Curriculum for the Bioregion[1]

Estimating Greenhouse Gas Offsets as Part of Shoreline Community College's Greenhouse Gas Inventory

A Service-Learning Project for Geography 204 Students

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Summary

Geography 204 (Weather, Climate and Ecosystems) is a physical geography lab science course that introduces atmospheric patterns and processes at different temporal and spatial scales and the relationship of these processes to people and the biosphere. In this service-learning project students will be asked to assess prior estimates of carbon offsets associated with plant and soil biomass on their college campus.

As an overview of the problem, students will be assigned readings and websites on greenhouse gas emissions and global warming; and, the use of carbon calculators and various Climate Action Plans (as part of Presidents' Climate Commitment). Additionally, students will have available (via Shoreline Community College's internal website) individual and institutional assessments of contributions to greenhouse gas emissions and the components of a green house gas inventory including the carbon calculator used in past assessments.

Learning Goals and Big Ideas

Students will gain direct experience with the difficulties of defining, collecting, and analyzing real data and the complexities of making data-driven decisions. Students will also grapple with making reasonable assumptions based on available information and see how changing assumptions affects calculations and results. Additionally, students will decide how best to present their results

[1] *The Curriculum for the Bioregion is an initiative of the Washington Center for Improving the Quality of Undergraduate Education at The Evergreen State College. This "teaching and learning activity" is one of several developed by a faculty learning community in math in February, 2010.*

and conclusions, which will help them assess other sources of information they encounter.

As a result of this activity it is hoped that students will understand the complexity of measuring the complex sources of carbon emissions and offsets; address the challenges of coordinating data collection and field measurement; and realize importance of estimation in public policy contexts.

"Big Ideas": Students will learn about the relationship between biological activity and carbon sequestration; the role of various campus activities in the global carbon cycle; field measurement; estimation; sampling techniques; spatial representation of biological patterns and processes.

Students will become familiar with the following: carbon offsets; carbon sequestration; GHG inventory; carbon calculator; primary productivity; quantitative plant sampling; service-learning; group data collection; project based teaching.

Context for Use

This project illustrates for students core concepts of the course including human and non-human factors in the carbon cycle, difficulties in estimating carbon emissions and offsets, the spatial measurement of biological patterns and processes.

Timeframe: For Geography 204, this service-learning project will be done during the last five weeks of the quarter. Students work in groups of four to eight people. Individual students are expected to contribute 15 to 20 hours on the project.

Possible Use In Other Courses: This activity also would be appropriate for Environmental Science and Biology.

Description of Teaching-and-Learning Activities

Preparatory Reading:
The Author's Preface, Section 1, and Section 4.1 (including all subsections) from Cool Campus! A How-To Guide for College and University Climate Action Planning (www.aashe.org/files/resources/cool-campus-climate-planning-guide.pdf).

Greenhouse Gas Role and Emissions
http://tonto.eia.doe.gov/energy_in_brief/greenhouse_gas.cfm

GHG Emissions
http://www.epa.gov/climatechange/emissions/index.html
http://www.epa.gov/climatechange/emissions/downloads09/GHG2007-01-508.pdf

Making Sense of GHG Accounting
http://www.sciencedaily.com/releases/2009/11/091130103630.htm
Carbon Calculator
http://www.nature.org/initiatives/climatechange/calculator/

Students read about greenhouse gas inventories and their campus climate action plan. Students are introduced to the issue through assigned readings and websites specifically addressing:

- Greenhouse gas emissions, global warming and the Presidents' Climate Commitment.
- Individual and institutional assessments of contributions to greenhouse gas emissions and the various components of a GHG inventory.
- The role of carbon calculators to estimate emissions and offsets in an inventory.

As a Service-Learning Project, students in groups of 4-8 will:

- Identify data sources to make annual calculations for the greenhouse gas inventory.
- Identify, among the data sources, any discontinuities or incomplete data sets.
- Identify types of data (including proxy data) that achieve higher levels of accuracy or resolution for carbon emissions or carbon offsets.

Guiding Questions for Project:

1) What are the basic challenges in estimating the amount of carbon "absorbed" or sequestered by plants and soil on our campus?

   Variables to consider:

   - Spatial or geographic
   - Temporal
   - Vertical

2) Determine how you would measure these variables.

3) Rank these variables by level of difficulty. Consider for example:

   A. which can be done in one quarter by 4-8 students

   B. which require multiple quarters with 4-8 students

   C. which require multiple quarters with several groups (4-8 students).

Teaching Notes and Tips

Estimating campus offsets as part of a carbon inventory is a very complex process that will require many quarters (and participating classes) to complete. The specifics of the assignment will be something of a moving target as the scale of the project, its sequencing, and the fact that understanding the biological aspects of carbon sequestration is a developing field.

Assessment

Formal Assessment: Currently there is no established rubric or set criteria for this project. However, the student project would have to demonstrate the application of course concepts, as well as accurate, appropriate and internally consistent methods and calculations. Any assessment would include content, formation and participation.

Informal Assessment: At various intervals in the project, student groups would be asked to explain where they are in the project in terms of time to completion, current hurdles or setbacks. If a field observation or measurement component of the project is necessary, the instructor is expected to accompany students in the field and provide feedback on procedures.

References and Resources

- www.aashe.org/files/resources/cool-campus-climate-planning-guide.pdf
- Climate Action Plan - American College & University Presidents' Climate Commitment www.presidentsclimatecommitment.org/