

# *Introduction to Human Geography with ArcGIS*

## Chapter 5 Exercises

### Exercise 5.1: City growth rates: Where are opportunities for businesses and development organizations?

#### Introduction

As described in this chapter, the rate of urban growth varies significantly from place to place. Cities in some countries have already moved through their boom phase and are growing much more slowly, while cities in other countries are expanding rapidly—for better and for worse. In this exercise you will use the Hotspot tool to identify clusters of cities that are growing at a fast rate and other clusters that are growing at a slow rate. This type of global-scale view is of use for businesses and development organizations that must identify where to target their goods and services.

#### Objectives

- Identify hot and cold spots for rates of urban growth.
- Evaluate the causes behind regional differences in growth rates.
- Discuss which goods and services will be in high demand in different regions.

#### 1. Open the map, Chapter 5 – Spatial Distributions and sign in to your account:

- <http://arcg.is/2jLxcfj>

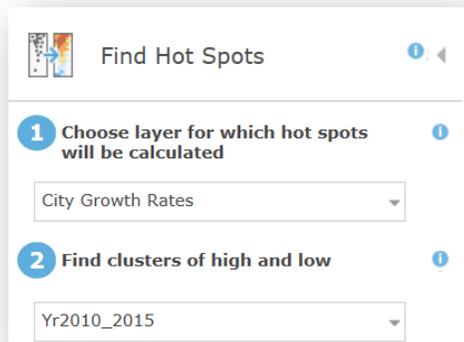
#### 2. Click the content tab if necessary to see all map layers.

3. Make sure that only the City Growth Rates layer is turned on.

4. Click the Analysis button , then Analyze Patterns and Find Hot Spots.

This will identify clusters of cities that grew quickly between 2010 and 2015. These fast-growing areas present opportunities for both businesses and development organizations.

- Choose layer for which hot spots will be calculated: City Growth Rates
- Find clusters of high and low: Yr2010-2015



5. Click Show credits and make sure about 1.7 credits are used.

Credit Usage Report	
Total records:	1,692
Credits required:	1.692

6. Click Run Analysis.

7. Answer the following (reviewing chapters 2 and 3 may help):

**Question 5.1.1**

What do the cold spots represent?

**Question 5.1.2**

What do the hot spots represent?

**Question 5.1.3**

Zoom in to the United States. How do the urban growth trends observed in much of the Midwest and Northeast relate to domestic migration trends?

**Question 5.1.4**

Zoom in to Japan and South Korea. Based on what you know about population trends in these countries, why do we see these patterns of urban growth?

**Question 5.1.5**

What can explain the urban growth trends in China? Think about demographic and economic changes.

**Question 5.1.6**

What can explain urban growth trends in parts of India, the Middle East, and Africa? Think about demographic and economic changes.

**Question 5.1.7**

What can explain urban growth trends in Europe and Russia? Think about demographic and economic changes.

**Question 5.1.8**

Imagine you work for a large construction company or a development aid organization. How could these hotspots affect planning for future projects? What types of infrastructure and housing projects would you propose for cities in the hotspots versus those in the cold spots? Think about demographics, levels of economic development, presence or lack of different types of infrastructure and housing.

**Question 5.1.9**

Print or take a screenshot of your map and submit.

**Conclusion**

In this exercise you have seen how urban growth rates vary by region at a global scale and evaluated the causal factors behind the observed trends. You have also explored how businesses and development organizations can target their products based on differences in urban growth patterns.

## Exercise 5.2: Zipf's law and primate cities

### Introduction

Primate cities are those that are significantly larger and more politically, economically, and culturally important than other cities in a country. Oftentimes they are defined according to Zipf's law, whereby the largest city in a country is twice as large in terms of population as the second largest. In this exercise you will search for a primate city, then research its dominant position in the country's urban hierarchy.

### Objectives

- Identify a primate city according to Zipf's law.
- Investigate how it dominates the urban hierarchy in terms of politics, economics, and culture.

