4. Amazing Adaptations
(1) Halophytes: Plants That Love Salt

***Halophytes** have found a **niche** at Bottomless Lakes State Park and Bitter Lakes National Wildlife Refuge by adapting to salty soils. (Field Trip / 45-60 minutes)*

Connecting with Science Standards			
Strand/Categories	***Grade***	***Standard(s)***	***Benchmark(s)***
Life Science	4/5	Forms, structures, habitats	Structures, roots, leaves, environmental changes
	4	Similarities, differences	Survival of organisms in environment
	5	Genetic traits	Inheritable traits, heredity
Scientific Thinking/Practice	4/5	Scientific methods	Instruments, investigations, appropriate tech

Goal: Students will identify halophytic (salt-loving) plants and learn how these plants have **adapted** to this environment.

Objective:

- Identify salt cedar, salt grass, iodine bush, four-wing salt bush and Pecos sunflower.
- Record data and observations about these halophytic plants.
- Using an **electrical conductivity meter**, students will test and compare the amount of salt in the soil around each plant.

Materials:

- Clipboards
- Pencils
- Data observation sheets
- Plant identifications cards
- Quart-size, zip-top plastic storage bags
- Small garden trowels
- Permanent markers
- Electrical conductivity meter
- Plastic cups
- Distilled water

Background

Are there certain foods that you just have to salt? Maybe French fries or popcorn? Salt is essential to life, and we all need some every day.

There are some plants that need salt too. They are called **halophytes** (HAL o fites), or salt-loving plants. They have **adapted** over time to living in soils that have much higher amounts of salt than other soils, absorbing the salt through their **roots**. These plants have learned to live in places and conditions that most plants can't. Several of these salt-loving plants grow at Bottomless Lakes State Park. You'll notice that much of the soil here is white and salty. These salts form when underground water containing **gypsum** and salt travels upward through the rocks and soil to the surface. When the water **evaporates**, the gypsum and salt are left behind, leaving behind a white crust. This white crust helps to create a special **niche** for local plants like salt cedar, four-wing salt bush, salt grass, iodine bush and even the endangered Pecos sunflower.

Pass the Salt?

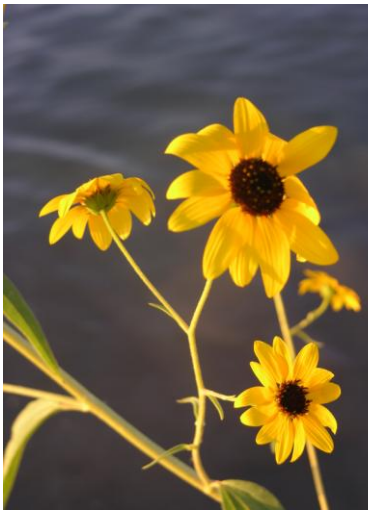
Similar to people, these halophytes "sweat" out excess salt through salt glands called **trichomes.** The excess salts are accumulated and **excreted** through **pores** in the plants' leaves. The salt is then re-deposited back into the soil and the cycle starts all over again. Some plants, like the salt cedar, actually change the **soil composition** with the salt they add, giving them a competitive edge over other plants.

Procedure I: A Dash of Salt

1. Have students divide into teams of 3-4 per group.
2. Hand-out clipboards, pencils, plant ID cards, keys and data observation sheets - one per group.
3. Using the ID cards and keys, students will locate the five different halophytes.
4. Once a halophyte is identified, teams will answer questions and list observations about each plant.
5. After teams find all five plants and return to the starting point, groups will share and compare their results with each other.

Procedure II: Worth Its Weight in Salt

1. Give each team a quart-size zip-top plastic storage bag and one small trowel.
2. Assign each team ***one*** of the halophytes to re-visit. Have team write the name of their plant on outside of bag with permanent marker.
3. Tell students they will be discovering which plant has the saltiest soil by testing the amount of salt in the ground near their plant. Ask students to guess which one they think it will be.
4. Once teams re-locate their plant, they will dig a small hole near the plant, approximately 6-inches deep. Students will put one scoop of soil from bottom of hole into the plastic storage bag.
5. After returning to the starting point, each team will test their soil sample for salt (saline) using the electric conductivity (EC) meter. Teachers/staff will assist students in using the EC meter.
6. Students will share results and discover which plant grows in the saltiest soil.



Pecos sunflower

Iodine bush

Saltgrass

Testing for salinity using the electrical conductivity meter (ECe)

Salinity indicates the amount of soluble (dissolvable in liquid) salt in soil. Different plants have different salt tolerance levels. Generally, if ECe = 0 to 2, salinity effects are very low; if ECe = 2 to 4, salinity is low and may affect sensitive plants; if ECe = 4 to 8, salinity is medium with many plants restricted; if ECe = 8 to 16, salinity is high, with only tolerant plants able to grow; if ECe is above 16, salinity is very high and only a few, highly tolerant plants will grow.

