Integrating a Community Model of the Chesapeake Bay into a Web 2.0 Based Framework using the Google Maps API, Django and AJAX

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Introduction

The Chesapeake Bay is the largest estuary in the United States

Watershed is home to more than 16 million people

Provides food, habitat, jobs, and many other benefits

Ecosystem is especially fragile due to its long dendritic shoreline and high concentration of human activities.

Introduction

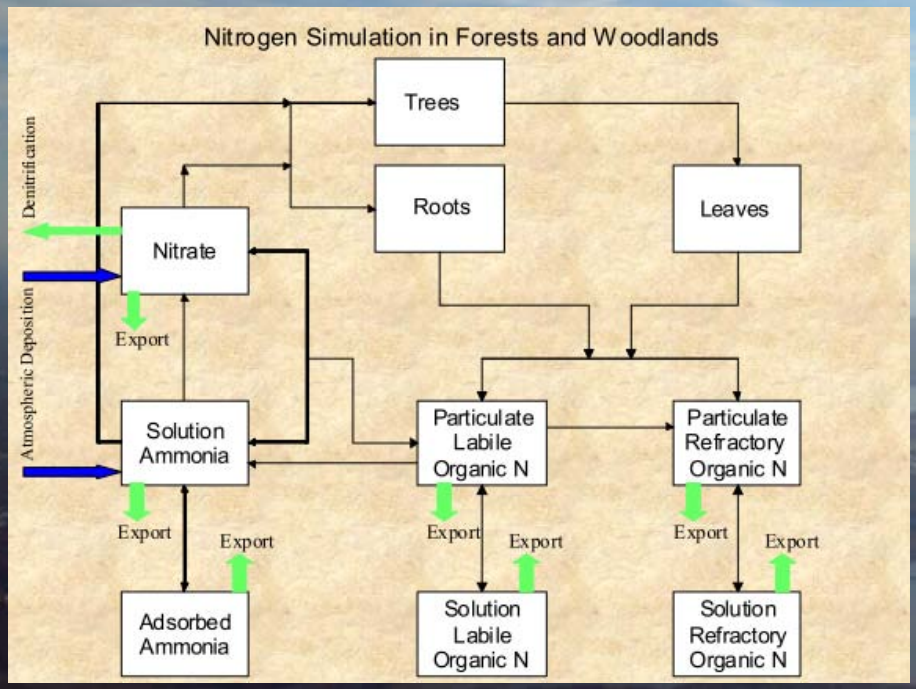
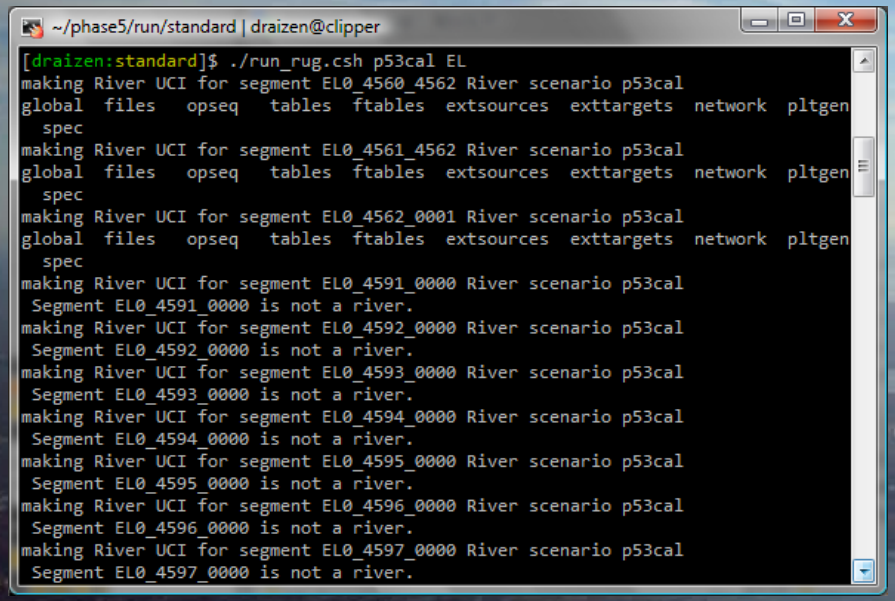


