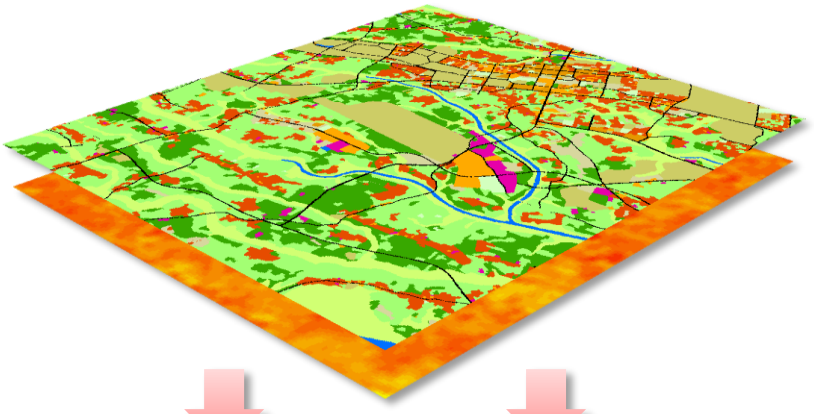
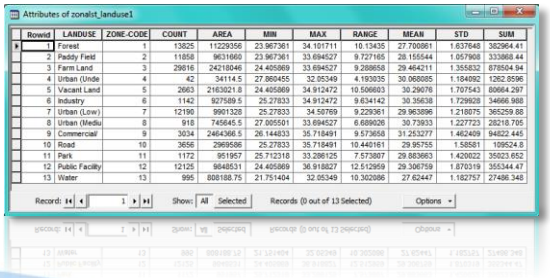
USE OF
ZONAL STATISTICS FUNCTION
in ArcGIS





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Design for beginner to intermediate level

PREFACE

Sometimes you may need to know average surface temperature of each land use category or average soil nitrogen content per paddy field or average slope per watershed or so on; Zonal Statistics Tool is right for you. It summarizes the values of a raster within the zones of another dataset (either raster or vector) and reports the results to a table. In this tutorial I provided two exercises, Exercise 1 explores the spatial relationship between surface temperature and land use category and Exercise 2 summarizes the building height from very fine-scale LIDAR derived 50cm Digital Height Model (DHM) with building footprints.

I hope you'll enjoy it!

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CONTENTS

1. DOWNLOAD TUTORIAL DATA

a) Download tutorial data from following URL.

http://giswin.geo.tsukuba.ac.jp/sis/tutorial/koko/zonalstatistics/ZonalExercise.zip

b) Unzip on your hard dive C or D

Example: D:\SIS_TUTORIAL

2. WHAT IS ZONAL STATISTICS FUNCTION?

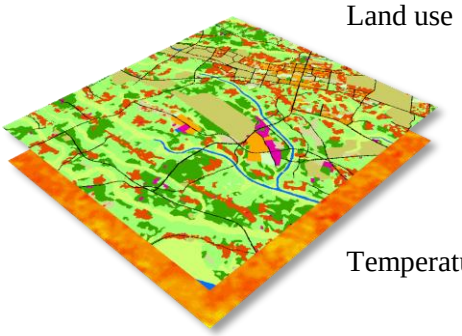
Zonal statistic function summarizes the values of a raster within the zones of another dataset (either raster or vector) and reports the results as a table.

INPUT

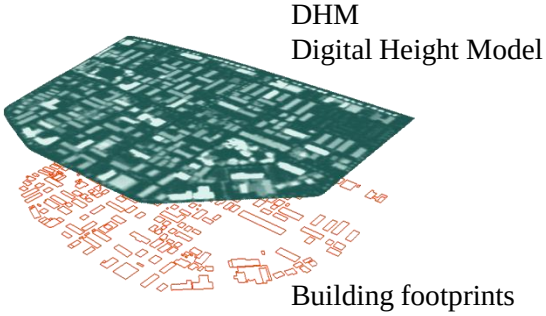
You have two layers.

Layer 1
Must be a thematic type of raster and include attribute values such as land use land cover, temperature, rainfall, soil nitrogen content, slope, aspect, etc.

Layer 2
This layer could be either raster or vector such as watershed polygons, administration boundaries, building footprints, etc.



