



How does remote sensing help us to observe human activities on Earth?



Investigation Overview

Landscapes that are influenced by human activities are found nearly everywhere on Earth. In this investigation, students use remotely sensed images to identify features of New Orleans, Louisiana. Using two different remote sensing techniques, a Space Shuttle handheld camera photograph and a Space Shuttle radar image, students compare and contrast the features that can be seen on each image. They also discover the advantages of remote sensing and why it is a valuable tool for learning geography. Students identify the following features on each image: human systems, features created by humans to adapt to their environment; surrounding natural features that are a positive influence on human systems; and surrounding natural features that are a negative influence on human systems.

Time required: One or two 45-minute sessions

Materials/Resources

Briefing and Log (one copy of each per student)

Figures 1 and 2:

transparency copies of the images (one copy to project using an overhead projector), or

paper copies of the images (one copy per student or student group), or

computer projector to project the image from this CD for the entire class

Road map of New Orleans

Topographic map of New Orleans

Map of Louisiana (to locate New Orleans and surrounding features)

U.S. map (to locate New Orleans)

****Note:** A travel map of New Orleans will be needed for this investigation and may be obtained at a bookstore or travel agency. Many Internet sources offer travel maps electronically. A topographic map of New Orleans is also needed. One can be obtained from the U.S. Geological Survey (USGS) at <http://mapping.usgs.gov/mac/isb/pubs/booklets/usgsmaps/orleans.html>.

Content Preview

Various samples of NASA handheld photography and radar images are used to examine why people settle in locations that, along with providing access to resources, also impose the negative aspects associated with dangerous physical hazards. Remote sensing data aid in describing settlement patterns and their physical features.

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

- Develop and use different kinds of maps, globes, graphs, charts, databases, and models.

Standard 3: The World in Spatial Terms

How to analyze the spatial organization of people, places, and environments on Earth's surface

- Analyze and explain distributions of physical and human phenomena with respect to spatial patterns, arrangements, and associations.

Geography Skills

Skill Set 4: Analyzing Geographic Information

- Interpret information obtained from maps, aerial photographs, satellite-produced images and geographic information systems.
- Interpret and synthesize information obtained from a variety of sources—graphs, charts, tables, diagrams, texts, photographs, documents, and interviews.

Skill Set 5: Answering Geographic Questions

- Develop and present combinations of geographic information to answer geographic questions.
- Make generalizations and assess their validity.

Classroom Procedures

Beginning the Investigation

1. To begin the investigation, have students discuss the reasons why their town or city was founded and why they live in the town. Give advantages and disadvantages for the town's location.

Developing the Investigation

2. This investigation looks at one area of human settlement, New Orleans, Louisiana. The effects the population have on the surrounding area, as well as the effects the surrounding area may have on the population, will be investigated. This task will be achieved by observing the same area, in two different ways, using two unique space-based observation (remote sensing) methods: radar imagery and Space Shuttle handheld photography. Figure 1 was taken from the Space Shuttle (STS 74, November 1995) with a handheld 35 mm camera showing natural colors. Figure 2 was taken by the Space Shuttle (STS-68, October 1994) using the Spaceborne Imaging Radar-C/X Band Synthetic Aperture Radar (SIR-C/X-SAR). The color in Figure 2 has been computer enhanced (false color) to highlight certain characteristics of the image that may not be observed in true-color photos. Each remote-sensing method reveals different features, giving a more detailed view of the area. The investigation shows how these different views can be interpreted and how information is gathered.
3. Distribute copies of the student pages for this investigation (**Briefing, Log, Figure 1, Figure 2**) and have students complete the investigation using the images and instructions on the student pages. This can be done individually or in student groups.

Concluding the Investigation

4. Have students continue their discussions concerning past human choices for settlements and consider choices that may be required in the future. For example, the American pioneers of the 19th century risked their lives to move westward. Will future pioneers risk their lives to settle on other worlds?

Background

Humans choose certain areas to settle because they need resources or want to be near suitable physical features such as rivers, coastal areas, fertile plains, or

areas with adequate rainfall. These valuable resources and suitable features will often outweigh the dangers of hazards caused by physical processes. For example, Los Angeles lies on an active fault system, and earthquakes are a common occurrence, yet it is one of the most populated areas of the world.

Earth may be observed in many different ways including from space using space-based instruments such as satellites. Data are gathered by the satellite and transmitted back to Earth. This is a form of remote sensing. The data are then organized and manipulated to obtain information needed by researchers. Astronauts also take handheld photographs of Earth's surface. These photographs are often breathtaking and offer a new perspective of our home planet. Scientists, engineers, farmers, geographers, geologists, and educators use many different views of the same area in order to get more detailed data to aid in their research.

Evaluation

Log

1.
 - A. Gulf of Mexico, Lake Pontchartrain, Mississippi River
 - B. Yes
 - C. Mississippi River
 - D. Answers will vary, 500,000-999,000; yes
 - E. Answers will vary but may include Mississippi River, Gulf of Mexico, Wetlands, Lake Pontchartrain.
 - F. Hurricanes and flooding pose a threat.
2.

White/gray: buildings, streets
 Light brown/tan: areas of little or no vegetation; river, sediment in water
 Dark brown: vegetation clearings
 Dark blue/black: water
 Light blue: N/A
 Green: vegetation, low-lying areas, wetlands
3.

