Observing Plant Adaptations to Sonoran Desert Environments

Need:
Extremes of climate and disturbance in the Sonoran Desert have shaped the morphological and life history traits of plants we see today. Understanding the connection between environment and plant adaptation and distributions is important to a larger appreciation of ecosystem function, evolution and biodiversity.

Objectives:
Students should be able to:

- Define adaptation, stress and disturbance.
- Describe specific adaptations observed in riparian and upland plants and how those adaptations are suited to the environment in which the species in found..

Connections to unit and other disciplines:
This lesson provides a starting place for more in depth lessons on plant function, diversity and distribution. Communicating observations and making predictions is a fundamental skill in the scientific process. Students who have already studied landscape change with time from aerial photographs will get further insight into the reasons for why such observed changes in vegetation patterns have taken place.

Prior knowledge:
Students should have some knowledge about the structure and function of plants (e.g. the function of root, leaves) and the importance of water to plants.

Introduction (Motivation and Interest Approach):
Show historic photos of the Santa Cruz River. Introduce the idea of observing modern day plants and distributions to answer questions about the adaptation of plants to the environment. The desert wash and surrounding area provides us with different environments in which to make observations and formulate predictions about the role of environment in shaping plant traits, particularly with regards to the role of water availability and flood disturbance.

Content and Procedures:

- (intro activity) Hand out envelopes to each group. Contained are drawings of Sonoran Desert plants. Ask them to come up with a classification scheme based on these simple drawings. Describe how scientists often try to classify like-plants together to better understand the role of different forms and species in the environment. After 3 minutes, quickly go from group to group and ask why they grouped organisms as they did. Move to the idea of grouping organisms by traits (eg deep rooted plants together, cacti together etc.).
- Define evolutionary adaptation: genetic change in a population due to selective pressures in the environment related to a trait (e.g. the deep roots of mesquite). Pressures can come in the form of *stress* and *disturbance*.
- Define stress: deviation of conditions from the optimum (water in the Sonoran Desert)

- Define disturbance: injuries suffered by plants caused by flooding, herbivory, burial, fire etc.
- Examples of plant adaptations using Burgess 1995 (intensive, extensive and water storers), make a chart on the whiteboard. Remind students to take notes.
- Fig. 2.1 (pg. 26) of Gordon et al. showing stream cross-section. Ask students: How the is presence of water in these three environments different? Which of the three classes of plant would you expect in each?

Activity and Assignment:

- DAY 1 Following the lecture, ask the students to rearrange the groups according to Burgess's system and then hand out stream cross-section diagram and ask students to place the plants on the diagram. On the whiteboard, draw your own cross-section and plant communities and go through the activity with the class. Close with describing the field-trip activity and predictions we've made.
- DAY 2 (see worksheet) Go out to the wash and choose and environment in which to work (channel, bank, bank-top). Sketch a plant you find there. In your sketch, focus on the sort of structures you think maybe related to the particular environment in which you find this plant. Answer these questions:
    (1) Can you identify your plant? If not, where would you look to do so?
    (2) Briefly describe the distribution of your plant. Is if found only in one environment (channel, bank, bank-top) or several?
    (3) Describe the structures you drew and how they are represent adaptations to the environment. Are these structures related to stress (hint: conserving water) or disturbance or both?
    (4) If you could dig up your plant, what do you predict its roots would look like? Would it be deeply or shallowly rooted? Would its roots be adapted as large, storage organs or a finely woven mat? Why?
    (5) Besides the availability of water, what do you think are other important environmental factors at work shaping plant traits in the Sonoran Desert.