The Brooker Creek Watershed Interactive Database

Information in this packet is taken from a website developed by Conrod Associates for the Pinellas County Board of County Commissioners.

Lesson Objectives: Students will be able to do the following:

- Name three water quality parameters that are being measured at Brooker Creek
- Compare traditional meteorological instruments to those used at Brooker Creek
- Explain how to set up a database

Key concepts: spectrometric instruments, electronic sensors, telemetry, "real-time" data, databases

Parameters and Sensors at Brooker Creek

As we discussed in the first program, Brooker Creek provides an opportunity to study a **watershed** and its impact on water quality without leaving your office or classroom. In order to do this, scientists placed **sensors** in three areas of Brooker Creek: one upstream, one midstream, and one downstream. These sensors collect a variety of data relating to the chemical and physical aspects of the water that flows through Brooker Creek. Scientists also set up **web cams** to take pictures of the area and supply additional information.

The chemical parameters of the water include such characteristics as **pH** and **dissolved oxygen** levels. In the past we have measured these characteristics using chemical test kits. The researchers at Brooker Creek Preserve measure these parameters using light sensitive sensors that are only a few inches long. These spectrometric instruments measure the energy levels associated with various light wavelengths. (For additional information on **spectrometry** and light wavelengths, see the Project Oceanography Spring 1999 packet for Ocean Technology and the Fall 2000 packet for Sounds of the Sea Lesson 1.)

The physical parameters measured include the surface water level, **precipitation**, and related **meteorological** parameters such as wind speed, **barometric pressure**, and temperature. The **surficial water level** is the depth of the water

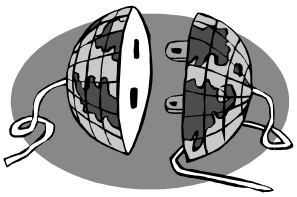
in the creek. Scientists use a sensor based on the **acoustic** properties of the water. It works much like **echolocation** in that the instrument measures the time it takes a sound to travel the distance from the water's surface to the bottom of the creek bed. The device used to measure precipitation is a simple tube attached to an electronic sensor. The sensor is activated in response to the water level in the tube. It then measures the capacity of the tube and flushes the system after the measurement has been recorded. Sensors attached to towers measure the atmospheric parameters. The mechanical parts of these instruments are similar to traditional ones except they are connected to electronic mechanisms that measure and record the information and send it to a computer system.

The use of electronic sensors and modern **telemetry** allows the data to be immediately relayed to a computer system and sent all over the world via the Internet. The sensor readings are constantly changing as chemical and physical properties change. This automated system allows scientists to keep track of the changes as they occur. This is called **"real-time"** data collection.

Real-time data collection is important to researchers, because it allows them to make predictions based on comparisons of measurements over time. For instance, if you took your body temperature every day for a month, you would find small changes from day to day, but your measurements would be within the "normal" range of about 98.6°. If there were a big and sudden change, you would know that something was wrong. Perhaps you have the flu! If scientists took measurements every hour, for a month they could also pinpoint times of abnormal readings that may help them to determine environmental problems.

Introduction to Databases

The information collected from the instruments installed at Brooker Creek watershed provide an ongoing **database** that is designed for easy information retrieval and modification as needed. This system allows for flexibility with regard to use and topic. For instance, characteristics can be compared at different locations at one time or one characteristic can be studied over time at a single site. In addition, **data** is archived so it can be used for comparisons at a later date.

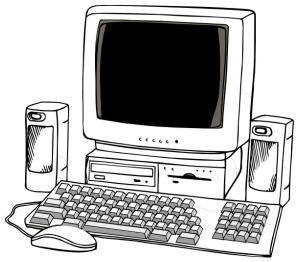


By using "real-time" data, students learn to manage information containing temporal and spatial components. They begin to

understand that this data provides a picture of what is happening in the environment, and that individual components are merely indicators of a more complex system. This can then lead to higher level critical thinking involving such topics as the interrelatedness of biotic and abiotic factors, cause and effect relationships, and the place of ecosystem components in the overall picture.

Students become involved in real world science by using the EDL "real-time'" Internet program. They have the opportunity to understand the importance of sound scientific practice and how it relates to everyday life. Hopefully this will move students to incorporate behavior changes that would lead to stewardship and activism.

Brooker Creek Data Graphing



The Internet allows easy access to the latest information. By using the real-time data available on the EDL website, students have the opportunity to understand the scientific process involved in data collection and usage. Students are able to apply math and science principles to real world situations.