Raster vs. raster

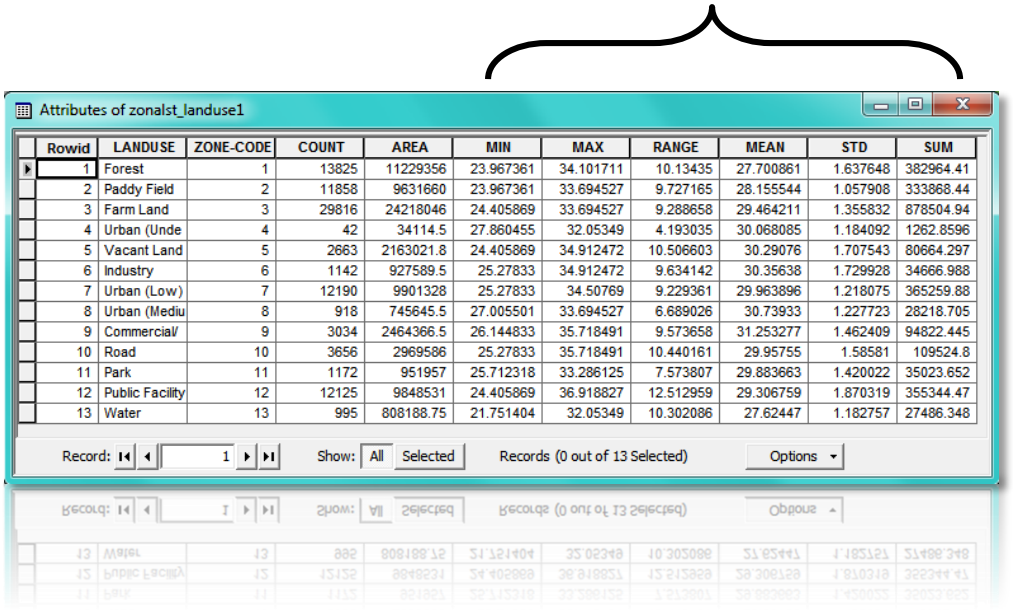


Raster vs. vector

OUTPUT

The output will be displayed as a table.

Statistical properties of source data



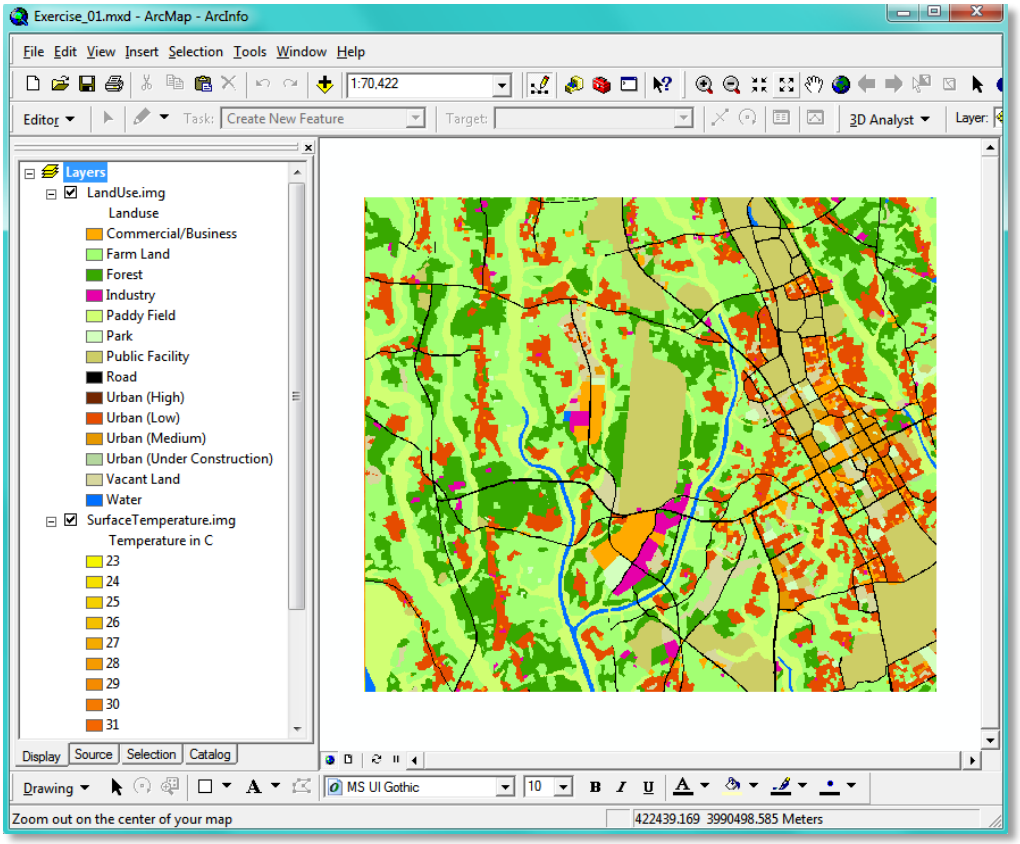
Rowid	LANDUSE	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Forest	1	13825	11229356	23.967361	34.101711	10.13435	27.700861	1.637648	382964.41
2	Paddy Field	2	11858	9631660	23.967361	33.694527	9.727165	28.155544	1.057908	333868.44
3	Farm Land	3	29816	24218046	24.405869	33.694527	9.288658	29.464211	1.355832	878504.94
4	Urban (Unde	4	42	34114.5	27.860455	32.05349	4.193035	30.068085	1.184092	1262.8596
5	Vacant Land	5	2663	2163021.8	24.405869	34.912472	10.506603	30.29076	1.707543	80664.297
6	Industry	6	1142	927589.5	25.27833	34.912472	9.634142	30.35638	1.729928	34666.988
7	Urban (Low)	7	12190	9901328	25.27833	34.50769	9.229361	29.963896	1.218075	365259.88
8	Urban (Mediu	8	918	745645.5	27.005501	33.694527	6.689026	30.73933	1.227723	28218.705
9	Commercial/	9	3034	2464366.5	26.144833	35.718491	9.573658	31.253277	1.462409	94822.445
10	Road	10	3656	2969586	25.27833	35.718491	10.440161	29.95755	1.58581	109524.8
11	Park	11	1172	951957	25.712318	33.286125	7.573807	29.883663	1.420022	35023.652
12	Public Facility	12	12125	9848531	24.405869	36.918827	12.512959	29.306759	1.870319	355344.47
13	Water	13	995	808188.75	21.751404	32.05349	10.302086	27.62447	1.182757	27486.348

