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| **Title of Unit** | *Please use a descriptive title that indicates content area* **Biogeochemical cycling.** |
| **Date and**  **Location of SI** | UH- Manoa, July 2013 |
| **Unit Developers & Contact Information** | *Add names, emails, institutional affiliations of developers*  *Don Drake, Fenny Cox, Kasey Barton, David Tallmon, Oceana Francis* |
| **Context** | *What kind of course is unit designed for? Ecology*    *How long is unit?* 3 weeks  *When will the unit be used in the course?* End of semester. |
| **Abstract**  (< 200 words) | This teachable tidbit is designed to be used in an introductory ecology course, following a general introduction of biogeochemical cycling and the global water cycle (GWC). A brief review emphasizes the closed nature of a global cycle, and the key concepts of pools and fluxes between pools. A clicker question asks students to consider and discuss the relative importance of various pathways by which rainfall in a rain forest is transferred to other pools. Students are then asked to brainstorm and list ways that humans are affecting the GWC. Groups are assigned to discuss one major effect each (e.g., deforestation, climate change), modify a GWC diagram to show how pools and fluxes are affected, share their predictions with other groups, and present a consensus to the class. Students are then asked to do outside assignments using additional information to make their predictive models more realistic (by combining multiple human effects) and to assess the ethical consequences of human effects. |
| **Rationale** | *How did the idea for the unit arise? Discussion among grp members.*  *Why was this topic chosen?*  It is a difficult challenge to present large-scale processes.  *What misconceptions or difficult topics are addressed?.* Connections between components of water cycle. |
| **Learning Goals:** what students will know, understand, and be able to do; includes content knowledge, attitudes, & skills | For students to understand the water cycle (H20). This includes:   1. Understand the pools and fluxes of H20 cycle. 2. Understand how human activities impact pools and fluxes of H20 cycle. 3. Appreciate the ethical consequences of human activities on the H20 cycle. |
| **Learning Outcomes:** Student behaviors or performances that will indicate they have successfully accomplished the goals | Students can:   1. Construct a diagram of H20 cycle. (previous class) 2. Rank the relative magnitude of each pool of global H20 cycle. (previous class) 3. Predict how several human activities will alter the H20 cycle (qualitative/quantitative). 4. Assess the global ethical implications of human activities on H20 cycle. |

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| **Incorporation of Scientific Teaching Themes** | | |
| **Active Learning** | **Assessment** | **Diversity** |
| How students will engage actively in learning the concepts | How teachers will measure learning; how students will self-evaluate learning | How the unit is designed to include participants with a variety of experiences, abilities, and characteristics |
| *Activities outside of class:*  Take home written exam.  *Activities in class:*  Clicker question to connect past content to current class meeting.  Group discussions of concepts and predictions.  Consensus building among groups to create consensus poster of impacts on water cycle.  Volunteer to present each consenss model to entire class.  *Activities during tidbit*:  Clicker question to connect past content to current class meeting.  Group discussions of concepts and predictions.  Consensus building among groups to create consensus poster of impacts on water cycle.  Volunteer to present each consenss model to entire class. | *Pre-assessments:None.*  *Post-tidbit assessments:*  **Discussion and take home written exam.** | All students participate. Includes clicker question and discussions so not biased against most physical dispositions. |

**Sample** Presentation Plan (general schedule with approximate timing for unit)

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| **Session 1** | | | |
| **Time (min)** | Learning Outcome(s) | Activity/assessment | Explanation, notes, suggestions, tips |
| *Preclass*  *(varies among clasees, but students will have had one class meeting and time spent reading text that introduces water cycle)* | 1) Students can construct a diagram of H20 cycle.  2) Students can rank the relative magnitude of each pool of global H20 cycle. | We assumed this would have been covered in a previous class meeting(s) using whatever activities wanted. | Students have previous explosure to water cycle (and biogeochemical cycling in general) in previous lecture and text reading assignment. |
| *Enter approx. class time for learning activity*  *preparatory*  *material presentation*  ***3 min*** | This gets at outcomes covered in previous meeting:  1) Students can construct a diagram of H20 cycle.  2) Students can rank the relative magnitude of each pool of global H20 cycle. | Clicker question on fluxes of forest water to atmosphere and surface water. | 5 minutes for re-cap and clicker question on previous class meeting material |
| *Enter approx. class time for learning activity #1*  *16 minutes*  *(will be closer to 25 min in normal class)* | 1) Predict how several human activities will alter the H20 cycle (qualitative/quantitative).  2) Assess the global ethical implications of human activities on H20 cycle. | Groups discussion and consensus of human impacts (deforestation and global warming) on water cycle. | Provide follow-up time (to Emphasize scale, diversity, long-distance impacts and effects.)  See last ppt slide for questions. Some can be done in class and some assigned as take-home. |
| *Enter approximate time for additional learning activities and associated class*  *Work/preparatory materials*  *(10 min)* |  | Discussion of ethical implications of human impacts in group think-pair-share. |  |
| *Enter approximate time for post-activity summing up or transition*   * 1. *mins)* | 1) Predict how several human activities will alter the H20 cycle (qualitative/quantitative).  2) Assess the global ethical implications of human activities on H20 cycle. | Presentation of summative assessment take-home exam questions. | See last ppt slide for questions. Some can be done in class and some assigned as take-home. |

*Add additional activities information as needed for the unit.*

Resources for Teaching the Unit

*(other files and information needed/helpful to teach the unit, including files for papers from which original data for class activities is taken, supporting information for the instructor, handouts, in class activities materials, assessments with answer keys, homework assignments, etc.)*

*Powerpoint slides (file attached) contain images to provide background info review, clicker question prompts, images that can be distributed for group activities and shown on screen and put up as poster.*

Effectiveness of unit (if you have used it in your own teaching)

Have not yet used in course.

Acknowledgements

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