WATERSHED ASSESSMENT
STUDENT LAB TEMPLATE

Dr. Edward Wells
Wilson College

This lab was produced using the design format developed by the Environmental Literacy Council's educator advisory group with funding from the Department of Education's Fund for the Improvement of Postsecondary Education (FIPSE).

Permission to Reprint Statement

The Advanced Placement Program intends this publication for non-commercial use by AP teachers for course and exam preparation; permission for any other use must be sought from the AP Program. Teachers may reproduce this publication, in whole or in part, **in limited print quantities for non-commercial, face-to-face teaching purposes.** This permission does not apply to any third-party copyrights contained within this publication.

When educators reproduce this publication for non-commercial, face-to-face teaching purposes, the following source line must be included:

> **Watershed Assessment, Student Lab Template. Copyright © 2003 by the College Entrance Examination Board. Reprinted with permission. All rights reserved. apcentral.collegeboard.com.**
> **This material may not be mass distributed, electronically or otherwise. This publication and any copies made from it may not be resold.**

The AP Program defines "limited quantities for non-commercial, face-to-face teaching purposes" as follows:

Distribution of up to 50 print copies from a teacher to a class of students, with each student receiving no more than one copy.

No party may share this copyrighted material electronically — by fax, Web site, CD-ROM, disk, e-mail, electronic discussion group, or any other electronic means not stated here. In some cases— such as online courses or online workshops — the AP Program may grant permission for electronic dissemination of its copyrighted materials. All intended uses not defined within "***non- commercial, face-to-face teaching purposes***" (including distribution exceeding 50 copies) must be reviewed and approved; in these cases, a license agreement must be received and signed by the requestor and copyright owners prior to the use of copyrighted material. Depending on the nature of the request, a licensing fee may be applied. Please use the required form accessible online. The form may be found at: http://www.collegeboard.com/inquiry/cbpermit.html. For more information, please see AP's Licensing Policy For AP® Questions and Materials.

Abstract

The purpose of this lab is to synthesize several areas of environmental science. These are: water quality, soil quality and soil capabilities, land use and zoning, and, as a potential extension, wetlands. After you study all of these parameters in a geographical location specified by your instructor, your lab group will make management recommendations that are based on your findings.

Objectives

This lab will enable you to see the links among specific areas of environmental science. You will especially realize how science must inform policy if land use and zoning regulations are to be sustainable for both the human and natural economy.

Introduction

Oftentimes, city and county planners overlook upstream and downstream land use activities when they write land use plans and zoning resolutions. For instance, large parcels of land that abut a stream may be zoned for agriculture. Downstream from this location, one may notice that stream water is warmer and stream health is degraded. Recognition of upstream/downstream issues has generated a greater movement toward regional environmental planning, especially since the 1980s. As you may have learned, *environmental pollutants do not obey political boundaries.*

In this study, you will examine several parameters and investigate water and soil quality, and perhaps the presence or absence of wetlands. As well, you will analyze land use and zoning. After having accomplished these tasks, you will make land use recommendations for the purpose of creating a more sustainable community for both the natural and human community. The recommendations you make will require critical thinking to design creative community solutions. Group participation is essential in this activity.

Background Research Information Links

http://www.ee.enr.state.nc.us/ecoadr.htm (especially for North Carolina Schools)

http://water.usgs.gov

http://usgs.gov/

http://cfpub1.epagov/surf/locate/index.cfm

http://www.epa.gov/safewater/dwinfo.htm

http://www.waterqualityreports.org

http://www.nwi.fws.gov/

http://ecos.fws.gov/webpage/webpage_usa_lists.html?state=all

http://www.soils.usda.gov/

http://nationalatlas.gov/

http://nutrientcontrol.com/

http://www.sprawlwatch.org/

http://www.plannersweb.com/sprawl/home.html

Materials

1. *LaMotte Water Pollution 1* Test Kit (Model AM-22)
2. *LaMotte Soil Macronutrients* Test Kit (Model AM-31)
3. County soil survey
4. 7.5 minute USGS quadrangle map
5. 100-meter tape
6. *Munsell Soil Guide*
7. Manual for identifying trees, shrubs, and herbaceous layers, e.g., *Newcomb, Audubon, Peterson*
8. Hydrologic species key for wetland identification (Contact the state office responsible for overseeing wetland protection and delineation if you have no other access to a manual.)
9. Access to county, city, township, or borough zoning resolution (depending on area of your study)
10. Other materials of your choosing for presentations, e.g., poster board, camera

Procedure

- Your assigned task is to select a stream segment (given the guidelines provided by your instructor) and perform your own watershed assessment. While it will be impractical to investigate an entire watershed, your group will analyze a segment. Delineate a 100-meter length of stream (this is a suggested length; your instructor may tell you to vary the stream length). If space warrants, the study area will go back three meters from the top of the bank of the shore of the creek, river, or lake. If you perform a wetland assessment, the study area will extend back an additional six meters for a total setback of nine meters. In addition to your assessment, you will make management/stewardship recommendations. As stated, your recommendations should consider factors such as sustaining the well-being of the ecosystems as well as providing for a sustainable human economy. This will be typed in a paper of three to five pages in addition to appendixes. The paper will be due at the time of your presentation. Work in groups of four to five for this exercise.