Procedure:

1. Collect soil samples.
2. Dissolve 10 g of each soil sample into 100 mL pure water. Mix the soil solution well.
3. Let settle and decant the soil solution into a container.
4. Measure the electrical current flows in each soil solution.
5. By using your group calibration line, determine the amount of salt in each soil solution.
6. Students will rate the amount of salt in their soil sample as very low, low, medium, high or very high.
7. Students will share their results and determine which plant grows in the saltiest soil.

Amazing Adaptations/ Halophytes
Vocabulary Words

Adapted: an organism that has adapted to living successfully in its environment is able to cope with environmental stresses and pressures. Adaptations can be structural, behavioral or physiological.

Electrical conductivity meter: (EC meter) measures the electrical conductivity in a solution. Commonly used in hydroponics, aquaculture and freshwater systems to monitor the amount of nutrients, salts or impurities in the water.

Evaporation: the process of water changing from liquid to vapor.

Excrete: to separate and discharge waste matter.

Gypsum: a very soft mineral composed of calcium sulfate dihydrate. Gypsum is a common mineral, with thick and extensive evaporite beds in association with sedimentary rocks.

Halophytes: plants that are adapted to growing in salty environments and accumulate high concentrations of salt in their tissues. Relatively few plant species are halophytes - perhaps only 2% of all plant species.

Niche: how an organism makes a living. The ecological niche describes how an organism or population responds to the distribution of resources and competitors

Pores: small openings in plant tissue, allowing absorption and transpiration.

Roots: the anchors of most plants. Usually underground, roots lack buds, leaves, or nodes and serves as support. They draw minerals and water from the surrounding soil, and sometimes store food.

Salinity: the amount of soluble salt.

Soil Composition: the ingredients of soil; mineral, nutrient and organic matter.

Trichomes: from the Greek meaning "growth of hair", trichomes are fine outgrowths or appendages on plants. A common type of trichome is a **hair**.

Amazing Adaptations/ Halophytes
Teacher Evaluation

Your feedback will help make the Outdoor Classroom Program a long-lived success. Please help us improve this activity and the BWBL curriculum by taking a few minutes to provide some constructive answers to the questions below.

Date of field trip:_____ Location of field trip: _____

School/City: _____ Grade: _____ # students: _____

Your name: _____ Your phone or email: _____

1. In what capacity did you use this activity? (please check one) ____ field trip _____ classroom (pre- or post-field trip)
2. Who led the activity? (please check one) ____you _____another teacher _____agency staff
3. Please rate your overall impression of this activity.

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poor Good Excellent

4. How well do you think it met the stated Goals/Objectives on the front page of the activity?

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poorly Fairly well Right on target

5. How well did it compliment/support classroom study?

1 2 3 4 5 6 7 8 9 10 (please circle one)
Poorly Fairly well Right on target

E1. What do you believe your students gained from this activity in terms of learning?

E2. How did you assess learning from this activity?

E3. What would you suggest as a practical assessment for future revisions of this activity?

E4. What else would you suggest to improve this activity and/or the BWBL curriculum?

Please fax this completed form to (505) 476-3361, Attn: Outdoor Classroom Program

AMAZING ADAPTATIONS
Halophytes: Plants That Love Salt Worksheet

Team/Name: _____ Date: _____

Using the flash cards or field guides, find and identify salt cedar, salt grass, iodine bush, four-wing salt bush and Pecos sunflower. Once you have identified these salt-loving halophytes, write down your observations about each one:

Halophyte #1

1. Are there leaves? If so, describe them (color, shape, texture):

2. What do you observe about the stems?

3. Are there flowers? If so, describe them:

4. What do you notice about the area surrounding this plant. Are there other plants growing nearby?

5. What plant is this halophyte?

Halophyte #2

1. Are there leaves? If so, describe them (color, shape, texture):

2. What do you observe about the stems?

3. Are there flowers? If so, describe them:

4. What do you notice about the area surrounding this plant. Are there other plants growing nearby?

5. What plant is this halophyte?

AMAZING ADAPTATIONS
Halophytes: Plants That Love Salt Worksheet

Halophyte #3

1. Are there leaves? If so, describe them (color, shape, texture):

2. What do you observe about the stems?

3. Are there flowers? If so, describe them:

4. What do you notice about the area surrounding this plant. Are there other plants growing nearby?

5. What plant is this halophyte?

Halophyte #4

1. Are there leaves? If so, describe them (color, shape, texture):

2. What do you observe about the stems?

3. Are there flowers? If so, describe them:

4. What do you notice about the area surrounding this plant. Are there other plants growing nearby?

5. What plant is this halophyte?

Halophyte #5

1. Are there leaves? If so, describe them (color, shape, texture):

2. What do you observe about the stems?

3. Are there flowers? If so, describe them:

4. What do you notice about the area surrounding this plant. Are there other plants growing nearby?

5. What plant is this halophyte?