Module Overview
This module focuses on Earth as our home and investigates the physical and human landscapes in which we live. Students learn that the world’s population is unevenly distributed, and they begin to understand the environmental factors that influence this distribution.

Investigation 1: What are physical and human-made features?
During this investigation students identify physical and human-made features using images from space. They match images of physical features with definitions of those features and identify physical and human features in images of several U.S. cities.

Investigation 2: What is there to see from sea to shining sea?
This investigation builds on the first investigation in this module. Students locate and identify more physical and human-made features in the United States using images from space and create their own U.S. maps that are illustrated with NASA images. The song “America the Beautiful” is used to help students recognize that our country has many different regions and that the landscape of our country is very diverse.

Investigation 3: How do images help us learn about our planet Earth?
Students interpret a nighttime image of the world using the arrangement of lights to identify broad patterns of world population distribution. They use maps showing landforms and climate regions to help explain the patterns.

Investigation 4: Where are the cities?
Students compare an image showing nighttime lights in the United States with atlas maps in order to identify major cities and relate population distribution patterns to the physical environment. By locating cities and physical features identified in the nighttime image on an outline map, students become more familiar with important locations in the United States. They also use atlas maps and geographic information to identify NASA images of areas around several major cities.
Connections to the Curriculum
This module can be integrated into social studies classes when introducing map and globe skills, continents, landforms, physical systems, differences between regions and cities, or global settlement patterns. The investigations strengthen scientific inquiry skills such as observing, predicting, infering, classifying, and noting patterns. The song “America the Beautiful” provides a Language Arts connection as students interpret the lyrics and master new vocabulary.

Time
Investigation 1: Two 45-minute sessions
Investigation 2: Two 45-minute sessions
Investigation 3: One 45-minute session
Investigation 4: Two 45-minute sessions

Mathematics Standards

Geometry
• Use visualization, spatial reasoning, and geometric modeling to solve problems

Measurement
• Understand measurable attributes of objects and the units, systems, and processes of measurement
• Apply appropriate techniques, tools, and formulas to determine measurements

Technological Literacy Standards

Nature of Technology
• Standard 1: The characteristics and scope of technology

Technology and Society
• Standard 4: The cultural, social, economic, and political effects of technology

The Designed World
• Standard 20: Construction technologies
What are physical and human-made features?

Investigation Overview
During this investigation students identify physical and human-made features using images from space. They match images of physical features with definitions of those features and identify physical and human features in images of several U.S. cities.

Time required: Two 45-minute sessions

Materials/Resources
Figure 1: An astronaut photographs Earth (overhead transparency)
Globe
Crayons
Scissors
Map of the United States
Log 1: What are physical features? (one copy per group of four students)
Log 2: Satellite images of physical features (one overhead transparency and one per group of four students)
Log 3: New Orleans, Louisiana (one overhead transparency and one per group of four students)
Log 4: Corpus Christi, Texas (one overhead transparency and one per group of four students)
Log 5: Panama City, Florida (one overhead transparency and one per group of four students)
File folders (two per group of four students)
Old magazines

Content Preview
To survive, people depend on the physical environment. They adapt to it and modify it to suit their changing needs for things such as food, clothing, shelter, and energy. They build homes, roads, airports, canals, and dams and transform the environment. Human-made features and naturally occurring features such as rivers, lakes, and coastlines can be observed from space using satellites and Space Shuttle photography. Natural features generally have irregular boundaries while human-made features have more regular geometric shapes.

Classroom Procedures
Beginning the Investigation
1. Show students a globe and guide students to identify its shape as a sphere. Ask if anyone can find the continent on which we live. Have a student locate North America on the globe and name it. Ask students to identify and name the six other continents and four oceans. Write the words Physical Features on the board. Tell them that physical

Geography Standards

Standard 1: The World in Spatial Terms
How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective
- Identify and describe the characteristics and purposes of geographic representations, tools, and technologies.

Standard 4: Places and Regions
The physical and human characteristics of places
- Use a variety of graphic materials and data sources to describe the physical and human characteristics of a region.

