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Analysis of the Relationship Between Local Climate Zone and Land Surface Temperature in Padang City

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Abstract. Changes in the earth's surface temperature can have significant impacts on climate, environment, human health, and ecological systems. Global warming becomes increasingly complex when applied to urban contexts, which often experience urban heat island (UHI) effects. This study aims to analyze the relationship between Local Climate Zone (LCZ) and Land Surface Temperature (LST) in Padang City. This study identifies the distribution pattern of LCZ and relates it to surface temperature variability. The data used to map the local climate zone using samples made using WUDADPT and to determine land surface temperature using Landsat 8 OLI/TIRS C1 Level 1 Satellite Imagery. The results of this study are that the Local Climate Zone (LCZ) in Padang City consists of 13 classifications. The type of building that dominates Padang City is Open Low-rise. Meanwhile, Densee Trees dominate the type of natural land cover in Padang City. Land Surface Temperature (LST) in Padang City is dominated by low temperatures covering an area of 43,987.94 Ha. The relationship between LCZ and LST in Padang City has a coefficient of determination of 0.608, which means that the level of relationship between LCZ and LST shows a moderate relationship with the greatest influence occurring in the heavy industry classification with a coefficient of determination of 0.904, which means that the influence of heavy industry on temperature is 90.4% or very strong.

Keywords: Local Climate Zone, Land Surface Temperature, Remote Sensing.

1. INTRODUCTION

The increase in the earth's surface temperature, known as the phenomenon of global warming, has become one of the main environmental issues worldwide. Changes in the earth's surface temperature can have significant impacts on climate, environment, human health, and ecological systems. Global warming becomes even more complex when applied to the urban context, which often experiences the urban heat island (UHI) effect.

Urban heat islands occur when surface temperatures in urban areas are significantly higher than temperatures in the surrounding rural areas. Factors that contribute to the urban heat island include changes in land cover, development density, disturbed airflow patterns, and human activities. One approach to understanding this phenomenon is through the analysis of the Local Climate Zone (LCZ), which is a classification system that describes the characteristics of micro-environments in urban areas based on physical structure and land use (Cai, M., 2017). In its understanding, the Local Climate Zone is a comprehensive and micro land use classification system initially developed to measure the relationship between the urban heat island (UHI) and urban morphological patterns (Choudhury, D., 2021), (Astuti, S.T. & Nucifera, F., 2021). LCZ maps various types of urban environments based on their physical and thermal characteristics.

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Padang City, as a city located in the tropics with typical Indonesian climate conditions, also faces challenges related to the urban heat island. Padang City residents often experience higher temperatures compared to surrounding rural areas. Therefore, an analysis of the relationship between Local Climate Zone (LCZ) and Land Surface Temperature (LST) in Padang City is relevant and important to do.

World Urban Database and Portal Tool (WUDAPT) is a community-based project to collect census data for urban areas around the world using the Local Climate Zone (LCZ) scheme(Ching, J., 2018). LCZ is a zone or area with similar land surface cover, building construction materials, structures, and human activities with a range of 100 meters to several kilometers on a horizontal scale (Stewart, I.D. & Oke, T.R., 2012). The tools and materials used in the LCZ classification can be obtained open source, namely Landsat imagery, Google Earth Pro. LCZ has been widely applied, developed, and modified in urban areas in various countries, both developed and developing countries.

This study aims to analyze the relationship between Local Climate Zone (LCZ) and Land Surface Temperature (LST) in Padang City. By identifying LCZ distribution patterns and linking them to surface temperature variability, this study can provide better insight into the contribution of various types of land use to the urban heat effect. The results of this study are expected to support efforts to develop sustainable urban spatial planning and provide valuable information for decision making in reducing the impact of urban heat effects in Padang City. Through this analysis, it is expected to identify urban planning strategies that focus on mitigating urban heat effects and increasing thermal comfort for residents. In addition, the results of this study can also contribute to the global understanding of the interaction between urban structure, microenvironment, and surface temperature, which can ultimately help in formulating more effective policies in facing the challenges of global warming in the future.