3. HOW TO USE?

3.1. EXERCISE 01 (RASTER VS. RASTER)

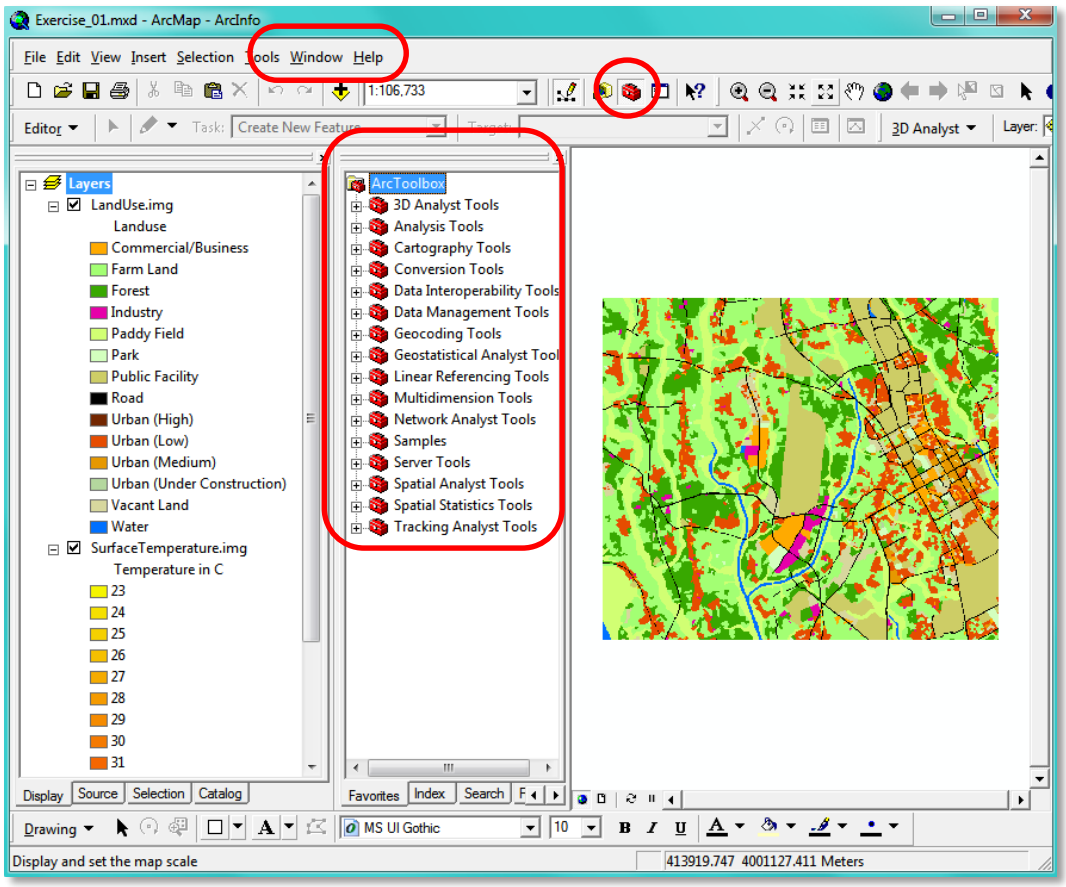
Assume you have already unzipped on:
D:\SIS_TUTORIAL\EXERCISE_01

1. To open a project file:
   Double click on file "Exercise_01.mxd"
   under "D:\SIS_TUTORIAL\EXERCISE_01" folder.



You will see two layers, land use land cover layer (raster) and surface temperature layer (raster).

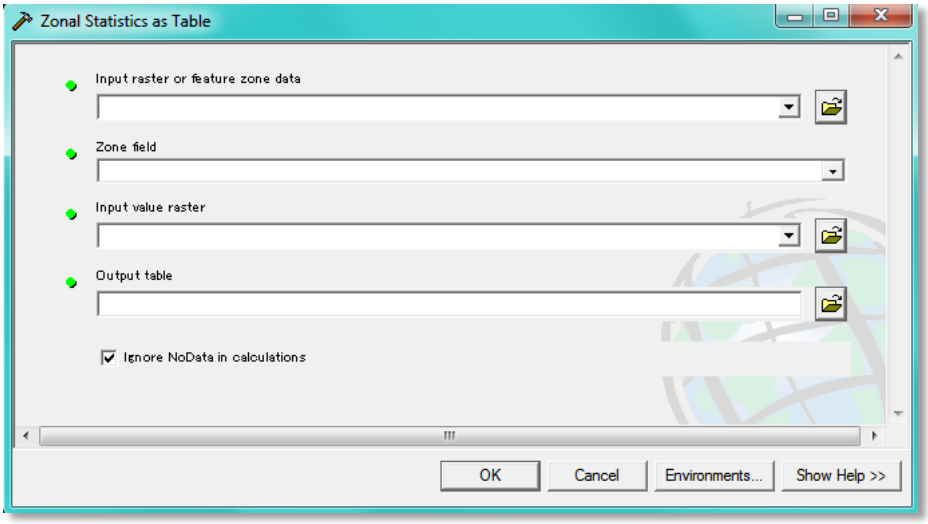
2 To display ArcToolbox window:
Click Window → ArcToolbox in Main Menu



This will display ArcToolbox window in your map view.