Geography Skills
Skill Set 2: Acquire Geographic Information
- Make and record observations about the physical and human characteristics of places.

Skill Set 4: Analyze Geographic Information
- Use texts, photographs, and documents to observe and interpret geographic trends and relationships.

Skill Set 5: Answer Geographic Questions
- Use methods of geographic inquiry to acquire geographic information, draw conclusions, and make generalizations.
features describe the features of the land such as landforms and water bodies. An example of a physical feature is an island. Ask students to identify other physical features that can be seen on the globe. (Lake, mountain range, island, gulf, bay, peninsula, etc.)

**Developing the Investigation**

2. Divide the students into groups of four and give each group a copy of Log 1. Instruct students to cut out the physical feature definition boxes. Give each student in each group two of these boxes and have them draw a picture of these physical features. Then ask each group to assemble its eight pictures and in a class discussion compare the various pictures of each feature.

- **desert**: a land area that receives very little precipitation and thus has sparse vegetation
- **island**: an area of land surrounded by water
- **mountain**: a natural elevation of Earth’s surface; more rugged, steeper, and higher than a hill
- **river**: a large natural stream of water emptying into an ocean, lake, or larger body of water
- **bay**: any inlet of the ocean bordering on land and partly surrounded by land
- **ocean**: the mass of salt water that surrounds the continents
- **lake**: an inland body of water usually of considerable size
- **peninsula**: an area of land which projects out from a larger land mass and is almost surrounded by water

3. Tell the students that one of NASA’s main goals is to learn about our Earth so that we will be able to understand and eventually predict both natural and human-induced global changes. Explain that people make changes to the environment to produce human-made features. Write **Human-Made Features** on the board and ask students to name some human-made features that are in their hometown, e.g., buildings, bridges, airport, city, town, canal, etc.

4. NASA uses satellites to produce images of Earth’s physical and human features. Astronauts also take photographs of the physical features and human-made features on Earth. Ask students why it might be difficult for astronauts to locate the features they want to photograph. (Looking down at Earth from space, there are no boundary lines to help identify the places at which one is looking: north and south are not “up” and “down”; clouds can keep one from seeing the ground, etc.) Tell students that astronauts have been taking photographs of Earth since the 1960s, and that they receive special training in order to learn to recognize Earth’s features. Show the overhead transparency of Figure 1, a photograph of John Glenn taking photographs from the Space Shuttle. Have a student point to his camera. Speculate with the class about the views from his window. Tell students that now they are going to use Space Shuttle photographs to identify physical features located on our planet.

5. Distribute a copy of Log 2 to each group. Explain that these are satellite images. Instruct students to cut out the images. Now, tell them to examine the images and match them with the definitions in the boxes they cut out in Log 1. After students have completed this task, show the transparency of Log 2 and ask students to identify each physical feature. Discuss how images from space look different than those taken from the ground. Show students the location of these places on a map of the United States. (See **Evaluation** below for place names).

6. Give each group a copy of Logs 3, 4, and 5. Explain that these are photographs taken by astronauts from the Space Shuttle. Help the students to explore how they are different from the satellite images. (They were taken from a lower altitude, so you can see more details in a smaller area. They were taken at an angle, from a window, while the satellite images are produced from satellites that are directly overhead.)

7. Have each student circle one physical feature with a sharp green crayon and one human-made feature with a sharp red crayon. Then have them take turns listing the kinds of physical and human-made features they see in each photograph on a separate sheet of paper.