2. RESEARCH METHOD

Areas and Types of Research

The location of this research is in Padang City, the capital city of West Sumatra Province. The area of Padang City is around 695 km2 with its area at coordinates between 00^{O} 44’ 00’’ – 1^{O} 08’ 35’’ LS and 100^{O} 05’ 05’’ – 100^{O} 34’ 09’’ BT. Padang City has regional boundaries where the west is directly adjacent to Mentawai Regency and the Indian Ocean. The north is directly adjacent to Padang Pariaman Regency. The east is directly adjacent to Solok Regency. The south is directly adjacent to Pesisir Selatan Regency.

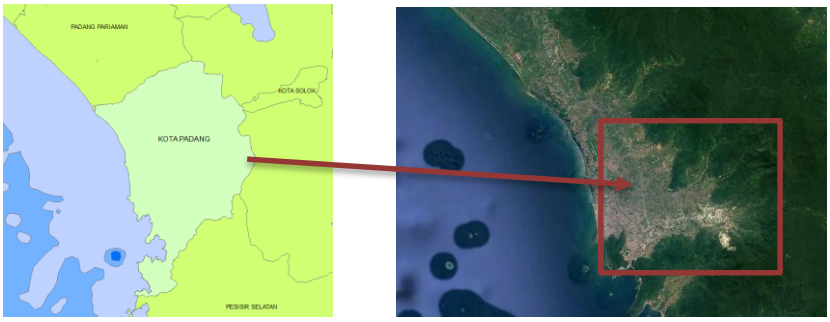


Figure 1. Research Location

The type of research conducted is descriptive with a quantitative approach. Descriptive research is research conducted to determine the value of independent variables, either one or more variables without making comparisons, or connecting with other variables. Quantitative is used to research populations or samples using measuring instruments or research instruments, data analysis is quantitative or statistical in nature with the aim of testing the hypothesis that has been made. (Zellatifanny, C. M., & Mudjiyanto, B., 2018)

Research Tools and Data

Tools

The tools used in this study can be seen in Table 1.

Table 1. tools used in research

No	Software	Function
1.	Microsoft Windows 10	as System Device
2.	Arcgis 10.8	Spatial Analysis
3.	ENVI	Image Processing
4.	Microsoft Office Word 2010	Report Creation
5.	Google Earth	Sample Creation
6.	SPSS Statistics	Relationship Analysis

Research Data

The data used in this study can be seen in Table 2.

Table 2. Data Used in the Research

No	Data	Description	Source
1.	Area Of Interest	For Reference Boundary	Google Earth
2.	Landsat 8 OLI/TIRS	To Determine Thermal and Classification	Earthexplorer.Usgs
3.	Google Earth Pro Imagery	For Creating Google Earth Training Area	Google Earth Pro

The research stages followed are described in Figure 2.

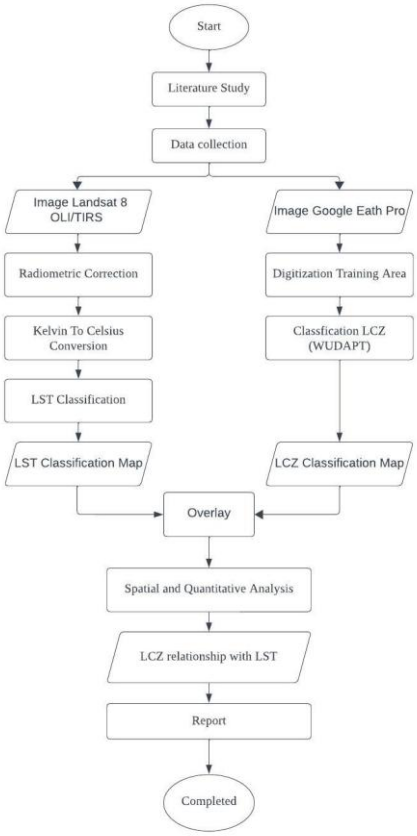


Figure 2. Flow Diagram

Research Stages

1) Preparation

In this study, the first thing that must be done is a literature study. Literature studies are the theoretical basis for developing previous research. Literature studies are used as material to understand references regarding theories related to the research being studied such as books, journals, articles, and websites. The purpose of the literature study is to strengthen the theory in solving the problems being studied regarding the relationship between Local Climate zones and land surface temperatures.

