ACORN

partners in education

FIELD STUDY LESSON PLANS:

Point Arena-Stornetta Lands & Marine Protected Areas

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INTRODUCTION

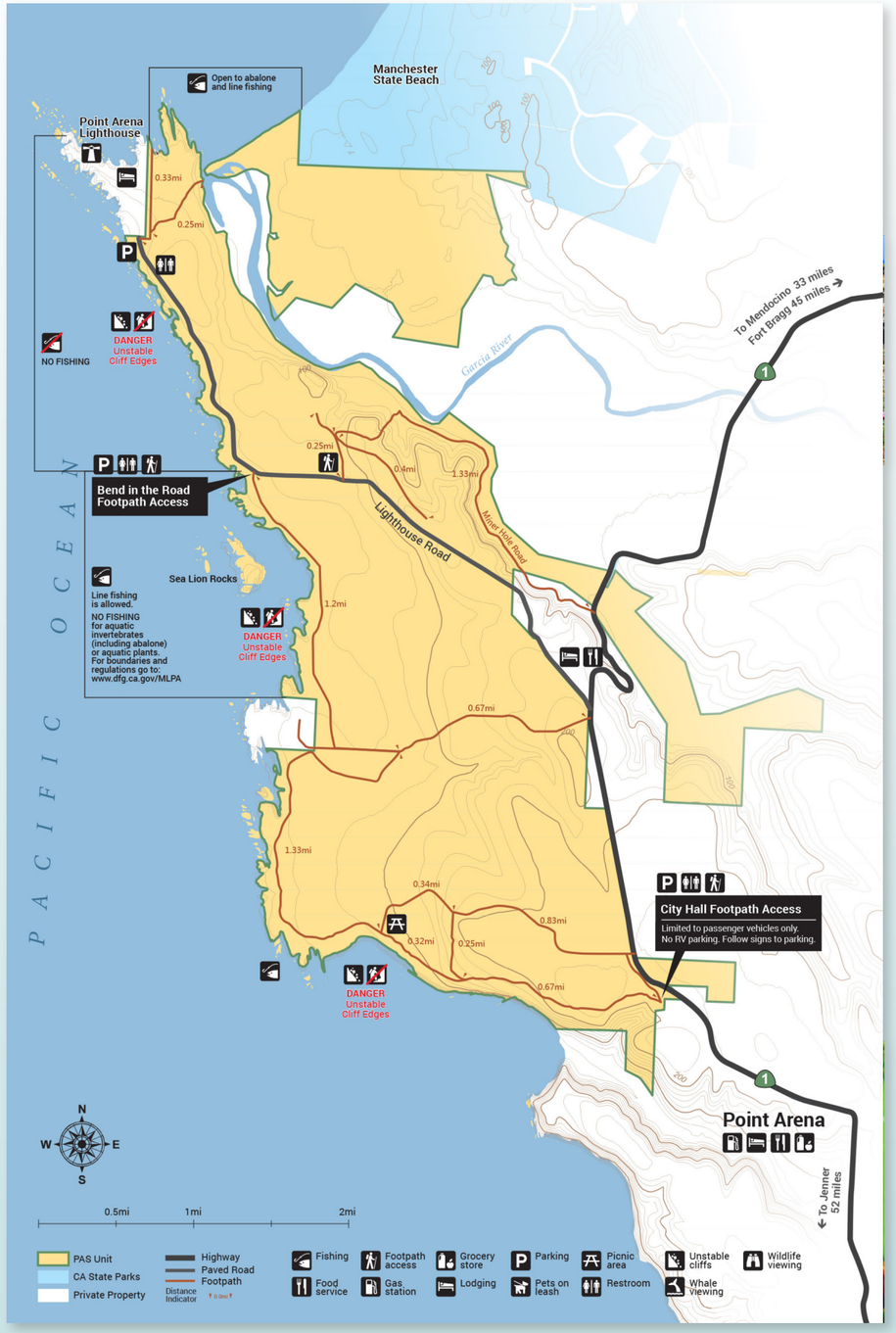
The **Point Arena-Stornetta Lands** is a great outdoor science classroom where students can learn about local endangered species, habitat, and conservation. The trail behind City Hall starts above Arena Cove and follows the edge of the bluff through coastal prairie all the way to the Lighthouse and the mouth of the Garcia River. Along the way, you will walk past sprawling patches of wild huckleberry plants and sinkholes large enough to swallow the Lighthouse. It's a gateway to a wilder part of California where great blue herons alternate between hunting for gophers and hermit crabs, and coyotes scramble down cliffs to try and steal cormorant eggs.