3 To launch Zonal Statistics Tool:

Under ArcToolbox
ArcToolbox → Spatial Analysis Tools → Zonal → Zonal Statistics as Table



This will display Zonal Statistics as table window will display.

4. Select LandUse.img in Input raster or feature zone data

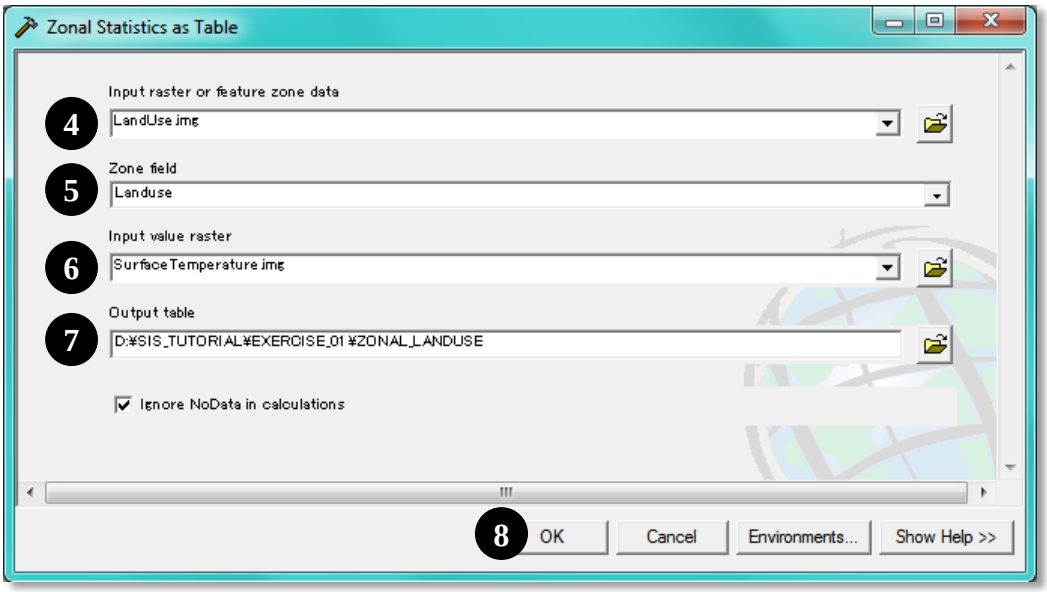
5. Select LandUse attribute field in Zone Field.

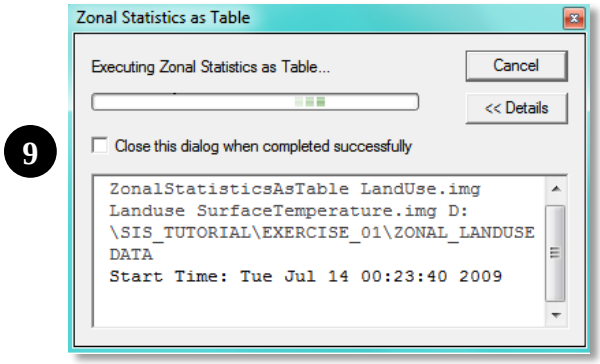
6. Select SurfaceTemperature.img in Input value raster.