- For the four water quality parameters you choose and four soil macronutrient parameters you are assigned, measure three equidistant locations for your samples. Your group will sample the locations at least three times in order to increase the validity of your survey -- the more you survey the location, the greater the validity of your results. Your instructor will have some of you take water quality tests along the bank of the creek. If it is possible to walk into the water body with boots/hip waders, the instructor may have others perform tests in deeper waters. Think about how your results may differ. Each group will also perform soil tests back from, but along the waterway. Make sure your group does not perform a survey in the same (precise) location as another group.

- Perform four water quality tests for the parameters that you think are most important to study. As a group, make the decision as to which parameters will be most appropriate to measure. This may take some background research on your own time (homework). Perform four tests on one day and four on each of the other two days (indicate the dates and times on which tests were performed). Soils will change little from day to day. To execute the soil tests, each LaMotte kit comes with a soil core borer. This handheld unit will penetrate the soil deep enough for you to get an appropriate sample of the soil horizons. You should, however, first remove any groundcover from the soil you will sample. Is there a topsoil layer? How deep is it? Analyze the profile. What does it tell you about the ecosystem? You will test four soil parameters. Make sure you fill out the LaMotte forms and include the forms as part of the appendixes.

- The list of possible parameters includes:
    - **Water Quality:** carbon dioxide, chloride, wide range alkalinity, ammonia nitrogen, pH, nitrate-N phosphate, dissolved oxygen, hardness, silica, sulfide
    - **Soil Macronutrients**: soil pH, nitrogen, potassium, phosphate

- Review the county soil survey. Determine the soils in your area and determine the soil types and limitations and opportunities associated with the soil types. This should inform your recommendations. You should copy the pages of the soil survey to append to your report. Also copy that corresponding portion of the 7.5 minute quadrangle map (see below).

- Go to the appropriate planning commission (borough, city, township, or county) and find out how your area (adjacent to, upstream, or downstream) is zoned. How might zoning affect your watershed? This will have to be an after-school activity. Most government offices close between 4 p.m. and 5 p.m. Some or all of the contact with the planning commission may be done by telephone.

- If you are doing your study on public land (e.g., community park) or school grounds, take a walk as far as you are able in both directions from the points at which you took your water and soil tests. (The length you can walk may be limited by private property as well as impenetrable topography and groundcover.) What do you expect of the quality of water downstream?

- Acquire a 7.5 minute quadrangle map of your area. (This should be available in an office in the county office building or on the Net at the United States Geological Service Web site. If you purchase a map at the office building, it may cost up to $4.) A map will be needed in your presentation to show your location and the topography of the area of your watershed.

- Now that you have collected data for your watershed analysis, make five to 10 management recommendations that have been mentioned. This should include recommendations for ecosystem and land use management of the entire stream or river watershed that you are studying, both upstream and downstream. As discussed, upstream activities directly influence downstream activities. All of the data you have gathered should provide the information for you to make these recommendations. The prescriptions you make need not be detailed. You can simply state it and add a sentence or two of explanation.

- Considerations (not comprehensive):
  - water quality
  - soil quality
  - soil types: affordabilities and constraints
  - land slope
  - land use and zoning
  - upstream/downstream issues

These are general guidelines. Your teacher may wish to adapt this investigation to fit your class needs and local environment. It is also up to your group's creativity to think of other material that you may wish to include, making the presentation and report effective.

Lab Tips

- Contact your planning commission office to locate maps of your study site and surrounding community. Tell them about your project and ask if they have additional resources that can be of aid to you.
- Always wear protective eyewear and gloves when handling chemical solutions.
- At least two of you will have to perform fieldwork together. This will be required to operate the soil and water quality kits.

Data/Observations

Both water and soil quality data should be graphed, and data must be shown on a spreadsheet. What data points do you have to graph, both water and soil? What other variables should your graph contain? Your graph will be important for both your formal presentation and lab report.

Analysis

What did the data tell you? Fill in the LaMotte sheets and analyze the results. What conclusions can you draw from your data based on the research you have done on the parameters that you tested? Data results should be recorded on a spreadsheet, and analysis of data should be recorded in the report. The spreadsheet should be an appendix to the report.

Additional Resources

This will be left up to your group. You may embellish the project to enhance the effectiveness of the presentation. All of the items to meet the minimum requirements are contained in this description. You must decide on the most effective way to present the material in an oral and written manner.