Session Description:

This session provides opportunities for ESA members to share and learn what their colleagues are doing to engage their undergraduate students using student-active methods. Instructors at all levels of experience are encouraged to participate. This session will break into small groups so that participants can present their educational activities and learning outcomes, offer feedback and suggestions on ways each activity can be improved, tailored, and/or adapted for use in different learning environments, and foster a network of support in advancing ecology education. The session will provide information on digital publishing options provided through ESA's EcoEd Digital Library and Teaching Issues and Experiments in Ecology (TIEE). *Organized by Dr. Carolyn Thomas, Education Section Chair.*

Session Agenda:

10:15 AM	Arrive / Welcome Introductions ESA Education Section & ESA Office of Education and Diversity Program Each presenter does a 1 minute pitch about their learning activity Attendees split into groups – each attendee will have the opportunity to be part of two groups (each 25 min long)

10:25 AM	Break into groups 5-10 min: Each Presenter describes their learning activity 10-15 min: Presenter fields questions or guides a discussion about learning activity
10:55 AM	Break into groups 5-10 min: Each Presenter describes their learning activity 10-15 min: Presenter fields questions or guides a discussion about learning activity
11:25 AM	Wrap Up EcoEdDL and /or TIEE Life Discovery – Doing Science Education conference Evaluations

For more information about REEFS visit: ESA Education and Diversity Programs Office website at www.esa.org/education_diversity

Resource Descriptions:

1. Bioengineering with willows to restore riparian areas.

Description: Plant cuttings are an important tool to protect riparian areas and the water courses that they fringe. During restoration, plant cuttings are used to stabilize and revegetate riparian areas disturbed by human activities. Although many plants can be used to restore riparian areas, willows are preferred for

their rapid growth in moist environments. In this activity, students collect and germinate willow cuttings, and construct miniature bioengineered fences to stabilize disturbed soil. Because willow cuttings are collected during winter, students learn to identify willows from vegetative traits. Collecting and germinating cuttings develops horticultural skills and teaches students to select optimal greenhouse growing conditions. Observing germinating roots and leaves teaches students about plant propagation and physiological adaptations, including the production of adventitious roots. The bioengineered fences, constructed using the germinated cuttings, can be used to revegetate a campus constructed wetland or adapted to teach components of the universal soil loss equation.

How developed is this activity? In development, has not been implemented in a classroom, lecture or laboratory

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2. Using Owl Pellet Analysis to Explore Space Use and Productivity

Description: Territory size is largely determined by productivity of an area. In this laboratory activity, students dissect owl pellets and use ecological and behavioral concepts to estimate the size of an owl's territory. This experience will also help students understand that estimates vary due to variation in physical and biological conditions, measurement methods, and assumptions made by researchers. This activity is designed to help students reject two common misconceptions: that scientists know the one true value for complex variables, and that everyone's opinion on scientific ideas are equally valid. Students are introduced to the differences between observations and inferences and they practice making judgments and dealing with uncertainty. They will also develop their abilities in quantitative analysis and problem solving.

How developed is this activity? Highly developed, implemented multiple times in a classroom, lecture or laboratory

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3. Life of a Garden: Exploring ecological concepts in fictional landscapes

Description: This course turns a senior seminar into a learning community. In a twist on armchair ecology, students treat the classic children's novel, "The Secret Garden" as a field book containing observations of animals and plants in North Yorkshire, England in the early 1900s. Students collaborate to pose

hypotheses, organize and manipulate data, and conduct simple analyses. For example, students asked whether abundance of organisms at different trophic levels fit the classic idea of an energy pyramid; whether isolation distance explained the proportion of species shared between habitats; and whether the progression of flowering matched historical or currently observed baselines. Student's understanding of process of science increased during the course. Unexpectedly, the way students perceived the relationship between science and art changed dramatically. The strategy of using a novel as a study system is applicable to a wide range of fiction, from "Little House on the Prairie to "The Hunger Games".

How developed is this activity? Newly developed, implemented once or twice in a classroom, lecture or laboratory

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4. Science and Society: Creative Communication

Description: During their study abroad ecology semester in South Africa, students are required to engage with South African History and Culture. As part of this course we require students to write a short essay entitled "Science, Society and Common Property Resources under South African Legislation". In recent years I have asked students as a second part to the assignment to utilise ideas developed in their essay to create a fun communication piece and highlight an issue around common property resources in South Africa making it informative and relevant to the lay public. The piece could take the form of a popular article, a short (3-4min) documentary, a podcast, a teaching/classroom tool, etc etc. This is a fun exercise and highlights an important skill in science education (scientific communication to non-scientific audiences), however, I would love to hear other's ideas about how to improve the design and assessment of the deliverable.

