Monitoring the earth

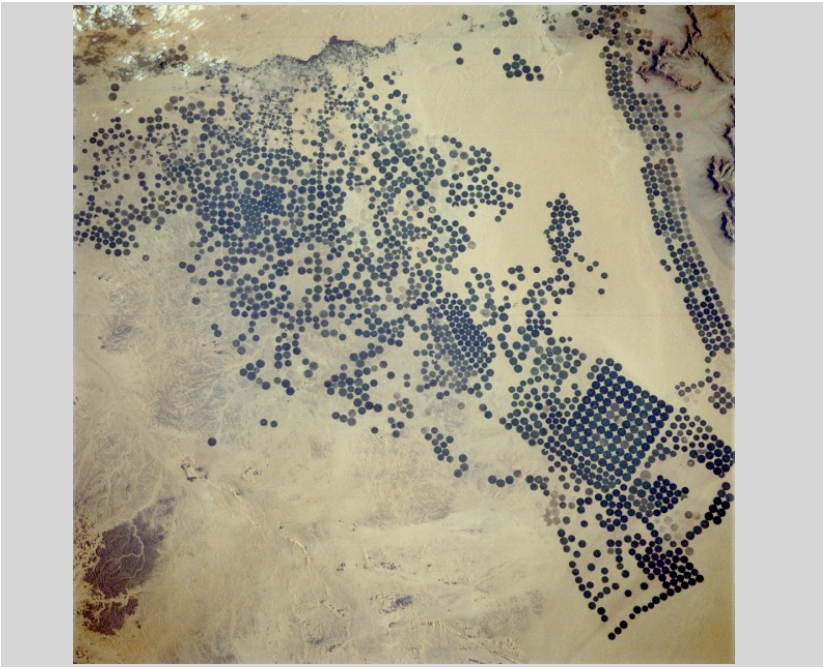
Name _____ Date_____

Technology has provided a way to monitor and "see" the ever-changing and often remote corners of the Earth. Satellite imagery, ocean buoys, and thermal imaging are all used to collect and transmit information about the planet. This method of real-time and archived data/information collection is called **remote sensing**.

Satellite imagery and computerized spectral radiometric buoys are two types of remote sensing devices. Satellite images reveal the type of soil, cultural centers (towns, roads, buildings), location of water, and type of vegetation that cover the earth's land masses. Oceanic electronic buoys transmit vital information about currents, air pressure, wave height, and water temperature. Scientists, city planners, ocean liners, even fisherman, have easy access to the electronic information from these remote sensors. To actually verify the information by physically visiting the area – a process known as **ground truthing** – would be much more difficult.

Remote sensing: Changes in the land

The arid landscape of Saudi Arabia is scattered with wheat fields irrigated with center-pivot irrigation systems.



http://earth.jsc.nasa.gov/sseop/EFS/photoinfo.pl?PHOTO=STS032-96-32

1. Why would the Saudi farmers go to such extremes to farm the arid soils in their region?

2. Where are they getting the water for the irrigation system?

3. How does this satellite image offer valuable information to the following professionals?
   Saudi city planners _____

   Military personnel _____

   Food and health care workers _____

Mount St. Helens

Mount St. Helens changed abruptly after it erupted in 1980. Pumice and ash covered a large area of the landscape even after 10 years. In 1999, vegetation began to reclaim the area and the land.

http://landsat.gsfc.nasa.gov/images/archive/f0002.html

4. How can scientists use these satellite images to map the change in the Mount St. Helens landscape over time?

5. How can satellite images like these be used to help after natural disasters, like volcanic eruptions?

6. Over time, developers will again begin to use the area around Mount St. Helens for homes and businesses. How can time-archived satellite images be useful?

Remote sensing using ocean buoys

There are over 100 electronic ocean buoy stations, which provide data about surface temperature, winds, wave height, water temperature, and air temperature over the ocean and seas. Look at the following data provided by an electronic buoy anchored at sea off the coast of North Carolina.

Station 41049
NDBC
Location: 27.500N 63W
Conditions as of:
Tue, 7 Jul 2009 20:50:00 UTC
Winds: S (190°) at 9.7 kt gusting to 11.7 kt
Significant Wave Height: 3.3 ft
Dominant Wave Period: 9 sec
Atmospheric Pressure: 30.07 in and falling
Air Temperature: 81.7 F
Dew Point: 75.6 F
Water Temperature: 82.0 F

http://www.ndbc.noaa.gov/obs.shtml (provided by the National Data Buoy Center)

Why would a fishing vessel operator be interested in wave height and water temperature?

