

1.6

Grade Level

6-9

Subjects

Science

Time Frame

1-2 class periods

Teacher Materials

- Oak Woodland Ecosystem Cards
- Sample Keystone Species
- Oak Woodland Keystone Species Answer Key
- Butcher paper

Oak Woodland Keystone Species Exploration

In this lesson, students learn about **keystone species**, and use their knowledge to build a food web using a selection of species from their **Oak Woodland Ecosystem Cards**. Students use observational thinking skills to determine two keystone species and read about ways to support those species.

Teacher Background

This lesson begins by introducing students to the concept of being a responsible and respectful guest on Indigenous traditional lands. Introducing **land stewardship** in this way promotes **allyship** with Native communities, as well as plant and animal species.

Students will further explore the relationship between animals, plants, and humans in the Pomo Oak Woodland Ecosystem by solving a food web puzzle. Students will create a food web using the information on the **Oak Woodland Ecosystem Cards** and will use their energy transfer labels to determine the keystone species. The keystone species is the species on which the ecosystem depends for balance and health. In this case, the keystone species are the Black Oak Tree and Humans (which, are also apex predators). Because the Black Oak carries significance in the following nutrition lessons, students will begin to look at oaks in detail.

1.6

Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

The **Oak Tree** is a keystone species in the Oak Woodlands Ecosystem because it provides food, shelter, shade, and cultural materials for so many different species. Due to massive deforestation, neglect, , disease, regulations on controlled fires, etc. California's Oak population has dramatically decreased and continues to decrease. This is dangerous because without oaks, much of California's ecosystem risks collapse, and a major cultural resource for California's indigenous people will be gone.

Although California is home to 20 species of Native oak trees, the Black Oak is featured in the following lesson and in many of the proceeding lessons. Each species is different in terms of preference, cultural importance, and degree of proliferation. Because acorns are a traditional staple food to the Pomo, and most California Native cultures, tribes have developed acorn species preferences based on flavor and ease of preparation. Pomo cultural knowledge bearers, for example, note that Tan Oaks in the area near Lake County, California are more prolific, meaning they bear more acorns in a given year, reducing the amount of gathering time needed. Black Oak acorns, on the other hand, are larger in size as compared to the Tan Oak. Not only are Black Oak acorns larger, they are also oilier, and carry more nutritious protein. Their oiliness makes them easier to leach, an action taken to reduce the bitterness from the acorns before they are turned into food.

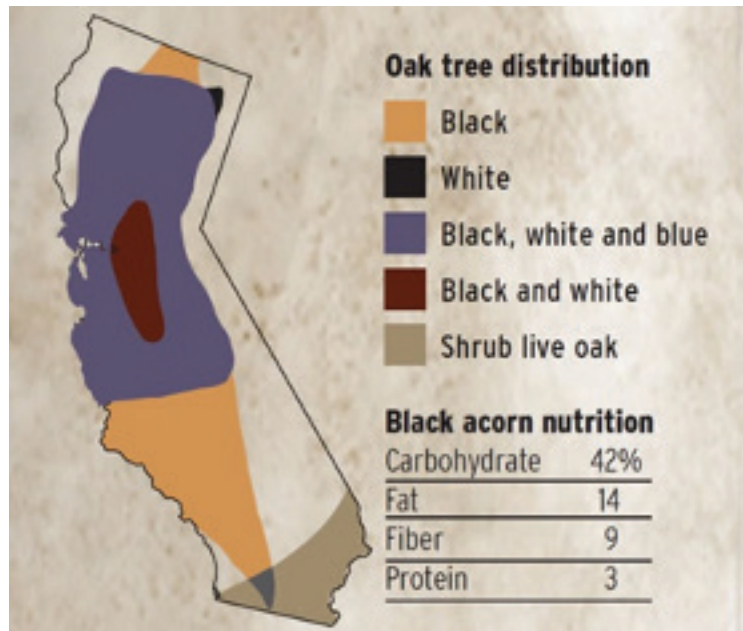
The cultural importance of the oak and acorn is highlighted in a wide variety of stories and cultural items. Specific baskets structures and designs are integral to every step of acorn care, from harvesting to storing, to cooking. Stories, such as those linked below, are used to explain the flavors and preference between acorn species:

Acorn Stories: <https://docs.google.com/document/d/1Kcoah659vn1FzkGJ-OehCsR-3Bhs-EVLG/edit>

1.6

Oak Woodland Kestone Species Exploration

Healthy Ecosystems Feed Healthy Communities



The image above shows the distribution of oak trees throughout California. Notice which oaks are most common in your local area. Over time, this distribution may change, as Oak populations continue to be threatened by climate change and human activity.

For more information about California's Oak populations, read:

- <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=25907.wba>
- <https://www.sfchronicle.com/environment/article/Sudden-oak-death-spreading-fast-California-s-14815683.php>
- <https://phys.org/news/2019-11-california-valley-oak-poorly-temperatures.html>
- <https://www.cnps.org/citizen-science/cnps-announces-re-oak-california-13718>
- <https://www.sciencedaily.com/releases/2016/05/160502161111.htm>
- <https://www.sciencedaily.com/releases/2007/08/070815145316.htm>



Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Vocabulary

- **Keystone Species:** A species on which other species in an ecosystem largely depend, such that if it were removed the ecosystem would change drastically.
- **Ecosystem:** A biological community of interacting organisms and their physical environment.
- **Consumer:** An organism that derives the organic compounds and energy it needs from the consumption of other organisms; a heterotroph.
- **Apex Predator:** A predator at the top of a food chain that is not preyed upon by any other animal.
- **Trophic Level:** One of the hierarchical strata of a food web characterized by organisms which are the same number of steps removed from the primary producers.
- **Primary Producer:** Organisms that convert energy from light or heat into organic tissue. Plants are an example of a primary producer.

1.6

Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Engage

Have students answer the following quick write prompt:

Quick write: When you go to someone's house, what does it mean to be a "good guest"? How do you behave, what do you not do, etc?

Explain that in California, all non-Native peoples are guests on indigenous traditional lands. Even Native people are guests if they are in a land that is not their traditional territory.

Below are a list of behavior statements. Put a "Y" if the behavior represents being a good guest on Native traditional land, and a "N" if it does not.

1. **Walking into someone's house when they are not home.**
2. **Asking if you can borrow something before taking it.**
3. **Cutting down your neighbor's apple tree without permission.**
4. **Offering to help do the dishes after a meal.**
5. **Cleaning up after yourself.**
6. **Dropping off a new pet at someone's house without warning.**
7. **Digging up items in your friend's yard without asking for permission.**

Engage students in a conversation about why they would usually not behave according to the examples.

Explore

Explain that we are all living on **Traditional Miwok, Wappo, Wailaki, or Pomo traditional lands**. Because of this, we must be respectful guests by taking care of the ecosystem. In the Oak Woodland ecosystem, disrespectful guest behavior can cause problems for the plants, animals, and humans. Today we are going to learn about some of the most important plant and animals species in our ecosystem, so that we can begin to learn how to support them.

1.6

Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Project the **Food Web Example** for students to see. Walk students through the food web, pointing out the direction of the arrows, as they point in the direction of the organism receiving energy. Take time to cover up specific organisms in the food web, asking students how other species would be impacted by the disappearance of each organism. Some species populations might diminish, while others might grow and expand, for example.

Explain

Review the role that keystone species play in their environments through the following EdPuzzle video:

<https://edpuzzle.com/media/5f1b3ae400f2863f11b1e201>

Review the questions in the EdPuzzle with the class, clarifying any questions about the role of Keystone Species.

Before moving on to the next section, students should know that food webs rely on keystone species for survival. When keystone species are harmed, all of the plants and animals that rely on that species for food, shelter, or other sustenance are also harmed.