2) Data Collection

At this stage, the data collected is in the form of Landsat-8 OLI/TIRS Imagery data, Google Earth Imagery of Padang City and the administrative map of Padang City. Landsat-8 OLI/TIRS Satellite Imagery Data is obtained by downloading images via the earthexplorer.usgs.gov website as an open source and can be accessed by all groups and Google Earth imagery data is used as a reference in making training areas for local

climate zone classification, the image data used must be clear and must not be obstructed by clouds.

3) Data Processing

In this study, there are two data processing methods carried out to obtain research results. First, processing Landsat-8 OLI/TIRS imagery and second, processing Local Climate Zone data.

The method used in processing thermal infrared imagery of Landsat 8 OLI/TIRS imagery used for this study in taking temperatures in 2023.

1) Change the digital number (DN) value to ToA radiance (radiance value) using the bandmath tool using the following equation:

$$L\lambda = ML * Qcal + AL \quad (1)$$

2) Change the radiance value to brightness temperature using the bandmath tool according to the equation:

$$T = K2/\{alog(K1/L\lambda + 1)\} \quad (2)$$

3) Convert brightness temperature into Celsius (℃)

$$\mathbf{C = K - 273{,}15} \quad (3)$$

Methods used in making Local climate zone maps The first step is to determine the ROI on Google Earth Pro. After the ROI is determined, the next step is to digitize the training area. The training area digitization process must consider aspects of the form and function of the city which are then categorized into one of 17 LCZ classes based on building types and land cover. Training area digitization only requires a few polygon samples for each class. Training areas are digitized according to the 17 LCZ classifications set by WUDAPT

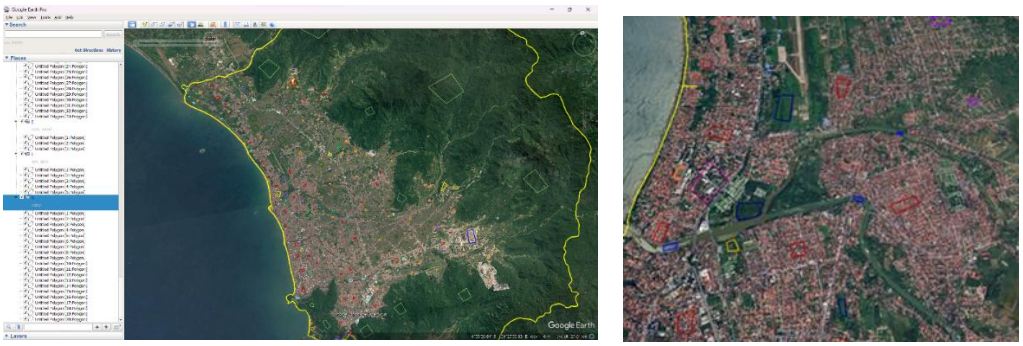


Figure 3. Sample LCZ Padang City

After creating the LCZ training sample ROI, the next process using the WUDAPT LCZ Generator is to complete the LCZ Training Area Submission form (https://lcz-generator.rub.de/ta_submission) and upload the Region of Interest (ROI) in KML/KMZ format. Then, the LCZ map results will automatically be inputted into the WUDAPT database and can be freely accessed on the official website.

4) Analysis

The method used in determining the relationship between local climate zones and land surface temperatures is the Correlation method. To determine the relationship between local climate zones and land surface temperatures, the following calculations are carried out

$$r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{(n\sum X^2 - (\sum X)^2)(n\sum Y^2 - (\sum Y)^2)}} \quad (4)$$

3. RESULTS AND DISCUSSION

Land Surface Temperature Variations Based on Landsat 8 OLI/TIRS Imagery on June 21, 2023

Based on the results of Landsat 8 OLI/TIRS image processing recorded on June 21, 2023, Figure 4 shows that the surface temperature variation values of Padang City are classified into 4 classes with the lowest temperature value of 12.26°C and the highest temperature value of 30.75°C.

