10th Resources for Ecology Education Fair & Share (REEFS)
Monday, August 6, 2018: 10:15 AM-11:30 AM
2018 ESA Annual Meeting, New Orleans, Louisiana
List of Presentations

Round 1:

1. Life Cycle Analysis and Assessment of Food Production Methods

Tracy Gartner
Department: Environmental Science, Biology
Carthage College

Students use their ecological knowledge of soil processes, energy, water systems, and human interactions to compare the environmental impact of food production. Each group of 3-4 students develop life cycle analyses for a single crop grown under different scenarios. As individuals, students are responsible for developing two life cycle analyses for that crop, and then they compile those products within their group to assess which combination of growing method and location is most "green" if you are purchasing this product at the location of our college. In their joint assessments, students justify their answer based on findings from their life cycle analyses. Through this activity, students recognize that there is not one simple answer; (e.g., always buy organic) but rather, the methods that are most ecologically sustainable are often dependent on the crop, the local conditions, and the impacts of both humans and the environment.

Vision and Change Core Concepts: Pathways and transformations of energy and matter; Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Understand the relationship between Science and Society; Use quantitative reasoning

Status of Activity: Newly developed, implemented once or twice in a classroom, lecture or laboratory

2. Quantifying and Visualizing Campus Tree Phenology

Nathan Emery
Department: Plant Biology
Michigan State University

Large enrollment courses present a challenge for instructors who want to engage students in authentic science practices that fit the recommendations of Vision & Change. Our lesson provides a meaningful science experience for undergraduates in the context of a large introductory biology course by guiding them to measure seasonal changes of plants on campus. Plant phenology is the study of periodic life cycle events in plants such as bud breaks, flowering, and leaf senescence. This lesson enables students, working in groups, to collect, quantify, and analyze observable seasonal changes in nature. Students collect phenology data on an open-source digital database accessible from their mobile devices. Data are then imported into a simple analytical application hosted by the Quantitative Undergraduate Biology Education and Synthesis Hub (QUBES). By the end of the lesson, students will have used the collected data to develop a proposal with questions, hypotheses, and data visualizations. This lesson, which could be implemented at different course levels and college campuses, enables students to experience steps of the scientific process in order to promote their quantitative skills, communication abilities, and observational awareness of local natural history patterns.

Vision and Change Core Concepts: Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Apply the process of Science; Use quantitative reasoning

Status of Activity: Newly developed, implemented once or twice in a classroom, lecture or laboratory

3. Tracking the spread of Lyme disease

Kim Bjorgo-Thorne
Department: Biology and Environmental Science
West Virginia Wesleyan College

Using resources from the CDC, students will track the spread of Lyme disease. This lesson is inquiry-based with quantitative inquiry, and highlights the use of scientific literature to support claims (information literacy).

Vision and Change Core Concepts: Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Apply the process of Science; Tap into the interdisciplinary nature of science; Understand the relationship between Science and Society

Status of Activity: In development, has not been implemented in a classroom, lecture or laboratory

4. Model-Based simulation tasks to predict, observe, and explain evolution

Anna Strimaitis Grinath
Department: Biology
Middle Tennessee State University

I used an instructional strategy called "Predict-Observe-Explain" (Kearney, 2004) to design two model-based simulation tasks that allow undergraduate students in a large (or small) classroom to explore and apply their ideas of the mechanisms of evolution. One task focuses on different mechanisms of evolution, and the other one focuses specifically on natural selection. Each tasks draws on a different simulation (one from PhET and one from NetLogo) to create a biological context in which students can discuss in small groups to PREDICT what they think will happen in the simulation and why, OBSERVE what does happen when they run the the simulation, and then generate EXPLANATIONS for what they observed and how those observations were or were not supported by their prediction. Each task includes a student handout and supports for instructor implementation (e.g. PPT slides, talk tools, anticipated student ideas) to facilitate small group and whole class discussion around the tasks.

Vision and Change Core Concepts: Evolution; Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Apply the process of Science; Use modeling and simulation; Use quantitative reasoning

Status of Activity: Newly developed, implemented once or twice in a classroom, lecture or laboratory

5. Review for Interdisciplinary Science Course (stream ecology, watersheds)

Cailin Huyck Orr
Department: Science Education Resource Center
Carleton College

This is a large-scale participatory activity used to prompt students to review what they have learned and to think actively and cooperatively about the connections between the systems we have discussed prior to the activity. It produces a large, visual product students can reflect on. Concept goals: Beginning to piece together how physical and biological (social) processes are linked, understanding feedbacks,

especially reciprocal feedbacks, between subsystems, and discovering the existence of heterogeneity and disturbance at different spatial and temporal scales. Higher order thinking skills goals: This activity requires significant synthesis of ideas, application to a new setting, and cooperation among classmates. This activity was selected for the reviewed On the Cutting Edge Exemplary Teaching Collection managed by the National Association of Geoscience Teachers. It is one of 228 activities designed to improve student understanding of complex systems, and 1,923 activities on ecological topics held by SERC.

