

The location and size of global population centers shifts over time (from maps of 2000, 1950, 2005, left to right).

Module 4: Lesson 1



The march of time

A global perspective

Lesson overview

Students will analyze the locations and populations of the world's largest cities from the year 100 CE through 2005 CE, describe spatial patterns of growth and change among the world's largest urban centers during the past two thousand years, and speculate on possible reasons for the patterns they observe.

Estimated time

Two 45-minute class periods

Materials

The student worksheet files can be found on the Data and Resources CD. Install the teacher resources folder on your computer to access them.

Location: OurWorld_teacher\Module4\Lesson1








- Student PDF: M4L1_student.pdf
- Student answer sheet: M4L1_student_answer_sheet.doc
- Student assessments: M4L1_assessment.pdf
- Lesson transparency: M4L1_transparency.pdf

Objectives

After completing this lesson, a student is able to do the following:

- Describe the locations and sizes of the world's largest cities over time
- Identify historical events and periods that influenced the locations of cities throughout history
- Explain the ever-increasing pattern of growth among the world's urban populations in the past two thousand years
- Define agglomeration and how that differs from city proper

GIS tools and functions

-  Find a specific feature in a layer
-  Learn more about a selected feature
-  Clear selected features
-  Label selected features in a layer
-  Move or unselect a graphic label
-  Zoom to the full extent of the map
-  Add a layer to the map
- Turn layers on and off
- Find a feature and select it
- Zoom to a layer's extent
- Open the attribute table for a layer
- Sort data in descending order
- Select a record in a table
- Clear selected features in all layers
- Zoom to a selected feature

National Geography Standards

Standard	Middle school	High school
1 How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective	The student knows and understands how to use maps to analyze spatial distributions and patterns	The student knows and understands how to use geographic representations and tools to analyze and explain geographic problems
12 The processes, patterns, and functions of human settlement	The student knows and understands the spatial patterns of settlement in different regions of the world	The student knows and understands the functions, sizes, and spatial arrangements of urban areas
17 How to apply geography to interpret the past	The student knows and understands how the spatial organization of a society changes over time	The student knows and understands how processes of spatial change affect events and conditions

Teaching the lesson

Introducing the lesson

Begin the lesson by briefly reviewing terms defining urban settlements. For example:

- A **city** is a place where many people live close together.
- An **urbanized area** is a cluster of cities, usually a large central city surrounded by some smaller cities.
- An **urban agglomeration** is where many large and small cities have merged into a very large, extended urban area.

A city's extent can be defined by its legal boundary, as a continuously built-up area, or as a functional area. Explain that in the past, cities had well-defined borders but rapid growth of urban areas in recent history has made it challenging to define their extent and to measure their population. This means that population data collected by different countries or organizations can vary drastically depending on how they define a city's extent.

Next, divide the students into pairs. Challenge each group to name the ten most populated cities in the world today. After five minutes, each group should share their list with the rest of the class. Use the blackboard or an overhead projector to tally the cities mentioned as each group reports. Based on the tally, circle the cities that were listed most often. Tell the class that they are going to do a GIS investigation that will use real data to identify the 10 most populated cities in the world from the last two thousand years.

Finally, engage students in a discussion about the cities circled on their list.

- What do they know about these cities?
- In what countries are these cities located?
- How many people live in these urban centers?
- Has anyone ever visited one of these cities?
- Can they think of any reasons why some cities grow to be so large?

Student activity

We recommend that you complete the activity yourself before presenting the lesson in class. Doing so will allow you to modify the activity to accommodate the specific needs of your students. If they will not be working on individual computers, be sure to explain any necessary modifications.

Distribute the activity to the students. Explain that in this activity they will use GIS to observe and analyze the locations and sizes of the world's ten largest cities in eight different time periods from 100 CE to the year 2005. They will identify changes in both location and size of the world's largest cities and speculate on possible reasons for the patterns they observe.

The following are things to look for while the students are working on this activity:

- Are the students using a variety of GIS tools?
- Are the students answering the questions?
- Are students asking thoughtful questions?

Concluding the lesson

Use the transparency from the CD to compare student ideas and observations from the activity. Summarize student observations on the transparency as they share and discuss their observations with the class. Use this discussion as a forum to elaborate on relevant themes in world history (such as the decline of the Roman Empire or the Industrial Revolution) and the value of using geography's spatial perspective to interpret the past. Ideally, this discussion should take place in the classroom with a projection device that displays the ArcMap map document as students discuss it. If this is not possible, you might want to conduct the discussion while students are still working on the computer.

