Full Throttle Model • Reflection Section Answer Guide

Introduction

The scientists wanted to accomplish two things with this research. Describe one of these things and tell why it was important to accomplish.
Students will have individual answers to this question. They should, however, understand that the scientists wanted to be able to predict water quality on the basis of how watersheds might change in the future; and the scientists wanted to figure out how to dentify Great Lakes watersheds which needed restoration, and could be done quickly and at a reasonable cost. It is important to be able to predict water quality based on future changes in watersheds so that managers can be prepared to deal with water quality issues. It is important to be able to identify which watersheds need to be restored and which of these could be restored quickly and at a reasonable cost. Identifying these watersheds would enable managers to set priorities for watershed restoration.

What kinds of things might be done to restore an ecosystem to a healthier condition?
Students will have individual answers to this question. They should think of actions like cleaning up litter, cleaning up the source of pollution, removing invasive species, planting or reintroducing native species, removing development that is no longer being used, and limiting certain kinds of uses in some areas. This question enables you to hold a class discussion about ecological restoration, and it challenges students to think about nearby degraded areas. You may want to look at the "Crash Course" on Conservation Biology and Restoration Ecology, found in the Web Resources on page 33.

Methods

How did the use of existing databases help the scientists understand which watershed conditions affected water quality?
Students will have individual answers to this question. By retrieving data from existing databases about watershed conditions, the scientists were able to compare many different conditions with measurements of phosphorus and turbidity. The cost and time it would take to collect new information could be a challenge, so using existing databases makes sense if existing information is available.

Look at the number of water quality sampling sites in figure 11. For each of those sites, the scientists also retrieved a lot of information about nearby landscape conditions in the watersheds. Why do you think a computer was necessary to discover the relationships between landscape conditions and water quality?
Students will have individual answers to these questions. They should, however, realize that if the scientists collected and retrieved data covering a number of years, the quantity of data would be too large to calculate by hand.

How could the scientists identify water quality problems near watersheds for which they had no water quality data?
Students will have individual answers to this question. They should realize, however, that once the scientists understood the relationship between landscape conditions and water quality (measured by the amount of phosphorus and turbidity), the scientists could use known landscape conditions from existing databases to predict water quality. To do this, scientists used mathematical models run on computers.

Findings

If you had to identify one general reason for low water quality within or near a Great Lakes watershed, what would it be?
Students will have different answers to this question. They should, however, ultimately conclude that forest disturbances, urban development, and agriculture appear to be closely related to low water quality within and near the watersheds studied in this research.

Why do you think forests that had been disturbed in the past had lower levels of phosphorus and turbidity than forests that had been recently disturbed?
Students should realize that disturbance happening in the past gave forests time to heal from the disturbance, thus protecting the soil from as much erosion.

Discussion

Do you think it is important to measure and predict water quality? Why or why not?
Students will have individual answers to this question. Apart from the information provided in this article, students should understand the importance of water quality. If they understand the importance of water quality, students should be able to articulate why measurement and prediction of water quality are important and even necessary to improve and protect water quality in the future. Without measurement, one cannot evaluate whether a situation is changing and how it is changing.

From this study, what would you say is the relationship between landscape change and water quality?
Students should conclude that as landscapes become more developed or forests more disturbed, a greater opportunity exists for lower water quality.

Time Warp
Full Throttle Model • Reflect and Connect Answer Guide

Introduction

Name one similarity and one difference between the recent Great Lakes research and the research done in West Virginia in the 1950s.
Students will have individual responses. Similarities include (but aren't limited to): Both research projects investigated how land use affected water quality, and both research

projects included an investigation of nonpoint source pollution.

Differences include (but aren't limited to) The recent research involved a variety of land uses and the historic research focused only on forest land use. The recent research was concerned with water quality in the Great Lakes, and the historic research was concerned with water quality in mountainous streams.

Methods

The scientists in both "Time Warp" and "Full Throttle Model" were researching how land use affected water quality. Describe how their data collection methods differed from one another.

Students will have individual answers to this question. In the historic research, the scientists collected their own baseline data, then applied experimental treatments to four areas. Following the treatments, the scientists continued to collect data. The scientists collected and used their own data. In the current research, the scientists used a number of existing databases and created computer models to look for relationships among variables. These scientists did not collect their own data.

Discussion

How does the recent research support or not support the findings from "Time Warp"? *Students will have individual answers to this question. Students should recognize, however, that although the two studies were different in many aspects, their findings were similar: Forest disturbances are related to reduced water quality as measured by turbidity.*