8. Show overhead transparencies of Logs 3, 4, and 5, and have students compare their responses.

**Concluding the Investigation**

9. Give each group two file folders and old magazines, and tell them that they are going to make pop-up folders. Demonstrate to the students how to make a folder, and repeat the directions as they make their own folders. Each folder will have two sections cut from the folded side and pushed inward, so that when the cover is opened the two sections pop up.
Directions: Place the folder with the folded side toward you. Along the folded side, measure 5 centimeters from the left edge and cut a 7.5 centimeter slit into the folder. Then, measure 12.5 centimeters from the same edge, and make another 7.5 centimeter slit into the folder. Next, measure 5 centimeters from the right edge of the folder and make a 7.5 centimeter slit and measure 21.5 centimeters from the same edge, and make the last 7.5 centimeter slit. Now, open the folder and pull the portion between the two slits on the left and the two slits on the right in toward the center. Close the folder, and crease the pieces into the inside of the folder. Open the folder and these two sections will pop up. Label one folder Physical Features and the other Human-Made Features, and paste pictures to illustrate each topic on the pop-up sections of each folder.

Evaluation

*Log 2: Satellite images of physical features
a. Desert (Sonoran Desert)
b. Mountain (Mount Rainier)
c. River (Colorado, San Juan, and Escalante Rivers)
d. Island (Lanai, Hawaii)
e. Bay (Chesapeake Bay)
f. Lake (Lake Tahoe)

*Log 3: New Orleans, Louisiana
Physical features—bay, river, island, ocean, coastline, lake
Human-made features—city, buildings, highway, bridge, streets

*Log 4: Corpus Christi, Texas
Physical features—lakes, river, sandbar or island, bay, coastline
Human-made features—city, buildings, highway, bridge, streets, cultivated fields

*Log 5: Panama City, Florida
Physical features—peninsula, bay, coastline, channel, beaches, sandbar, river
Human-made features—city, buildings, highway, bridge, cultivated fields
Figure 1: An astronaut photographs Earth
During this investigation, you will work as a group to identify physical features of our Earth. Cut out the definition cards and use them to help you identify each of these places.

**Module 3, Investigation 1: Log 1**

**What are physical features?**

- **desert**
  a land area that receives very little rainfall

- **island**
  land area surrounded by water

- **mountain**
  a natural elevation of Earth’s surface, more rugged, steeper, and higher than a hill

- **river**
  a large natural stream of water emptying into an ocean, lake or larger body of water

- **peninsula**
  an area of land which projects out from a larger land mass and is almost surrounded by water

- **bay**
  any inlet of the ocean bordering on land and partly surrounded by land

- **ocean**
  the mass of salt water that surrounds the continents

- **lake**
  an inland body of water usually of considerable size
Module 3, Investigation 1: Log 2
Satellite images of physical features

Directions: Cut out the boxes that contain satellite images of physical features.

a
b
c
d
e
f
1. This photograph was taken by an astronaut from the Space Shuttle. Have each person in your group circle one physical feature with a green crayon and one human-made feature with a red crayon.

2. Take turns listing each kind of physical feature you can see in the image on the left side of a sheet of paper and all the human-made features on the right side. Put the headings *Physical Features* and *Human-Made Features* at the tops of your lists.
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2. Take turns listing each kind of physical feature you can see in the image on the left side of a sheet of paper and all the human-made features on the right side. Put the headings *Physical Features* and *Human-Made Features* at the tops of your lists.
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2. Take turns listing each kind of physical feature you can see in the image on the left side of a sheet of paper and all the human-made features on the right side. Put the headings Physical Features and Human-Made Features at the tops of your lists.
What is there to see from sea to shining sea?

Investigation Overview
This investigation builds on the first investigation in this module. Students locate and identify physical and human-made features in the United States using images from space and create their own U.S. maps that are illustrated with NASA images. The song “America the Beautiful” is used to help students recognize that our country has many different regions and that the landscape of our country is very diverse.

Time required: Two 45-minute sessions

Materials/Resources
Atlases or U.S. maps (one for each group of four)
Log 1: How many physical and human-made features can you find? (one for each group of four)
Log 2: What features make our country a special place? (one for each group of four)
Log 3: What features make our country a special place? (answer page) (one for each group of four)
Log 4: Sea to shining sea—Images (one for each student)
Poster board (one for each group)
Masking tape
Wall map

Content Preview
Places on Earth are characterized by their physical and human properties. Their natural physical features include climate, landforms, soils, bodies of water, vegetation, and animal life. Their human characteristics include language, religion, political systems, economic systems, population distribution, and the features people construct such as cities, airports, roads, bridges, and canals. Both natural environmental features and human-made features are visible from space.