7. Give ZONAL_LANDUSE in Output table.

8. Click OK to process.

9. You will see a progress window.



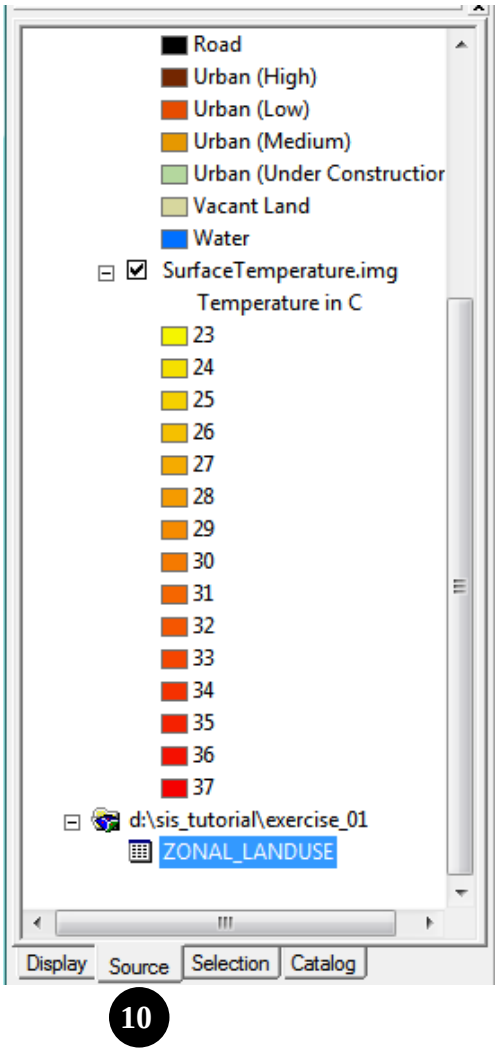


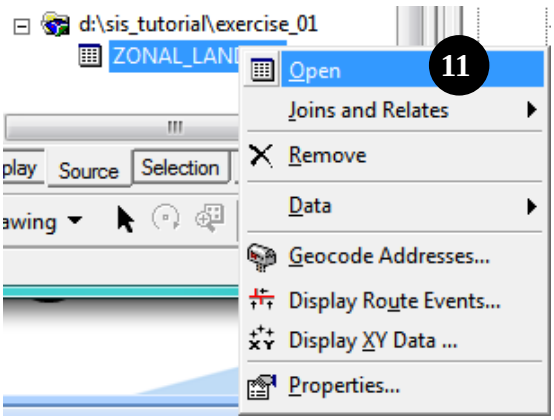
To see the result table:

10 Click Source Tab in Table of Content window.

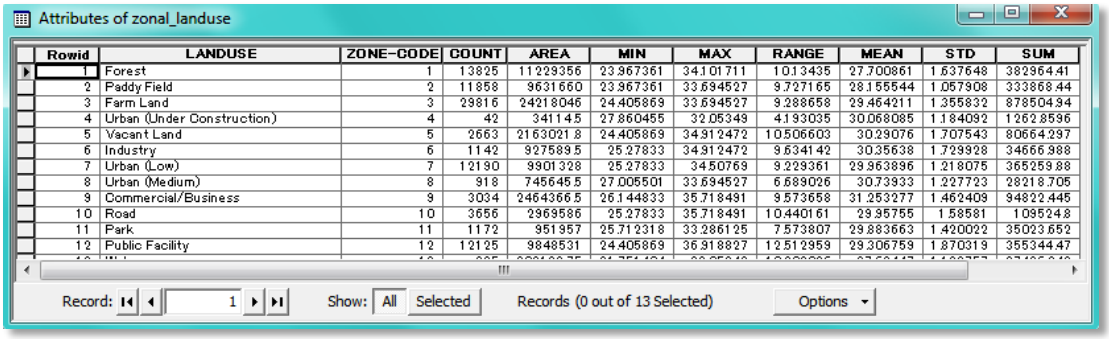
11 Right click on ZONAL_LANDUSE and select Open to see it.

Table of Contents Window





You will see the following table. Surface temperature values were summarized by land use category.

