

Life in the Zone

Rangers in the Classroom—Presentation
Lesson Plan



Grade Level(s): 3rd & 4th

Setting: Classroom

Duration: 45 min —1 hour

Standards Addressed:

3rd Grade

- ° Science—Life Sciences:
3.a, 3.b, 3.d
- ° Listening & Speaking:
1.1, 1.3
- ° Reading Comprehension:
2.6, 2.7

4th Grade

- ° Science—Life Sciences:
2.a, 3.a, 3.b, 3.c
- ° Listening & Speaking:
1.1, 1.2
- ° Reading Comprehension:
2.4, 2.7

Vocabulary:

3rd and 4th Grade
adaptation, conifer,
elevation, estivate, habitat,
hibernate, life zone, rain
shadow, treeline

Introduction:

Welcome to the Rangers in the Classroom—Habitat Zones of the Sierra Nevada presentation. This program introduces students to the concept of life zones within the Sierra Nevada. It explores how different plants and animals have adapted to survive at different elevations.

Objective:

After completing this program, 3rd and 4th grade students will be able to:

1. Identify the three general habitat or life zones in the Sierra Nevada.
2. Identify at least three animals that live in the Sierra Nevada.
3. Describe how one plant or animal has adapted to survive in the foothills life zone, in the montane life zone and in the alpine life zone.

Materials:

- ° Laptop (if the classroom is not equipped)
- ° Speakers
- ° Projector
- ° Extension cord
- ° Power point presentation
- ° Animal Materials:
 - ° Bear pelt
 - ° Bear skull
- ° Plant Materials:
 - ° Sequoia cones, seeds, bark
 - ° Sugar Pine cone
- ° Life Zones Game: cards (six sets of eighteen) and worksheets (six sets of three)
- ° Park maps and student fee waivers



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Presentation:

A. What is a national park?

1. National parks are unique places that are preserved and protected for the enjoyment of current and future generations.
2. National parks belong to all of us.
3. What two national parks are right in your backyard?
 - a. Sequoia and Kings Canyon National Parks (SEKI). Show slide of Tulare county.
 - b. These two parks are situated in the Sierra Nevada mountains.

B. What is the Sierra Nevada?

1. It was named by a Spanish explorer. It means “jagged snowy mountain range.”
2. It formed about 80 million years ago and then doubled in size about 10 million years ago during a major geological uplift.
3. About 80% of the ground surface in SEKI is made of granite.
 - a. Granite is a type of igneous rock formed from magma that cooled slowly beneath the earth’s surface.
4. Sierra Nevada extends ~400 miles north and south along the eastern edge of California.
5. Elevation increases gradually on the west side (our side) of the range.
6. Elevation increase is very steep on the east side.
7. There are gradual, but significant changes in elevation on the western front from the low hills (foothills) to Mt. Whitney, the highest mountain in lower 48 states at ~14,495 feet.
8. Another major difference between the western and eastern fronts of the Sierra is that the eastern side is very dry.
 - a. The dryness is caused by our prevailing westerly weather pattern. As clouds are pushed up the western slope, the temperature drops and the ability of clouds to hold moisture decreases resulting in precipitation on the western front as the moisture is expelled from the clouds as rain or snow.
 - b. As the clouds descend down the eastern front, they warm up, which increases the clouds’ ability to hold moisture. Therefore there is little precipitation.
 - c. The eastern side of the Sierra Nevada is therefore very dry (e.g. Death Valley).
 - d. This phenomenon is called a rain shadow.

C. What is a life zone?

1. Similar to a community with different plants, animals and climate (weather, temperature, precipitation, humidity, etc.).
2. Life zones are usually associated with elevation changes.
3. How is a life zone different from a habitat?
 - a. A habitat is simply a place where animals and plants live.
 - b. It provides the requirements for survival: food, water, shelter and space.
 - c. There may be many different habitats within one life zone or one habitat may spread across different life zones.
4. Although each life zone is associated with a certain range of elevation, there is no distinct line separating one life zone from another.
 - a. There are transitional areas between life zones where the zones overlap.

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- b. The range of a life zone depends on many factors besides elevation, including steepness of the slope, soil composition, climate and threats.
- c. Life zones are broad classifications that can be further subdivided.
- d. As we move up in elevation through the life zones, summers are shorter and winters are longer.

D. Three primary life zones of the Sierra Nevada:

1. Foothills Zone

- a. The elevation range is about 1,000—5,000 feet.
- b. It is closest to the Central Valley.

2. Montane Zone

- a. The elevation range is about 5,000—9,000 feet.
- b. It is dominated by conifer forests.

3. Alpine Zone

- a. The range is above 9,000 feet.
- b. It is mostly above the treeline (11,000 feet in the southern Sierra).