Middle school assessment. Students will create a line graph of the most populous cities for the time periods studied and use the graph as a reference for writing an essay comparing two of the time periods. The essay will illustrate their understanding of the changes in spatial patterns of major population centers.

High school assessment. Students will create a line graph of the most populous cities for the time periods studied and use the graph as a reference for writing an essay comparing three or more time periods. The essay will illustrate their understanding of the changes in spatial patterns of major population centers. In addition, they will take the historical information from the map and their own research to make predictions about future locations of major population centers.

Extending the lesson

Challenge students to try the following:

- Explore the relationship between physical characteristics of the landscape and the locations of the world's most populated cities by adding layers reflecting world climate data (module 3) and ecoregion data (module 7).
- Conduct research on the historic cities and time periods mentioned in the lesson.
- Reflect on the questions this activity has raised in your mind and conduct further research and spatial analysis to answer those questions.
- Create ArcMap layouts of the historic time periods. Print these layouts and use them in reports about ancient European cities.
- Create hypothetical maps of the world's most populated cities in future years. Compare these predictions with the 2005 maps. Discuss population growth trends you foresee in the twenty-first century.

See the “Resources by Module” section of this book’s Web site—www.esri.com/ourworldgiseducation—for print, media, and Internet resources on the topics of population, historical time periods, and ancient cities.

Answer key

Step 2: Look at cities in 100 CE

- Q1. Where are the ten largest cities in the world in 100 CE located on the earth's surface? **Many of the cities are at about the same latitude (north of the Tropic of Cancer, or approximately 30 degrees north latitude). All of the cities are in the Northern and Eastern hemispheres.**
- Q2. Where are they located in relation to each other? **Five of the cities are located on the Mediterranean Sea. All but three of the cities are in Asia. None of the cities is located in North or South America or Australia.**
- Q3. Where are they located in relation to physical features? **All of the cities are located near rivers or near the coast.**
- Q4. What are possible explanations for the patterns you see on this map? **Answers will vary and may include the influence of climate, the extent of the Roman Empire, trade, suitability for agriculture.**

Step 3: Find historic cities and identify modern cities and countries

- Q5. Use the Find and Identify tools to complete the information in the table below.

City		Modern country
Historic name	Modern name	
Carthage	Tunis	Tunisia
Antioch	Antioch	Turkey
Peshawar	Peshawar	Pakistan

Step 4: Find the largest city of 100 CE and label it

- Q6. What's your estimate of how many people lived in the world's largest city in 100 CE? **Answers will vary.**
- Q7. What was the largest city in 100 CE? **Rome**
- Q8. What was the population of the world's largest city in 100 CE? **450,000**

Step 5: Look at cities in 1000 CE and label the most populous city

- Q9. What notable changes can you see from 100 CE to 1000 CE? **All the cities have changes from 100 CE to 1000 CE. The Mediterranean Sea is no longer the site of half the world's largest cities.**
- Q10. What similarities can you see between 100 CE and 1000 CE?
**Cities still cluster around 30 degrees north latitude.
 The population of each of the cities is under 1,000,000.
 Nearly all of the cities are in Asia.
 None of the top 10 cities is located in the Americas or Australia.**

Q11. What was the largest city in 1000 CE? **Cordova**

Q12. What was the population of the world's largest city in 1000 CE? **450,000**

Step 6: Compare other historical periods and formulate a hypothesis

Q13. Complete the table below.

Year CE	Largest city	Population of largest city	Major differences in top 10 cities compared with previous time period
100	Rome	450,000	Not applicable.
1000	Cordova	450,000	Mediterranean Sea is no longer a center of urban development.
1500	Beijing	672,000	Four of the 10 largest cities are now in China.
1800	Beijing	1,100,000	A city exceeds 1,000,000 for the first time. Europe now has three of the largest cities. Japan now has three of the largest cities.
1900	London	6,480,000	Nine of the 10 largest cities are now on two continents Europe (six) and North America (three). Five of the European cities are in Western Europe. Only one of the cities is in Asia. All 10 cities are over 1,000,000. Major cities move into more northern latitudes. The size of the largest city is six times the size of the largest city 100 years earlier.
1950	New York	12,463,000	First time a South American and Southern Hemisphere city is on the top 10 list. Europe drops back to three of the top 10 cities.
2000	Tokyo	34,450,000	Half of cities are over 15,000,000. None of the top 10 cities is in Western Europe.
2005	Tokyo	35,197,000	Jakarta, Indonesia, has replaced Los Angeles, USA, on the top 10 list. The United States has only one of the top 10 cities.

Q14. Using the map document and your answers in Q13, identify historical periods associated with the greatest changes and provide possible explanations for the changes.