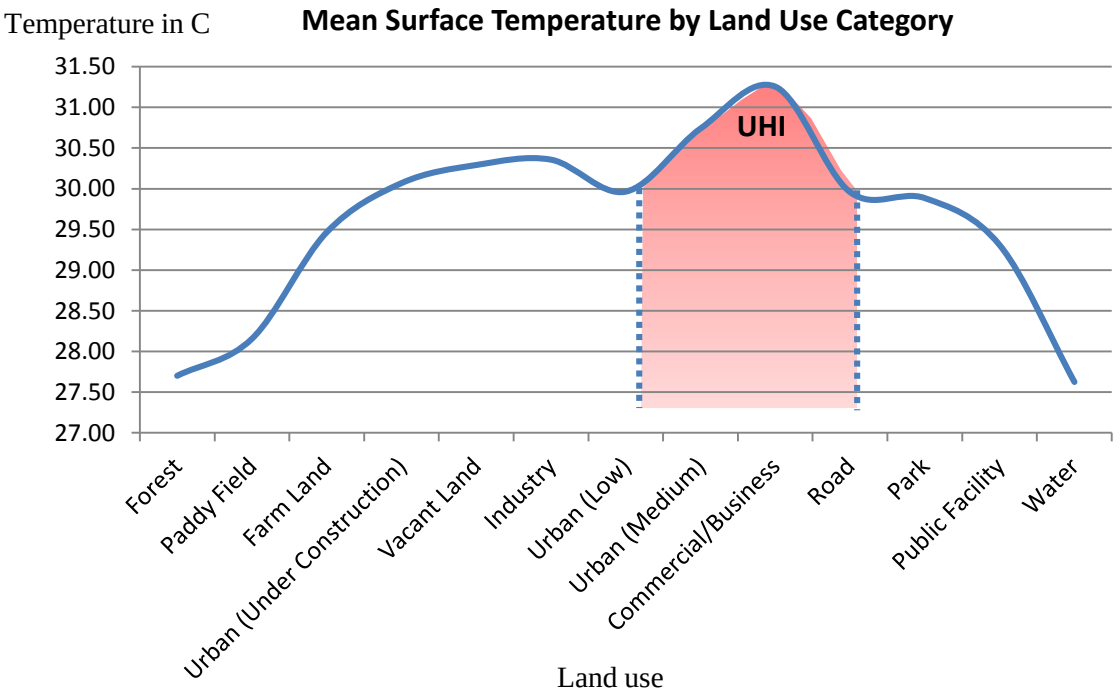


Attributes of zonal_landuse

Rowid	LANDUSE	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	Forest	1	13825	11229356	23.967361	34.101711	10.13435	27.700861	1.537648	382964.41
2	Paddy Field	2	11858	9631660	23.967361	33.694527	9.727165	28.155544	1.057908	333868.44
3	Farm Land	3	29816	24218046	24.405869	33.694527	9.288658	29.464211	1.355832	878504.94
4	Urban (Under Construction)	4	42	341145	27.860455	32.05349	4.193035	30.068085	1.184092	1262.8596
5	Vacant Land	5	2663	2163021.8	24.405869	34.912472	10.506603	30.29076	1.707543	80664.297
6	Industry	6	1142	927589.5	25.27833	34.912472	9.634142	30.35638	1.729928	34666.988
7	Urban (Low)	7	12190	9901328	25.27833	34.50769	9.229361	29.963896	1.218075	365259.88
8	Urban (Medium)	8	918	745645.5	27.005501	33.694527	6.689026	30.73933	1.227723	28218.705
9	Commercial/Business	9	3034	2464366.5	26.144833	35.718491	9.573658	31.253277	1.462409	94822.445
10	Road	10	3656	2969586	25.27833	35.718491	10.440161	29.95755	1.58581	109524.8
11	Park	11	1172	951957	25.712318	33.286125	7.573807	29.883663	1.420022	35023.652
12	Public Facility	12	12125	9848531	24.405869	36.318827	12.512959	29.306759	1.870319	355344.47

Record: 1 Show: All Selected Records (0 out of 13 Selected) Options

Well, analyzing and utilizing of this table is your own choice. Here is an example of Urban Heat Island (UHI) visualization.