Classroom Procedures
Beginning the Investigation
1. Divide students into groups of four and give each group an atlas and a copy of Log 1. Review the definition of physical and human-made features. (Physical features describe the natural features of the land such as landforms and water bodies, and human-made features are the characteristics of a place or region that are made by people.) Tell them to look carefully at the satellite image and ask if anyone can identify the city. It is San Francisco, California. Now tell students to locate San Francisco on the wall map and describe its location. (On
the west coast, near the Pacific Ocean, on a bay, etc.) Have them list the kinds of physical and human-made features they can see in the satellite image. Discuss and compare their lists.

2. Have the students find a physical map of the United States in the atlas and help them to identify the physical features they see on the map by name. (Various mountain ranges, major lakes and rivers, deserts, etc.) If the wall map shows these features, there is no need to use the atlases.

Developing the Investigation

3. Divide the class into groups and give each group an atlas and a copy of Logs 2 and 3. Tell the students to cut out the three boxes in Log 3 and match them to the three correct images in Log 2. Have the students look at the images and discuss the kinds of physical and human-made features they can see. Ask them to determine whether the features are mostly physical or mostly human-made and circle the answer. Then have them list examples of these features. When students have completed the activity, discuss their answers.

4. Tell the students that about 100 years ago Katharine Lee Bates wrote a poem which later was made into a song by Samuel A. Ward. This song describes the United States’ wide skies, rich farmlands, mountains, and more. Ask if anyone can name the song. Have the class sing “America the Beautiful.”

America the Beautiful

O beautiful for spacious skies,
For amber waves of grain,
For purple mountain majesties
Above the fruited plain!
America! America!
God shed His grace on thee
And crowned thy good with brotherhood
From sea to shining sea!

5. Use the wall map to discuss the song. Have students help identify the places in the United States that we associate with “amber waves of grain” (the Great Plains); “purple mountain majesties” (coastal ranges, Sierra Nevadas, Cascades, Rockies, Appalachians); “the fruited plain” (southeastern coastal plain including Florida).

Concluding the Investigation

6. Have the students work in their groups to draw an outline map of the United States on a large posterboard using an overhead projector. Instruct them to cut out the images from Log 4. Have them work in small groups to decide where each image belongs on their maps. They should check the locations on the wall map or in an atlas. Have each group attach its images on the posterboard map with tape. Discuss the map as a class and correct any misplaced images.

This activity can be extended by having students affix magazine pictures and postcards to the map.

7. Ask each group to collaborate and write a poem that will describe the images on the map. Suggest that they identify and describe the geographic features they learned about, and that they include information on ways we can protect our country’s environment from “sea to shining sea.” Display the poems in the classroom.

Evaluation

*Log 1: How many physical and human-made features can you find?
  Physical features: bay, ocean, strait, peninsula, island
  Human-made features: city, buildings, bridges, streets, parks, roads, airport

*Log 3: What features make our country a special place?
  Grand Canyon—image #1
  Lanai, Hawaii—image #4
  Lake Michigan and Chicago, Illinois—image #6

*Log 4: Sea to shining sea
  1. San Francisco
  2. Mount Rainier
  3. Sonoran Desert
  4. Great Salt Lake—Salt Lake City
  5. Rocky Mountains
  6. Albuquerque, New Mexico
  7. New Orleans
  8. Great Lakes
  9. Cape Canaveral, Florida
  10. Chesapeake Bay
  11. New York City

O beautiful for spacious skies,
For amber waves of grain,
For purple mountain majesties
Above the fruited plain!
America! America!
God shed His grace on thee
And crowned thy good with brotherhood
From sea to shining sea!
Module 3, Investigation 2: Log 1
How many physical and human-made features can you find?

<table>
<thead>
<tr>
<th>Physical Features</th>
<th>Human-Made Features</th>
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Module 3, Investigation 2: Log 2
What features make our country a special place?

