

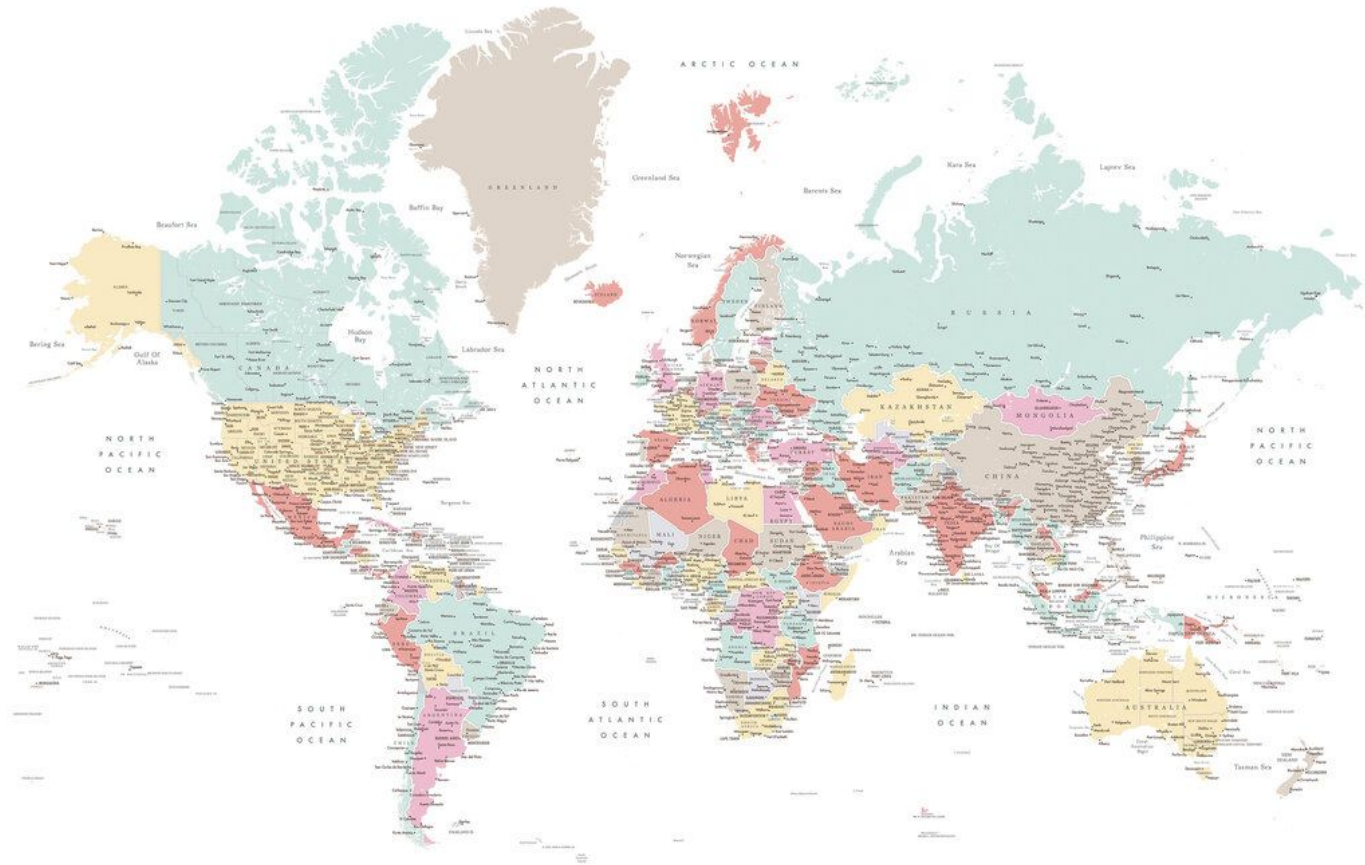


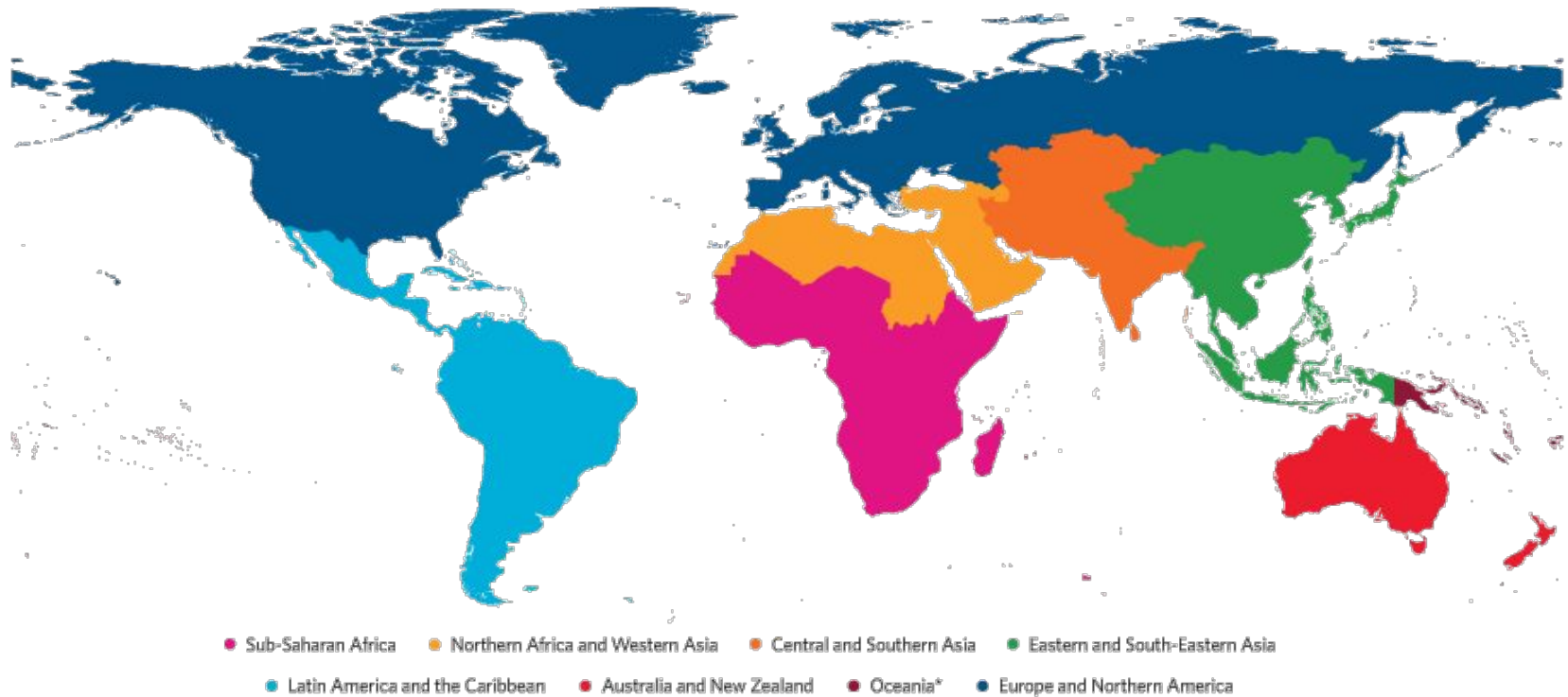
NYU

Urban Expansion

Selin Hekimgil

11.08.22





New York



United States

Region: Land-Rich Developed Countries

2011 POPULATION

18,412,093

2011 URBAN EXTENT

951,103 hectares

2011 DENSITY

19 persons/hectare



NYU

Istanbul



Turkey

Region: Western Asia and North Africa

2013 POPULATION

13,974,428

2013 URBAN EXTENT

131,606 hectares

2013 DENSITY

106 persons/hectare



NYU

Geographical location as well as the level of development of a region might affect urban expansion.

