**Problem Posing in *Zamia***

**Module Overview**: Dinosaur Plants: *Zamia*: is an activity that allows students to explore reproductive biology of Zamia and how variables are correlated to themselves and to an environmental variable (light availability) from data they collected in the field with multiple datasets.

**Setting**:

Target course- Title, majors/non-majors, level [introductory/upper-division], size of class [# of students])

* **General Ecology Laboratory, Majors, Introductory, ~20 students.**

Learning Outcomes for the activity

* **Collect data in the field, by measuring plant size characteristics and LAI (Leaf Area Index above each plant)**
* **Learn how to add data to google sheet in order share with other students**
* **Learn how to ask meaningful questions that could be answered scientifically about a biological problem**
* **Answer scientific questions using real data**
* **Identify appropriate ways to visualize the data.**
* **Use statistical evidence to draw conclusions.**

How does data acumen align with this learning outcome? Place an “X” in the column next to the skills practiced in this activity.

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| **Quantitative Pillars** |  | **Data Life Cycle** |  | **Social/Pedagogical Concepts** |  |
| Mathematical |  | Data import |  | Communication | **X** |
| Computational |  | Management |  | Equity, Diversity, Inclusivity |  |
| Statistical thinking | **X** | Curation |  | Universal Design for Learning |  |
| Reproducibility | **X** | Analysis | **X** | Ethics |  |
|  |  | Sharing/Reporting | **X** |  |  |

**Activity**:

Course type (e.g. Lecture, lab)-

* Field Data collection, Laboratory exercise

Pedagogy (e.g. Case, research project, final report, lab activity)-

* Problem-posing activity; hypothesis testing

Describe the data and the tools used to interact with the data-

* Students will gather data in the field of the vegetative and reproductive status and size of Zamia (Dioecious plants)
	+ Number of leaves, length of longest leaf
	+ Number of male cones, height of cones
	+ Number of female cones and height of cones
	+ LAI (Leaf Area index above each plant)

Make the students make a decision of the alternative hypothesis prior to seeing the results

Describe where problem posing will be used and how you as the instructor will use problem posing to shape the activity-

 Each set of students will come up with a set of hypotheses to test/questions and figures analysis. These should include.

1. Vegetative
2. Reproductive
3. Comparison across subset of data
* Question Focus:
	+ How are morphological and reproductive variables correlated?
	+ Are male and female plants reproductive units (cones) correlated with vegetative in the same fashion?
	+ Are plants size correlated with LAI?
	+ Are reproductive units correlated with LAI?
	+ If students use subsets of data from other groups, do they get the same results?
* Compare data sets across year if ratio of M&F changes across year

Describe the activity-

 This is a multi-week activity

 Week one – Field day

 Week two – Data upload, Question focus, Analysis

 Week three –

Describe the student products-

* Students Oral presentations (in groups of 2-3)

**Assessment**:

How will this learning outcome be assessed?

* Students will earn points for using the best visualization for their data/question and if they correctly interpreted the result.

Will students practice this skill again?  In what setting (same topic, new topic)?

* Yes. Students will also practice question posing in the following activity which is evaluating the Evolutionary processes in a herb. Is there evidence of phenotypic selection for size in a small Euphorbiaceae?

**Extra information**:

What will students need to know before completing this activity?

* Students will need to know how to interpret a p-value and some basic statistical tests (e.g. regression, t-test) to know which test is the most appropriate for analyzing their data and understand the importance of confidence intervals.
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