Directions: Cut out the boxes on Log 3. Match them to the three correct images.
Module 3, Investigation 2: Log 2
What features make our country a special place?
Module 3, Investigation 2: Log 2
What features make our country a special place?
Module 3, Investigation 2: Log 3
What features make our country a special place?

Name ___________________________ Date _____________________

Directions
1. After you have matched the satellite images, look at each image to see if it has “mostly physical” or “mostly human-made” features. Circle your answer.
2. Identify the kinds of physical and human-made features you can see.

<table>
<thead>
<tr>
<th>Location</th>
<th>Mostly Physical</th>
<th>Mostly Human-Made</th>
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<tbody>
<tr>
<td>Grand Canyon, Arizona</td>
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<tr>
<td>1) Mostly Physical</td>
<td>Mostly Human-Made</td>
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<td>2) Identify the features you see:</td>
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| Lanai Island, Hawaii         |                 |                   |
| 1) Mostly Physical            | Mostly Human-Made |
| 2) Identify the features you see: |                 |                   |
| Physical                      | Human-Made      |
|                               |                 |
|                               |                 |
|                               |                 |
|                               |                 |
|                               |                 |
|                               |                 |

| Lake Michigan and Chicago, Illinois |                 |                   |
| 1) Mostly Physical | Mostly Human-Made |
| 2) Identify the features you see: |                 |                   |
| Physical | Human-Made |
|         |           |
|         |           |
|         |           |
|         |           |
|         |           |
|         |           |
Module 3, Investigation 2: Log 4
Sea to shining sea—Images

Rocky Mountains

Cape Canaveral, Florida

San Francisco, California, and surrounding areas

Salt Lake City, Utah, and Great Salt Lake

The Great Lakes
Module 3, Investigation 2: Log 4
Sea to shining sea—Images

Long Island, New York

Albuquerque, New Mexico

New Orleans, Louisiana, and Lake Pontchartrain

Chesapeake Bay

Mount Rainier, Washington

Southwest corner of the Sonoran Desert
How do images help us learn about our planet Earth?

Investigation Overview
Students interpret a nighttime image of the world using the distribution of lights to identify broad patterns of world population. They use maps of landforms and climate to help explain these patterns.

Time required: One 45-minute session

Materials/Resources
Figure 1: Nighttime lights of the world (transparency and student copies)
Log: True or false?
Globe
1 apple (as round as possible, or if allowed, Terry’s Chocolate Orange)
Knife
Atlases (one per group of students)

Content Preview
The nighttime lights of the world illustrate the uneven distribution of the world’s population. In the image, light is evidence of large numbers of people; dark indicates the absence of people. Settlements are clustered near water and other resources needed for transportation and economic activities.

Classroom Procedures
Beginning the Investigation
1. Where Do People Live? Tell students that you will use an apple to help them see why people live where they do. Show an apple and tell them it represents Earth. Ask them to compare this shape to a globe and note that even the roundest apple is not a sphere, like a globe. An orange would be better but is difficult to cut into small slices. Note: If candy is allowable, use Terry’s Chocolate Orange which is precut into slices.

- Ask the students to look at a globe and guess on what portion of Earth people live: more than half or less than half?
- Quarter the apple; place three-quarters in one hand, one-quarter in the other.
- Explain that the three-quarters represents water. Nearly three-quarters of Earth’s surface is covered with water. No one can live there. Set these pieces aside.
- Hold up the fourth quarter. It represents land.

Geography Standards

Standard 1: The World in Spatial Terms
How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective
- Identify and describe the characteristics and purposes of geographic representations, tools, and technologies.

Standard 17: The Uses of Geography
How to apply geography to interpret the past
- Describe how the physical and human characteristics of places change over time.
Module 3 Educator’s Guide Investigation 3

- Ask the students to guess what portion of the land is too cold, too dry, too wet, or too mountainous for people to live on. (About half.) Slice the quarter apple lengthwise in half and set aside one of the slices.
- The remaining slice—an eighth of the apple—represents the area of Earth on which the human population lives.