#### 1. Open the Zipf's Law and Primate Cities application:

- <https://learngis.maps.arcgis.com/apps/webappviewer/index.html?id=b675fdf2ad9547178175235174f0ac6a>

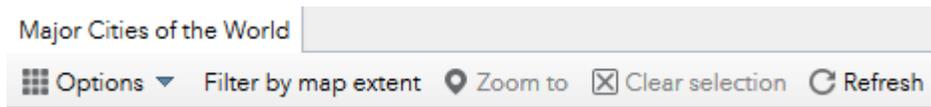
The application opens with a graduated symbols map of cities by population size.

#### 2. Zoom in to different countries and find one that appears to have a primate city. To do this, look for a country with a city that is significantly larger than other cities in the same country.

#### 3. Filter for your selected country and click the filter icon .

4. In the Filter window, click the dropdown arrow and then click on your selected country.
5. Click the slider button to apply the filter .
6. Open the attribute table, and at the bottom of the screen Open Attribute Table .
7. Click Filter by map extent so that it is not highlighted.

This will ensure that all cities in your selected country are included in the next calculation.



8. In the Table, click on the POPULATION field heading, then Sort Descending.
9. Calculate the ratio of the second largest city to the largest city.

#### Question 5.2.1

Based on the definition of a primate city, does your selected city appear to be one? Why or why not? Show your calculations.

#### Question 5.2.2

Research your primate city online. Write a paragraph on how that city dominates the politics, culture, and economy of the country.

## Conclusion

As you have discovered in this exercise, some countries have a single primate city that is substantially more important than other cities in the urban hierarchy.

## Exercise 5.3: Site and situation: Why is my city here?

### Introduction

Cities are founded and grow based on a combination of site and situation factors. As your recall from the chapter, site factors are the beneficial characteristics of a specific place, while situation factors reflect how a city is connected to and interacts with different places. In this exercise you will explore map layers and search for clues as to what site and situation factors have contributed to the origin and evolution of a city of your choice in the US.

### Objective

- Apply the concept of site and situation to a US city by evaluating clues in map layers.

#### **1. Open the Chapter 5 Site and Situation map and sign in to your account:**

- <https://arcg.is/1f5nXT>

#### **2. Zoom in to your city.**

The map contains several layers that can be used to identify site and situation characteristics of your selected city.

- a. The World Topo Base, USGS National Map, and World Navigation Map are all base reference maps that can help illustrate the site and situation characteristics

of your city. You can also turn off all layers and see high-resolution satellite imagery with the Imagery with Labels basemap.

- b. The USA Coal Fields and USA Soils Farmland Class layers can also provide site and situation information relevant to some urban areas.

### **Question 5.3.1**

Describe the site characteristics (those at or in the immediate vicinity of the city) that help drive its urban growth. Focus on the physical features that constitute the site. Some will be visible with the map layers. Others may be things you already know about your city.

### **Question 5.3.2**

Describe the situation characteristics that help drive its urban growth. Consider various types of transportation linkages and how they link your city to other places. Again, map layers can help you evaluate many of these connections.

## **Conclusion**

Each city has a unique combination of site and situation factors that contribute to its fortune. Positive factors will help it grow, but negative factors, especially a loss of linkages to other places, can lead to urban decline.

## Exercise 5.4: Urban models: which best represents my city?

### Introduction

Urban models serve as generalized descriptions of city form. They serve the purpose of explaining how cities evolve and how they may change over time. However, cities in the real world rarely fit perfectly with any single model. In this exercise you will examine a US city of your choice to see how well the concentric ring, sector, and multiple nuclei models fit, based on map variables in a set of different layers.

### Objectives

- Use real-world map data to apply urban model concepts to a US city.
- Describe why the observed map data fits or does not fit with the urban models.

**1. Open the Chapter 5 – Urban Models map (<http://arcg.is/2kR97Gb>) and sign in to your account.**

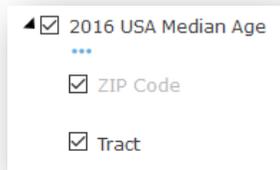
This map includes several data layers from the Esri Living Atlas, which are only visible when you sign in to your organization account. The map opens centered on Austin, Texas, with the 2016 USA Median Household Income layer active.

