

Megacities

from the Esri GeoInquiries™ collection for Environmental Science

Audience – Advanced environmental science

Time required – 15 minutes

Activity	Explore urban sprawl, factors, and impacts.
Science Standards	<p>APES Benchmark: IV. Land and Water Use (urban land development; planned development, suburban sprawl, urbanization)</p> <p>NGSS: HS-LS2-7. Design, evaluate, and refine a solution for reducing the impact of human activities on the environment and biodiversity.</p>
Learning Outcomes	<ul style="list-style-type: none"> • Students will be able to describe the scale of urbanization. • Students will be able to analyze environmental impacts and advantages of urban centers.

Map URL: <http://esriurl.com/enviroGeoInquiry4>



Engage

What characteristics define a city?

- Click the map URL above to open the map.
- List at least three observations from the initial map, *Earth at Night*.
- ? What patterns do you notice? *[Answers will vary.]*
- ? What is the difference between “city” and “urban”? *[Cities include business, population, and cultural landscape; urban areas include non-rural areas, cities, and suburbs.]*
- ? What is a megacity? *[Urban areas with populations greater than 10 million.]*



Explore

What are some examples of megacities?

- ? What are some possible characteristics of a megacity? *[A dense population center, large surface footprint, and extensive transportation system]*
- Using the Details pane, click the button, Show Contents Of Map.
- Click the checkbox to the left of the layer name, World Urban Sprawl.
- Zoom out to a world view.
- Why is the layer not visible? *[It is set to be visible at a specific scale.]*
- Zoom in and out to view and explore some of these cities.
- ? What cities around the world might be megacities? *[Answers may include Paris, Tokyo, and Los Angeles.]*



Explain

What factors influence urban center geography?

- ? What might be some factors leading to an increase in urbanization? *[Industrialization, climate, waterways, and other transportation]*
- Click the checkbox to the left of the layer name, Megacities.
- ? Where are most megacities located? *[Southeast Asia and India]*
- Hover over the Megacities layer name and click the button, Show Table.
- In the table, click the column header, % Growth. sort ascending.
- ? Which cities are growing the fastest? *[Karachi, Delhi, Dhaka, and Guangzhou]*
- Investigate three cities by clicking their map markers.
- ? What are the growth rates for these cities? *[Answers will vary.]*

more ►

Elaborate

How have cities changed over time?

- ? What are some possible factors leading to urban sprawl? [*Open space, desire for privacy, highways, and telecommunication*]
- Click the button, Show Map Contents.
- Turn off the layer, World Urban Sprawl.
- Turn on three layers, Tokyo 1929, Tokyo 1954, and Tokyo 1972.
- Toggle between the three years. Observe how Tokyo has changed over time.
- ? Click the button, Measure. Calculate the square kilometer footprint of urban growth for Tokyo 1929. Hint: See tool tip below. [*Approximately 300 sq. km.*]

Evaluate

What is wrong with sprawl?

- Repeat the measuring step for the remaining two years (1954, 1972).
- ? What is the square kilometer footprint for each year? [*1954 - 400 sq. km.; 1972 - 1,400 sq. km.*]
- ? What patterns of growth do you notice? [*Answers will vary. Cities grow along main transportation routes, and along water boundaries.*]
- ? What are some potential negative effects related to urban sprawl? [*Traffic congestion, pollution, and land consumption.*]

USE THE MEASURE TOOL

- Click the button, Measure.
- Select the Area button and choose a unit of measurement.
- On the map, click once to start the measurement, click again to change direction, and double-click to stop measuring.
- Hint: Position the area of interest on the map so that it is not obscured by the Measure window.

SHOW TABLE AND SORT

- Tables are only available for certain map layers.
- With the Details pane open, click the button, Show Contents of Map.
- Hover over a layer name.
- Click the button, Show Table.
- Click on field name (top row).
- Choose sort ascending or descending

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.esri.com/schools>.

THEN TRY THIS...

- Using an ArcGIS Online organizational subscription for schools, create a drive-time analysis layer for that city and explore the transportation network.
- Explore the story map, *The Age of Megacities*, at <http://esriurl.com/Geo41114131>.



TEXT REFERENCES

This GIS map has been cross-referenced to material in sections of chapters from these texts.

- *Environmental Science: A Global Concern* (12th) by McGraw-Hill — Chapter 22
- *Living in the Environment* (15th) by Thomson — Chapter 23
- *Environment: The Science Behind the Stories* (3rd) by Pearson — Chapter 13