In 2014, President Obama signed the designation to make the Point Arena-Stornetta Lands part of the **California Coastal National Monument.** It was the culmination of a decade-long campaign by community members who wanted to protect the unique land and provide public access to hiking trails in an area full of privately owned open space. The unit covers 1,665 acres, has eight miles of trails, goes from the bluffs above Point Arena Cove to the Lighthouse, crosses over the mouth of the Garcia River, and covers a swathe of Manchester Beach. The Bureau of Land Management's (BLM) Ukiah Field Office administers the land.

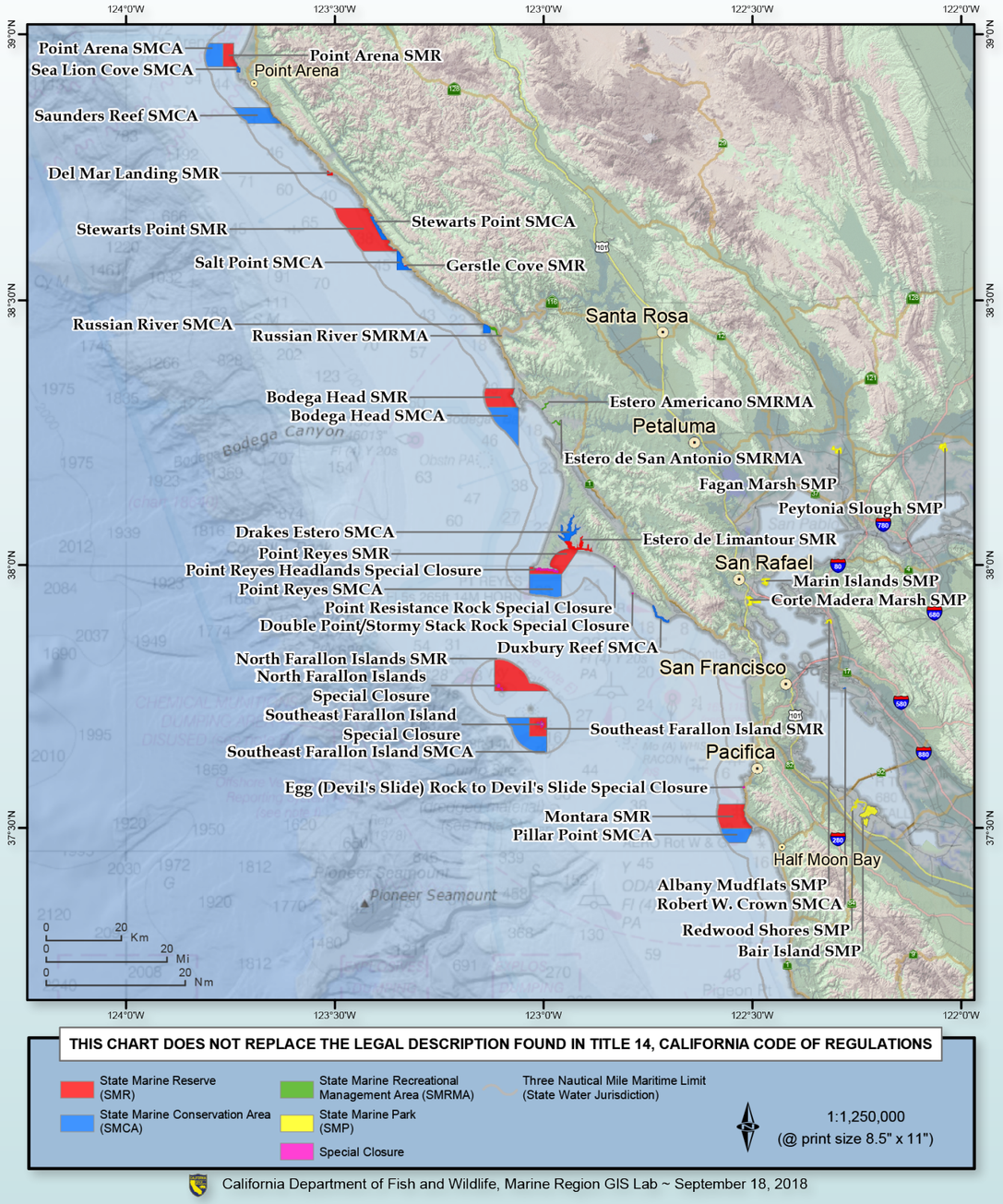
The Point Arena-Stornetta Lands bluff top trail is also a gateway for students to learn about Marine Protected Areas off the coast. **Marine Protected Areas** (MPAs) are underwater places designed to protect critical habitats and species by prohibiting or restricting the take of marine life. Just as the nation's parks, forests, and wilderness areas protect special places on land, California's MPAs protect unique places in the ocean and estuaries. The California MPA network includes the many different habitats found along our coast, from sheltered estuaries to rocky intertidal areas and lush kelp forests. The Point Arena Area MPAs are rich in marine resources. Over 250 species of invertebrates and numerous fish, seabirds, and marine mammals call this area their home. MPAs here support thriving species while also helping to restore endangered or threatened marine life.