Diagram from U.S. EPA, 2010. Chesapeake Bay Phase 5 Community Watershed Model In preparation EPA 903S10002 - CBP/TRS-303-10 Chesapeake Bay Program Office, Annapolis, Maryland. December 2010.

Many computer models and simulations exist with varying degrees of complexity

The Phase 5 Watershed Model consists of three sub-models: hydrologic, non-point source, and river

Introduction



The Phase 5 Model is very detailed and complex, both in its installation and use

Linux command line environment, requiring special training or experience to fully utilize

Text files specifying the details of the watershed environment are input into the system, which in turn generates text files detailing the changes in water quality over the extent of the bay

Objectives

To enhance secondary and post-secondary science instruction relating to the Chesapeake Bay

National Science Education Standards: systems, models, and the abilities necessary to do scientific inquiry

Maryland Science Education Core Learning Goals: Goal 1 - Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science.

NASA's 2010 Science Plan recognizes Enhancing Environmental Stewardship and Educating the Next Generation as important goals that this project could contribute to

Objectives

To improve upon the first version of the Chesapeake Bay Community Model Visualization Tool by using a robust web framework and enhance its user interface by using AJAX technology

To complete the final requirements of a Master of Science degree at in the field of Natural Resources Science

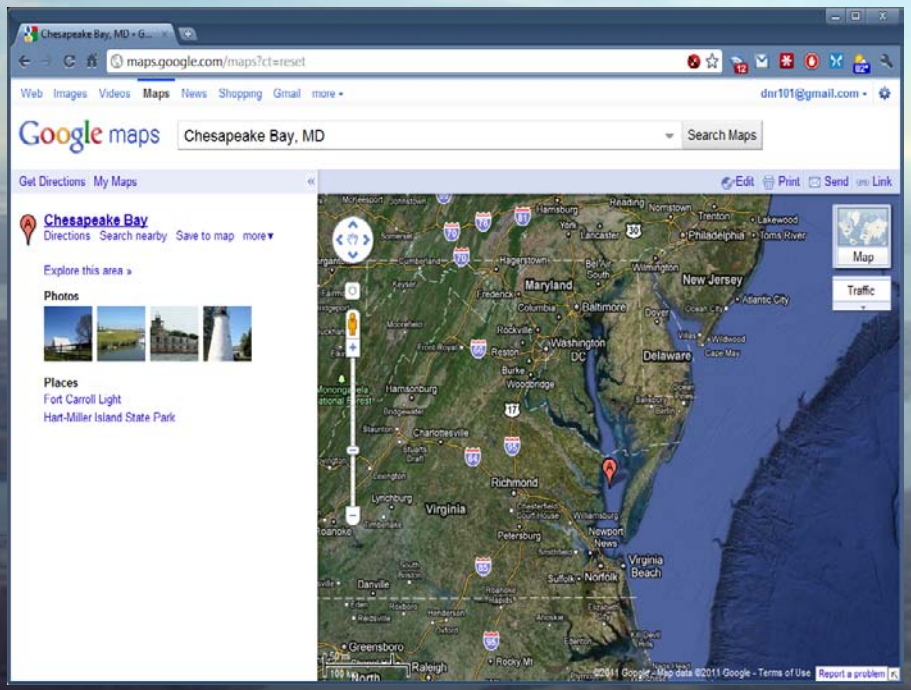
To disseminate this work to a wider audience by including members of the agricultural extension community

