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Land Use Patterns in Relation to Lake Water Quality in the Webber Pond Watershed

Problems in Environmental Science course (Biology 493), Colby College
Colby Environmental Assessment Team, Colby College

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LAND USE PATTERNS IN RELATION TO LAKE WATER QUALITY IN THE WEBBER POND WATERSHED

BI493
Problems in Environmental Science
Colby College
Waterville, ME  04901
2003
TO: Report recipients  
FROM: Professors Russell Cole and David Firmage  
RE: Class report on Webber Pond

We have very much enjoyed working with the people concerned with the water quality of Webber Pond and hope that the work done by Colby students and herein reported will be of value to them and to other interested parties. We realize that some areas of the study could and perhaps should be expanded. We feel confident of the quality of the work done and only wish the time had been available so that the students could fulfill their desire to conduct a more comprehensive study.

This report is the work of students enrolled in the Problems in Environmental Science course (Biology 493) taught at Colby College during the fall semester of 2002. The course is taken by seniors who are majoring in Biology, most with a concentration in Environmental Science. The students work as though they were an environmental consulting firm. The object of the course is to teach the students how to approach a problem, how to develop a workplan, and what is necessary to implement the plan successfully. As part of this learning process, the students use methods and tools they have learned in other courses and they are also introduced to new methodology as needed. Standard methods of analysis are used as well as state of the art instrumentation for any of the original analysis done. The methods used were those approved by EPA and/or the DEP. However, there are time constraints involved in the study since all requirements for the course must be completed within the fall semester. These constraints mean that some of the new data can only be gathered during the months of September through early November and, typically, that extensive analysis can not be done. Some of the water quality data were gathered during the previous summer and made available to the class for analysis in addition to their fall sampling. In order to teach various techniques and to have the students consider a problem from a number of angles, the project is expanded to more areas than a group might normally take on for a short term project. This means that in some areas we sacrifice some depth for more breadth.

While the class was constrained by time, they have managed to accomplish an amazing amount of work during that period and we are very pleased with the quality of that work! We hope that you find it useful.

The first section of the report provides background material, somewhat general in nature, which will help readers who are not familiar with some basic concepts concerning lakes and their watersheds. There is also a small section discussing the general features of the lake itself. The majority of the report consists of the analysis done by the students during the fall semester class.
Authors

The analysis of the Webber Pond watershed was conducted by the students of the Biology 493: Problems in Environmental Science class at Colby College, Waterville, Maine.

Back row: Chris Makarewich, Paul Mathewson, William McCloy
Front: Melanie Newton, Lauren Bliss, Erin Estey, Serena Vayda, Madeleine Mineau

The advisors for this study were Professor F. Russell Cole and David H. Firmage
EXECUTIVE SUMMARY

The Colby Environmental Assessment Team (CEAT) investigated the water quality of Webber Pond in Vassalboro, Maine from June through December 2002. CEAT analyzed several factors that contribute to water quality, including physical and chemical measurements, land use patterns, and the impact of residential and commercial development. All of these measurements were compared and used to compute models, which enabled CEAT to determine the sources of pollution most threatening to the current and future water quality of Webber Pond. These data were also compared to those collected in previous years to gain a historical perspective. Water quality is affected by the accumulation of nutrients, particularly phosphorus, due to surface runoff, erosion, and internal nutrient loading. When concentrations of phosphorus reach threshold levels, a lake can experience algal blooms that decrease the aesthetic, recreational, ecological, and economic value of the lake.

A brief summary of CEAT findings in the Webber Pond watershed:

- Webber Pond is an eutrophic pond with a mean phosphorus level of 23 ppb, which is well above the threshold for algal blooms (12 ppb to 15 ppb).
- Phosphorus concentrations in the hypolimnion (lake bottom) are becoming increasingly higher, with a mean of 353.76±33.93 ppb. Internal nutrient loading is a significant problem in Webber Pond, contributing about 26 percent of the total phosphorus load to Webber Pond.
- Transparency and dissolved oxygen measurements at Webber Pond correspond to characteristics found in an eutrophic pond. The mean transparency is consistently lower than the 6.0 m limit for eutrophic ponds, with a mean reading of 1.24±0.14 m in September. There is a sharp decline in dissolved oxygen below 6 m in depth. Anoxic conditions increase internal nutrient loading and impact the recreational fishery at Webber Pond.
- A water budget, which indicates the flushing rate and was calculated to be 1.58 flushes per year. This value indicates that the Water in Webber Pond is theoretically replaced 1.58 times a year. This value is higher than expected for a pond that has the algae bloom problems that Webber Pond exhibits.
- A comparison of land usage from 1956 to 1997 shows a significant decrease in land used for agriculture. In 1956, 35.9 percent of the land in the Webber Pond watershed was used for agriculture,