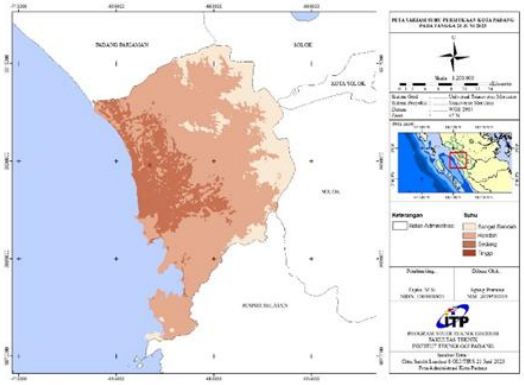


Figure 4. LST map of padang city

Figure 4 shows that the highest temperatures are found in coastal areas which are also urban areas with dense populations, while the lowest temperatures are found in hilly areas which are areas with cool forest vegetation.

Local Climate Zone Classification in Padang City

In 2023, Padang city has 13 out of 17 Local Climate zone classifications consisting of 6 building types and 7 land cover types. In Figure 4.2, the building types identified using the LCZ generator are Compact Low-rise (LCZ 3), Open Mid-rise (LCZ 5), Open Low-rise (LCZ 6), Large low-rise (8), Sparsely built (9) and Heavy Industry (10). Meanwhile, the types of land cover identified are Trees (LCZ A), Scattered Trees (LCZ B), Bush/Scrub (LCZ C), Low Plants (LCZ D), E (Bare rock or paved), Bare Soil (LCZ F), and Water (LCZ G).

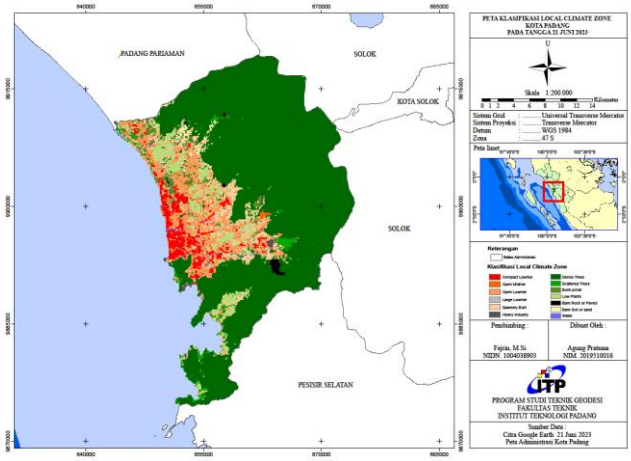


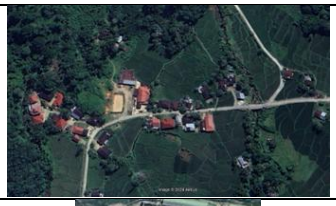
Figure 5. Local Climate Zone Classification Map

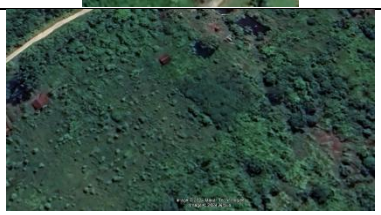
Based on the results of data processing, the widest LCZ is the dense trees (A) land cover type, namely trees that have 68.49% of the total area. Meanwhile, the LCZ with the smallest area is the open midrise building type LCZ (5), namely a half-height building with an open layout of 0.19% or 131.7 hectares.

Table 3. Local climate zone classification results

Classification LCZ	Area (Ha)	Percentage (%)	Classification LCZ	Area (Ha)	Percentage (%)
Compact Lowrise (3)	2826,15	4,03	Dense Trees (A)	47979,03	68,49
Open Midrise (5)	131,7	0,19	Scattered Trees (B)	1518,08	2,17
Open Lowrise (6)	7173,9	10,24	Bush,Scrub (C)	1897,95	2,71
Large Lowrise (8)	245,68	0,35	Low Plants (D)	3773,69	5,39
Sparsely Built (9)	3036,18	4,72	Bare Rock (E)	319,7	0,46
Heavy Industri (10)	165,71	0,24	Bare Soil or Sand (F)	474,66	0,68
			Water (G)	243,52	0,35