Progress

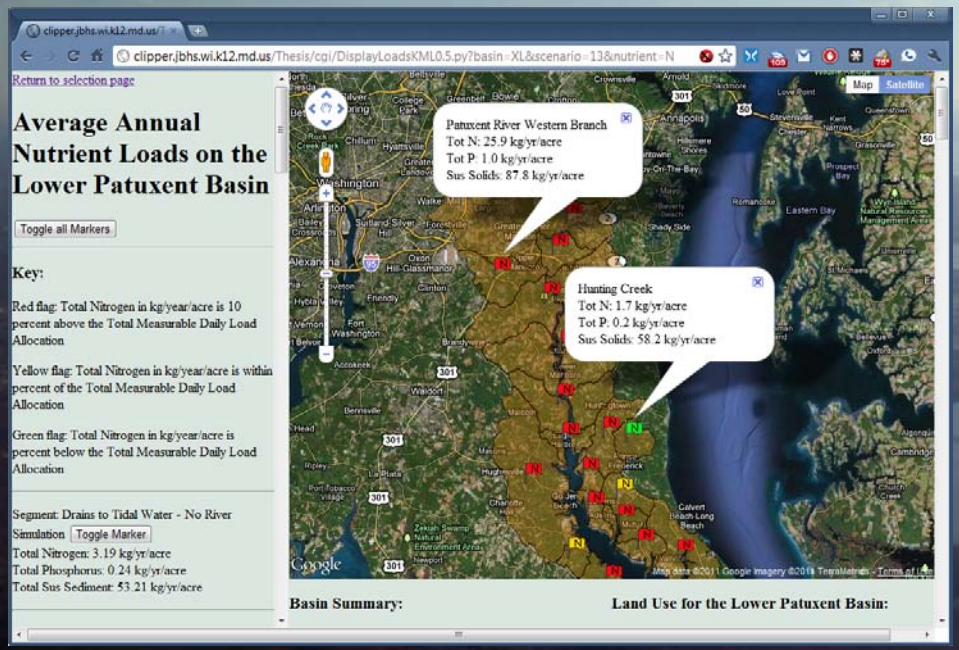
A web-based interface to the Phase 5 Watershed Model was created, to facilitate its use in secondary and post-secondary classrooms

Output is displayed using the Google Maps Application Programmer Interface (API)

Nitrogen, Phosphorus, and Suspended sediment are shown in kg/year/acre for each river segment in the watershed.