**Developing the Investigation**

2. Next show students the transparency of the figure: Nighttime lights of the world. Ask them what the white “dots” might represent. Explain that they are the lights of towns and cities. Lights are evidence of large numbers of people; dark means few people. Note the clustering of people in certain parts of the world. In some places, there are so many people that large areas are lit up. Have the students take turns pointing out the continents and discuss whether each continent has a large or small population. Are these populations clustered in particular places? If so, where?

3. Place the students in small groups and give each group an atlas and a copy of the Log. Tell students to cut out the sentence strips. Next, they read the facts on the strips and determine which strips contain true facts about the nighttime lights and place them in one group. The other groups of strips contain information that is not true about the image. Tell students to look carefully at the image and discuss the information before making their decision. They may need to look up the locations in their atlases in order to find them on the image. Discuss their decisions when the groups have completed the activity.

**Concluding the Investigation**

4. Tell the students to look again at the figure: Nighttime lights of the world and to point to places where there are not many lights. Give each group an atlas, and assign each group a continent. Have them identify landforms and climate characteristics on their continents and speculate with the whole class whether those features would deter people from living there. On the board write the names of the continents and under each continent list the physical features in the unpopulated areas as students identify them.

- North America—mountains, forests, deserts, lakes
- South America—mountains, forests, desert
- Africa—desert, forests, mountains
- Europe—mountains, tundra
- Asia—mountains, desert, tundra, lakes (Be certain that the students understand the definition of desert and tundra.)

**Background**

The nighttime lights of the world dataset contains the first satellite-based global inventory of human settlements, derived from nighttime data from the Defense Meteorological Satellite Program (DMSP) and Operational Linescan System (OLS). The DMSP-OLS has the unique capability to observe faint sources of visible-near infrared emissions present at Earth’s surface, including cities, towns, villages, gas flares, and fires. Lights in the Gulf of Mexico are not people and cities. What you see are flares from the burn-off of offshore oil and natural gas fields. This can be explained to the students as appropriate.

**Evaluation**

*Log*

**True statements:**
- There are more lights east of the Mississippi River than west of it.
- There are very few lights in the Amazon Basin region of South America.
- Many lights can be seen on the continent of Europe.
- Most of the cities in Asia are along the coastlines.

**False statements:**
- Africa has many lights in the center of the continent.
- In the middle of Australia there are many big cities.

**Additional Resources**

**Geography from Space**—This free video resource guide contains background material and classroom activities related to the geography and geology of North and South America, Europe, Asia, Africa, and Australia as seen from the vantage point of orbit. The free videotape to accompany this guide may be ordered from NASA CORE at http://education.nasa.gov/.

Module 3, Investigation 3: Nighttime lights of the world

Circle the continents on this image.

**Module 3, Investigation 3: Log**

**True or false?**

Name____________________________________ Date____________________

**Directions:** Cut out each of the strips. Sort the strips into two groups: true statements about the nighttime lights image and false statements about the image. Look carefully at the image and discuss the information. Refer to your student atlas for help.

<table>
<thead>
<tr>
<th>Statement</th>
<th>True/False</th>
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<tbody>
<tr>
<td>Africa has many lights in the center of the continent.</td>
<td>True</td>
</tr>
<tr>
<td>There are more lights east of the Mississippi River than west of it.</td>
<td>True</td>
</tr>
<tr>
<td>There are very few lights in the Amazon Basin region of South America.</td>
<td>True</td>
</tr>
<tr>
<td>Many lights can be seen on the continent of Europe.</td>
<td>True</td>
</tr>
<tr>
<td>In the middle of Australia there are many big cities.</td>
<td>False</td>
</tr>
<tr>
<td>Most of the cities in Asia are along the coastlines.</td>
<td>True</td>
</tr>
</tbody>
</table>
Where are the cities?

Investigation Overview
Students compare an image showing nighttime lights in the United States with atlas maps in order to identify major cities and relate population distribution patterns to the physical environment. By locating cities and physical features identified in the nighttime image on an outline map, students become more familiar with important locations in the United States. They also use atlas maps and geographic information to identify NASA images of areas around several major cities.