ACORN Partners in Education developed the Lesson Plans presented here to complement field studies on the Point Arena-Stornetta Lands and provide a framework for increasing environmental literacy through experiential learning. ACORN Partners in Education is a Point Arena-based nonprofit that facilitates youth stewardship projects through its Students Protecting the Coast program. ACORN initially partnered with the Pacific Community Charter School during the 2012-13 school year in support of the community effort for transferring the Point Arena-Stornetta Lands to the California Coastal National Monument. ACORN and the BLM Ukiah Field Office registered the Point Arena-Stornetta Lands as a Hands on the Land site during the 2014-15 school year. Hands on the Land is a network of public, nonprofit, and private partners who use local natural, historical, and archaeological settings to engage K-12 populations in place-based learning. on public lands and waterways. ACORN continues to bring students outdoors for hands-on learning.

POINT ARENA-STORNETTA LANDS MAP



MARINE PROTECTED AREAS MAP



LESSON PLAN: *DISCOVERY HIKE AND SCAVENGER HUNT*

Overview: This lesson is designed to be used as a field study activity for trail hikes on the Point Arena-Stornetta Unit of the California Coastal National Monument. This lesson encourages practice of observation skills and introduces students to the concept of energy transfer within an ecosystem through food chains.

Learning Objectives: At the end of this lesson, students will be able to:

- Identify and categorize living things into one of the following energy trophic levels: producers, primary consumers, secondary consumers, and decomposers.
- Demonstrate how energy is distributed throughout the ecosystem by creating a model of a food chain.

Time: 60-90 minutes (depending on hiking pace)

Grade Level: 3rd-5th grade

Suggested Group Size: Entire class, small groups or an individual student

Materials:

- Discovery Hike & Scavenger Hunt" handout
- Writing/drawing implement for each student

PROCEDURE

Engage: Explain to students that they are about to take a hike through a coastal ecosystem. An ecosystem is a community of interacting organisms, living things. Ask students to brainstorm and share, what type of organisms they think they may encounter on this hike. "*What types of living things, organisms do you think you will see on this hike?*" Try not to correct these guesses. Let students express and share any ideas they may have. The hike and discovery will act as a clarifying activity.

Explain that as they hike on the national monument trails they will conduct a scavenger hunt. They will be looking for a variety of organisms that are found on the handout. Give each student a handout, let them look over and browse the handout briefly.

Field note: Depending on how much time has been allotted for the field study, it may be best to have students hike and make mental notes of what they see and notice, ***then*** *share out only at various stopping points on the trails.*

Explore: Begin hiking and noticing the different organisms that live in the ecosystem. For the first checkpoint, the teacher/guide will want to find a good stopping place in which students will be able to easily identify a variety of plants. Give students time to discover and explore the plants in the area. They may also identify animals. Let students share their observations with partners and/or with the entire group. Direct their attention to the handout. Focus primarily on the **"producers"** for the first stop. Challenge students to see if they can identify all producers on the list.

Field note: If time allows, the teacher may wish to encourage students to fill in the "blank bubble" with a quick sketch and description of a producer that is not featured in the scavenger hunt, but one that students find interesting.

Ask students what they notice about the first section of the scavenger hunt labeled **"producers"**. What do all these living organisms have in common? *They are all plants!* How do plants get their energy to live and function?

Explain: Explain that all life on earth requires energy. The starting point for ALL energy on Earth begins with the SUN. Sunlight is captured by the producers, plants. Through a process called photosynthesis, plants use energy from sunlight to turn a gas called carbon dioxide and water into sugar. Plants make, or PRODUCE, their own food! Therefore, when we look at an ecosystem's living organisms, we can put all plants in the category of PRODUCERS. Anything that must consume, or eat, something else is called a CONSUMER. All animals in this ecosystem are consumers. Ask students to be on the lookout for the consumers on the scavenger hunt handout for the rest of the hike. What animals or decomposers can they find?

