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Monitoring our Changing World The USGS Streamgage Network

Objectives

Having completed this multi-session lab exercise, students will be able to:

- Define streamflow and specify how it is measured
- Identify factors that affect streamflow
- Describe the relationship between streamflow and ecosystem health
- Give examples of the uses of streamflow data
- Explain the need for widespread, long-term collection of streamflow data
- Access streamflow data and examine hydrographs for patterns and trends
- Collect and process local streamflow data by “mining” of USGS databases

Target Audience

This lab exercise, which consists of a set of 5 activities, would be suitable for an introductory undergraduate Environmental Science or Ecology course.

Scheduling

With exception of Activity #1, these activities require access to computers with an Internet connection. One computer for each group of 4 students is adequate.

The first 4 activities require about 3 hours and could be done together as part of a 3-hour lab. (If scheduled lab sessions are only 2 hours in length, considering doing the first activity during class time and/or assigning one of the computer lab activities as an out-of-class assignment.)

Planning of inquiries and presentation of plans via poster could be done in a second 2-3-hour session. Allocate a third session at a later date, chosen depending on the projects selected, as the time for an Inquiry Conference, during which groups will report their findings.

In a general Ecology course, this exercise would be appropriate as the first exercise for the semester. In an introductory Environmental Science course, the exercise would be most appropriate to accompany discussion of Water Resources in lecture.

Overview of Activities

Activity #1: Going with the Flow

Synopsis: Students brainstorm reasons why various people would find streamflow data helpful in decision-making.

List of Materials Needed

- Copies of **Streamgages: Measuring the Pulse of our Nation's Rivers** (<http://water.usgs.gov/nsip/pubs/nsip-2page.pdf>)
- Copies of Student Handout

Time Required: 30 minutes

Instructions

- Divide the class into groups of 3 or 4.
- Present the information in the document or have them read the information for themselves.
- Allow time for brainstorming and then have groups share their reasoning.

Activity #2: What Watershed are we In?

Synopsis: Students use the EPA Surf Your Watershed website to identify the HUC number for their local watershed.

List of Materials Needed

- Computers with Internet Access
- Copies of Student Handout

Time Required: 30 minutes

Instructions

- Have students work individually or in pairs.
- Have students follow the instructions on the handout. (Since this information will be used in later activities, you may wish to clarify whether they are to focus on the watershed the school is located in or the watershed in which they live.)

Activity #3: A Stream's Ups and Downs

Synopsis: Students use USGS data to create online graphs of streamflow data for a particular stream over the course of one or more years to try to discern a regular pattern of annual change in streamflow.

List of Materials Needed

- Computers with Internet access
- Copies of Student Handouts

Time Required: 1 hour

Instructions

- Divide the class into pairs. (Even if there are enough computers available for students to work alone, experience has shown that having them work in pairs may facilitate their search for patterns and trends in the hydrographs.)
- Provide each pair with a copy of the Student Handouts (instruction and data sheet).
- Allow time for groups to share their observations.

Activity #4: Taming the Mighty River?

Synopsis: Students access USGS streamflow data and create online graphs for a particular stream over several years to look for changes resulting from damming, diversion, land development, and/or climate change during that time.

List of Materials Needed

- Computers with Internet access
- Copies of Student Handout

Time Required: 1 hour

Instructions

- Divide the class into pairs.
- Provide each pair with a copy of the Student Handouts (instructions and data sheet).
- Allow time for groups to share their observations.

Activity #5: Data Mining to Monitor Changes in Our Local Area

Synopsis: Groups of students identify a question for inquiry and use USGS data to graph streamflow in local streams to predict, identify, and interpret fluctuations, patterns, and trends.

List of Materials Needed

- Computers with Internet access
- Copies of Student Handout
- Copies of the **Guide to the USGS NWISWeb**

Time Required: depends on goals, duration of projects and time available.

Instructions

Divide the class into Inquiry Teams of 3-4 students

- Have each team propose an inquiry question. (Examples would be, “How quickly does streamflow change after a rainfall event?” “Do different streams respond differently to rainfall events?”)
- Have each team create a poster or Power Point presentation to explain the procedure that they intend to use to answer their question.
- Have each team present their plans to the rest of the class and have the rest of the class critique their plans.
- After teams have collected and analyzed their data, have them use posters or a Power Point presentation to share their results and conclusions with the rest of the class.

Teaching Tips

Many students are likely to be confused by the term **stream**. Whereas in everyday usage, a stream is a “small river”, in hydrology, stream is the general term for any natural body of flowing water.

Students may also confuse streamflow, which refers to the volume of water passing a particular point, with current, which refers to the velocity of the water. Mathematically streamflow is the product of the velocity and the cross-sectional area.

After students accomplish the introductory database activities by following the steps specified in the Student Handouts, encourage them to use time available to go back and experiment with different buttons, menu choices, site selection criteria, data formats, and time intervals.

If you are unfamiliar with any of the topics related to this exercise, refer to one or more of the **References**.

References

National Streamflow Information Program Homepage

<http://water.usgs.gov/nsip/index.html>

EPA Surf Your Watershed

<http://www.epa.gov/surf/>

An Overview of Stream-Gaging Program

<http://water.usgs.gov/wid/html/SG.htm>

Explanation of Realtime Streamflow Stations

<http://www.nationalatlas.gov/realstahelp.html>

Streamflow as a Geoinicator

<http://www.gcrio.org/geo/toc.html>

Stream-Gaging Program of the U.S. Geological Survey
<http://water.usgs.gov/pubs/circ/circ1123/index.html>

Water – Managing a National Resource
<http://water.usgs.gov/wid/html/wtrmgt.html>

Earth's Water: Surface Water
<http://wwwga.usgs.gov/edu/mearthsw.html>

The National Water-Use Information Program
<http://water.usgs.gov/watuse/wufactsheet.html>

Fish Habitat and Flow: What's the Connection?
<http://www.fish.state.pa.us/Fish/ma2001/habtflow.htm>

Current USGS Streamgauge Network
<http://water.usgs.gov/nsip/nsipmaps/currentgages.html>

Flood of Evidence
<http://whyfiles.org/107flood/index.html>