Table 4. Characteristics of the Local Climate Zone in Padang City

Classification LCZ	Image	Description
Compact Lowrise		Compact midrise building with a building height of 1 to 3 floors with general commercial land use, with little vegetation and paved or paved. The temperature obtained has an average of 28.11°C with the highest temperature of 30.75°C. The largest compact lowrise LCZ is located in Padang Timur sub-district with an area of 495.21 ha.
Open Midrise		Half-height buildings (3 - 9 floors) with an open layout and vegetation spread around them. Characteristics of low to medium building density, usually dominated by apartment blocks, campuses or office buildings. The average temperature obtained from this LCZ is 25°C. The largest open midrise LCZ is located in Pauh District with an area of 92.99 ha.
Open Lowrise		Buildings with open layouts surrounded by vegetation. However, the only difference is the height of the building, which is (1–3 floors) for open low-rise. Land use is dominated by housing, villages and public service facilities. The average temperature obtained from this LCZ is 26°C. The largest open low-rise LCZ is in Kuranji sub-district with an area of 1473.61 ha.
Large Lowrise		Half-height wide buildings (1-3 floors) built with an open layout, the surrounding area is covered with asphalt and little or no vegetation. Land use for the large low-rise LCZ is dominated by warehousing. The highest temperature obtained from this LCZ is 28.8°C. The largest large low-rise LCZ is located in Lubuk Begalung sub-district with an area of 79.26 ha.
Sparsely Built		Multi-storey residential area with buildings (1-3 floors) scattered randomly and the surrounding land cover is vegetation. The average temperature obtained by this LCZ is around 24°C. The largest sparsely built LCZ is in Koto Tangah sub-district with an area of 887.82 ha.
Heavy Industri		Low to medium buildings that function as non-agricultural industries. The area around this zone is covered with asphalt and little or no vegetation and its characteristics are the presence of tanks, towers, chimneys and stacks. Building materials tend to be composed of concrete or steel, and the building structure is elongated. The maximum temperature obtained in this LCZ is 28.7°C. The largest heavy industry LCZ is located in Lubuk Kilangan sub-district with an area of 89.47 ha .

Classification LCZ	Image	Description
Dense Trees		Land in this zone is used as a forest, this zone usually has low to very low temperatures, because the forest has a lot of vegetation, no built-up land and little human activity. The average temperature obtained is around 20°C. The largest dense tree LCZ is in Koto Tangah sub-district with an area of 15,064 ha.
Scattered trees		Scattered trees are randomly patterned, spread out and there is a distance between vegetation and the temperature obtained has an average of 23°C. The LCZ scattered tree with the largest area is in Koto Tangah sub-district with an area of 469.65 ha.
Bush, Scrub		High to low shrub land cover with various types of shrub vegetation and porous soil. the characteristics of low vegetation and spread randomly, then also influenced by transportation activities because the bush zone, scrub is often found adjacent to the road network. the temperature obtained is around 24 ° C. LCZ bush, scrub with the largest area is in Koto Tangah sub-district with an area of 1192.42 ha.
Low Plants		a zone covered by low vegetation with no surrounding trees and porous soil types. Land use for this Low plants zone in Padang City is agriculture with various types of rice fields and city parks with natural grass as green paths. The temperature obtained ranges from an average of 24.3°C. The largest area of LCZ low plants is in Koto Tangah sub-district with an area of 1413.53 ha.
Bare Rock or Paved		Land cover with asphalt or rock cover and no or little vegetation around it. The temperature obtained has a maximum value of 28.6°C. The largest bare paved or rock LCZ is located in Lubuk Kilangan sub-district with an area of 229.95 ha.
Bare Soil or Sand		Plain plain consisting of soil or sand with little or no vegetation around it. Bare Soil is also found as open land in Padang City. The average temperature is 24.07°C. The largest area of bare soil or sand LCZ is in Koto Tangah District with an area of 327.23 ha
Water		Zone with land cover of water bodies with various land uses, both open and large (lakes, oceans) or small (rivers and reservoirs). average temperature 24.87°C. The largest area of LCZ water is in Koto Tangah sub-district with an area of 77.71 ha.

Relationship Between Local Climate Zone and Land Surface Temperature

The relationship between Local Climate Zone and Land Surface Temperature in Padang City in 2023 is explained in a linear regression test and overlay analysis of the two maps.