Progress

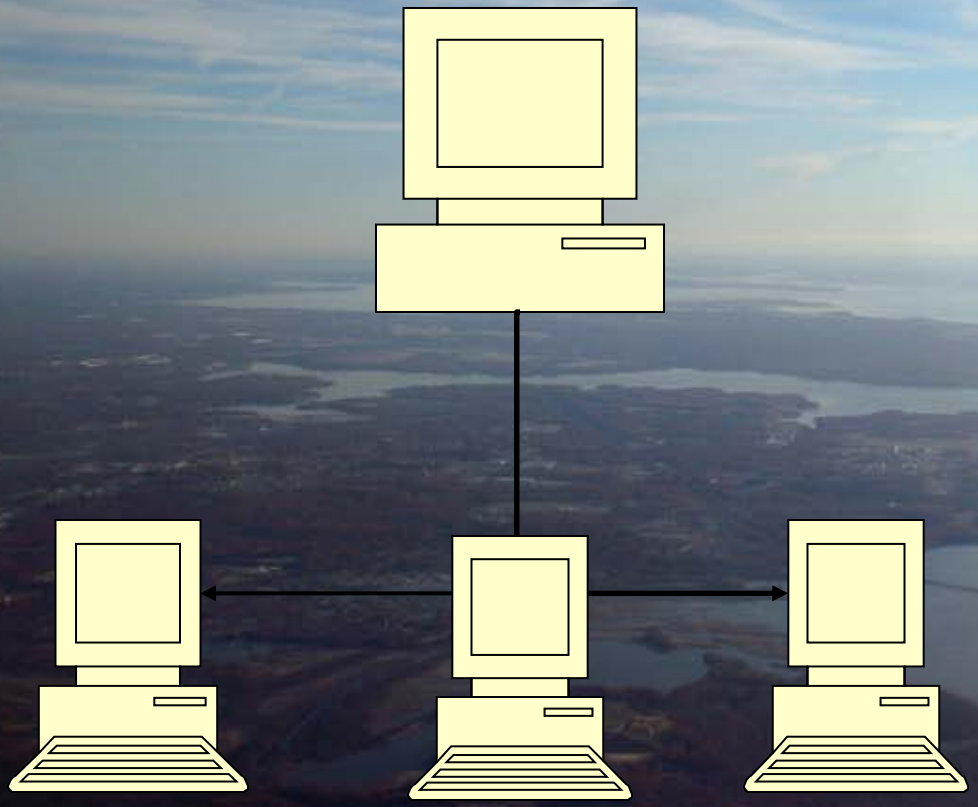


This tool is called the Chesapeake Bay Community Model Visualization Tool, or CMVT and is a functional first step

Created using standard web technologies including html, JavaScript, and Python

Chesapeake Bay CMVT

Progress



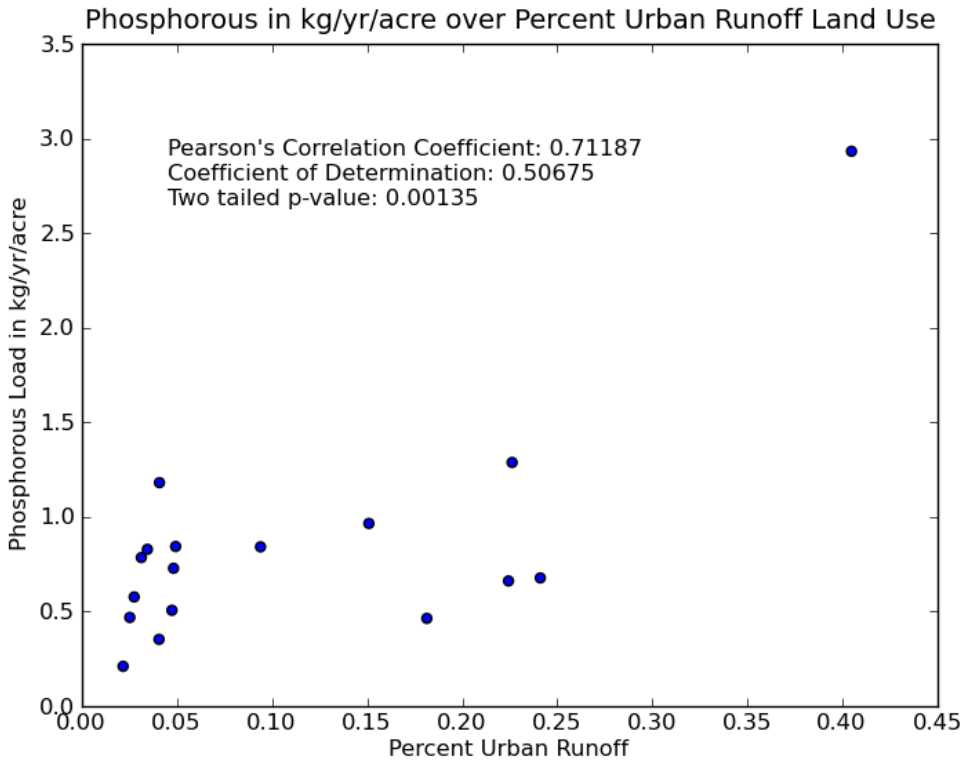
A lesson using the Phase 5 Model and data in a secondary science classroom was tested

Students were given background information about nutrient pollution and computer modeling

A 21 question survey was administered to students before and after the lesson to assess their attitudes and understanding of these issues.