INTRODUCTION | PROBLEM STATEMENT | DATA & ANALYSIS | RESULTS | DISCUSSION

City Name	Country	Region	CBD Location		Land Cover Dates			Urban Extent Population			
			Latitude	Longitude	T1	T2	T3	T1	T2	T3	Ann
Accra	Ghana	Sub-Saharan Africa	5.615	-0.159	1/1/91	2/1/00	3/1/14	1,307,784	2,513,026	4,429,649	4.0%
Addis Ababa	Ethiopia	Sub-Saharan Africa	9.001	38.756	1/1/86	12/1/00	12/1/10	1,445,701	2,276,356	3,009,130	2.8%
Ahmedabad	India	South and Central Asia	23.037	72.589	12/1/89	10/1/00	10/1/13	3,737,723	4,718,391	6,232,952	2.1%
Ahvaz	Iran	South and Central Asia	31.320	48.665	11/1/91	9/1/00	9/1/13	698,310	853,527	1,178,560	2.5%
Alexandria	Egypt	Western Asia and North Africa	31.152	29.884	10/1/87	4/1/99	7/1/13	2,558,891	3,132,780	4,345,193	2.3%
Algiers	Algeria	Western Asia and North Africa	36.732	3.140	8/1/87	6/1/00	7/1/14	1,535,735	2,184,791	3,085,561	2.5%
Anqing, Anhui	China	East Asia and the Pacific	30.536	117.050	9/1/90	4/1/00	10/1/13	402,524	350,035	642,626	4.5%
Antwerp	Belgium	Europe and Japan	51.220	4.403	7/1/90	8/1/00	9/1/13	885,820	1,107,990	1,277,376	1.1%
Arusha	Tanzania	Sub-Saharan Africa	36.695	-3.370	10/1/88	9/1/00	10/1/13	84,150	181,168	377,169	5.6%
Astrakhan	Russia	Europe and Japan	46.340	48.020	7/1/88	9/1/03	3/1/14	475,766	532,541	567,629	0.6%
Auckland	New Zealand	Land-Rich Developed Countries	-36.915	174.786	6/1/89	9/1/01	4/1/14	838,074	1,031,718	1,300,733	1.8%
Bacolod	Philippines	Southeast Asia	10.664	122.961	12/1/92	9/1/00	3/1/15	269,117	378,445	443,456	1.1%
Baghdad	Iraq	Western Asia and North Africa	33.320	44.379	8/1/90	8/1/00	8/1/13	2,837,103	3,985,382	5,279,193	2.2%
Baku	Azerbaijan	Western Asia and North Africa	40.400	49.881	7/1/89	1/1/00	8/1/14	1,318,615	1,383,761	1,671,787	1.3%

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```
# columns 1-3: name, country, region
# columns 4-5: CBD location (latitude, longitude)
cbd_location = df1.iloc[1:,3:5]
# columns 6-8: land cover dates (T1, T2, T3)
dates = df1.iloc[1:,5:8]
# columns 9-11: urban extent population (T1, T2, T3)
# column 12: annual change T2-T3 (of population)
population = df1.iloc[1:,8:11]
population_change = df1.iloc[1:,11:12]
# columns 13-15: built-up area total (T1, T2, T3)
# column 16: annual change T2-T3 (of total area)
total_area = df1.iloc[1:,12:15]
total_area_change = df1.iloc[1:,15:16]
```

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```
# the 8 regions, as defined by the United Nations
sub_saharan_africa = df1[df1["Region"] == 'Sub-Saharan Africa']
south_and_central_asia = df1[df1["Region"] == 'South and Central Asia']
western_asia_and_north_africa = df1[df1["Region"] == 'Western Asia and North Africa']
east_asia_and_the_pacific = df1[df1["Region"] == 'East Asia and the Pacific']
europe_and_japan = df1[df1["Region"] == 'Europe and Japan']
land_rich_developed_countries = df1[df1["Region"] == 'Land-Rich Developed Countries']
southeast_asia = df1[df1["Region"] == 'Southeast Asia']
latin_america_and_the_caribbean = df1[df1["Region"] == 'Latin America and the Caribbean']
```

```
df1 = df1.iloc[1:201,:]  
# columns 1-3: name, country, region  
# columns 4-5: CBD location (latitude, longitude)  
cbd_location = df1.iloc[1:,3:5]  
# columns 6-8: land cover dates (T1, T2, T3)  
dates = df1.iloc[1:,5:8]  
# columns 9-11: urban extent population (T1, T2, T3)  
# column 12: annual change T2-T3 (of population)  
population = df1.iloc[1:,8:11]  
population_change = df1.iloc[1:,11:12]  
# columns 13-15: built-up area total (T1, T2, T3)  
# column 16: annual change T2-T3 (of total area)  
total_area = df1.iloc[1:,12:15]  
total_area_change = df1.iloc[1:,15:16]  
# columns 17-19: urban built-up area (T1, T2, T3)  
# column 20: annual change T2-T3 (of urban area)  
urban_area = df1.iloc[1:,16:19]  
urban_area_change = df1.iloc[1:,19:20]  
# columns 21-23: suburban built-up area (T1, T2, T3)  
# column 24: annual change T2-T3 (of suburban area)  
  
# columns 25-27: rural built-up area (T1, T2, T3)  
# column 28: annual change T2-T3 (of rural area)  
rural_area = df1.iloc[1:,24:27]  
rural_area_change = df1.iloc[1:,27:28]  
# columns 29-31: urbanized open space (T1, T2, T3)  
# column 32: annual change T2-T3 (of urbanized open space)  
urbanized_open_space = df1.iloc[1:,28:31]  
urbanized_open_space_change = df1.iloc[1:,31:32]  
# columns 33-35: urban extent (T1, T2, T3)  
# column 36: annual change T2-T3 (of urban extent)  
urban_extent = df1.iloc[1:,32:35]  
urban_extent_change = df1.iloc[1:,35:36]  
# columns 37-39: built-up area density (T1, T2, T3)  
# column 40: annual change T2-T3 (of built-up density)  
built_density = df1.iloc[1:,36:39]  
built_density_change = df1.iloc[1:,39:40]
```