Table 5. LCZ Correlation Test Results with LST

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	LCZ[b]	.	Enter

a. Dependent Variable: LST

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.608[a]	.370	.364	1.40950

a. Predictors: (Constant), LCZ

In the table above, it explains that the correlation coefficient or relationship between the dependent variable, namely land surface temperature data with the independent variable, namely the local climate zone, is 0.608. Based on the interval stating the closeness of the relationship between these two variables, the r value is included in the interval $0.41 < r \leq 0.60$. To find the local climate zone classification value that influences the surface temperature of Padang City, a simple regression test was carried out using SPSS statistics, the results of which can be seen in the image below.

Results of the regression test of the classification of local climate zone building types with surface temperature

A) Regression test compact lowrise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.654[a]	.427	.364	.60336

a. Predictors: (Constant), LCZ Compact Lowrise

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.446	1	2.446	6.720	.029[b]
	Residual	3.276	9	.364		
	Total	5.723	10			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Compact Lowrise

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	27.016	.368		73.329	.000
	LCZ Compact Lowrise	.003	.001	.654	2.592	.029

a. Dependent Variable: LST

B) Regression test open midrise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.876[a]	.767	.689	.53058

a. Predictors: (Constant), LCZ Open Midrise

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.779	1	2.779	9.871	.052[b]
	Residual	.845	3	.282		
	Total	3.623	4			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Open Midrise

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	27.106	.301		90.155	.000
	LCZ Open Midrise	-.022	.007	-.876	-3.142	.052

a. Dependent Variable: LST

C) Regression test open lowrise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.285[a]	.081	-.021	.41535

a. Predictors: (Constant), LCZ Open Lowrise

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.138	1	.138	.798	.395[b]
	Residual	1.553	9	.173		
	Total	1.690	10			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Open Lowrise

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	26.756	.185		144.376	.000
	LCZ Open Lowrise	.000	.000	-.285	-.893	.395

a. Dependent Variable: LST

D) Regression test large lowrise

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.376[a]	.142	.034	.71234

a. Predictors: (Constant), LCZ Large Lowrise

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.670	1	.670	1.320	.284[b]
	Residual	4.059	8	.507		
	Total	4.729	9			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Large Lowrise

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	26.818	.334		80.182	.000
	LCZ Large Lowrise	-.012	.010	-.376	-1.149	.284

a. Dependent Variable: LST

E) Regression test sparsely built

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.326[a]	.106	-.006	.63653

a. Predictors: (Constant), LCZ Sparsely Built

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.385	1	.385	.950	.358[b]
	Residual	3.241	8	.405		
	Total	3.626	9			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Sparsely Built

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	25.271	.276		91.518	.(
	LCZ Sparsely Built	-.001	.001	-.326	-.975	.:

a. Dependent Variable: LST

F) Regression test heavy industry

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.951[a]	.904	.856	.21531

a. Predictors: (Constant), LCZ Heavy Industri

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.875	1	.875	18.878	.049[b]
	Residual	.093	2	.046		
	Total	.968	3			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Heavy Industri

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	25.062	.168		149.152	.000
	LCZ Heavy Industri	.014	.003	.951	4.345	.049

a. Dependent Variable: LST

G) Regression test dense trees

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.784[a]	.615	.560	1.22762

a. Predictors: (Constant), LCZ Dense Trees

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16.865	1	16.865	11.191	.012[b]
	Residual	10.549	7	1.507		
	Total	27.415	8			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Dense Trees

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	23.493	.568		41.344	.000
	LCZ Dense Trees	.000	.000	-.784	-3.345	.012

a. Dependent Variable: LST

H) Regression test scattered trees

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.571[a]	.326	.242	.86883

a. Predictors: (Constant), LCZ Scattered Trees

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.923	1	2.923	3.873	.085[b]
	Residual	6.039	8	.755		
	Total	8.962	9			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Scattered Trees

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	24.550	.361		68.065	.000
	LCZ Scattered Trees	-.003	.002	-.571	-1.968	.085

a. Dependent Variable: LST

I) Regression test bush,Scrub

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.127[a]	.016	-.107	.90931

a. Predictors: (Constant), LCZ Bush, scrub

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.109	1	.109	.132	.726[b]
	Residual	6.615	8	.827		
	Total	6.724	9			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Bush, scrub