Progress

Summary data are presented on the site as well, including graphs showing correlation between land use and nutrient pollution

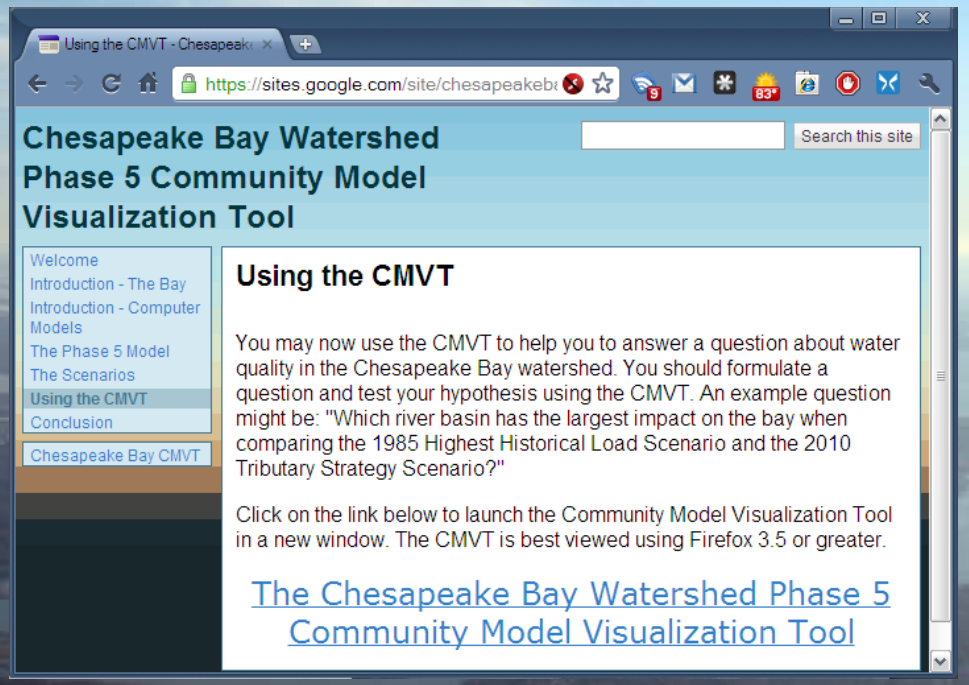


Controls for the display of summary data can be added as an enhancement to the current, giving the user more control over the analysis