E. Foothills Life Zone: elevation 1,000—5,000 feet

1. It is the warmest of the three zones.

2. Characteristics: grassland, oak woodland, riparian woodland and chaparral.

3. Mediterranean Climate

- a. Hot, dry summers with mild, wet winters.
- b. Temperatures often exceed one hundred degrees Fahrenheit during the hot, dry summers.
- c. Very little snow falls in this zone; precipitation is mostly rain.
 - 1. About 25 inches per year of rainfall from November to April.
- d. It has the highest summer temperatures and lowest annual precipitation of the Sierra life zones.

4. Animals and plants have adaptations for surviving the hot, dry summer.

a. What is an adaptation?

- 1. A feature an animal or plant has or a way it behaves that helps it successfully survive in its environment.

5. Animal adaptations: migrate, hibernate or tolerate.

- a. Nocturnal—Sleep during the day, more active at night when it is cooler.
- b. Afternoon siestas—Diurnal animals (those active during the day) often nap through the hottest part of the day.
- c. Upslope migration—Some animals (e.g. deer, bear, bobcat, and coyote) migrate to higher elevations during the summer when the vegetation in the foothills has dried up.
 - 1. Predators follow the prey as the prey follows the vegetation uphill.
- d. Estivation—Dormant during the summer (v. hibernate—dormant during the winter).
- e. Light coloration—Animals in hot arid regions tend to be light colored, which reflects heat away from the body.
 - 1. Coloration also assists with camouflage (e.g. American Black Bears are lighter colored in the west where forests are more open).

6. Plant Adaptations

- a. Most plants exhibit adaptive strategies designed to reduce water loss and prevent

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heat damage.

b. Plants in the foothills life zone tend to grow during the winter and spring when soil moisture is plentiful and temperatures are cool.

c. Evergreen

1. No time or energy is wasted growing an entirely new set of leaves (e.g. Yucca and Interior Live Oak).

2. Leaves are constantly dying and re-growing (kind of like human hair).

d. Summer dormancy

1. Some plants lose their leaves during the hot, dry summer—drought deciduous (e.g. California Buckeye).

e. Small, waxy leaves

1. The shiny, waxy surface of such leaves helps reduce moisture loss and provides insulation against heat and cold. (e.g. Blue Oak)

f. Lignin

1. A compound found in all vascular plants; it makes vegetables firm and crunchy; it regulates the transport of liquid in the plant and is very resistant to degradation.

2. When water becomes scarce, the leaves of some species become reinforced with cellulose and lignin (e.g. Blue Oak).

g. Fire adaptations

1. Chaparral is one of the most fire-prone vegetation types. It burns very hot.

a. The roots are not destroyed by fire and will generate new sprouts within a few weeks following a burn.

b. Various species of manzanita and ceanothus produce seeds that are impervious to moisture until dried or cracked by fire. They are capable of remaining dormant for decades until fire causes them to open and germinate.

2. Soil is more fertile following a fire. Nutrients locked up in the plant tissues are released back to the soil in the form of ash.

F. Montane Life Zone: elevation 5,000—9,000 feet.

1. Weather: warm, dry summers and cold, wet winters.

a. Precipitation is mostly snow—about forty-five inches of precipitation year. (One inch of precipitation = ten inches of snow.)

b. When the foothills life zone has turned brown during the hot, dry summer, the montane forest is warm and green from the previous winter's snow.

2. Characteristics: coniferous forest with sparsely vegetated rock outcroppings and meadows.

a. The lower limit of this zone is closely tied to precipitation. (Above this line, winter precipitation is greater and falls primarily as snow instead of rain.)

b. The upper limit of this zone is closely tied to air temperature. (Above this line, temperatures are too low and the growing season too short for coniferous forest.)

c. It has gentle slopes and well-drained soils that are capable of absorbing enough snow melt to last the entire summer.

d. It is not a dense forest, but generally more open.

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e. As elevation increases, so does the open ground, the extent of rock outcroppings, and the number of meadows and lakes.

3. Animal Adaptations: migrate, hibernate or tolerate.

a. Down-slope migration—Some animals migrate to lower elevations during the winter when food is scarce at the higher elevations.

b. Hibernation—Some animals are dormant during the winter when food is scarce.

c. Tolerate—Some animals stockpile food in preparation for the winter.

d. A thick fur (coat and on feet) helps some animals survive the cold temperatures.

4. Plant Adaptations

a. Maximum growth—The long, warm summers plus the soil moisture from the snowmelt enable numerous conifer species to reach their greatest stature in the Sierra.

1. The largest trees in the world, the Giant Sequoia, grow only on the western front of the Sierra.

b. Most conifers have needle shaped leaves to hold moisture and resist damage from the cold.

c. Conifers have a conical shape. The branches point down to help shed snow.

d. Some trees have a shallow root system for maximum absorption of surface water.

e. Fire Adaptations

1. This area burned every ten to thirty years (low intensity ground fires), which kept the forest relatively open.

2. Giant Sequoias evolved with fire and adapted.

a. Their thick bark is porous and resistant to low intensity fire.

b. Hot dry air from the fire rises into the canopy, drying out the cones. The cones open up and release their seeds.

c. Fire clears the forest floor of debris, so seeds land on the bare mineral soil.

d. Fire kills fir trees which compete with sequoia seedlings.

