ELA Common Core Content Standards:
Reading Standards Informational Text 4, 5, 7, 8
Reading Standards: Foundational Skills 1, 2, 3
Writing Standards 2, 3, 8
Speaking and Listening Standards 2, 4

Estimated duration: One 2-hour lesson and a field trip for plant identification and collection

Goal: Students will further their knowledge of Native plant identification, drawing from both Traditional Ecological Knowledge and Western Science traditions.

Teacher Background: The cultural heritage of most Native American and Alaska Native peoples, including that of the Karuk People, incorporates sophisticated traditional ecological knowledge into all components. This Native Science is derived from "a lived and storied participation with the natural landscape."[1] Despite these strong cultural traditions, Native People are the most under-represented minority in scientific disciplines overall, especially in the natural sciences. While many people would agree that Native scientists would be likely to bring new perspectives and potential insights to environmental science and resource management, it appears that most Native American students, as well as many students from other cultural traditions, are intimidated by science and math courses.

Native American students also come up against an additional barrier--the tendency of western scientific and academic traditions to either ignore or make light of the principles and knowledge of indigenous peoples. The cultural bias that is at the core of this behavior rests on an idea the science must be objective to qualify as science. The fact that there is nothing in the human experience that exists outside of culture (and is thus inextricably influenced by it) is often overlooked, however. More and more, social scientists understand that culture frames all of human thought and activity – including developing systems of knowledge, technology, and education.

This lesson will help students understand that two forms of science – Traditional Ecological Knowledge (TEK) and western science – can augment each other when properly understood. The scientific focus here is on botany, the science of plants.

[1] quote from Leroy Little Bear, J.D., former director of the Native American Program at Harvard University

Theme/Big Idea: Wise teachers can be found in many places

Big Questions: How can we learn about plants? How can we help protect them?

Vocabulary: specimen, mount, deterioration, habitat, integration, botany, imbedded code, inherent, authority, distribution, inventory, facilitate

Materials:

Pírish: Medicinal Plant Field Guide, interactive media (included; also in G5L4)

Plant Specimen Collection: Tips for Botanical Field Work PowerPoint (included)

Learning about Your Herbaria: Karuk Tribe's Special Plant Collections, Megan Mucioki, Ph.D. (included)

Vocabulary Worksheet (included)

Preparation:

Arrange a field trip to collect plant specimens, and invite a botanist to join

Prepare the PowerPoint for projection

Print out **Learning about Your Herbaria** article and Vocabulary Worksheet for each student

Check out plant presses from the Karuk Department of Natural Resources, if desired

Make sure students have their **Pírish: Medicinal Plant Field Guide** for this lesson and field trip

Discussion Circle: Tell students that today we will continue learning about nature's gifts. Ask them if they remember some of the medicinal plants native to this area in our last lesson (We learned about eleven different plants: chitem/buckthorn, dogwood, prince's pine, mountain balm, wormwood, peppernut, angelica root, rattlesnake plantain, madrone, choke-cherry, and wild strawberry). Tell them that people of all cultures learn about their environment by studying the plants and animals. We have a responsibility to care for all that is given us. Ask them: "If you agree say, "**chími***!*[2]*"* (fine, alright)

Make sure students understand that the word "science" means "knowledge" and that different people have different ideas about what knowledge is. Karuk People, like other tribal people, have watched the plants, animals, fish, stars, winds and weather for thousands of years – and still do – to learn how and when to do things to improve their lives and the lives of their relations, which includes all these things. This kind of knowledge is called traditional ecological knowledge or TEK for short. The well-known ecologist, M. Kat Anderson, defines TEK as "rich knowledge of how nature works and how to judiciously harvest and steward its plants and animals without destroying them" and describes its development as "the product of keen observation, patience, experimentation, and long-term relationships with plants and animals…built on a history, gained through many generations of learning passed down by elders about practical as well as spiritual practices."[3]

[2] Pronounced something like "CHI-me."

[3] Anderson, M. K. (2005). *Tending the Wild.* Berkeley and Los Angeles, CA: University of California Press

Some people use other ways of measuring changes to notice differences in the environment, and one way we will talk about here: western science. This is a system of knowledge which relies on certain laws that have been established through measurable methods. For friends of the natural environment, it is important to understand both of these ways of thinking and looking at things.

