

CONCEPT DEVELOPMENT

INDUCTIVE: PLANT ADAPTATIONS

Susan Talkmitt and Tobi McMillan, Texas Tech University T-STEM Center/CISER



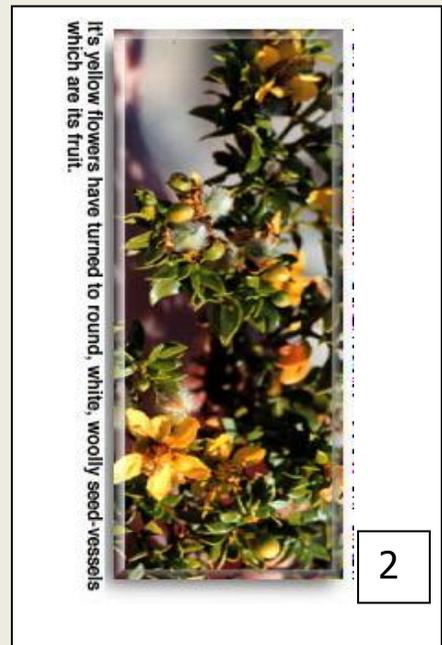
You may use the attached pictures as examples for this activity, or you may find your own examples. Have students work in teams to group the examples in any way they choose, but do not share the concept you are seeking. They should group the examples under a common title and the groups should have subtitles. All groups should relate under a common theme. Tell students that all answers are correct. They are building understanding by looking for patterns. If time permits, ask students to group the examples again with new titles. Once all teams have their examples grouped, have a member from each team share the groupings by telling titles and subtitles. This strategy works well as a pre-assessment or a post assessment.

There are many ways to group the pictures; some of these groups might include: plants with flowers, edible plants, water plants, plants with sharp projections, etc. Once students have made their initial groupings ask them how these groups relate to adaptations, or characteristics that increase the survival of that plant. Following that discussion, provide students with the Adaptive Characteristics handout which offers students additional information about the plants. Have students adjust their groups or make new groups according to this information.

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It's yellow flowers have turned to round, white, woolly seed-vessels which are its fruit.

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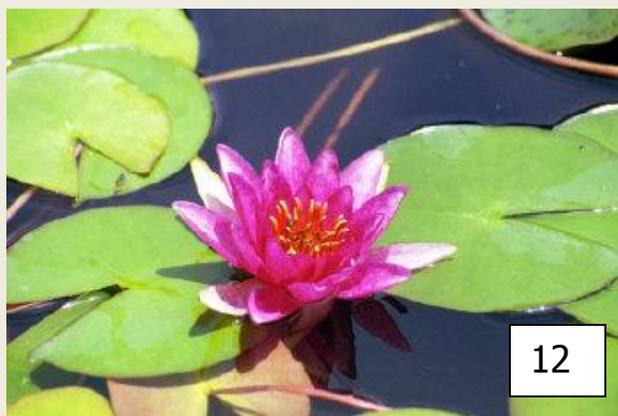
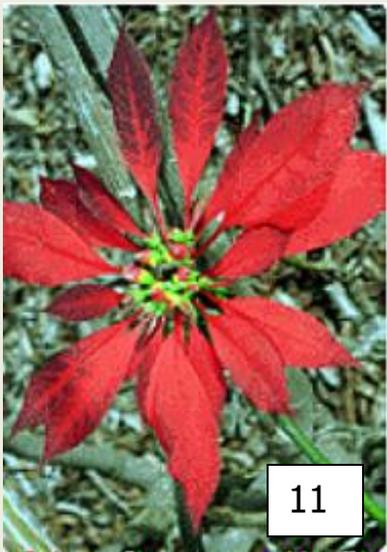
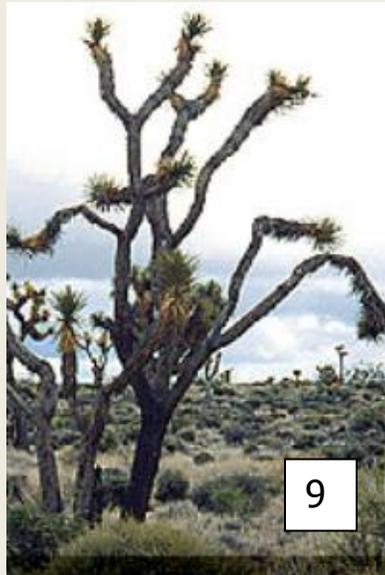
Robert Potts, California Academy of Sciences