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	24.661	.329		74.945	.000
	LCZ Bush, scrub	.000	.001	-.127	-.363	.726

a. Dependent Variable: LST

J) Regression test low plants

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.379[a]	.144	.049	.68191

a. Predictors: (Constant), LCZ Low Plants

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.702	1	.702	1.510	.250[b]
	Residual	4.185	9	.465		
	Total	4.887	10			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Low Plants

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	24.890	.267		93.126	.000
	LCZ Low Plants	-.001	.000	-.379	-1.229	.250

a. Dependent Variable: LST

K) Regression test bare rock

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.180[a]	.032	-.210	1.77257

a. Predictors: (Constant), LCZ Bare rock or paved

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.419	1	.419	.133	.734[b]
	Residual	12.568	4	3.142		
	Total	12.987	5			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Bare rock or paved

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	23.729	.864		27.454	.000
	LCZ Bare rock or paved	.003	.009	.180	.365	.734

a. Dependent Variable: LST

L) Regression test bare soil or sand

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.190[a]	.036	-.205	.56163

a. Predictors: (Constant), LCZ Bare Solid or sand

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.047	1	.047	.150	.718[b]
	Residual	1.262	4	.315		
	Total	1.309	5			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Bare Solid or sand

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	23.881	.280		85.245	.000
	LCZ Bare Solid or sand	.001	.002	.190	.387	.718

a. Dependent Variable: LST

M) Regression test water

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.076[a]	.006	-.105	1.72777

a. Predictors: (Constant), LCZ Water

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.156	1	.156	.052	.825[b]
	Residual	26.867	9	2.985		
	Total	27.022	10			

a. Dependent Variable: LST

b. Predictors: (Constant), LCZ Water

Coefficients[a]

Model		Unstandardized Coefficients B	Unstandardized Coefficients Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	24.656	.779		31.633	.000
	LCZ Water	.006	.028	.076	.228	.825

a. Dependent Variable: LST

Based on the results of the regression test, three variables were obtained that had a significance value <0.05, namely Compact Lowrise, heavy industry and Dense trees, which means that the temperature in Padang City on June 21, 2023 was greatly influenced by these three variables. The greatest influence occurred in heavy industry with a coefficient of determination of 0.904, meaning that the influence of heavy industry on temperature was 90.4%. Dense trees have a coefficient of determination of 0.615, which means that the influence on surface temperature is 61.5%. Compact lowrise or low-rise buildings with a dense

arrangement have a coefficient of determination of 0.427, which means that the influence on surface temperature is 42.7%.

4. CONCLUSIONS

Local Climate Zone (LCZ) in Padang City consists of 13 classifications consisting of 6 building types and 7 land cover types. The type of building that dominates Padang City is Open Low-rise (LCZ 6). LCZ 6 is described as a residential area that has low vegetation density and moderate building density. Meanwhile, Densee Trees (LCZ A) dominates the natural land cover type in Padang City and is found in many areas in the forest to the east of Padang City. Padang City itself is dominated by low temperatures with an area of 49.26 hectares or around 63.21% of Padang City. High LST tends to spread in areas with low vegetation density and moderate to high building density. These areas are often found in dense settlements with some vegetation. The relationship between LCZ and LST in Padang City, West Sumatra Province using Google Earth satellite imagery data and thermal infrared data in this study has a correlation value of 0.608, which means that the level of relationship between LCZ and LST shows a moderate relationship, there are three variables with a significance value <0.05, namely Compact Lowrise, heavy industry and Dense trees which means that the temperature in Padang City on June 21, 2023 was greatly influenced by these three variables. The greatest influence occurs in heavy industry with a determination coefficient of 0.904, meaning that the influence of heavy industry on temperature is 90.4%. Dense trees have a determination coefficient of 0.615, which means that the influence on surface temperature is 61.5%. Compact lowrise or low-rise buildings with a dense arrangement have a determination coefficient of 0.427, which means that the influence on surface temperature is 42.7%.

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