

Kids as Airborne Mission Scientists

Lesson plan overview: What is remote sensing?

<u>FRAME</u>	<u>INFORM</u>	<u>EXPLORE</u>	<u>TRY</u>	<u>SUPPORT</u>
Students are divided into teams to draw a sensory map of a prepared surface with different elevations and temperatures.	Students are prompted to relate the sensory map activity to the remote sensing fundamentals.	Students work in teams to review a remote sensing tutorial and compare the major elements and processes of remote sensing to the sensory activity.	Students develop a model of how remote sensing will be used to identify where the coral reefs are in Kailua Bay.	Support materials for the teacher including ideas to promote student reflection, sample answers to activities, and extension ideas.

Lesson context: This lesson prompts students to develop background knowledge of remote sensing. During this lesson, students participate in the sensory map activity where they experience remote sensing, relate the sensory map activity to the remote sensing fundamentals, and apply their understanding of remote sensing to the Kailua Bay coral reef mission. Based on new understanding of remote sensing, students will investigate how remote sensing works and how it can be used for the mission in the next lessons.

Key science concepts:

- Basic elements and processes of remote sensing

Links to teacher resources:

- [Explanation of Remote Sensing Process](http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/fundam_e.html) (http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/fundam_e.html)

Problems addressed in this lesson:

- To determine specifically how remote sensing can help investigate coral reefs in Kailua Bay

Activity bursts:

- [The sensory map activity](#)
- [Identifying the elements of remote sensing](#)

Links to other resources:

Lesson	<u>Teacher</u>	<u>Student</u>
EXPLORE	What is remote sensing? (RS tutorial) http://imagers.gsfc.nasa.gov/adventure/rs_lesson.html	What is remote sensing? (RS tutorial) http://imagers.gsfc.nasa.gov/adventure/rs_lesson.html
	Explanation of remote sensing http://observe.arc.nasa.gov/nasa/education/gis/gis11.html	Explanation of remote sensing http://observe.arc.nasa.gov/NASA/education/GIs/gis11.html
	Explanation of Remote Sensing Process http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/chapter1/chapter1_1_e.html	Explanation of Remote Sensing Process http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/chapter1/chapter1_1_e.html

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What is Remote Sensing?

Related subject area: science

Overall problem: Which restrictions (if any) should be applied to tourism, recreational, or commercial activities to ensure the lasting protection of the coral reefs of Kailua Bay?

Relationship of problem in this lesson to overall problem: At this point, students have developed a cursory understanding of what remote sensing is, e.g., the acquisition of information about an object, without being in physical contact with that object. However, to investigate the overall problem, students need to develop a deeper understanding of how remote sensing works and how it is used to study the earth. The problem in this lesson is to develop a more precise definition of remote sensing and determine specifically how remote sensing can help investigate coral reefs in Kailua Bay.

Estimated time required: Three class periods.

Student outcomes/objectives:

- Students will be able to describe the basic elements and the process of remote sensing.

Prerequisite skills or knowledge:

- Ability to work in teams
- Basic understanding of problem solving
- Basic reading skills
- Basic presentation preparation skills

Teacher preparation:

- Print Student Journal / Activity sheets for these activities.
- Secure internet computers and projection equipment.
- Gather enough red, pink, dark blue, and light blue pencils, markers, or crayons for students to use during the mapping activities.
- Bookmark student website on student computers (if not available, print and copy necessary websites).

Student reflection and assessment: [Student reflection activities](#) | [Assessment](#)

Education standards supported by this lesson:

[National Science Education Standards](#) | [Project 2061 Benchmarks](#)

[National Standards for School Mathematics](#) | [National Technology Standards](#) | [National Geography Standards](#)

Cross-curricular connections to support National Education Standards for this lesson:

[math](#) | [technology](#) | [geography](#)

Teacher activities	Student activities
<p>FRAME the lesson by having students experience remote sensing while drawing a sensory map of a prepared surface with different elevations and temperatures.</p> <p>Teacher preparation immediately prior to class:</p> <ul style="list-style-type: none"> • Freeze water in several different size bowls. • Secure a few heating pads, heating pillows, or some other devices that will hold heat such as bags of potatoes or beans, heat in a microwave or some other means just prior to the activity. • Place the two or three of each of the hot and cold items in different locations on a table top space that is approximately 2 feet by 2 feet. • Place a light cloth, with grids painted on it, over the objects. <p>Teacher note: You may want to set up several of these areas depending on the size of your class. This activity should proceed quickly so that the hot and cold zones do not</p>	<p>Student activities:</p> <ul style="list-style-type: none"> • Students draw the topographical map of the prepared tabletop area on Activity sheet: Sensory map (RS-1).