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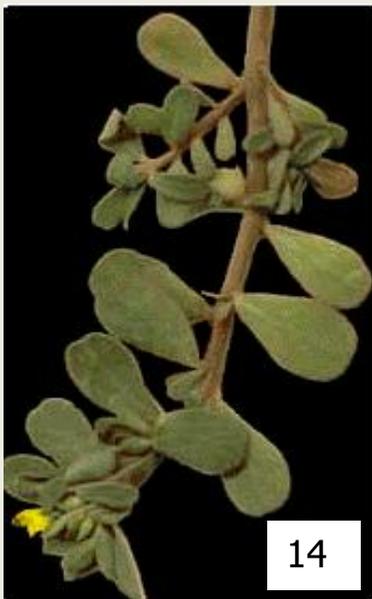
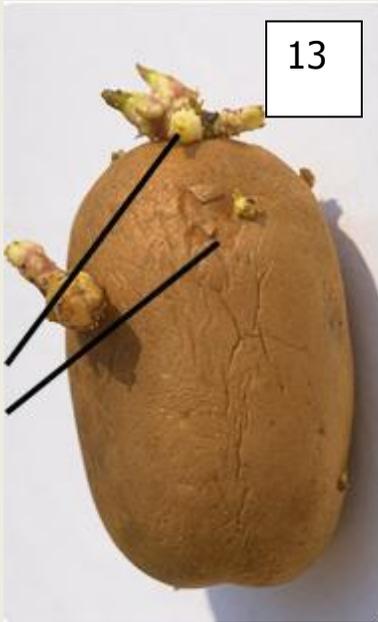
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PLANT	ADAPTIVE CHARACTERISTICS
1. Cattail	<ul style="list-style-type: none">• Spread by numerous underground stems (rhizomes)• Tissue contains pockets of oxygen to stay afloat and allow gas exchange• Deep lateral roots anchor the plant• Numerous fruits –to insure seed production--are produced in a spike that resembles a cat’s tail• Leaf blades are strap-like and stiff with rounded backs for growing tall• Leaf blades spiral in the top half to facilitate plants getting sunlight exposure in thick stands
2. Creosote	<ul style="list-style-type: none">• Small, shiny (waxy), thick leaves conserve water and reflect sunlight to stay cool• Loses most leaves during dry periods• Strong smell/taste and resin coated leaves to deter predators• Two types of roots – radial roots get surface water and deep roots grow towards ground water-both make plant a strong competitor in arid climates
3. Dandelion	<ul style="list-style-type: none">• Deep root to anchor and absorb water• Many reduced flowers in a cluster resemble one flower and insure pollination leading to many seeds• Seeds blow in the wind
4. Ephedra	<ul style="list-style-type: none">• Conifer with needle-like leaves that are circular in shape and covered in a thick cuticle to reduce water loss• Produces chemical (ephedrine) that is deadly in high doses
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6. Four O’clock	<ul style="list-style-type: none">• Bloom late afternoon through evening hours• Flowers release a musky aroma to draw pollinators
7. Poison Ivy	<ul style="list-style-type: none">• Produces sap with chemicals that causes a rash--leads to pain, inflammation, and ulcers of skin
8. Jimsonweed	<ul style="list-style-type: none">• Produces deadly chemicals, as do other members of its family, the nightshade family that includes potatoes and tomatoes• Produces a large flower to attract pollinators
9. Joshua Tree	<ul style="list-style-type: none">• Succulent leaves with thick cuticles and reduced size to prevent water loss in this plant• Spiked leaves to deter predators - not a cactus, but actually the

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	<p>largest of the yuccas, which are members of the lily family</p> <ul style="list-style-type: none">• Clusters of flowers with unpleasant aroma to attract pollinators• Numerous surface roots to quickly collect water
10. Pine Tree	<ul style="list-style-type: none">• Small, waxy, round needles reduce surface area and prevent water loss—small surface to volume ratio• Deep tap root grows to deep ground water needed in drought conditions• Produces resin to deter predators
11. Poinsettia	<ul style="list-style-type: none">• Special leaves turn red to attract pollinators to small yellow flowers that are clustered in the center• Produces a milky latex sap that is an irritant to skin• (studies show the sap is not deadly)
12. Water Lily	<ul style="list-style-type: none">• Shiny leaves reflect sunlight• Large flat leaves (high surface to volume ratio) and oxygen pockets in the leaves help leaves to float• Flowers open in the morning to attract pollinators and close during the day
13. Potato	<ul style="list-style-type: none">• Stores food in an underground stem• Like other members in the nightshade family, it produces a toxic substance in the leaves and stems to deter predators
14. Purslane	<ul style="list-style-type: none">• Low growing plant with succulent stems and leaves to prevent water loss• Small flowers to minimize water loss• Produces many seeds in each flower to assure future generations• Red coloration in the leaves and stems to reflect some of the high-intensity light
15. Saltbush	<ul style="list-style-type: none">• Reduced leaf size to reduce transpiration and hairy to hold moisture• Light gray leaves to reflect light• Leaves weeps salt that it removes from soils that are too salty for most plants
16. Onion	<ul style="list-style-type: none">• Stem is protected below the soil line by fleshy leaves that store food for the plant• Strong smell deters predators
17. Cantaloupe	<ul style="list-style-type: none">• Produces fleshy fruit with numerous seeds to draw animals that will eat the fruit and pass seeds• Thick epidermis protects fruit from small pests