G. Alpine Life Zone: elevation above 9,000 feet.

1. Weather: long, very cold winters with short, cool, dry summers and high winds.

2. Characteristics

a. It has a very short growing season—about six to eight weeks.

b. It is essentially a cold desert during the short summer months—scarce rainfall and minimal soil moisture, intense sunlight, drying winds and large areas of rock outcrops where soil is thin or absent.

c. Winds are nearly constant, but wind alone does not limit the upper distribution of trees.

1. Wind batters the plants, limiting their size and affecting their shape.

2. Wind makes unsheltered areas colder than sheltered spots.

3. Wind deposits snow in some places and scours it from others .

4. Wind speeds up transpiration (loss of water from plants to the atmosphere).

d. Some of this zone is above the treeline, which is about 11,000 feet in the southern Sierra.

1. Treeline—The limit beyond which trees do not grow because of harsh climate, thin soil (or absence of soil), topography, snow and wind.

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- e. The air is thin and dry.
- 3. Animal Adaptations: migrate, hibernate or tolerate.
 - a. Few animals live in the alpine zone where food and shelter are scarce.
 - b. Tolerate—Some animals collect and dry out plants, storing food for the winter (e.g. Pika).
 - c. Migration—Some animals depend on the desolation and rough terrain as protection from predators (e.g. Big Horn Sheep).
 - d. Hibernation—Some animals are only awake and active during the short summer (e.g. Marmot).
 - e. Tolerate—Some remain active throughout the winter.
 - f. Body shape—Some animals are low to the ground, with fur covered paws and thick fur on the body (e.g. Pika).
 - 1. Birds have similar adaptations: low to the ground with thick, white plumage (for winter camouflage) and feather covered feet (e.g. Ptarmigan).
- 4. Plant Adaptations
 - a. Between 9,000—11,000 feet: dwarfed vegetation.
 - b. Deep tap roots or numerous carpet-like roots help (1) obtain moisture and (2) act as an anchor against the wind.
 - c. Dwarfed plants hunker close to the ground to take advantage of warm pockets created by the sun heating the rocky ground more than the air.
 - d. Small plants need less water than larger plants simply because they have less tissue to supply.
 - e. Cushion-shaped plants are streamlined for maximum sun absorption with the least exposure to wind and cold.
 - f. Flagging—Where limbs grow with the prevailing wind.
 - g. Some produce large, showy flowers that hide the foliage beneath.
 - 1. The large flower captures the attention of bees and butterflies, allows the plant access to wind pollination and helps with seed dispersal all while protecting the leaves.
 - h. Above the treeline vegetation is sparse, but hundreds of plant species manage to make this desolate area home.
- 5. Global Climate Change
 - a. Plants and animals in this zone have adapted to extreme climatic conditions—cold, drought, wind—and are therefore very sensitive to changes in climate.
 - b. Alpine species are the focus of many studies on vegetation shifts resulting from a changing climate.
 - 1. It is predicted that plant species will “migrate” or retreat upslope as their environment becomes inhospitable.
 - 2. Theoretically, such a “migration” could cause significant loss of diversity at lower elevations and significant loss of species in the alpine zone as these plants and animals have no place higher to migrate.

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Activity—Life Zones Game

Instructions:

1. The goal of this game is to have the students apply what they learned during the presentation by separating eighteen different plants and animals into one of the three life zones.
discussed in the presentation: Foothills, Montane or Alpine. The students should also be able to discuss *why* each plant and animal is part of a particular life zone.
2. Divide the students into small groups. There are enough materials for six groups.
3. Hand out to each group three life zone worksheets (one for each life zone) and a packet of eighteen life zone cards.
4. Assign one life zone to each group.
5. Explain to the students that each group will be responsible for filtering through the eighteen cards to find the six plants and animals appropriate to their life zone.
6. The worksheets and the cards have clues to assist the students.
7. If time permits, encourage the students to complete all six worksheets.
8. Once every group has completed their assigned life zone (or all three) engage the students in a discussion about why these plants and animals are found in a particular life zone.

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Vocabulary

Adaptation—noun—a change or adjustment in structure or habits that allows a species or individual to improve its condition in relationship to its environment

Conifer— noun—any of the needle-leaved or scale-leaved, cone-bearing trees (e.g. pines, spruces and firs); the cones contain seeds for reproduction

Elevation—noun—altitude of a place above sea level

Estivate—verb—to spend a hot, dry season in an inactive or dormant state

Habitat—noun—the natural environment of an organism; the place where a thing is usually found

Hibernate—verb—to spend a winter in an inactive or dormant state

Life Zone—noun—a geographic region characterized by a distinct set of plants and animals, usually associated with a particular elevation

Rain Shadow—noun—an area having relatively little precipitation due to the effect of a topographic barrier, such as a mountain range, that causes the prevailing winds to lose their moisture on the windward side, causing the leeward side to be dry

Treeline—noun—the altitude above sea level where trees cease to grow