How would someone ground truth the actual data sent by this buoy?

A meteorologist may watch this buoy for a drastic increase in wave height, wind speed, and a sudden drop in water temperature? Why?

Monitoring the earth: Answer key

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Remote sensing: Changes in the land

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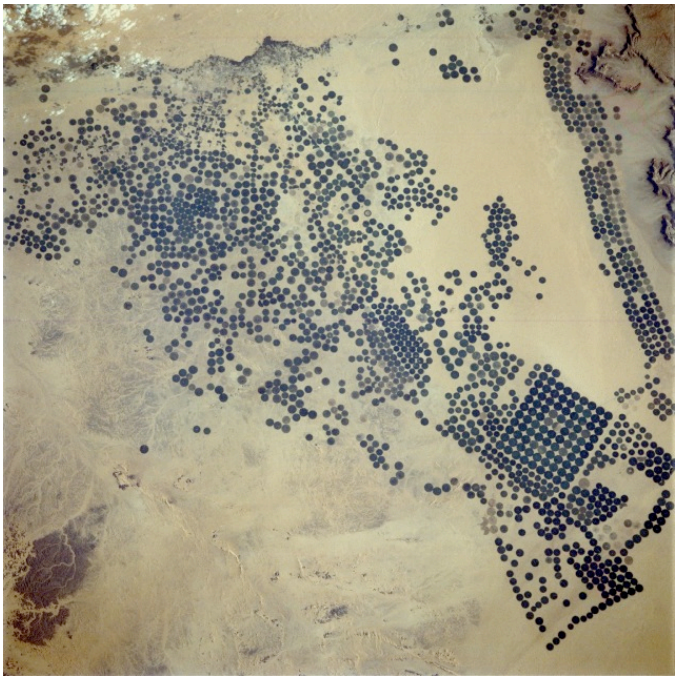

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1. Why would the Saudi farmers go to such extremes to farm the arid soils in their region?
   The farmers are planting wheat to provide food for the growing populations.

2. Where are they getting the water for the irrigation system?
   Underground aquifers

3. How does this satellite image offer valuable information to the following professionals?

Saudi city planners use satellite images to remotely monitor urban sprawl and planned expansion of cities and villages in the area. Images of active farming would be enormously important to their management of natural resources in the region – especially water use in this arid environment.

Military personnel use satellite images to provide land and air protection from foreign invasion. This image would allow military surveillance of land use.

Food and health care workers could use this image to monitor food production and to survey population growth.

Mount St. Helens

Mount St. Helens changed abruptly after it erupted in 1980. Pumice and ash covered a large area of the landscape even after 10 years. In 1999, vegetation began to reclaim the area and the land.

http://landsat.gsfc.nasa.gov/images/archive/f0002.html

4. How can scientists use these satellite images to map the change in the Mount St. Helens landscape over time?

Satellite images like these can be monitored to detect bulges in the mountain slopes, which can indicate that an eruption will happen. (During the 1980 eruption, the entire North Slope exploded, sending molten rock, ash, and gas over the surrounding area.) Satellite images can also give status of reclamation of the area. The ash and pumice, which appear white in the images, will gradually be replaced by green vegetation.

5. How can satellite images like these be used to help after natural disasters, like volcanic eruptions?

Satellite images enable scientists and emergency workers to more effectively target areas that have been affected by a natural disaster. The perspective offered by the images allows them to make informed decisions about how to allocate personnel, equipment, and health services.

6. Over time, developers will again begin to use the area around Mount St. Helens for homes and businesses. How can time-archived satellite images be useful?

Images showing the areas affected by previous eruptions can help developers predict safe areas for building in the future.

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Why would a fishing vessel operator be interested in wave height and water temperature?

To determine if conditions are favorable for launching a boat into the water.

How would someone ground truth the data sent by this buoy?

Ground truthing the data sent by this buoy would require actually navigating to the buoy in the ocean.

A meteorologist may watch this buoy for a drastic increase in wave height, wind speed, and a sudden drop in water temperature? Why?

Such sudden changes may indicate a hurricane or other storm moving into the area.