

The K-12 Standards Conundrum: Math, Ecology, & Authentic Field Research

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Introduction

- Common Core Standards are being developed and implemented in K-12 curricula nationwide.
- Mathematical modeling is a central focus of the Common Core Standards. Specific needs for math students include gaining:
 - proficiency in the use of computer tools to mine, synthesize, and interpret raw data
 - experience in dealing with the errors, outliers, and variability associated with lab and field data.
- To address these needs, numerical data from three research projects was compiled for use in developing and implementing multiple math lessons for grades 6 -12.
- Lessons developed around the three projects will require students to graph, analyze, and interpret data.

Project 1: A Field Survey of Saguaro Cacti



- Sites on contrasting Sonoran Desert landforms (e.g., alluvial fans, south- and north- facing slopes) were registered using a global positioning system and inventoried.
- More than 1,500 data points were generated from a sampling of 130 saguaros plants:
 - height in meters, # of arms, % epidermal browning, degree of cuticular damage, # of bird's nests, presence of freeze lines.
- Landform and plant locational data were registered within a geographic information system.

Project 2: Leaf Litter Decomposition Field Study

- Radiant energy impacts on leaf litter decomposition was quantified over 1 year.
- Litter bags containing mesquite leaves (n=200) were placed in shaded areas under shrubs and in open areas between shrub canopies.
- Half of the bags contained a UV-B blocking film (Mylar) and the other half a UV transparent film (Aclar).
- Litter mass loss was determined on 9 dates over one year.
- Rainfall was recorded daily; and soil moisture and light levels (400-700 nm wavelengths) were recorded periodically.



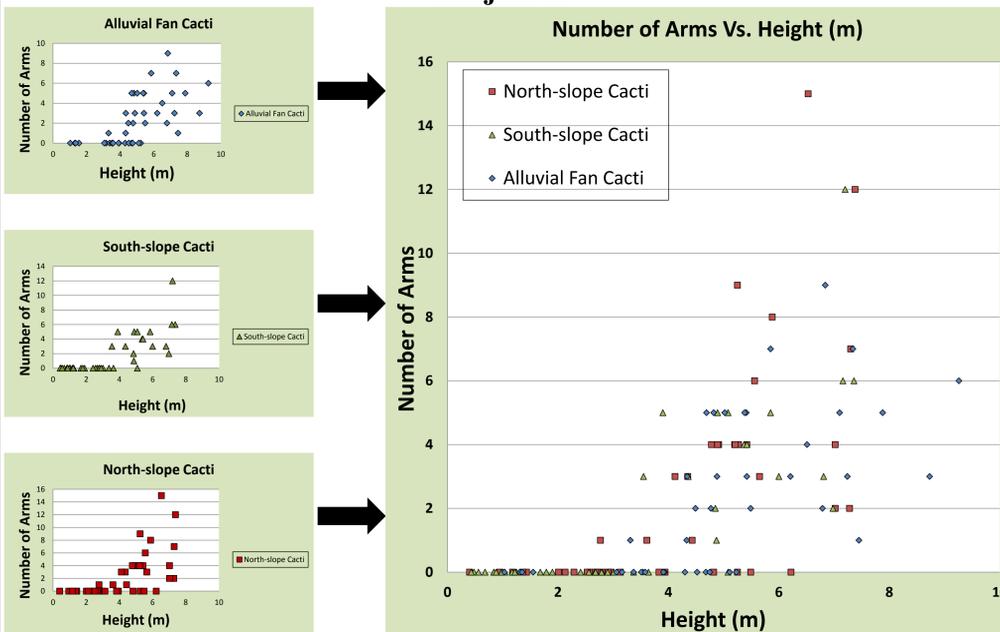
Project 3:

Herbaceous Response to Rangeland Management and Precipitation

- A review of published literature documenting the herbaceous production response to land management and precipitation was conducted.
- Created database of more than 5,000 points from 20 short & long term (>20 years) studies.