- **Sub-Saharan Africa** (18 cities)
- **South and Central Asia** (32 cities)
- **Western Asia and North Africa** (15 cities)
- **East Asia and the Pacific** (42 cities)
- **Europe and Japan** (34 cities)
- **Land-Rich Developed Countries** (18 cities)
- **Southeast Asia** (15 cities)
- **Latin America and the Caribbean** (26 cities)

Population Growth

Increase in population

Built-Up Area

Presence of buildings (but not necessarily other urban structures such as roads or parks)

Lack of infrastructure

Unemployment

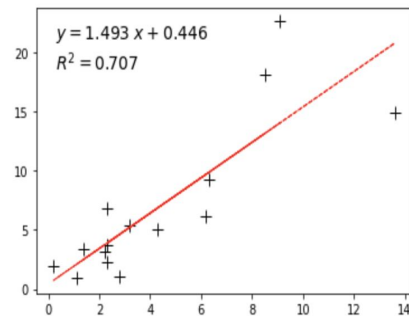
Poverty and homelessness

Consumption of land

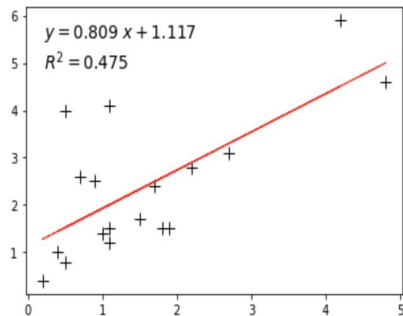
Decrease in sustainability

Effects on the environment

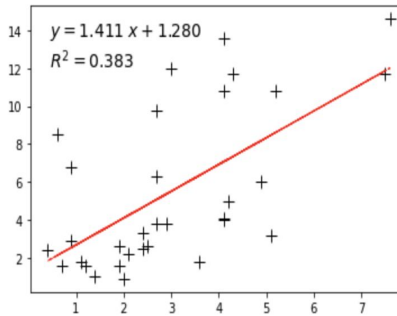
Southeast Asia



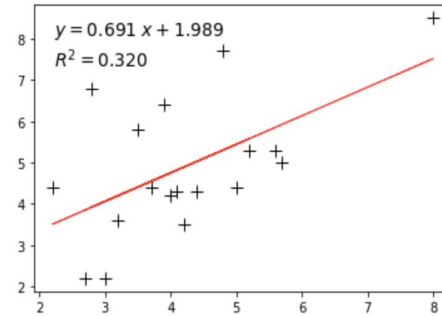
Land-Rich Developed Countries



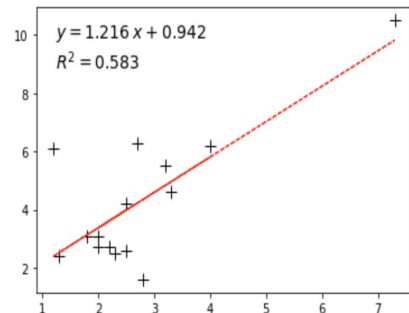
South and Central Asia



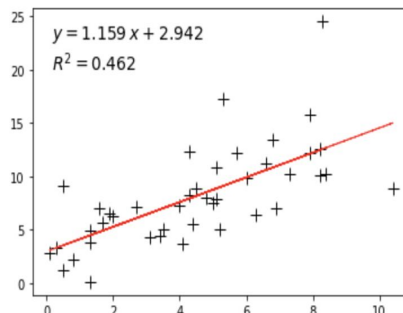
Sub-Saharan Africa



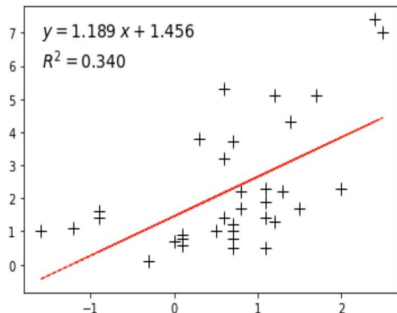