Elaborate/ Extend

Organize students in groups of 2-3.

Distribute a piece of butcher paper and the **Oak Woodland Ecosystem Cards**. Ask students to pull out the following six cards:

1. **Grasshopper**
2. **Deer**
3. **Black Oak Tree**
4. **Quail**
5. **Squirrels**
6. **Humans**

1.6

Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Pair or group students up with one another. Ask students to develop a food web using the six **Oak Woodland Ecosystem Cards** and the information included on them.

Remind students to draw arrows between species to show relationships and energy transference.

In groups of 2-3, have students build a food web that connects all six species cards. Ask students to draw out their web on their butcher paper, including arrows that show energy transference. Remind students that the arrows should point towards the species receiving energy.

Once students have designed their food web, ask students which two species in their webs are keystone species.

Prompting questions may include:

- 1. Which species has the most arrows pointing towards them? Why?**
- 2. Which species has the least arrows pointing towards them? Why?**
- 3. How would the food web be impacted if either of the species named disappeared?**

Explain to students that, of the three keystone species in their food web, Oak Trees are perhaps the most impacted by irresponsible human behavior- or bad behavior from guests/ settlers.

As a class, read the following short article from California's Audubon Society, exploring ways people can protect Oak trees: https://ca.audubon.org/sites/default/files/workinglands_oaks_021412.pdf



Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Evaluate

Prompt students to reflect on the importance of protecting keystone species with the following questions:

- 1. Why are oak trees so important to our local food webs?**
- 2. Are there any specific human behaviors that impact oak tree populations negatively? Positively?**
- 3. What are some ways that humans can protect oak tree populations?**

1.6

Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Lesson Resources

Supporting resources for educators:

- **Acorn Stories:** <https://docs.google.com/document/d/1Kcoah659vn1FzkGJ-OehCsR-3Bhs-EVLG/edit>
- **Oak Population Links:**
 - <https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=25907.wba>
 - https://nature.berkeley.edu/matteolab/wp-content/uploads/2019/11/Sudden-oak-death-spreading-fast-California%E2%80%99s-coastal-forests-facing-devastation-SFChronicle.com_.pdf
 - <https://phys.org/news/2019-11-california-valley-oak-poorly-temperatures.html>
 - <https://www.cnps.org/citizen-science/cnps-announces-re-oak-california-13718>
 - <https://www.sciencedaily.com/releases/2016/05/160502161111.htm>
 - <https://www.sciencedaily.com/releases/2007/08/070815145316.htm>

Lesson Materials:

- **Edpuzzle Link:** <https://edpuzzle.com/media/5f1b3ae400f2863f11b1e201>
- **Audubon Society Link:** https://ca.audubon.org/sites/default/files/workinglands_oaks_021412.pdf



Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Learning Standards

CA Indian Essential Understandings

Essential Understanding 3: Tribal traditional beliefs and practices, including links to spirituality, are practiced in communities where the culture, traditions and languages are vibrant parts of daily life.

This lesson builds towards Essential Understanding 3 by introducing students to some of the most important plants and animals in the indigenous ecosystem, specifically focusing on the Black Oak, which produces the staple food of the Pomo people.

CA Content Standard

Common Core

WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research

WHST .6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content

RST .6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flow chart, diagram, model, graph, or table)

NGSS Standards

Performance Expectations:

(MS-LS2-3) Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Science and Engineering Practices:

Developing and Using Models

(MS-LS2-3) Modeling in 6–8 builds on K–5 experiences and progresses developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to describe phenomena.

1.6

Oak Woodland Kestone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Analyzing and Interpreting Data

(M S-LS2-1) Analyzing Data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

Core Disciplinary Ideas:

M S-LS2: Interdependent Relationships in Ecosystems

Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.

MS-LS2-5. LS4.D: Biodiversity and Humans

Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling.

