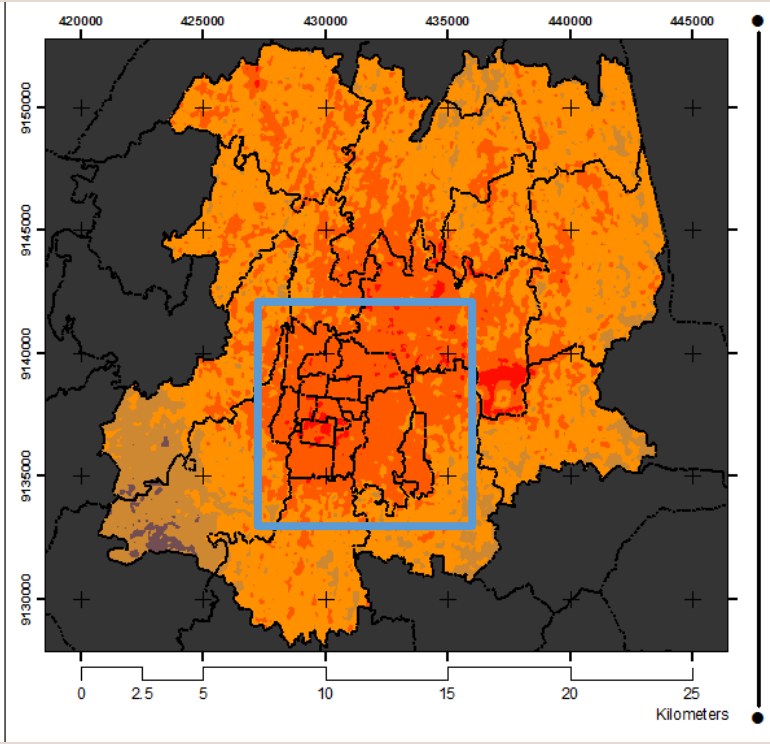


Figure 9. Dependency Ratio 2002.
Source : Population census and report



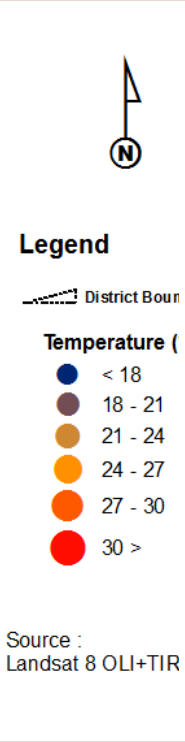


Figure 10. Surface Temperature Distribution 2014.
Source : Landsat 8 OLI/TIRS processing

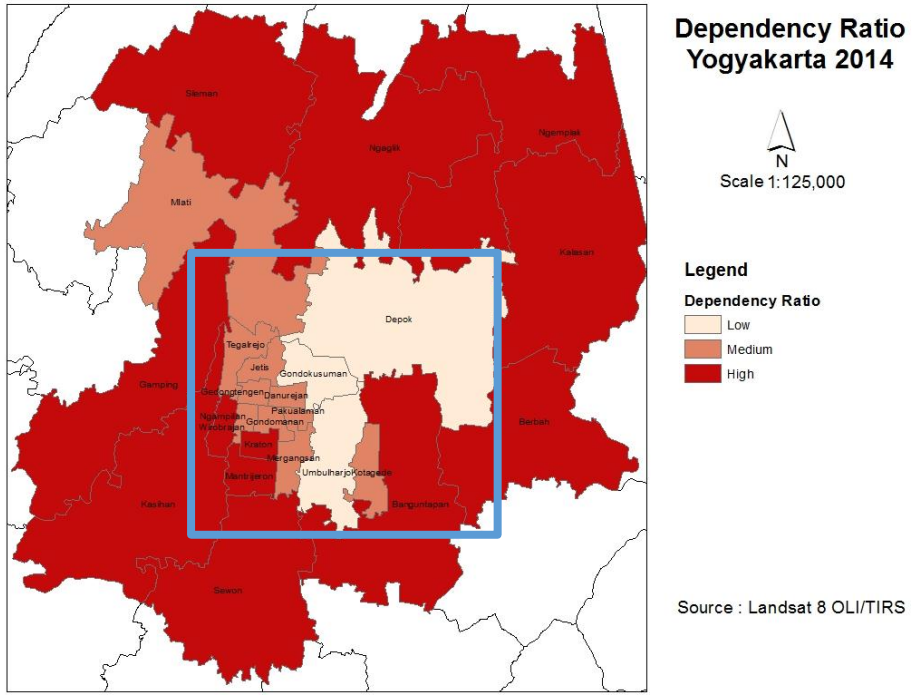


Figure 11. Dependency Ratio 2014.
Source : Population census and report

DISCUSSION AND CONCLUSION

1. Urban heat island in the city of Yogyakarta is associated with the type of land cover change due to urbanization process in Yogyakarta.
2. The spatial pattern of temperature trends is shown to be significantly correlated with population density and social economic activities indicated by the large number of land built up, but not significant with demographic dividend phenomenon. Insignificantly of the urban heat island phenomenon with demographic dividend is linked to the different between both of the unit of analysis.
3. The use of remote sensing imagery for estimation of surface temperature value which is "underestimate," meaning that the value of the range in temperature resulting from the extraction of lower than the actual value of the field.

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Bibliography

BKKBN (2010). Penduduk DIY Hasil Sensus Penduduk Tahun 1961-2010. Seri Laporan BKKBN DIY

Bloom ,D E. , Canning ,D , Fink ,G , Finlay.,J E. (2009).Fertility, Female Labor Force Participation,And The Demographic Dividend. J Econ Growth (2009) 14:79–101 Doi 10.1007/S10887-009-9039-9 : Springer Science+Business Media, Llc 2009

Torok ,Sj. Morris, Cj. Skinner C And Plummer N. (2001) .Urban Heat Island Features Of Southeast Australian Towns . *Aust Met Mag* 50:1–13

United Nations, *World Population Policies 2005* (United Nations publication, Sales No. E.06.XIII.5, 2006).

Thank you

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