Vision and Change Core Concepts: Pathways and transformations of energy and matter; Structure and Function; Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Communicate and Collaborate with other disciplines; Tap into the interdisciplinary nature of science; Understand the relationship between Science and Society; Use modeling and simulation

Status of Activity: Highly developed, implemented multiple times in a classroom, lecture or laboratory

Round 2:

6. Using a breakout box to encourage critical thinking in the undergraduate ecology classroom

Erica S. Tietjen
Department: School of Public Policy and Leadership
University of Nevada, Las Vegas

Inspired by the escape room phenomenon, in which players work together to solve a series of puzzles using clues and strategy to complete objectives, a breakout box is a self-contained box with combination lock solutions that are attached to specific puzzles, questions or tasks. Students work in small teams to complete content objectives and gain practice with the "4Cs" skills: critical thinking, communication, collaboration and creativity. An inexpensive breakout box can be constructed from any container (e.g. tool box, plastic bin) and locking option (alphanumeric, combination, etc.) and tasks can be modified for any content area, class size and time frame making it a dynamic, challenging and infinitely adaptable tool. My undergraduate students in Ecology worked collaboratively on a set of questions inspired by Binghamton University's "Overcoming Ecomisconceptions" as an introductory exercise to explore frequently misunderstood concepts in Ecology. The "code breaking" aspect of a breakout box also serves as a metaphor for the endeavoring and complex problem-solving nature of science, including the concepts of evidence, inference, and multiple methods.

Vision and Change Core Concepts: Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Apply the process of Science; Use quantitative reasoning

Status of Activity: Newly developed, implemented once or twice in a classroom, lecture or laboratory

7. Data Management using NEON Small Mammal Data with Mark-Recapture Analysis

Megan A. Jones
Department: Science & Education
National Ecological Observatory Network – Battelle

Students use small mammal data from the National Ecological Observatory Network (NEON) to understand necessary steps of data management from data collection to data analysis by estimating small mammal population sizes using the Lincoln-Peterson model. The lesson introduces students to proper data management practices including how data moves from collection to analysis. Students perform basic spreadsheet tasks to complete a Lincoln-Peterson mark-recapture calculation to estimate population size for a species of small mammal. Pairs of students will work on different sections of the datasets allowing for comparison between seasons or, if instructors download additional data, between sites and years. Data from six months at NEON's Smithsonian Conservation Biology Institute (SCBI) field site are included and other data can be downloaded from the NEON data portal. In the REEFS presentation, participants with computers can go through the materials, while others will walk through on the presenter's computer.

Vision and Change Core Concepts: Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Apply the process of Science; Use quantitative reasoning

Status of Activity: Newly developed, implemented once or twice in a classroom, lecture or laboratory

8. C.R.E.A.T.ing the Ecology Classroom

Cath Kleier
Department: Biology
Regis University

This activity is a model developed with National Science Foundation funding to help students read and understand primary literature. Many students are not equipped with the tools to understand scientific papers, and the C.R.E.A.T.E. method helps faculty teach primary literature in a structured way that students can follow. C.R.E.A.T.E. stands for (Consider, Read, Elucidate the hypotheses, Analyze and interpret the data, and Think of the next Experiment). Being able to read and understand primary literature directly addresses two Core Competencies and Disciplinary Practice from Vision and Change: 1) ability to apply the process of science and 2) ability to use quantitative reasoning. After learning

ecology this way, students report being less fearful of primary literature and report using it more often in later classes.

Vision and Change Core Concepts: Systems: Living systems interconnected and interacting

Vision and Change Core Competencies: Apply the process of Science; Use quantitative reasoning

Status of Activity: Highly developed, implemented multiple times in a classroom, lecture or laboratory

9. Cardinal case study to introduce ecology, evolution and scientific competencies

Loren Byrne
Department: Biology, Marine Biology, and Environmental Science
Roger Williams University

Cardinals are common and familiar birds to nearly everyone and therefore provide an engaging focus for introducing ecological and evolutionary concepts and scientific competencies. This REEFS presentation describes a case study centered on cardinals used in an introductory biology course for undergraduates. The case is organized into four modules that use a variety of resources (including free online materials) to explore phenotypic variation, natural selection, phylogenetics, and basic ecological concepts related to individuals, populations, communities, and ecosystems. While exploring concepts, students practice a full range of scientific competencies, from asking questions through testing hypotheses with data to drawing evidence-based conclusions. In one module, students practice reading, presenting, and synthesizing peer-reviewed articles. This exemplifies how the case provides opportunities for collaborative work and open-ended thinking that result in productive discussions and serendipitous teaching moments. Overall, the case has helped students understand the interconnectedness of ecological and evolutionary patterns, processes, and research.

Vision and Change Core Concepts: Evolution; Systems: Living systems interconnected and interacting; Ecology

Vision and Change Core Competencies: Apply the process of Science; Tap into the interdisciplinary nature of science; Use quantitative reasoning; Locate, read and synthesize peer-reviewed articles; use a spreadsheet to make graphs; give an oral presentation

Status of Activity: Highly developed, implemented multiple times in a classroom, lecture or laboratory