Chesapeake Project 2014

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GEOG654: GIS and Spatial Modeling

The course that I will be modifying for the Chesapeake Project is GEOG654: GIS and Spatial Modeling. This is a master's level class developed for students in the Masters of Professional Studies in GIS program. As a professional degree, its focus is on technology. As a result, the course needs to be designed with this mindset, with a heavy emphasis on learning how to apply the tools available in a GIS to various applications across a broad range of disciplines. This course is designed to teach students the fundamentals of modeling in a spatial context. Modeling is the act of representing real life systems in a simplified manner (usually as mathematical equations) so that we can simulate phenomenon and processes. Through these simulations we hope to better understand the system as well as make predictions about future events.

The concept of systems modeling is one aspect of modeling that I plan to emphasis more in this class. A systems-based approach to modeling is to consider all of the different parts that exist in the system being modeled. This includes all of the individual components within the system as well as the different ways these components interact. A systems-based approach is a very natural way to design a model. It involves making assumptions about the system's boundaries and initial conditions, for example, the Chesapeake Bay watershed, as well as the variables and parameters that are important to the system. The goal is to design a flowchart that represents the system's inputs (what goes into the system), outputs (what comes out of the system), and processes (how these things interact).

I believe that the systems-based thinking concept is critical for getting students to think more about sustainability. By considering the entire system when applying models for a particular application, students can develop a more complete understanding of the problem they are trying to solve. A systems-based approach to modeling allows them explore concepts such as the sensitivity of the system to changes. For example, in our system model of the Chesapeake Bay watershed, we can consider how different inputs of all size and magnitude, such as agricultural nonpoint source pollution as well as urban runoff, contribute to the overall health of the Bay.

Based on my learning objectives, the students will be able to use a system-based approach for problem solving, with an emphasis on sustainability. I plan to assess students on this objective through a lab assignment. This assignment will involve learning how to integrate models within a GIS framework. To further relate this assignment to sustainability, the topic of the assignment will be on modeling regional food security. Food security is a problem that is perfectly designed for a systems-based approach, since it involves aspects such as production, distribution, and consumption of food. This is an important, contemporary issue that concerns many themes of sustainability. For example, considering food systems, what advantages, if any, would a regional system have over a more, traditional, global system? What would be the effect on a food system due to impacts such as climate change and land use change?

The students will begin the assignment by designing a conceptual diagram of the model (inputs, outputs, and processes involved with the system). They will then be given a crop production model (for a specific crop such as corn or potato) that has been integrated into a GIS, in essence a geospatial crop model. This geospatial crop model will be used to simulate crop production at various spatial locations based on spatial input data such as soil, weather, management, and land use. The model will be simplified for the lab assignment, but with it the students will be able to explore how crop production varies throughout a region, such as the Northeast United States. The students will then be able to use the geospatial crop model to simulate various scenarios, such as potential climate change and land use change, and see how that affects crop production. They could also use network analysis to determine the estimated transportation costs involved with shipping food locally versus globally. Overall, I feel that this lab assignment has a lot of potential for getting GIS students to think more about sustainability in their projects.

A case study of the regional food security concept is a current project taking place among many researchers and scientists across the U.S. east coast called, "Enhancing Food Security in the Northeast". Its website is located here: http://agsci.psu.edu/research/food-security.