Reading for Vocabulary: Have students read the title of **Learning about Your Herbaria: the Karuk Tribe's Special Plant Collections** (included). Ask students if they can tell what *herbaria* means by seeking clues in the title. Explain to students that this word is Latin, which is the ancient language of the Roman people who used to inhabit southern Europe. This language has a different way to indicate number, that is, whether a noun is singular or plural. An *herbarium* is one collection of plants, but *herbaria* are collections of plants, i.e., plural.

Next, ask students to read the text silently and to underline or highlight words with which they are unfamiliar. Tell them that some terms may be defined already in the text, and so these shouldn't need to be underlined if they read the context. After the students have finished reading, pass out Vocabulary Worksheet. Ask them if they have underlined the same words listed as vocabulary. Clear up the meaning of any other words they may have trouble understanding. Finally, have students take turns reading the text aloud, stopping to find synonyms for vocabulary words.

Comprehension: Lead the class to a general discussion of the text in order to gauge their comprehension. Some suggested leads are:

- What is the main difference between western science and traditional ecological knowledge? (the former is based on measurement, or analytical data; the latter is based on experience and oral history, or empirical data)
- What did the author list as reasons why the Karuk Herbaria are important?
- Do you agree with her reasoning, and can you think of other reasons?
- Do you think that being able to look at pressed plants would help you identify them better?

Building Background

Tell students that they will be going on a field trip to collect some of the plants to press. Because the drying of plants takes several months, students will have to be patient to do the final mounting in their field books (this may have to wait until the following school year, depending on your schedule). Today, they will view a PowerPoint on **Plant Specimen Collection: Tips for Botanical Field Work** to learn how to prepare for this field trip.

Presentation: Show **Plant Specimen Collection** PowerPoint and ask students to take notes during the presentation. This slide presentation explains to students what they should bring on their plant collection field trip, how they can prepare by researching the plants they want to collect, what information to collect on site, how to harvest and transport plants, and how to press the plants.

Make sure they have the information that they need to prepare for the trip, and to record the information needed during the activity by asking questions about what they've just seen. Lead questions could be:

- What should you bring on a plant collection field trip?
- How can you prepare for this trip if you are unsure of what plants you want to collect?
- What information should you collect on site?
- How should you harvest and transport plants? (Make sure they remember to follow the Harvesting Etiquette they learned in G5L4)
- How should you press the plants?
- How can you prevent pests and mold from spoiling your plant specimens?
- How long should you wait until you remove the plants from the press?

Some important information that should not be forgotten to place next to specimens:

- ***Name, if known:*** *Note that students may look up missing information back at school if needed.*
- ***Locality***
- ***Habitat and Plant Associates:*** *Students should try their best to describe the plant's environment.*
- ***Collector(s) Names***
- ***Date***

Field Excursion: Making sure students have at least a working copy of their Medicinal Plant Field Guide and proper clothing, take students on a field excursion to find some of the plants listed for collection. You may wish to contact the Karuk Tribe Department of Natural Resources for suitable locations to visit, and for contacts to local botanists – TEK or western science learned.

References:

Anderson, M. K. (2005). *Tending the Wild.* Berkeley & Los Angeles, CA: Univ. of California Press

Mazzocchi, F. (2006). *Western science and traditional knowledge: Despite their variations, different forms of knowledge can learn from each other*. European Molecular Biology Organization, EMBO *reports*, VOL 7, No. 5. Available online at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1479546/ [retrieved 11/16/15]

Resources:

Karuk Tribe Dep. of Natural Resources, (530) 627-3446 – Environmental Education Division

Karuk Tribe Education Department, (530) 498-1600

Home Science Tools – online site for students: http://www.hometrainingtools.com/a/botany-herbarium-science-teaching-tip

Learning about Your Herbarium: the Karuk Tribe's Special Plant Collections

Megan Mucioki, Ph.D.

A herbarium is a collection of pressed and dried plants. The flowers, leaves, stems, fruits, and sometimes seeds of each plant are called voucher specimens. These plant specimens are usually mounted on rigid paper and filed in cabinets to protect the plants from further deterioration. Herbaria can be found at universities, museums, and botanical gardens and usually comprise plants from all over the world. Some of the largest collections contain over 6 million voucher specimens.

Karuk Herbaria

The Karuk Tribe has two herbaria. One is located in Happy Camp at the People's Center and the other in Orleans at the Department of Natural Resources. These collections of pressed plants are very special because they only include plants found on Karuk Ancestral Territory and homelands and used by Karuk people for food, medicine, baskets, bows, nets, regalia, ceremony, and other traditional uses.