Time required: Two 45-minute sessions

Materials/Resources
Atlas maps or U.S. wall maps showing landforms and vegetation
Outline map of the United States (copy for each student)
Figure 1: Nighttime lights of the continental United States (make an overhead transparency and one copy for each group of 3 students)
Log 1: Understanding the nighttime lights (one for each group of 3)
Log 2: Where are these cities?—Questions (one for each group of 3)
Log 3: Where are these cities?—Space Shuttle photographs (one for each group of 3)
Light blue crayon, red crayon

Content Preview
Population in the United States is unevenly distributed. Physical features such as mountains and deserts have discouraged settlement in some areas while features such as lakes, rivers, and coastlines make other locations more attractive to settlers. The United States is more densely populated in the East because of historical settlement patterns and physical geography.

Classroom Procedures
Beginning the Investigation
1. Distribute outline maps of the United States to each student and speculate with the students about where in the United States most people live. Ask them where they think the big cities are located.

2. Tell students that in earliest times people lived in rural areas and small communities. Explain how the growth of industry enabled some of these communities to grow into big cities. Explain that there were several reasons why sites developed into cities. Ask the students to think of reasons why specific places make good sites for cities. (Protected harbor, fresh water available, easy to reach, easy to defend, streams or river for water power and transportation, raw materials for industry, etc.)

Geography Standards

Standard 1: The World in Spatial Terms
How to use maps and other geographic representations, tools, and technologies to acquire, process, and report information from a spatial perspective
- Identify and describe the characteristics and purposes of geographic representations, tools, and technologies.

Standard 5: Places and Regions
That people create regions to interpret Earth’s complexity
- Predict the consequences of a specific physical process operating on Earth’s surface.
Developing the Investigation

3. Divide the class into groups of three. Give each group an atlas and a copy of Figure 1 and Log 1. Ask the students what they think the white areas represent. (*They are lights that have been identified by satellites. They show where large towns and cities are located.*) Use the information in the Background section for more details, as appropriate. Explain that larger areas of light mean larger cities. Ask the students to describe how the U.S. population is distributed. (*More people in the eastern half; most along the coastlines, etc.*) Tell students to try to find the location of their hometown on this map. Ask them if it is in a white area or a dark area.

4. Ask each group to use Figure 1, an outline map of the United States, and their atlases to answer the questions in Log 1. Have the whole class discuss the answers.

Concluding the Investigation

5. Where are these cities? Keep students in their groups and tell them that they will continue to use the atlas, the map, and Figure 1. Give each group a copy of Log 2 (Where are these cities?—Questions), and Log 3 (Where are these cities?—Space Shuttle photos). Write the names of the cities on the board: Boston, Massachusetts; Detroit, Michigan; Pittsburgh, Pennsylvania; San Francisco, California; Minneapolis, Minnesota; and Miami, Florida. Have students locate these cities in the atlas and follow the directions in Log 2, questions 1 and 2. Then explain that the clues in question 3 refer to the images in Log 3. Explain that these are Space Shuttle images that show the physical environments around each city. Ask the students to use the clues and their atlases to identify each city. After the students have identified the cities, discuss the physical features that might have contributed to making each city a good settlement site.

Evaluation

Answer Key

*Log 1: Understanding the Nighttime Lights

2. To the east
3. Minneapolis, St. Louis
5. Easy transportation on the lakes, water for people and industry
9. The lights come together
10. Chicago, Milwaukee

Log 3: Where are these cities?—Space Shuttle photographs

a. San Francisco, California
b. Boston, Massachusetts
c. Detroit, Michigan
d. Miami, Florida
e. Pittsburgh, Pennsylvania
f. Minneapolis, Minnesota

Background

On the nighttime lights of the continental United States image: light is evidence of towns and cities; dark means the absence of towns and cities. You will see great clusters of cities from Boston to New York, Philadelphia, Baltimore, and Washington. This is the original megalopolis. The nighttime lights of the world dataset contains the first satellite-based global inventory of human settlements, derived by nighttime data obtained by the Defense Meteorological Satellite Program (DMSP) and Operational Linescan System (OLS). The DMSP-OLS has the unique capability to observe faint sources of visible-near infrared emissions present at Earth’s surface, including cities, towns, villages, gas flares, and fires. Lights in the Gulf of Mexico are flares from the burn-off of oil and natural gas fields.