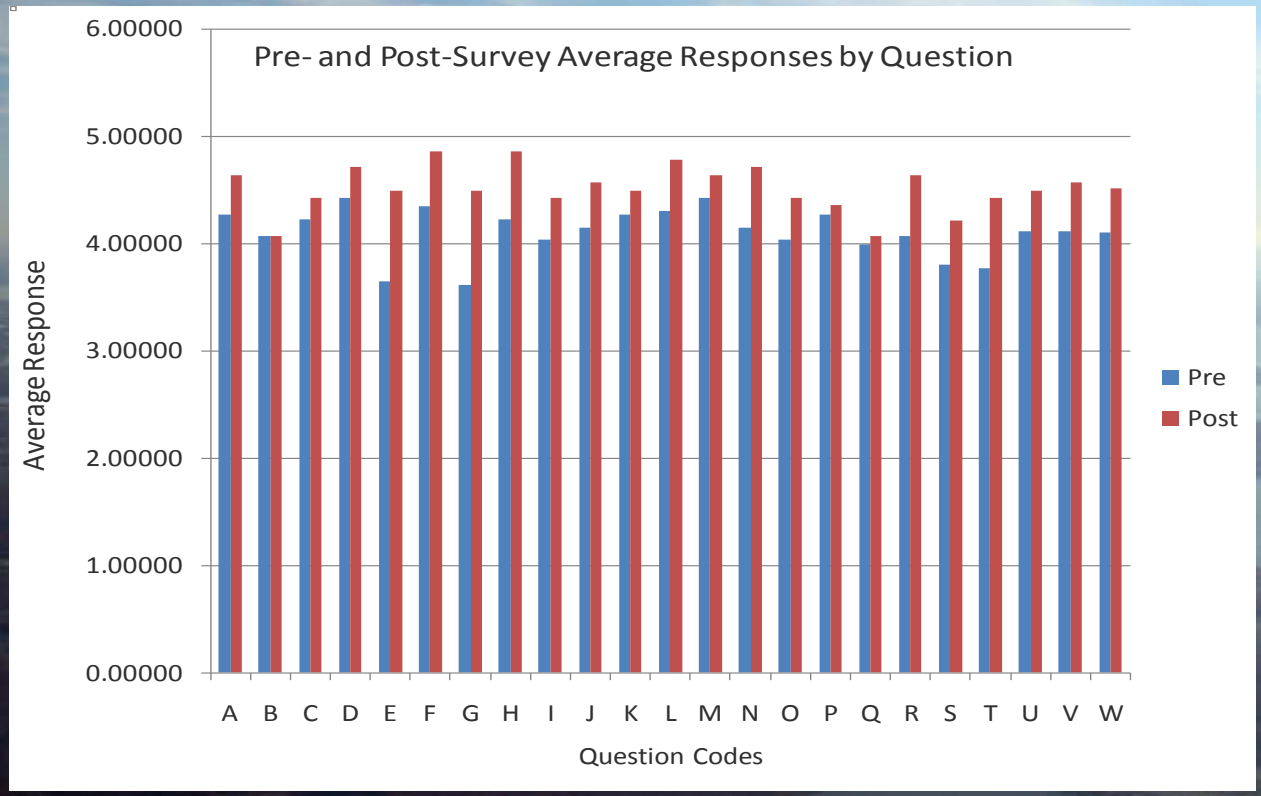
Results

Students used the CMVT to investigate nutrient pollution in the Chesapeake Bay

Pre- and Post- survey responses were analyzed to determine the effectiveness of the CMVT and the use of authentic data



Results



Students in Biology and Computer Science courses have used the site and participated in the survey so far

Results have been positive, though the sample size so far is somewhat small (n < 20)

Results

Sample of the six highest performing survey questions as well as the overall mean response

Code	Question	%Difference Pre to Post
W	Overall Mean	10.01
G	My activities have an impact on water quality in the Chesapeake Bay	24.47
E	I understand how scientific data is used to make decisions about the Chesapeake Bay	23.16
T	Nutrient pollution is a problem for the Chesapeake Bay that can be addressed by everyone	17.49
H	Computer models are useful scientific tools	14.81
R	The Chesapeake Bay watershed is a very complex system	13.88
N	Excess nutrients in the Chesapeake Bay can harm its water quality	13.49

Results

Sample of the six highest performing survey questions as well as the overall mean response

Code	Question	%Difference Pre to Post
W	Overall Mean	10.01
B	Nutrient pollution is a problem for the Chesapeake Bay	-0.1347
Q	Computer models can provide accurate descriptions of our world	1.7857
P	There are many uses for computer models	2.0592
C	Agricultural activities have a great impact on the Chesapeake Bay	4.6753
M	Human activities on the Chesapeake Bay can be controlled better so they are less harmful to the Bay	4.9689
K	Many diverse living things can be found in the Chesapeake Bay watershed	5.4054

Discussion and Conclusions

Image by flickr user martinilounge834 used with permission under Creative Commons Attribution-ShareAlike 2.0

Future improvements include implementation of CMVT using Django framework and Ajax web technologies to enhanve user interface

The creation of additional useful scenarios

The implementation of controls for data summary

The addition of more publicly available data layers to the map to allow additional analysis

Discussion and Conclusions

Use of the software with additional secondary and post-secondary courses: Environmental Science, Marine and Estuarine Ecology

Use of the software with Agricultural Extension workers

Questions?