Each plant specimen is accompanied by information about the plant's habitat, where it was found, who collected the specimen, and what date it was collected. The voucher specimens in the tribal herbaria may include other information, for example what the plant is used for by Karuk people or references to stories in which the plant is featured.

Using western science and traditional ecological knowledge

While other herbaria have been developed and maintained through western science based methods, the Karuk Herbaria are established and maintained through the integration of western science and traditional ecological knowledge (TEK).

Western science methods of plant collection, pressing, mounting, and long-term preservation were used to establish the Karuk Herbaria. For example, western science has established guidelines for preventing pests from invading collections, and developed a type of glue that will not destroy the plant

when it is mounted on paper. In addition to Karuk names and common English names, the plant naming system established by western science is also included on each specimen to identify the plant. This naming system uses two words to identify each plant: first, the genus, which refers to the plant's class or kind; and second, the plant's species, which refers to its particular kind. This naming system is known as the botanical nomenclature and is used by scientists all over the world.

The traditional botany of the Karuk people has been developed over centuries. This TEK is essential to finding plants in the field, identifying these plants, and understanding their uses. Frequently, Karuk words or word parts describing plant habitat and use are imbedded in the Karuk name of a plant. These names are therefore doubly important in their function to classify plants in the Karuk Herbaria. Additionally, tribal codes that are founded on Karuk TEK govern where and how plants are collected for the herbaria. These rules ensure that plant populations are maintained sustainably.

Why are the Karuk Herbaria important?

The Karuk Herbaria are one resource that can be used to exercise the Tribe's inherent authority over their land, resources, food, and knowledge. Because properly stored pressed plants last hundreds of years, and future generations of Karuk people will be able to access, learn from and use these collections. Collecting multiple specimens of the same plant species over time can provide information about how climate change is effecting the distribution of plants. Also collecting an inventory of plants from an area before and after cultural burns as well as after wildfires can demonstrate the ecological benefits of fire on the landscape. Lastly, the tribal herbaria can be used as a teaching tool for youth and adults and facilitate knowledge transfer about traditional foods and medicines.

You can make a herbarium

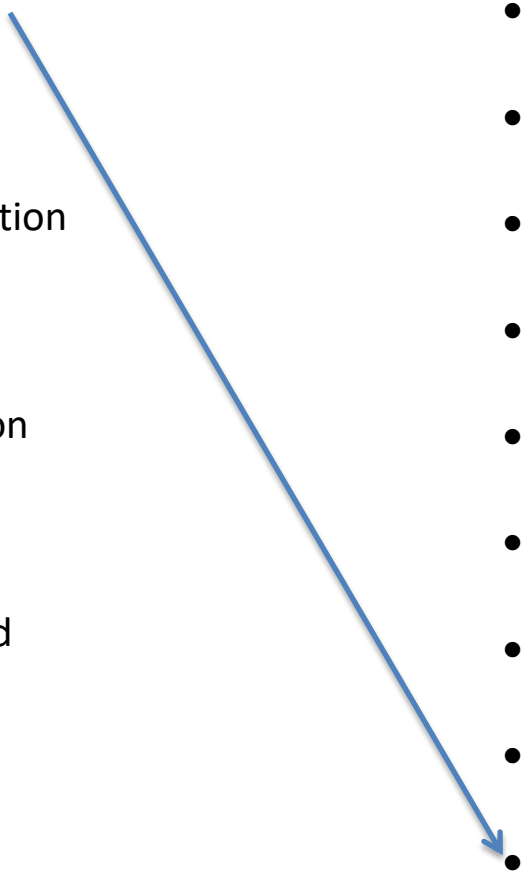
Anyone can collect and press plants. It is a great way to interact with and learn about traditional foods and medicines and enjoy a day outside. The Karuk Department of Natural Resources has plant presses to loan to local schools and youth with their guardians.

Name: _____

Vocabulary Worksheet

Match the vocabulary words with synonyms or word phrases that can replace the words in the lesson text. The first one is done for you.

1. specimen
2. mount
3. deterioration
4. habitat
5. integration
6. botany
7. imbedded
8. code
9. inherent
10. authority
11. distribution
12. inventory
13. facilitate



- affix
- combination
- environment
- fundamental
- law
- right
- rooted
- ruin
- sample
- spreading
- study of plants
- summary
- help