Resources

http://svs.gsfc.nasa.gov/imagewall/LandSat/boston.html Boston, Massachusetts
http://svs.gsfc.nasa.gov/imagewall/LandSat/detroit.html Detroit, Michigan
http://svs.gsfc.nasa.gov/imagewall/LandSat/pittsburgh.html Pittsburgh, Pennsylvania
http://svs.gsfc.nasa.gov/imagewall/LandSat/downtown_minneapolis.jpg Minneapolis, Minnesota
http://svs.gsfc.nasa.gov/imagewall/LandSat/san_françois.html San Francisco, California
http://svs.gsfc.nasa.gov/imagewall/LandSat/miami.html Miami, Florida
Module 3, Investigation 4: Figure 1
Nighttime lights of the continental United States

Module 3, Investigation 4: Log 1
Understanding the nighttime lights

1. Draw a blue line on the outline map where the Mississippi River is located. (Find the location in the atlas.)

2. Figure out where the Mississippi River is on the image and draw a blue line there, too. Are there more cities to the east or west of the Mississippi River?

3. Color the two brightest lights along the Mississippi River red. Use the atlas to find out which two cities you picked.

4. Make a small circle to show each city on the outline map and label them.

5. Color the Great Lakes blue on the outline map and label them. Use the atlas to find the big cities on each lake. Mark and label them on the map. Circle these cities in Figure 1. Why do you think cities developed along the Great Lakes?

6. Find the Rocky Mountains, the Appalachian Mountains, the Sierra Nevada Mountains, the Cascades Range, and the Coastal Ranges in the atlas. Label them on the outline map.

7. Find the desert areas of the west and southwest in the atlas. Mark and label them on the outline map.

8. Can you find the mountains and the dry areas in the nighttime image? Circle them with the blue crayon.

9. A megalopolis is a giant city. It occurs when individual cities grow so big that they merge together. Locate Boston, New York City, Philadelphia, Baltimore, and Washington, D.C., in the atlas. Mark and label them on the map and color them red on the image. What pattern do you see on the image?

10. Find another megalopolis on the image at the south end of Lake Michigan and color it red. Mark and label two cities in this megalopolis on the map.
Module 3, Investigation 4: Log 2
Where are these cities?—Questions

Name ___________________________ Date ______________

Geographers, scientists, and planners are just a few of the people who look at population and ask, “Where are people? Where are the cities?” Now it’s your turn to look at a map that shows us many cities and decide what makes some places good for large and dense settlements. To do this, complete the investigation below:

1. Images on Log 3 are of the following cities:
   - Boston, Massachusetts
   - Detroit, Michigan
   - Pittsburgh, Pennsylvania
   - San Francisco, California
   - Minneapolis, Minnesota
   - Miami, Florida

2. Locate these cities in the atlas. Then mark and label them on your outline map. Circle them on the nighttime image (Figure 1).

3. Look at the NASA images of these cities in Log 3 and see if you can identify them. Use the atlas and the clues below to help you match the cities and the images. Write the name of each city in the space next to the image.

   a. This city is on a bay on the Pacific Ocean.

   b. This city is in New England, on Massachusetts Bay.

   c. This city is on a river between Lake Huron and Lake Erie.

   d. This city is in the southeastern United States on the Atlantic Ocean.

   e. This city is located west of the Appalachian Mountains where the Ohio and Allegheny Rivers meet to form the Monongahela River.

   f. This city is the northernmost port on the Mississippi River.
Module 3, Investigation 4: Log 3
Where are these cities?—Space Shuttle photographs

a. 

b. 

c. 

d. 

e. 

f. 