Geoscape Ottawa-Gatineau

Grade 9 - 11 Lesson Plans to accompany the Geoscape Ottawa-Gatineau poster and website

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Theme 6 : OTTAWA RIVER : A VITAL RESOURCE

OVERVIEW

- Students identify and describe the stages that the Ottawa River and its tributaries go through in their evolution.
- Students locate and explain the characteristics of the significant drainage basins and watersheds of the Ottawa-Gatineau Geoscape.
- Students understand how a river's discharge rates are a variable of the hydrologic cycle and the hydrogeology of the region.
- Students appreciate the importance of the variety of uses of the Ottawa River drainage basin.

DURATION

190 minutes (2 periods + homework) + .5 day field trip

ACTIVITY

1. Student Worksheet 1: In small groups, students (3-4) use topographic maps to identify, locate and describe a drainage basin, including explaining the characteristics of the stages of development of a river in the area. This activity can be applied to the Geoscape area or to the entire Ottawa Drainage Basin or to a major tributary river and its tributaries. (If you choose the entire Ottawa River and its main tributaries, you will need to use smaller scale topographic maps or use on-line topographic maps using Google Earth. This program can be downloaded for free from Google.)

2. Student Worksheet 2: In small groups, students complete a field study of a local stream or river to calculate flow velocity and discharge rates. Field trip permission and safety precautions must be covered in advance.

3. Student Worksheet 3: Students answer questions on the various uses of the Ottawa River drainage basin.

4. Optional: The Water Survey of Canada (Environment Canada) http://www.wsc.ec.gc.ca/ provides daily stream gauge data (discharge and water level). Choose 'Data Products & Services' and then 'Archived Hydrometric Data - Query the Data Base On-Line'. *(I recommend station 02LB005 (South Nation River near Plantagenet Springs for year 2003.)* A link on the same site will take you to climate data at http://climate.weatheroffice.ec.gc.ca/climateData/canada_e.html . An annual record of discharge could be graphed, analyzed, and compared to precipitation data. Similarities and differences in the peaks could be explained. Alternatively, stations on a small and large drainage basin could be compared, or a comparison could be made between a controlled station (dam on the Ottawa River) and a natural (uncontrolled) upstream station.

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Student worksheet #1 :

DRAINAGE BASINS

Reference: Earth Matters p.202

1. Using topographic maps of Ottawa (scale 1:250 000), make a tracing of the Ottawa River drainage system to include its main tributaries – Gatineau, Rideau, South Nation, Lievre, Blanche, Petit Nation, Quyon, Madawaska, Mississippi, Carp, Jock, etc.

2. Label the main river, significant tributaries, the mouths, sources and direction of flow of each tributary, confluences and other significant drainage features such as lakes and wetlands.

3. Label the location of the major dams on the Ottawa River and its tributaries on the same map. Account for their locations.

4. Label the location of rapids and waterfalls occur along the Ottawa River and its tributaries. Do some areas have faster flowing water than others? Why? Can they be related to local geology (see geology maps)?

5. Establish the drainage divide separating a major drainage basin and adjacent ones by drawing a line around the basin at the height of land (highest contour). Divide the watershed of each major tributary in a similar way.

The following questions can be applied to a local, major tributary river and its smaller tributaries. (If you choose the entire Ottawa River and its main tributaries, you will need to use smaller scale topographic maps or use on-line topographic maps using Google Earth. *This program can be downloaded for free from Google*. Or Toporama of the Atlas of Canada - http://atlas.gc.ca/site/english/maps/topo/index.html)

6. Choose a river.

7. Estimate the area of the drainage basin, using the scale or grid on the map. For the grid system count all the full and partial squares. Then determine the size of each grid and multiply them to get the total area.

8. Determine the elevation of the source of the river and each major tributary. Subtract the elevation at its mouth to determine the rise of the river or the drop in elevation.

9. Measure the length of the river and each major tributary to find the run of each.

10. Calculate the gradient (slope) of each by dividing the rise by the run.

11. List the river and tributaries in order from 'fastest' to 'slowest' flowing. Do you think that this is a valid estimation of the speed? What other factors may strongly influence the 'speed' of the rivers in your drainage basin?

12. Determine the type of drainage pattern of the system.

13. Indicate on the map places where erosion, deposition and flooding have occurred. What patterns exist and why do they occur?

14. Write a descriptive 1-page paper summarizing the characteristics of your drainage basin including an evaluation of its efficiency to drain the land.

Student worksheet #2 :

FIELD STUDY OF A STREAM OR RIVER

Reference Earth matters p.192-193

1. Measuring Width: Using a tape measure, measure the width of the stream. Take several measurements and calculate the average. If the stream is too deep to be waded, measure across a bridge or throw a ball of string across the stream to a partner and measure the length of the string.

2. Measuring Depth : Tie a weight to the end of a long piece of string. Lower the weighted end into the water until it hits the bottom. Pull the string tight and mark the water level. Measure the length of the string that was submerged. Take several depth measurements across the stream at the same location where you measured the width.

3. Cross-sectional Area: To calculate the volume of water that passes a certain point in the stream, the area must be calculated. Draw the cross-sectional profile of the stream on graph paper and estimate the cross-sectional area using the grid squares.

4. Measuring Flow Velocity: Measure a 10 m distance along the stream , marking the start and finish position. Place a floating object (i.e. ball or orange) in the middle of the stream at the start position. Measure the time taken for the object to reach the finish line. Repeat several times and calculate the average. Calculate the velocity in metres per second using the formula v = d / t. (Note: this is only valid for the surface velocity.)

5. Calculating Discharge Rate and Capacity:

    A. Present discharge rate (in m^3/s) is flow velocity times the cross-sectional area.

    B. To estimate the maximum discharge capacity, measure the additional cross-sectional area above the water surface to the top of the stream bank. Multiply this by the flow velocity already established. Now add the 2 discharge values (A+B) to derive the maximum discharge capacity. Discharge greater than this would cause flooding at this place.

6. Would there be variations in these discharge rates? Where and why?

7. What system would need to be in place to warn people of potential flooding?

8. **Walk along of** a segment **of your stream and sketch a map. On the map, indicate areas of erosion and deposition. Relate these areas to the shape (morphology) of the stream.**

Student worksheet #3 :

MULTIPLE USES OF THE RIVER

Reference: Topographic Map
Geoscape Poster/Website

1. List as many uses of the Ottawa River Drainage Basin as you can.

2. What historic uses were made of the rivers in the region but are no longer functions today?

3. Locate and identify the Britannia and Lemieux Island Water Filtration Plants and the Robert Pickard Water Treatment Plant on the map drawn in Worksheet 1. Account for their locations.

4. Name and locate the bridges across the Ottawa River on the same map. Where and why are they located there? If you were planning new bridges across the Ottawa River where would you place them and why?

5. Research any one of the following topics and prepare a brief 1 – 2 page report
    A. New bridges across the Ottawa River
    B. Petrie Island Aquatic Park
    C. Chaudiere Falls Heritage Industrial Site
    D. Rideau River Canal and Waterway
    E. Ottawa River Heritage Waterway

This map may be used instead of the map drawn in Worksheet 1.