Crosscutting Concepts:

Patterns

Patterns can be used to identify cause and effect relationships. (M S-LS 2-2)

Cause and Effect

Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Energy and Matter

The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

Stability and Change

Small changes in one part of a system might cause large changes in another part. (M S - LS 2-4), (M S -LS2-5)



Oak Woodland Kestone Species Exploration

Healthy Ecosystems Feed Healthy Communities

California Environmental Principles and Practices

Principle 1 - People Depend on Natural Systems

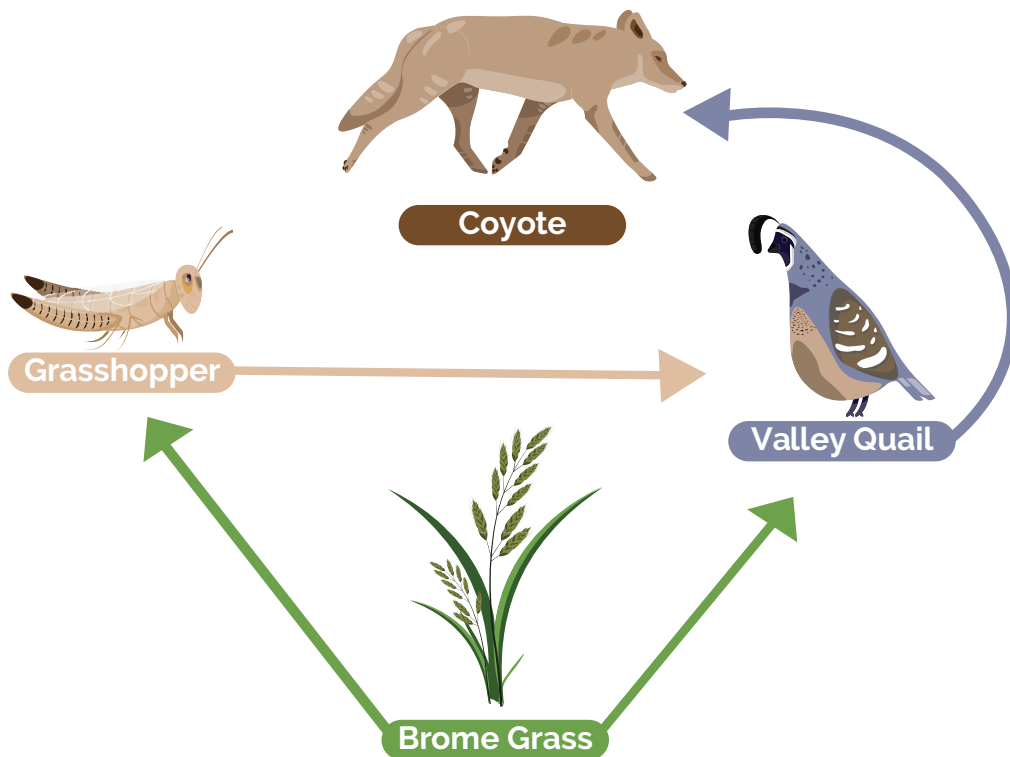
The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services.

1.6

Oak Woodland Kestone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Sample Food Web:



1.6

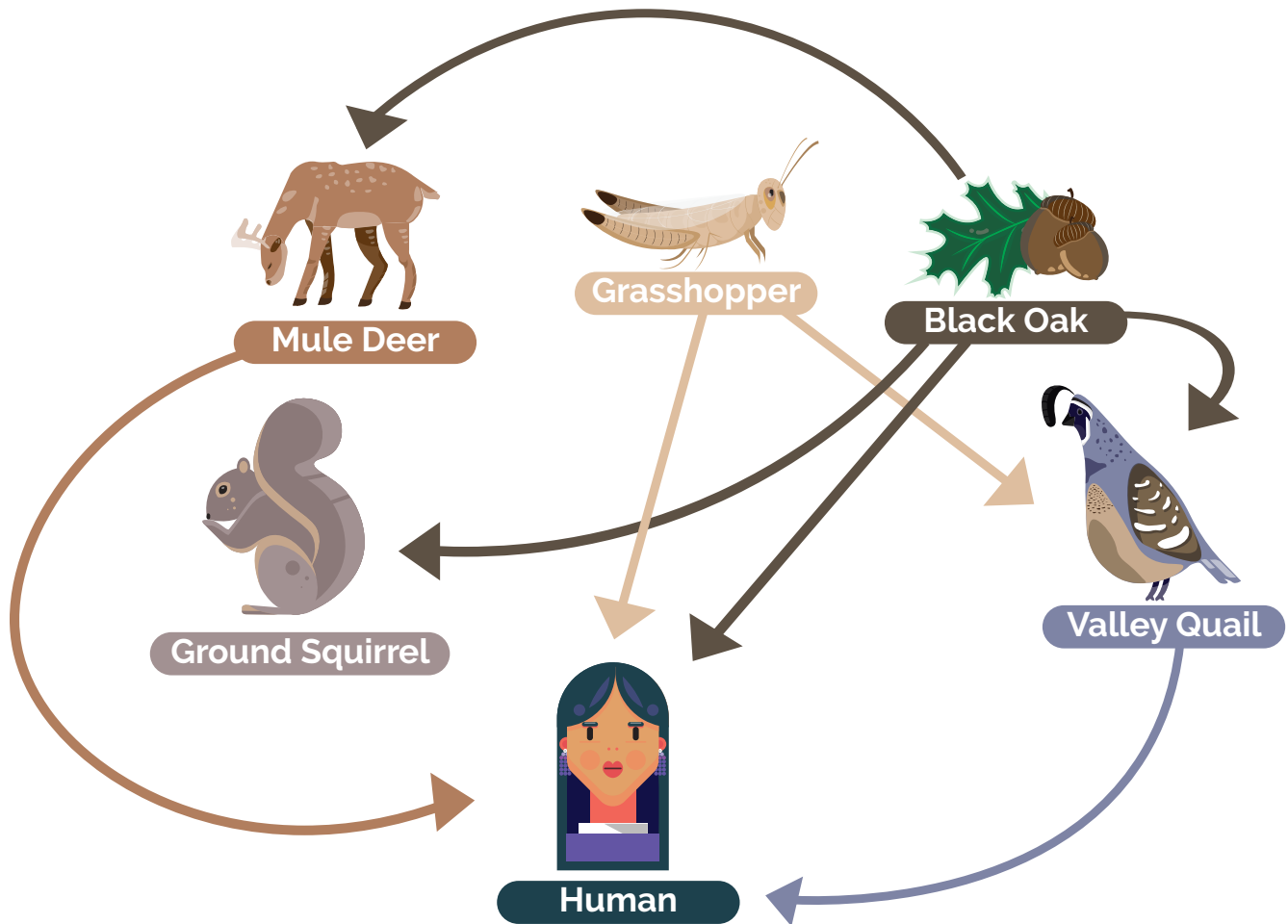
Oak Woodland Keystone Species Exploration

Healthy Ecosystems Feed Healthy Communities

Answer Key: Oak Woodland

Ecosystem Keystone Species

Notice that certain species have more arrows pointing toward them, and more arrows pointing away from them. In this food web, humans are an apex predator and also a keystone species, as species populations rely on human consumption. The Black Oak is a keystone species because it provides food/energy to many species, as does Brome Grass. Once students have created their web, it may be helpful to cover up the keystone species one at a time in order to discuss the impact they have on the food web.



Oak Woodlands Keystone Species

Name: _____

Date: ____/____/____

1. What were the keystone species in your food web?
2. Are the keystone species consumers or producers?
3. Why are keystone species so important to our local food webs? Look at the relationships between the keystone species and the other species to understand this.
4. Why are oak trees specifically important to our local food webs?
5. Are there any specific human behaviors that impact oak tree populations negatively? Positively?
6. What are some ways that humans might be able to protect oak tree populations?