Time period of significant change	Explanation for change
1800 through 1900	The Industrial Revolution caused rapid growth of European and North American cities. It also led to the immigration of millions of people to the United States from Europe.
1950 through 2005	The size of the world's largest cities mushroomed because of rapid economic growth in the developed world and the loss of agricultural jobs in the developing world (sending people to cities in hopes of finding a job).

Step 7: Investigate cities in the present time

- Q15. How many of your original guesses are among the Top 10 Cities, 2000 CE? **Answers will vary.**
- Q16. Which cities did you successfully guess? **Answers will vary.**
- Q17. In the table below, write the city's name, 2005 population, and rank. **Possible answers are listed in the table below.**
- Q18. Continue to fill out the table for the other cities in your list or cities that interest you. If you have cities on your list that are not in the top 30, fill in the name, leave the Population column blank, and write >30 in the Rank column. Possible answers are listed in the table below.

City	2005 population	Rank
Los Angeles	12,298,000	12
Hong Kong		>30
Bombay	18,196,000	5
Mexico City	19,411,000	2
Chicago	8,814,000	24

- Q19. In general, how far are these other cities from the top 10? **Answers will vary.**

Assessment rubrics

Middle school

Standard	Exemplary	Mastery	Introductory	Does not meet requirements
1 The student knows and understands how to use maps to analyze spatial distributions and patterns	Creates an accurate and well-labeled graph of the most populous cities over time; uses GIS to analyze population patterns and how they change throughout time, compares this with his/her original predictions, and makes predictions on future trends	Creates an accurate graph of the most populous cities over time; uses GIS to analyze population patterns and how they change throughout time, and compares this with his/her original predictions	Creates a graph of the most populous cities over time that is inaccurate or mislabeled in some places; uses GIS to view location patterns of the major population centers	Does not complete a graph of the most populous cities over time; has difficulty identifying location patterns of major population centers
12 The student knows and understands the spatial patterns of settlement in different regions of the world	Describes in detail how major cities have changed and are influenced by their location relative to physical features, and elaborates on what these features are and whether they were a positive or negative force on the cities	Identifies how major cities have changed and are influenced by their location relative to physical features such as water and other major cities	Identifies how the major cities have spread throughout the various regions of the world	Identifies the locations of major cities but does not identify a pattern of settlement
17 The student knows and understands how the spatial organization of a society changes over time	Compares the major cities of at least two time periods and makes predictions as to why changes occurred over time; provides detailed evidence of how factors such as technology and transportation influenced life in these cities	Compares the major cities of two time periods and makes predictions as to why changes in these population centers occurred over time	Identifies characteristics of the major cities of two different time periods but does not draw comparisons between the two eras	Identifies a few characteristics of major cities of two different time periods or describes characteristics for only one time period

This is a four-point rubric based on the National Standards for Geographic Education. The mastery level meets the target objective for grades 5–8.

High school

Standard	Exemplary	Mastery	Introductory	Does not meet requirements
1 The student knows and understands how to use geographic representations and tools to analyze and explain geographic problems	Creates an accurate and well-labeled graph of the most populous cities over time; uses GIS to analyze how population patterns change throughout time, compares this with his/her original thoughts, and makes predictions on future trends; uses GIS to create an original map to illustrate these points	Creates an accurate graph of the most populous cities over time; uses GIS to analyze how population patterns change throughout time, compares this with his/her original thoughts, and makes predictions on future trends	Creates a graph of the most populous cities over time that is inaccurate or mislabeled in some places; uses GIS to analyze population patterns and how they change throughout time	Does not complete a graph of the most populous cities over time; uses GIS to analyze population patterns, but has difficulty identifying how they change throughout time
12 The student knows and understands the functions, sizes, and spatial arrangements of urban areas	Elaborates, by using visual and textual materials, on characteristics of major cities throughout time and how factors such as trade routes and technology influenced the growth of these places	Identifies characteristics of major cities throughout time and how factors such as trade routes and technology influenced the growth of these places	Identifies characteristics of major cities throughout time	Identifies major cities and a few of their characteristics
17 The student knows and understands how processes of spatial change affect events and conditions	Cites specific examples of how changes in politics, transportation, etc., caused major population centers to shift from one location to another between three time periods	Identifies how changes in politics, transportation, etc., influenced the location of major population centers in three time periods	Lists one or two major cities that changed from one time period to the next and provides explanation for the change	Lists one or two major cities that changed from one time period to the next

This is a four-point rubric based on the National Standards for Geographic Education. The mastery level meets the target objective for grades 9–12.

Answer key to part A of the assessment