<p>equilibrate or dissipate before the students have a chance to sense them.</p> <p>Separate students into teams of two and provide them with work sheets with grids like the cloth.</p> <p>Direct students, without any explanations, to do the following activity, using Activity sheet: Sensory map (RS-1).</p> <ul style="list-style-type: none"> • Draw a topographic map of what they see on the tabletop, showing the differences in elevation evident on the table area. <p>Direct one student from each team to take turns slowly moving their hand closely over the top (not touching) of the area explaining what they feel (sense: hot and cold) while their teammate draws indications of the differences in temperature on their visible map.</p>	<ul style="list-style-type: none"> • Students indicate differences in temperature zones on their maps on Activity sheet: Sensory map (RS-1).
<p>Teacher activities</p>	<p>Student activities</p>
<p>INFORM students of the relationship between the sensory map activity and remote sensing fundamentals. Students will begin to develop an understanding of remote sensing by relating the sensing map activity to remote sensing fundamentals – process and elements.</p> <p>Prompt students to relate the sensing activity they just completed to the process of remote sensing.</p> <ul style="list-style-type: none"> • What did you see in the area? • Based on your sensing activity, what did the area look like? • How were you able to draw a map of the differences in temperature? • What process did you have to go through to develop this sensory 	<p>Sample student responses:</p> <ul style="list-style-type: none"> • A 2 ft. by 2 ft. area with high and low points, the location of the high and low points. • Different parts of the area were either hot, warm, cool, or cold, and the location of temperature boundaries. • Moving my hand over the area, I could feel (prompt for "sense") changes in temperature and I gave that information to my teammate who indicated the changes on the map. • First we drew a picture of what we

<p>map?</p> <p>Prompt students to think about the necessity of airborne remote sensing.</p> <p>Ask:</p> <ul style="list-style-type: none"> • If the hot and cold regions were really big, how can you sense those areas? • If your sensing areas are inaccessible such as coral reefs under the sea or are in dangerous locations like an erupting volcano, how can you sense those areas? • What types of instruments are needed to sense places like these? <p>Inform students that the activity they just completed is representative of how remote sensing instruments work. Now that they have seen an example of remote sensing, they will further explore each of the elements of remote sensing and how they work together to provide scientists with the data they need to study the earth. Your goal is to develop a detailed drawing and description of how remote sensing works.</p>	<p>saw, then we gathered temperature information by waving our hands over the area (not touching it), and transferred that information onto our map.</p> <p>Sample student responses:</p> <ul style="list-style-type: none"> • Sense large areas from the air or space. • Airborne and space-borne remote sensing instruments could be used to sense large, inaccessible, or dangerous areas.
Teacher activities	Student activities
<p>EXPLORE the elements and process of remote sensing. In this activity, students will develop a scientific description of the remote sensing process using the sensory activity completed previously as a reference. This level of understanding will help them learn the correct terminology for discussing remote sensing.</p> <p>Direct students to explore the following website. The goal of this activity is to relate</p>	<p>Student activities:</p> <ul style="list-style-type: none"> • Students will explore the website: What is remote sensing? • Students compare the processes and

<p>the previous sensory activity to the processes and the elements of remote sensing.</p> <ul style="list-style-type: none"> • What is remote sensing? <p>Divide students into several groups and provide the following instructions:</p> <ul style="list-style-type: none"> • In teams, students review the tutorial on the website and further explanation of remote sensing. • In teams, students review the following explanation (http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/chapter1/chapter1_1_e.html) of remote sensing • In teams, students identify the relationship between the sensory activity and remote sensing tutorials and complete the Activity Sheet: Defining the Elements (RS-2) and draw a picture of the remote sensing on Activity sheet: Remote sensing process cycle (RS-3). 	<p>elements of remote sensing to the sensory activity previously completed.</p> <ul style="list-style-type: none"> • In teams, students review the tutorial on the website and further explanation of remote sensing. • In teams, students review the following explanation of remote sensing and • In teams, students identify the relationship between the sensory activity and remote sensing tutorials and complete the Activity Sheet: Defining the Elements (RS-2) and draw a picture of the remote sensing on Activity sheet: Remote sensing process cycle (RS-3).
Teacher activities	Student activities
<p>TRY using new knowledge to apply to new understanding of remote sensing to the Kailua Bay coral reef mission.</p> <p>Ask how do you think we can use remote sensing to evaluate the state of Kailua’s coral reef.</p> <ul style="list-style-type: none"> • Prompt for element and process responses, such as to sense the reflected light from coral reefs using airborne remote sensing instruments. <p>Prompt students to think about what they just learned about remote sensing and develop a model of how remote sensing will</p>	<p>Student activities:</p> <ul style="list-style-type: none"> • Students complete Activity sheet: Applying your understanding (RS-

be used to evaluate the state of Kailua's coral reef. They should draw and label the picture of the remote sensing process and respond to the questions on the [Activity sheet: Applying your understanding \(RS-4\)](#).