**2. Zoom to a US city of your choice, and type city name in Find Address or Place search bar.**

This should take you to the CBD or downtown area of your chosen city. You can zoom in and out to see a ZIP Code or census tract scale of analysis.

You will not see the layers unless you zoom to the correct scale.

3. **Zoom in and out until you see the Zip Code or Tract layer in black. For example:**



4. **Include these layers:**

- **2016 USA Median Age. Lower values represent places with more young people, such as families with children. Higher values represent places with older populations, such as where “empty nesters” live.**
- **2016 USA Diversity Index. Lower values represent less diverse place, which are dominated by a single race or ethnicity. Higher values represent more racially/ethnically diverse places. If you like, you can use the Change Symbol option under Zip Code or Tract (expand the layer name with the black arrow to see these) to map a specific group. For example: Asian Non-Hispanic divided by Total Population.**
- **2016 USA Median Home Value.**
- **2016 USA Median Household Income.**
- **2016 USA Population Density. Number of people per square mile. Higher values can represent denser apartment and condominium**

**housing. Lower values can represent suburban and rural single-family homes.**

- **2016 USA Tapestry Segmentation. This may show patterns based on the socioeconomic and demographic composition of neighborhoods.**
5. **Activate one layer at a time. Look at each of the layers to see if it best reflects the concentric zone, sector, or multiple nuclei model.**
  6. **The patterns will not be perfect, so use your best judgement as to which model each layer best fits.**
  7. **Observe the ZIP Code and Tract scales.**

Patterns may become clearer in one than the other.

**8. Answer the following using the template:**

- **Layer Name: write the name of the layer. Use at least three different layers.**
- **Best Fitting Urban Model: give the name of the model that the selected layer best fits—concentric ring, sector, multiple nuclei/Galactic/Edge City.**

Reasons for best fit. Describe exactly how the layer fits the model. Which form do the data in the selected layers take (ring, sector, node)? What are the specific neighborhoods? What is the spatial relationship with other features (i.e. transportation networks, amenities,

housing type and quality, adjacent land uses, etc.)? Use descriptions of the models in the text to guide your answers.

#### **Question 5.4.1**

Print or take a screenshot of your map for each active layer. Mark the rings, zones, or nodes on the map with a pen, or if you want to get fancy, by adding a Map Note.

#### **Question 5.4.2**

Answer template:

a. Layer Name #1:

i. Best Fitting Urban Model:

ii. Reasons for best fit:

b. Layer Name #2:

i. Best Fitting Urban Model:

ii. Reasons for best fit:

c. Layer Name #3:

i. Best Fitting Urban Model:

ii. Reasons for best fit:

## Conclusion

Urban models are useful generalizations for describing cities, yet the real-world can be much messier. As you have discovered in this exercise, different types of data can match well with some models, but not with others.

## Exercise 5.5: Suburban poverty and gentrification

### Introduction

For many decades, North American cities could be generally described as having affluent suburbs and lower income inner cities. But over time this pattern has become less clear. There are now poor pockets in suburban communities and gentrified neighborhoods in the inner city. In this exercise you will search for examples of low-income suburban areas and high-income inner-city places.

### Objectives

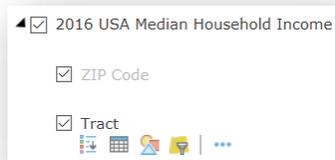
- Explore income and home value data to identify poor suburban communities and upper income inner-city communities.
- Explore factors that can contribute to the neighborhood's economic condition.
- Discuss solutions to help resolve problems associated with these types of neighborhoods.

- 1. Continue with your map from the previous exercise or skip to step 2.**
- 2. Open the Chapter 5 – Urban Models map (<http://arcg.is/2kR97Gb>) and sign in to your account.**

This map includes several data layers from Esri Living Atlas, which are only visible when you sign in to your organizational account.

The map opens centered on Austin, Texas, with the 2016 USA Median Household Income layer active.