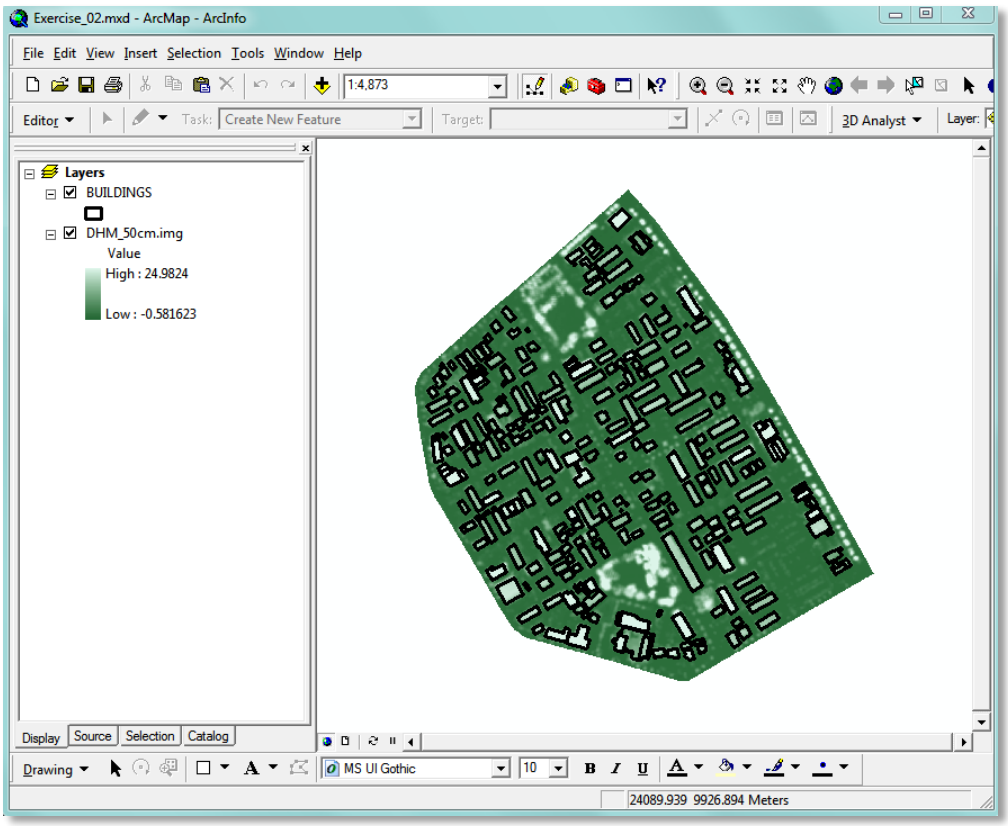


3.2. EXERCISE 02 (RASTER VS. VECTOR)

Assume you have already unzipped on:
D:\SIS_TUTORIAL\EXERCISE_02

1 To open a project file:

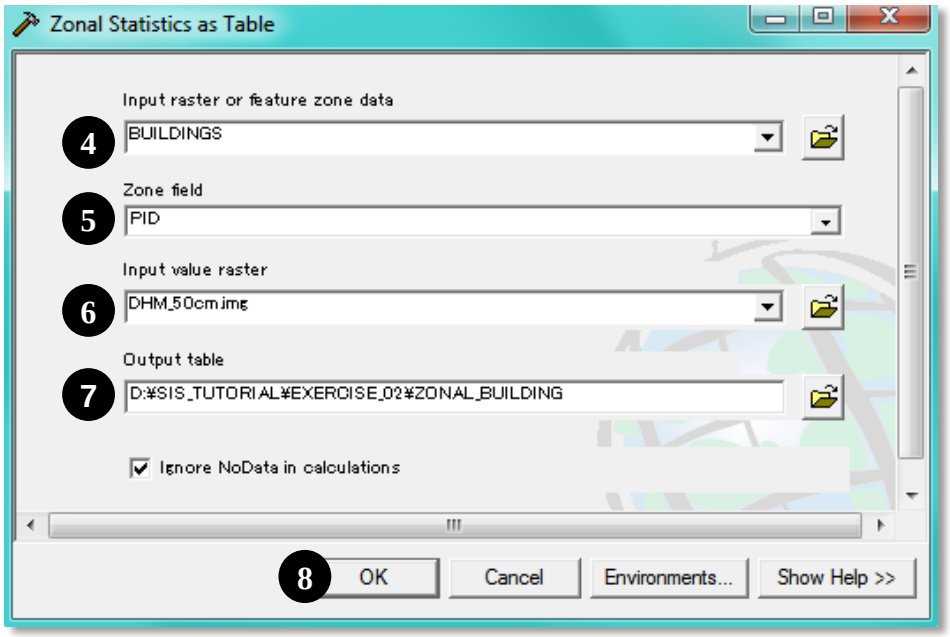
Double click on file "Exercise_02.mxd"
under "D:\SIS_TUTORIAL\EXERCISE_02" folder.



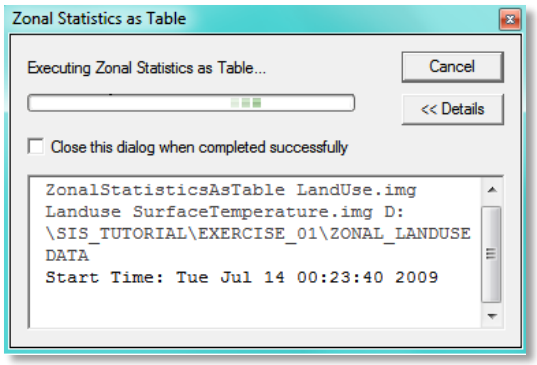
You will see two layers, Digital Height Model (raster) and building footprints (vector)

The procedure of analysis is same as Exercise_01. Except from here.

4. Select BUILDINGS in Input raster or feature zone data
5. Select PID attribute field in Zone Field.
6. Select DHM_50cm.img in Input value raster.
7. Give ZONAL_BUILDING in Output table.
8. Click OK to process.
9. You will see progress window.

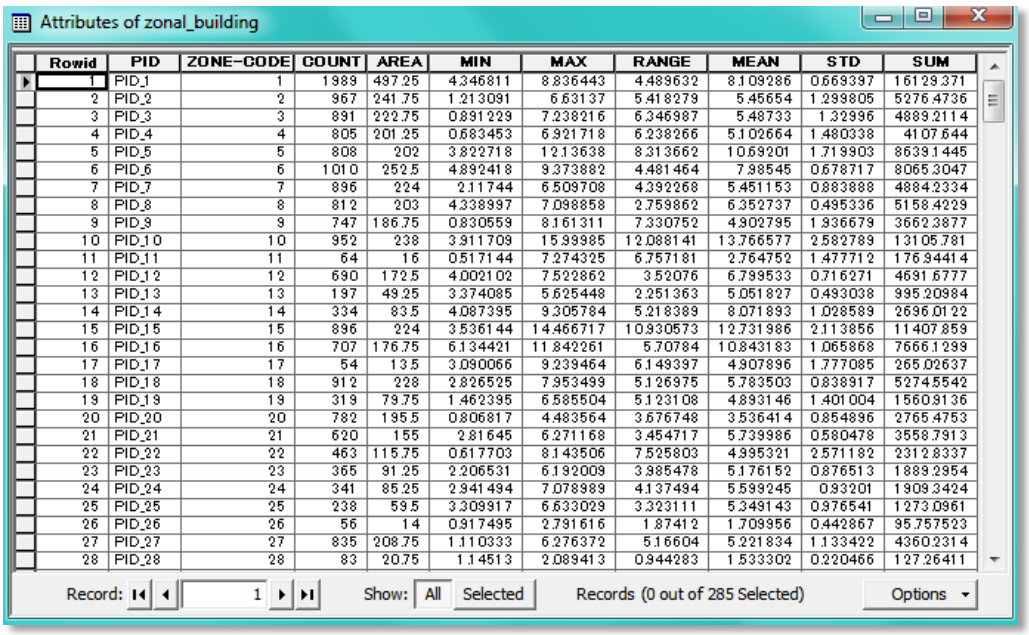


9



Browse ZONAL_BUILDING table and see it as follow.