Objectives: Students will be able to do the following:
1. Collect data from the EDL website.
2. Create graphs using the data.
3. Compare data.

Materials:
- Internet access to the EDL website sponsored by the Pinellas County Board of County Commissioners (Please watch the Project Oceanography programs to obtain the website address.)
- Graph paper
- Paper and pencil
- Colored Pencils

Procedure:
1. Explain to students that they will be graphing data from the EDL website.
2. Have students access the website and locate the appropriate data.
3. Have students make a table to record the upstream temperature of Brooker Creek over a given time period.
4. Have students use this information to create a line graph. Discuss the significance of this data.
5. Have students create a table including the pH levels of Brooker Creek at all three sites over a given time period.
6. Have students create a graph using lines to represent data at each of the three sites. Have students compare and discuss the results.
7. Have students create a graph showing the correlation between water temperature and dissolved oxygen level in midstream over a given period of time. Have students discuss the results.
8. Have students answer the following questions:
   Can data be depicted in other ways?
   Are bar graphs appropriate for comparing this data?
   What can you infer from the data collected?

Possible Extensions:
1. Have students decide if a pictograph could be drawn to represent water level.

2. Have students create graphs using spreadsheet files.
3. Have students compare other parameters such as water temperature vs. air temperature. Discuss the validity of the results and the limiting factors.
4. Have students formulate questions concerning the data.

Student Information: Brooker Creek Science

Scientists are using the latest technology to gather information about the chemical and physical characteristics of Brooker Creek. They have placed “web cams” at the site that take pictures of the area, so people can see what is happening in the preserve. They have also placed tiny electronic instruments in the Brooker Creek watershed to record information that reflects water quality. Some of these tiny sensors react to light to determine such water characteristics as pH and dissolved oxygen. Other sensors react to sound to record such things as water level. This data is then instantly fed from the sensors into a computer system without the use of wires and can be broadcast all over the globe via the Internet as it is being collected.

Personnel at Brooker Creek are gathering data in “real-time” or as it is registered on the equipment. By taking measurements at short intervals over long periods of time, scientists can determine the health of the ecosystem. Using this information, they may also learn how specific activities affect water quality. In addition, researchers could determine patterns for making predictions about the system they are studying. For instance, riding your all terrain vehicle may destroy plants that would slow water runoff and prevent flooding. Since this water is now passing more quickly through the system, it may not be cleaned of pollutants before it reaches the bay. This could cause fish kills.

Today with the latest technology, you can become a real world scientist. By logging on to the EDL website, you can see what is happening at Brooker Creek right now. The information you find can help you make comparisons between the water characteristics and predict some trends for the water quality in the watershed.

Brooker Creek Vocabulary

Acoustic-referring to sound

Aquifer-an underground water system made of porous rock and sand

Barometric pressure-force per unit area produced by a column of atmosphere

Channelization-to form streambeds that water will follow

Controlled Burn-land management technique using fire to restore a natural area

Data-factual information used for analysis

Database-a collection of information arranged for ease of search and retrieval

Dissolved oxygen-the amount of free oxygen found in water

Echolocation-a method of locating objects by determining the time for an echo to return and the direction from which it returns, as by radar or sonar

Ecosystem-a community of living organisms

Exotic-not native; introduced from abroad; foreign

Fiber-optic cable-transparent fibers through which light passes to transmit data, voices, or images

Habitat-area or environment in which an organism normally lives or occurs

Meteorological-pertaining to the atmosphere, especially the weather

Nutrient-a source of food

pH-a measure that indicates the relative acidity or alkalinity of a substance. pH ranges from 1 (most acidic) to 14(most basic), where a pH of 7 is neutral

Pollutant-harmful waste material

Precipitation-all the forms of water deposited on the earth from the atmosphere. They include rain, snow, frost, hail, dew, etc.

Real-time-term used to describe data collection as it happens

Sensor-a device that receives and responds to a signal

Spectrometer-an instrument used to measure energy at specific wavelengths

Spectrometry-optical measurement of the energy of specific wavelengths to study the interaction of light with matter

Surficial water level-water depth, measured from the surface to the creek bed

Telemetry- transmission of data by wire, radio, or other means from remote sources, as from space vehicles, to receiving stations for recording and analysis

Watershed-an area of land over which water flows to reach a common body of water such as a lake or pond

Web Cam-camera that sends pictures to the Internet

Brooker Creek References

Institute for Environmental Studies at the University of South Florida. Brooker Creek Preserve Management Plan. Prepared for the Pinellas County Dept. of Environmental Management. 1 Dec. 1993.

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