- 3. Zoom to a US city of your choice.**
- 4. Type city name in Find Address or Place search bar (this should take you to the CBD or downtown area of your chosen city). For this exercise, make sure you are zoomed in to the Tract level of analysis.**



- 5. Use the 2016 USA Median Home Value and 2016 USA Median Household Income layers to identify suburban areas with poverty, and inner-city areas that may have gentrified.**
- 6. Answer the next questions based on the maps and information from Chapter 5 of your textbook.**

#### Question 5.5.1

Name the city/neighborhoods with suburban poverty. What accounts for the suburban poverty? Are there spatial relationships with negative features or characteristics, such as

undesirable land uses? Was there economic change that impacted employment or wages nearby?

### **Question 5.5.2**

What types of social services may be needed in these suburban areas? What challenges may make it difficult to implement them in this area?

### **Question 5.5.3**

Name the gentrified neighborhoods in your selected city. What are the place characteristics and economic conditions that have drawn higher income or more educated residents to the area?

(In addition to income and housing value layers, use the Tapestry Segmentation layer to identify gentrified areas. Look for L3: Uptown Individuals. This segment reflects many gentrifiers).

### **Question 5.5.4**

How do you think gentrification is affecting long-time residents of the area? What is the best solution if housing prices are rising too much?

## **Conclusion**

Suburban poverty is a less well-known aspect of some cities that require solutions that may differ from those in the inner-city. Likewise, while improving inner-city neighborhoods is a laudable goal, care must be taken to help those who may be displaced by rising rents.

## Exercise 5.6: Smart vs. suburban growth

### Introduction

As this chapter has described, some cities and neighborhoods are denser and walkable, with mixed land uses of residences, commerce, and entertainment, while other cities and neighborhoods are more auto-oriented, with stricter segregation of land uses and lower densities. In this exercise you will compare a city that is often associated with “smart growth” urban planning—Portland, Oregon—with a city that is more commonly associated with low-density suburban sprawl—Las Vegas, Nevada. You will look at how commuting patterns differ in each city and consider the implications associated with these differences.

### Objectives

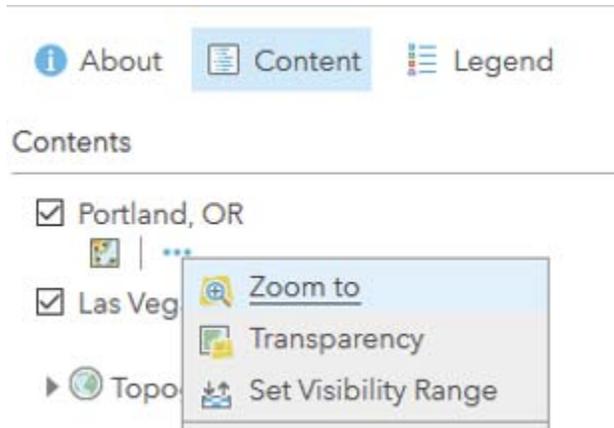
- Quantify the number of people by their mode of commute to work in a smart growth city and a suburban sprawl city.
- Calculate the proportion of workers in each city who commute by car, transit, bike, and walking.
- Discuss the health and environmental implications of smart growth and suburban development patterns.

#### **1. Open the Chapter 5 Smart Growth Vs. Suburbs map (<http://arcg.is/2khs2qp>).**

##### **Sign in to your account.**

The map opens with two Map Notes, one for Portland, Oregon, and one for Las Vegas, Nevada.

2. If necessary, zoom to Portland by clicking on the More Options dots in the Contents pane and selecting Zoom to.



You will probably be zoomed in to a very large scale.

3. Zoom out some until you can see more of the city.
4. Click the Analysis button , then click Data Enrichment and Enrich Layer.
5. In the Enrich Layer window, set the following:
  - Choose layer to enrich with new data: Portland, OR (Points)
  - Click Select Variables.
6. In the Data Browser window, click Jobs, then Commute.
7. Expand 2011-2015 Population by Journey to Work (ACS)
8. Check the boxes for:
  - 2011-2015 ACS Workers Age 16+

- **2011-2015 ACS Workers Age 16+ Drove Alone to Work**
  - **2011-2015 ACS Workers Age 16+ Took Public Transportation**
  - **2011-2015 ACS Workers Age 16+ Bicycled**
  - **2011-2015 ACS Workers Age 16+ Walked**
- 9. Make sure that you have the ACS values, not the MOE values (Margin Of Error), and click Apply.**

**10. Define areas to enrich: Driving Distance, 5 Miles.**

This will create a Manhattan distance polygon, which accounts for following the street network—as all commuters must do.