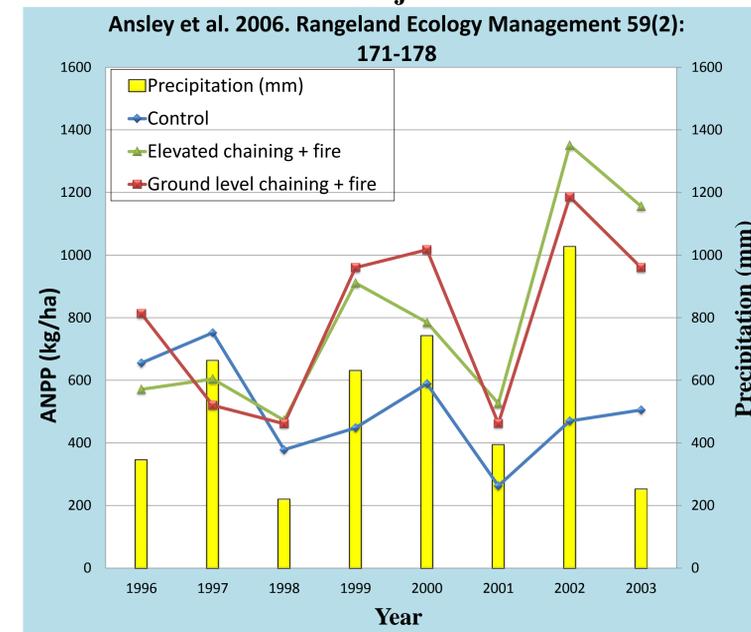


Project 1:



- Student groups graph data by location on transparencies. These subsets are then overlain to illustrate similarities and differences by landform.
- Data shows that saguaros may grow their first arm after reaching a height of 2 m & this is not dependent on location

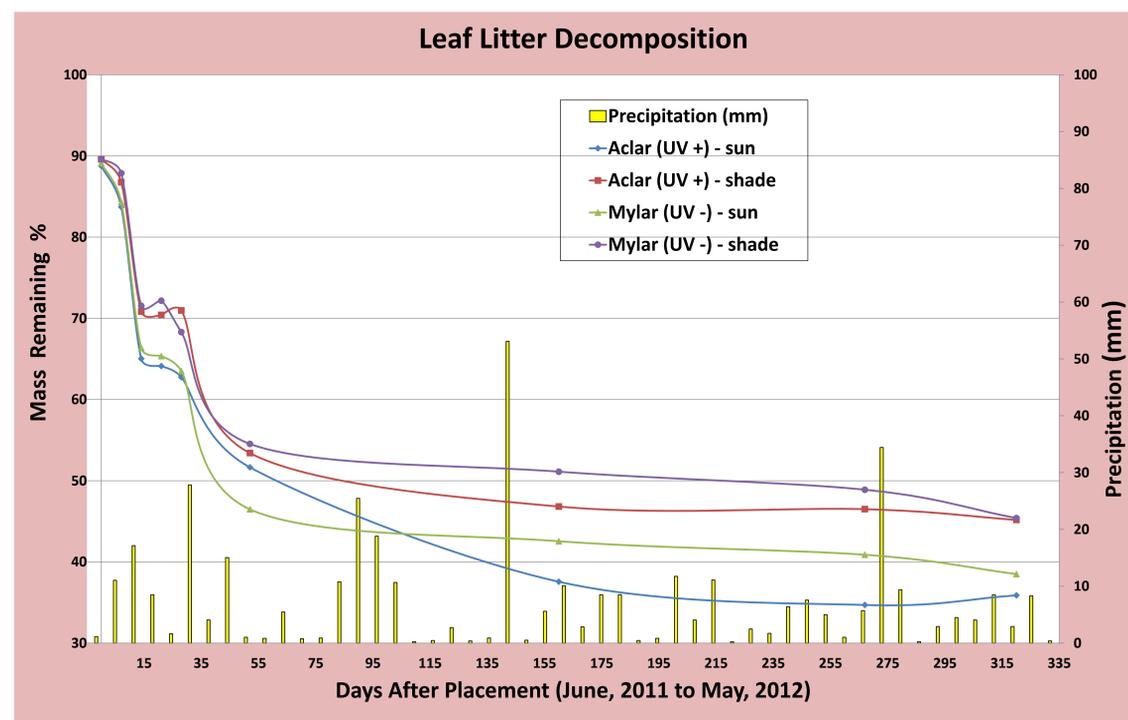
Project 3:



- Temporal patterns of annual herbaceous aboveground net primary production (ANPP) over an 8 year time span.
- Students will determine that ANPP is strongly influenced by management and precipitation.

Project 2:

- Decomposition in full sun placements was greater than that in shade placements (mixed model; $p=0.0013$).
- UV exposure (+, -) did not significantly affect decomposition.
- Mean daily precipitation (between sample dates) was a significant predictor of mass loss (mixed model; $p=0.0079$).



Future Activities

- Disseminate raw databases for peers to use and develop collaborative interdisciplinary instructional units.
- Use the instructional units to foster the students' ability to deal with raw data and its inherent inconsistencies from real world interdisciplinary research.
- Foster connections between math and science educators.

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