White/gray: dense population, buildings, concrete
 Light brown/tan: N/A
 Dark brown: N/A
 Dark blue/black: water
 Light blue: shallow water, sediments in water
 Green: vegetation, wetlands
 Purple: less dense population, suburban areas

- 4.
- A. Urban and suburban areas, more definitions between populated areas and vegetation areas. Other answers may vary.
 - B. Answers will vary, but students may identify more vegetation and natural colors.
 - C. Center of images (downtown, inner-city area)
 - D. Along the Mississippi River. Figure 2 shows definite boundaries between populated areas and dense vegetation areas.
 - E. Mississippi River, Lake Pontchartrain Causeway
 - F. Lake Pontchartrain Causeway
 - G. The Mississippi River is one example. It affects transportation and trade.
 - H. All the water systems surrounding the city have strong potential for flooding.
 - I. Yes
 - J. Flooding in low-lying areas, hurricanes
 - K. Answers will vary.

Resources

NASA Spacelink

<http://spacelink.nasa.gov/>

SIR-C/X-SAR images

<http://southport.jpl.nasa.gov/>

Spaceborne Imaging Radar—Seeing Earth in a New Way CD (SIRCED03)

NASA *Exploring Earth from Space* Lithograph Set and Instructional Materials (LS-1999-05-001-HQ)

NASA *Our Mission to Planet Earth* Educator's Guide (EP-1997-12-292-HQ)



Module 2, Investigation 2: Briefing

How does remote sensing help us observe human activities?

Background

What physical evidence of our presence do we create on Earth's surface? How is this evidence detected from space? Observing Earth from space helps us to understand better the forces that shape the planet. Many times humans choose areas to settle because of needed resources or suitable physical features such as locating near water or in a favorable climate. These valuable resources and suitable features outweigh the fact that an area may be dangerous because of one or more physical processes. For example, Los Angeles lies on an active fault system, yet it is a densely populated area.

In Part A of this investigation, we will look at one specific area of human settlement, New Orleans, Louisiana, and the effects of the population on the surrounding area. We will also look at the effects of the surrounding area on the population. This will be achieved by observing the same area using two different space-based observing methods: Space Shuttle handheld photography and radar imagery. Each space-based method will show different features to give a more detailed view of the area. Scientists, engineers, farmers, geographers, geologists, and educators use many different views of one area to get a better overall picture of a location. This investigation shows how these different views may be interpreted and how information is gathered. NASA uses these space-based observations to study and better understand the forces that shape Earth.

Objectives

Upon completion of this investigation, you will

- understand different ways a region of Earth may be observed from space,
- understand how space-based images are interpreted, and
- interpret space-based images to gather information about the observed area.



Module 2, Investigation 2: Log

How does remote sensing help us observe human activities?

Procedures

1. On a U.S. map, locate the city of New Orleans, Louisiana, and answer the following questions:

A. Near what major body of water is New Orleans located? _____

B. Are there major highways passing through New Orleans? _____

C. What major waterway passes through New Orleans? _____

D. Using the map legend, what is the approximate population of New Orleans? Is it the most populated city in the state?

E. From the map, identify some of the physical features surrounding New Orleans. Do any of these pose hazards to the population?

F. What natural hazards do you speculate may affect New Orleans and its population?

2. Each of the following images were taken from space. Figure 1 was taken from the Space Shuttle with a handheld 35 mm camera and shows natural colors. Observing Figure 1, what do the following true colors show? Use a travel map and a topographic map of the area, supplied by your teacher, to help answer the question.

White/gray: _____ Dark blue/black: _____

Light brown/tan: _____ Light blue: _____

Dark brown: _____ Green: _____

3. Figure 2 was taken by the Space Shuttle using the Spaceborne Imaging Radar-C/X Band Synthetic Aperture Radar (SIR-C/X-SAR). The color in Figure 2 has been computer enhanced (it is false color) to highlight certain characteristics of the image that may not be observed in true-color photos. Observing Figure 2, what do the following false colors show? Use the knowledge you gained in question 2, a travel map, and a topographic map of the area to help answer this question.

White/gray: _____ Light blue: _____

Light brown/tan: _____ Green: _____

Dark brown: _____ Purple: _____

Dark blue/black: _____



Module 2, Investigation 2: Log

How does remote sensing help us observe human activities?

4. Using both Figures 1 and 2, answer the following questions:

- A. Identify some details that were observed in the false-color image that were not observed in the true-color image.

- B. Identify some details that were observed in the true-color image that were not observed in the false-color image.

- C. Locate and identify the areas that show the highest densities of human population.

- D. Identify areas that appear to have been influenced or changed by humans.

- E. Identify any naturally formed features.

- F. Identify any features that appear to be human made.

- G. Are there any natural systems that appear to have a positive effect on the population? If so, identify them. _____

- H. Are there any natural systems that appear to have a negative effect on the population? If so, identify them. _____

- I. Using a topographic map of the area, locate the low-lying areas. Are they areas of high population? _____

- J. What problems might be faced by the people living in these areas?

- K. Based on what you know of New Orleans, would you live here? Why or why not?



Module 2, Investigation 2: Figure 1

New Orleans, Louisiana





Module 2, Investigation 2: Figure 2

New Orleans, Louisiana