**11. Check the box next to Return result as bounding areas.**

This creates a new polygon layer showing the area within 5 miles.

**1 Choose layer to enrich with new data**

Portland, OR (Points)

**2**

- ACS Workers Age 16+ X
- ACS Workers 16+: Drove Alone X
- ACS Workers 16+: Public Transpor... X
- ACS Workers 16+: Bicycle X
- ACS Workers 16+: Walked X

SELECT VARIABLES 5 / Selected Variables

**3 Define areas to enrich**

Driving Distance

5 Miles

Return result as bounding areas

**12. Uncheck the box next to Use current map extent.**

**13. Click Show credits and make sure only one credit or fewer are being used.**

Credit Usage Report	
Total records:	1
Maximum credits required:	0.55

**14. Click Run Analysis.**

**15. Repeat the same steps, using Las Vegas NV (Points) as the layer to enrich.**

**16. For each of your new enriched layers, hover over the layer name and Show**

**Table**  .

17. In the table, scroll to the far right until you see the fields as in the table below.

18. Fill in the next table with the values from the table in ArcGIS Online.

**Question 5.6.1**

Calculate the ratio of each field value as a proportion of Workers 16+

Portland, OR:

	Workers 16+	Drove lone	Public Transit	Bicycle	Walked
<b>Value:</b>					
<b>Ratio: Mode of transportation divided by Workers 16+:</b>	Workers 16+/ Workers 16+= 1	Drove Alone /Workers 16+=	Public Transit /Workers 16+=	Bicycle /Workers 16+=	Walked /Workers 16+=

**Question 5.6.2**

Las Vegas, NV:

	Workers 16+	Drove Alone	Public Transit	Bicycle	Walked
<b>Value:</b>					
<b>Ratio: Mode of transportation divided by Workers 16+:</b>	Workers 16+/ Workers 16+= 1	Drove Alone /Workers 16+=	Public Transit /Workers 16+=	Bicycle /Workers 16+=	Walked /Workers 16+=

**Question 5.6.3**

Which city has a high proportion of workers that use public transit, bikes, and walking?

**19. Use information from the Smart Growth section of Chapter 5 to answer the following questions:**

**Question 5.6.4**

What are the possible health impacts for the people of these two cities?

**Question 5.6.5**

What are the possible environmental impacts?

**Question 5.6.6**

Which type of city do you prefer? Do you prefer better access to jobs and entertainment in a denser smart growth city, or more space and privacy as in an auto-oriented suburban community? Why?

**Conclusion**

In this exercise you have seen how commuting patterns differ in smart growth and suburban places. These differences can have distinct health and environmental impacts, but also can reflect different personal lifestyle preferences.

**Exercise 5.7: Open data**

**Introduction**

Many cities are sharing their data with the public to be more transparent and accountable, as well as to facilitate innovative uses of the information they collect. In this exercise you will explore the Esri Open Data portals developed by local governments and

describe how they are sharing their geospatial data. Open data hubs are being added around the world on a regular basis, as governments and organizations increasingly see the benefits of sharing data.

### Objectives

- Explore local government open data portals.
- Describe how the data is being used to improve quality of life in urban areas.

#### 1. Open one of the following city geospatial data sites:

- **Washington DC Open Data: <http://opendata.dc.gov/>**
- **Los Angeles, CA GeoHub: <http://geohub.lacity.org>**
- **Long Beach, CA GeoSpatial & Open Data Portal:  
<http://data.lb.longbeach.gov>**

#### 2. Scroll down and look at applications and popular datasets. Try to find something that is more than a mere data layer.

#### Question 5.7.1

In one paragraph, explain how the city is sharing data, how it assists the public, and how it can improve quality of life.