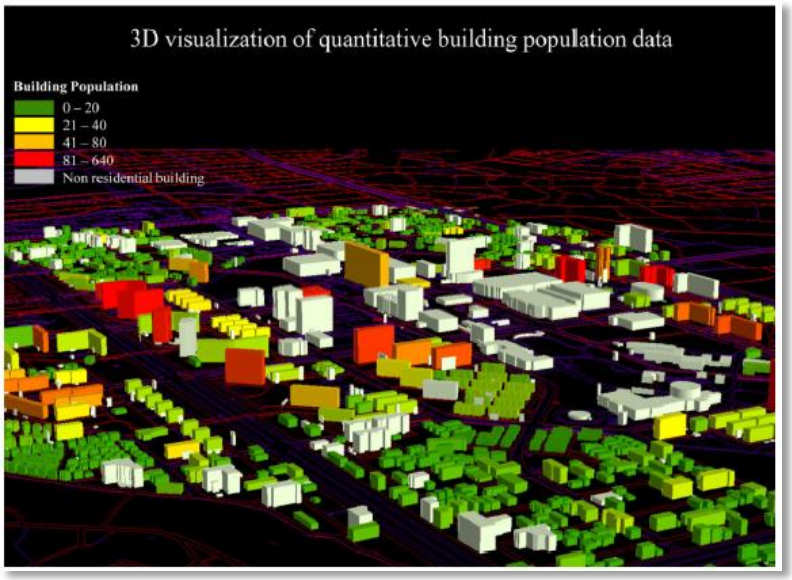
This table shows statistical properties of each building height that was extracted from DHM raster layer.



Rowid	PID	ZONE-CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	PID_1	1	1989	497.25	4.346811	8.836443	4.489632	8.109286	0.669397	16129.371
2	PID_2	2	967	241.75	1.213091	6.63137	5.418279	5.45654	1.299805	5276.4736
3	PID_3	3	891	222.75	0.891229	7.238216	6.346987	5.48733	1.32996	4889.2114
4	PID_4	4	805	201.25	0.683453	6.921718	6.238266	5.102664	1.480338	4107.644
5	PID_5	5	808	202	3.822718	12.13638	8.313662	10.69201	1.719903	8639.1445
6	PID_6	6	1010	252.5	4.892418	9.373882	4.481464	7.98545	0.678717	8065.3047
7	PID_7	7	896	224	2.11744	6.509708	4.392268	5.451153	0.883888	4884.2334
8	PID_8	8	812	203	4.338997	7.098858	2.759862	6.352737	0.495336	5158.4229
9	PID_9	9	747	186.75	0.830559	8.161311	7.330752	4.902795	1.936679	3662.3877
10	PID_10	10	952	238	3.911709	15.99985	12.088141	13.766577	2.582789	13105.781
11	PID_11	11	64	16	0.517144	7.274325	6.757181	2.764752	1.477712	176.94414
12	PID_12	12	690	172.5	4.002102	7.522862	3.52076	6.799533	0.716271	4691.6777
13	PID_13	13	197	49.25	3.374085	5.625448	2.251363	5.051827	0.493038	995.20984
14	PID_14	14	334	83.5	4.087395	9.305784	5.218389	8.071893	1.028589	2696.0122
15	PID_15	15	896	224	3.536144	14.466717	10.930573	12.731986	2.113856	11407.859
16	PID_16	16	707	176.75	6.134421	11.842261	5.70784	10.843183	1.065868	7666.1299
17	PID_17	17	54	13.5	3.090066	9.239464	6.149397	4.907896	1.777085	265.02637
18	PID_18	18	912	228	2.826525	7.953499	5.126975	5.783503	0.838917	5274.5542
19	PID_19	19	319	79.75	1.462395	6.585504	5.123108	4.893146	1.401004	1560.9136
20	PID_20	20	782	195.5	0.806817	4.483564	3.676748	3.536414	0.854896	2765.4753
21	PID_21	21	620	155	2.81645	6.271168	3.454717	5.739986	0.580478	3558.7913
22	PID_22	22	463	115.75	0.617703	8.143506	7.525803	4.995321	2.571182	2312.8337
23	PID_23	23	365	91.25	2.206531	6.192009	3.985478	5.176152	0.876513	1889.2954
24	PID_24	24	341	85.25	2.941494	7.078989	4.137494	5.599245	0.93201	1909.3424
25	PID_25	25	238	59.5	3.309917	6.633029	3.323111	5.349143	0.976541	1273.0961
26	PID_26	26	56	14	0.917495	2.791616	1.87412	1.709956	0.442867	95.757523
27	PID_27	27	835	208.75	1.110333	6.276372	5.16604	5.221834	1.133422	4360.2314
28	PID_28	28	83	20.75	1.14513	2.089413	0.944283	1.533302	0.220466	127.26411

Later you can join this table with BUILDINGS shape file using "Join and Relates" function if you wish.

Again, analyzing and utilizing of this table is your own choice. Here is an example of 3D visualization of buildings in ArcGIS 3D Analysis.



Source: Lwin, K. K. and Murayama, Y., 2009, A GIS approach to estimation of building population for micro-spatial analysis, ***Transactions in GIS*** 13(4):401-414.

Applications

Applications are numerous. Here are some.

- Urban planner may want to know average green space per planning zone or unit.
- Hydrologist may want to know average slope and height per watershed.
- Crop scientist may want to compute average soil nitrogen content per paddy field.
- More …..