Western Asia and North Africa



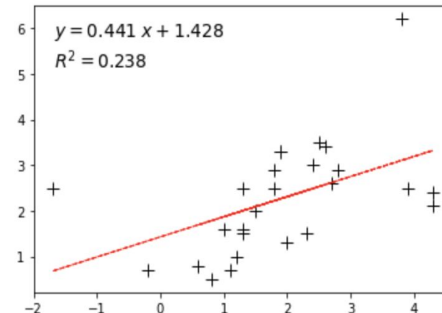
East Asia and the Pacific



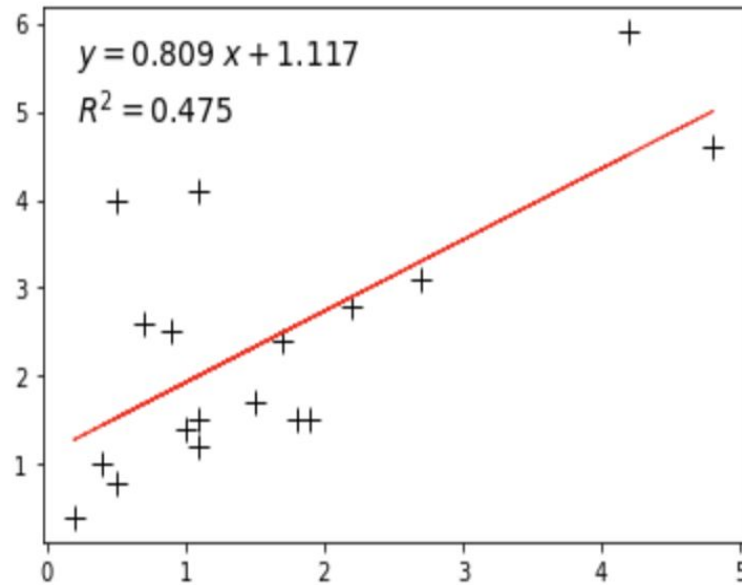
Europe and Japan



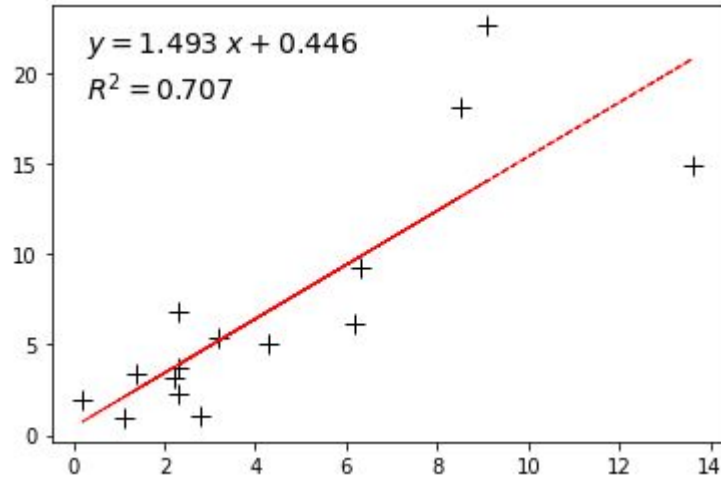
Latin America and the Caribbean



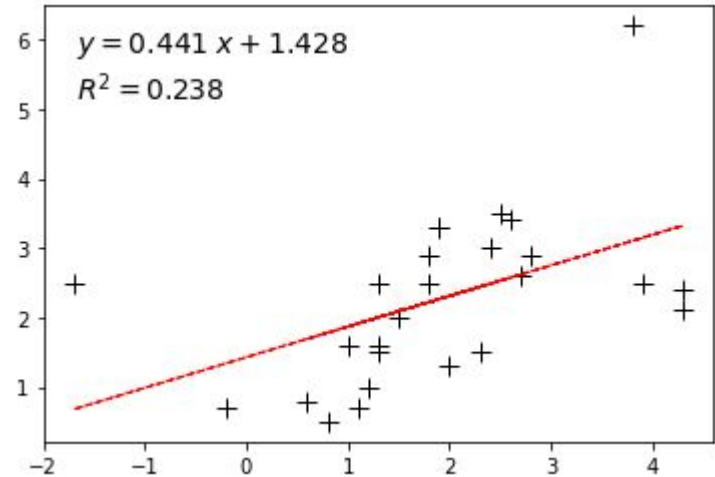
Land-Rich Developed Countries



Southeast Asia



Latin America and the Caribbean



- The main idea was to track urban expansion by region.
- Most of the time was spent on researching urban expansion: its causes, effects, and importance.
- If given more time to put into this project, the goals of it would be greater.
- One disparity that this code has from one that could have resulted, given more time, is the variable names and uses.

These shortcomings can be traced back to limited time, limited knowledge, and individual approach. Nevertheless, it was a pleasure learning more about this topic and getting the chance to work with a dataset that has the potential to lead to useful discoveries!