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	<ul style="list-style-type: none">• Hairy leaves keep moisture close to plant• Hairy leaves and prickly stems deter pests• Large leaves maximize photosynthesis but curl in drought conditions• Produces tendrils that facilitate quick, aggressive growth
18. Cocklebur	<ul style="list-style-type: none">• Reduced leaves to prevent water loss• Numerous, spiny fruits attach to predators for seed dispersal
19. Water Hyacinth	<ul style="list-style-type: none">• Reduced roots• Shiny leaves to reflect light and stay cool• Flat, thick leaves with oxygen pockets for floating• Dominates ponds by growing so rapidly: abundant decaying biomass creates an anaerobic environment that eliminates other plants
20. Water Lily	<ul style="list-style-type: none">• Large flat leaves (high surface to volume ratio) and oxygen pockets in the leaves help leaves to float• Shiny leaves reflect sunlight• Flowers open in the morning to attract pollinators and close during the day
21. Watermelon	<ul style="list-style-type: none">• Plants produce fleshy fruits and numerous seeds to attract animals that will disperse the seeds• Plants have tendrils to facilitate quick spreading and aggressive growth• Leaves and stems have coarse, prickly hairs to prevent water loss and to protect the plant from predators• Thick epidermis protects fruit from small pests• Large leaves maximize photosynthesis but curl in drought conditions
22. Prickly Pear	<ul style="list-style-type: none">• Conserves water by having reduced leaves: spines• Stores water in fleshy stems: cactus pads• Extensive shallow root system quickly collect water when it rains• Has spikes to protect from predators• Contains calcium oxalate under the skin that causes kidney damage when eaten.• Fruits have thick, waxy covering with spines to deter predators
23. Mesquite	<ul style="list-style-type: none">• Has modified stem extensions called thorns that provide protection• Has deep roots that grow to the water table to get water• Reduces water loss by small leaf size and by folding leaves that close to reduce surface area
24. Poison Hemlock	<ul style="list-style-type: none">• Reduced leaves in alternating pattern that reduces plant stress from sun

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	<ul style="list-style-type: none">• Numerous, tiny flowers in clusters facilitates pollination and seed production• Poisonous sap that causes paralysis and possible death
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Reference URL sites

http://plants.usda.gov/cgi_bin/topics.cgi?earl=plant_profile.cgi&symbol=TOVE&photoID=tove_1v.jpg

<http://www.botanical.com/botanical/mgmh/poison.html>

<http://www.microscopy-uk.org.uk/mag/articles/anne1.html>

<http://www.edibleplants.com/month/purslane.htm>

<http://www.webschool.org.uk/science/adaptations3/sld004.htm>

http://www.desertusa.com/du_plantsurv.html

<http://www.desertmuseum.org/education/tip6-8sample.html>

http://plants.usda.gov/cgi_bin/topics.cgi

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EVALUATION

The following is an extension on the initial inductive activity and can be used as further assessment to determine whether students understand the concept.

MATERIALS

Plant Adaptations Inductive Cards
Environmental Conditions Cards

PROCEDURE

1. Have each student in the class take one card from the Plant Adaptations inductive activity. The student will refer to this plant card for each set of conditions provided in the evaluation.
2. Divide the room into two sides to represent the following groups:
 - Survive
 - Show characteristics needed to survive in this environment
 - Die
 - Lack overall characteristics needed to survive in this environment
3. Draw a card to introduce a set of environmental conditions (such as hot, dry, and sunny), and have students observe their plant cards to determine “survive” or “die.” Next, they should quickly move to the side of the room that best describes the fate of their individual cards.
4. Once students are divided into two sides, have each group brainstorm by looking at the cards, collectively, to derive two or three characteristics that justify the choice to survive or die.
5. Get representatives from each group to share the characteristics with the class.
6. Draw a different card with a set of environmental conditions, and have the class repeat the procedure of choosing a side and brainstorming to find similar characteristics. Again, representatives from each group should share the information.
7. Repeat this procedure for each card drawn.

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HOT DRY SUNNY	HOT HUMID SUNNY
COLD DRY SUNNY	COLD HUMID SUNNY
TEMPERATE HUMID SHADY	HOT SWAMPY SHADY



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