How developed is this activity? Newly developed, implemented once or twice in a classroom, lecture or laboratory

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5. Breeding Discussion: Using fiction to understand population ecology

Description: Undergraduate students tend to have a love/hate relationship with population ecology. On the one hand, topics such as reproduction and death are inherently interesting to them. On the other hand, the quantitative nature of population ecology can be intimidating and confusing. In order to bolster their inherent interest and pacify their unease, we augment the straight science with fiction using an original short story "Breeding Discussion" and the episode "Mark of Gideon" from the classic Star Trek

series. “Breeding Discussion” centers on a conversation between four college students about their own reproductive and lifestyle choices. Our undergraduate students have responded very favorably to the characters and conflict in this story which helps them relate to the underlying science. We have found “Mark of Gideon” to be an excellent means to help students understand exponential and logistic growth. This exercise requires a mix of out-of-class and in-class preparation and discussion.

How developed is this activity? Newly developed, implemented once or twice in a classroom, lecture or laboratory

Would you be willing to submit to EcoEdDL? Yes, within 6 months after the ESA meeting

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6. Authentic ecological inquiry using BearCam archives

Description: In this authentic ecological inquiry project, students conduct background study of grizzly bear biology and behavior, observe BearCam photos and generate testable hypothesis, design sampling and collect and analyze data, interpret results and develop a report guided by a rubric, conduct Calibrated Peer Review, and revise their reports based on peer feedback and self-evaluation. A rubric for research report is used to communicate expectations, facilitate peer feedback and self-reflection, and evaluate student product and learning. A survey for self-assessment and feedback for the project is available. Students consistently reported significant learning gains in interest in ecology, ability to formulate testable hypothesis, understanding how ecologists conduct research, and ability to evaluate quality of scientific report. This project is designed for a blended setting but can be used in-class as well.

How developed is this activity? Highly developed, implemented multiple times in a classroom, lecture or laboratory

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7. Using sensors to measure soil moisture in a competition experiment

Description: Students build and use microcontroller-based sensing systems to test for soil moisture change with increasing plant density. The standard radish seed experiment, a 4-inch pot array planted with a range of seed densities, is augmented by in situ measurement of soil conductivity or water content of soil. Armed with an introduction to sensing systems, basic circuitry, the programming interface, and a description of data to collect, student groups build the sensing system and take weekly soil moisture measurements starting mid-experiment. Along with the response of the competitive effects on shoot

biomass, plotting the moisture data against seed density and date fortifies the research-based nature of this experiment. Inexpensive and easy to use, these microcontrollers and sensors enhance learning by exposing students to computer controlled sensors that are used in scientific data collection, including opportunities to learn how to monitor and collect data in the context of an ecological experiment.

How developed is this activity? In development, has not been implemented in a classroom, lecture or laboratory

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8. Interdisciplinary multi-class labs

Description: Last year three faculty members from Furman University hosted two interdisciplinary labs, one in the fall and one in the spring. The faculty members represented biology, environmental science, and economics. In these labs students from three different classes and three different majors were brought together around a common theme. In the fall this theme was Arbor Day. In this lab 90+ students, mostly from intro-level classes measured the ecosystem service value of all the trees on the campus during a 3 hour sampling period. These data were used in each class as the relate to the major but also how they overlap to address common issues. In the spring we hosted a mega field trip with the same majors, but upper level classes. Again the trip was a mix of class specific content, but the keystone was an interdisciplinary effort to address a common question. Feed back from students, faculty peers, and administration has been very positive and we plan to replicate the labs in the next academic year.

How developed is this activity? Newly developed, implemented once or twice in a classroom, lecture or laboratory

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9. Genetic Population Structure in the Red Worm, *Lumbricus rubellus*

Description: Population genetics lies squarely at the intersection of ecology and evolutionary biology, yet there are few "wet" labs for undergraduate courses that use student-collected data to elucidate the genetic consequences of geographic barriers, selective regimes, or other factors. We developed a new laboratory exercise for our second-semester introductory course that investigates genetic population structure of Red Worms (*Lumbricus rubellus*) using Simple Sequence Repeat (SSR) microsatellite loci identified by Harper et al. (2006) in populations native to Wales. Our goal was to examine genetic

differentiation of populations separated by distance or by distance and major river barriers. Our first use of the lab brought mixed results: many students did not successfully extract DNA, and with the resulting small sample sizes there were too many alleles to estimate frequencies with any precision. We're confident that these methodological problems will be easy to solve, however. We're looking for advice and/or collaborators to a) refine the protocols for greater student success, and b) share data across institutions to facilitate more interesting ecological and evolutionary comparisons across a wider geographic area. We'd especially appreciate having some collaborators with a research emphasis in population genetics.

How developed is this activity? Newly developed, implemented once or twice in a classroom, lecture or laboratory

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Page Break

WK 31 Submit Your Teaching Resource to ESA's EcoEd Digital Library

Tuesday August 12
11:30am – 1:15 pm
103, Sacramento Convention Center

Visit the Education and Diversity Table in Exhibit Hall

www.esa.org/ecoed

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