Discuss student maps and responses to questions.

Remind students to complete the **Activity sheet: Reflection page (RS-5)** in their student journal for this lesson.

Discuss next lesson:

- We just learned the about the basic elements and processes of remote sensing.

Ask:

- What questions do you still have about remote sensing?

Summarize lesson by stating that these questions are what we will investigate in the next lesson.

[4](#)) in their student journal.

- Students complete the **Activity sheet: Reflection page (RS-5)** in their student journal for this lesson.

Sample responses:

- How does remote sensing actually work?
- What needs to be considered when planning a remote sensing mission?
- How high should the aircraft be when collecting data?

What angle should the instruments be looking at the target?

- Remote sensing instruments collect energy that is emitted or reflected by targets.

Student reflection activities:

- Prompt students to relate their understanding of remote sensing to the coral reef mission.
- Prompt students to record the questions they have, the information they think they know, and ideas for additional investigation of the problem in their reflective journal.

Assessment:

- Students define remote sensing.
- Students identify the key components and processes of remote sensing, including:
 - Energy source
 - Propagation upward of EM energy
 - Recording of energy by the sensor
 - Receiving and processing station
 - Procession, interpretation, and analysis
- Students demonstrate their understanding of how the basic concepts of remote sensing relate to the coral reef mission.

Ideas for math lesson connections:

- Students draw maps to scale of the 2 ft. by 2 ft. surface area.
- Students calculate the area and perimeter of the hot and cold regions on their sensory map.

Related National Education Math Standards:

- [numbers and operations](#)
- [geometry](#)
- [measurement](#)
- [representation](#)

Ideas for geography lesson connections:

- Students research, list, and describe the numerous ways in which remote sensing is used to study the earth.
- Students learn how to Geographic Information Systems (GIS) are used to study the earth. Free GIS software and support is available for download from the Environmental Systems research Institute ([ESRI](#)).

Related National Education Geography Standards:

- [The World in Spatial Terms](#) (#1)
- [The World in Spatial Terms](#) (#3)

Ideas for technology lesson connections:

- Students research active versus passive remote sensing and compare the two processes.

Related National Education Science Technology Standards:

- [Nature of Technology](#) (#2) The Core Concepts of Technology

Activity Sheet: Defining the Elements (RS-2) - answer key

1. Definition - What is remote sensing? (In your own words)

- Remote sensing is the science (and to some extent, art) of acquiring information about the earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information (Reference-
- http://www.ccrs.nrcan.gc.ca/ccrs/learn/tutorials/fundam/chapter1/chapter1_1_e.html

• 2. Elements - What are the main elements of remote sensing?

	Element in the tabletop mapping activity	This element in the tabletop area is similar to what element in the remote sensing website?	This element represents what part of the remote sensing process?
Part of remote sensing	Hot and cold items under the surface	Objects on earth's surface	Energy source
	Temperatures emitted from hot and cold items	Emitted energy	Propagation upward of EM energy
	Hand waving over the surface area	Satellite, sensor on board	Recording of energy by the sensor
	Students describing what they are feeling while waving their hands over the surface area	Antenna	Receiving and processing station
	Topographical and sensory map of area	Computer	Processing, interpretation and analysis

Activity Sheet: Remote Sensing Process Cycle (RS-3) - answer key

Draw and label a picture of how remote sensing works. Be sure to include energy sources, targets, remote sensing instruments, transmission of data, interpretation of data, and application of data (final version).

Activity Sheet: Applying Your Understanding (RS-4) - answer key

Apply your understanding of remote sensing to the Kailua Bay coral reef mission.*

1. What might be sensed from the Kailua Bay to evaluate the state of coral reefs?
 - Visible light
2. What are the possible energy sources on a **Kailua Bay coral reef** mission?
 - Visible light reflected from the coral reefs.
 - Near-infrared light reflected from the coral reefs
3. Where will the remote sensing instruments be sensing from during the investigation of Kailua Bay?
 - NASA aircraft
4. What might the final data look like?
 - Airborne images of Kailua Bay showing the coastal environment features and locations of coral, sand, rocks, etc. in different colors. The images will show characteristics that we may not be able to see with our eyes.
5. Draw and label a picture of the remote sensing process for studying Kailua Bay. Be sure to include the energy sources, remote sensing instruments, the transmission of data, and data processing.
 - The student picture should have an indication of an aircraft over Kailua Bay, energy sources including the sun transmission of sensory information from the coastal environment to the aircraft (remote sensing instrumentation), data analysis stations, and some indication of the data in a final form.

* **Teacher note:** The above answers are a few of the possible student responses. It is recommended that you review the following websites:

<http://www.pgd.hawaii.edu/~scott/rsens1.htm>