Explore: As the hike continues look for animals or signs of animals. Signs of animals may include: scat, footprints, carcasses, animal homes such as: nests, burrows, or webs. Encourage students to explore and note as many of the consumers that they can find on the list.

Field note: It's best to intuit good stopping places that may be of interest when teacher or students identify interesting observations. Remember to look up in the sky and trees as well as looking at the ground. Great discussions may develop as the ocean comes into view. Be prepared to possibly discuss the ocean organisms as a unique, yet connected ecosystem to the coastal prairie.

Ask students what they notice as they compare the animals that are listed in the category labeled **"primary consumers"** as opposed to the animals listed in the category labeled **"secondary consumers"** on the handout. How does the energy sources differ for these animals?

Explain: Herbivores are primary consumers, they get their energy by consuming plants. Omnivores and carnivores are considered secondary producers. Secondary producers get their energy by consuming other animals (and plants in the case of omnivores). There is another group of consumers called DECOMPOSERS. Decomposers get their energy from breaking down dead plants and animals. Microorganisms such as bacteria are decomposers, but these living organisms are too small to see without a microscope. Some decomposers that might be seen on the hike include: fungi (mushrooms), lichens (usnea), molds.

Field note: If time allows, the teacher may wish to encourage students to fill in the "blank bubble" with a quick sketch and description of consumers that are not featured in the scavenger hunt.

Elaborate: At the conclusion of the hike, discuss what organisms were observed.

Self-assessment: Ask students to recall that they made guesses about what organisms they might see on the hike. Were their guesses accurate? Were students surprised by any of the organisms? Which did they find most interesting?

Review: All the living organisms in this ecosystem must either create energy by capturing sunlight, such as plants, or they must get energy through consuming either plants or animals in order to survive.

Evaluation: In the space provided on the worksheet, ask students to think about how energy flows through the ecosystem. Ask them to build a food chain model, starting with sunlight, to show how this light energy is changed into a food source and then distributed.

Extended evaluation for classroom: Using what they have learned, have students create a poster that demonstrates understanding of how energy flows throughout the Point Arena-Stornetta coastal ecosystem. Students can choose plants and animals that they found most interesting on the hike. Students should be able to label the organisms with appropriate terms that include: producers, primary consumers, secondary consumers, decomposers.

Students can also write a short paragraph explaining how the energy from sunlight travels throughout the ecosystem. Written work should also appropriately use terms such as: producers, primary consumers and secondary consumers.

More extensions:

- Students can expand upon the concept of food chains and create food web models via posters or other creative expressions.
- Students can explore concepts about what happens if one organism disappears in the ecosystem, how might it affect the other organisms?
- Students can explore concepts about what happens if a new organism appears in the ecosystem, how might it affect the other organisms?
- Individual students can investigate and research one particular organism that they observed during the hike. Students can create presentations based on their research. An entire class can then give presentations on their chosen organisms
- Students may further discuss how their chosen organisms interact with those of other classmates.

VOCABULARY

- **Ecosystem:** An ecosystem is a community of interacting organisms and their environment. Living things interact with each other and also with non-living things like soil, water and air.
- **Organism:** An organism is any living thing.
- **Producers:** Producers are living things that can make their own food using air, light, soil, and water.
- **Photosynthesis:** The process by which plants make their own food using carbon dioxide, water and sunlight.
- **Primary Consumers:** An organism that ONLY eats producers. An herbivore.
- **Secondary Consumers:** Organisms that eat primary consumers for energy.
- **Decomposers:** Organisms that break down dead plants and animals and recycle waste.

NEXT GENERATION SCIENCE STANDARDS (4TH-5TH GRADE)

4-LS1-2: From Molecules to Organisms: Structures & Processes: A system can be described in terms of its components and their interactions. (Crosscutting concepts.)

5-LS2-1: Ecosystems: Interactions, Energy, & Dynamics: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-LS2-1 A: Ecosystems: Interactions, Energy, & Dynamics: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

5-LS2-1 B: Ecosystems: Interactions, Energy, & Dynamics: Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment.

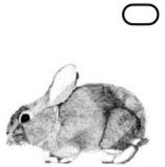
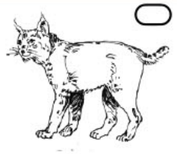
Name:

Date:

Discovery Hike & Scavenger Hunt

A Point Arena-Stornetta Unit of the California Coastal National Monument Hiking Activity

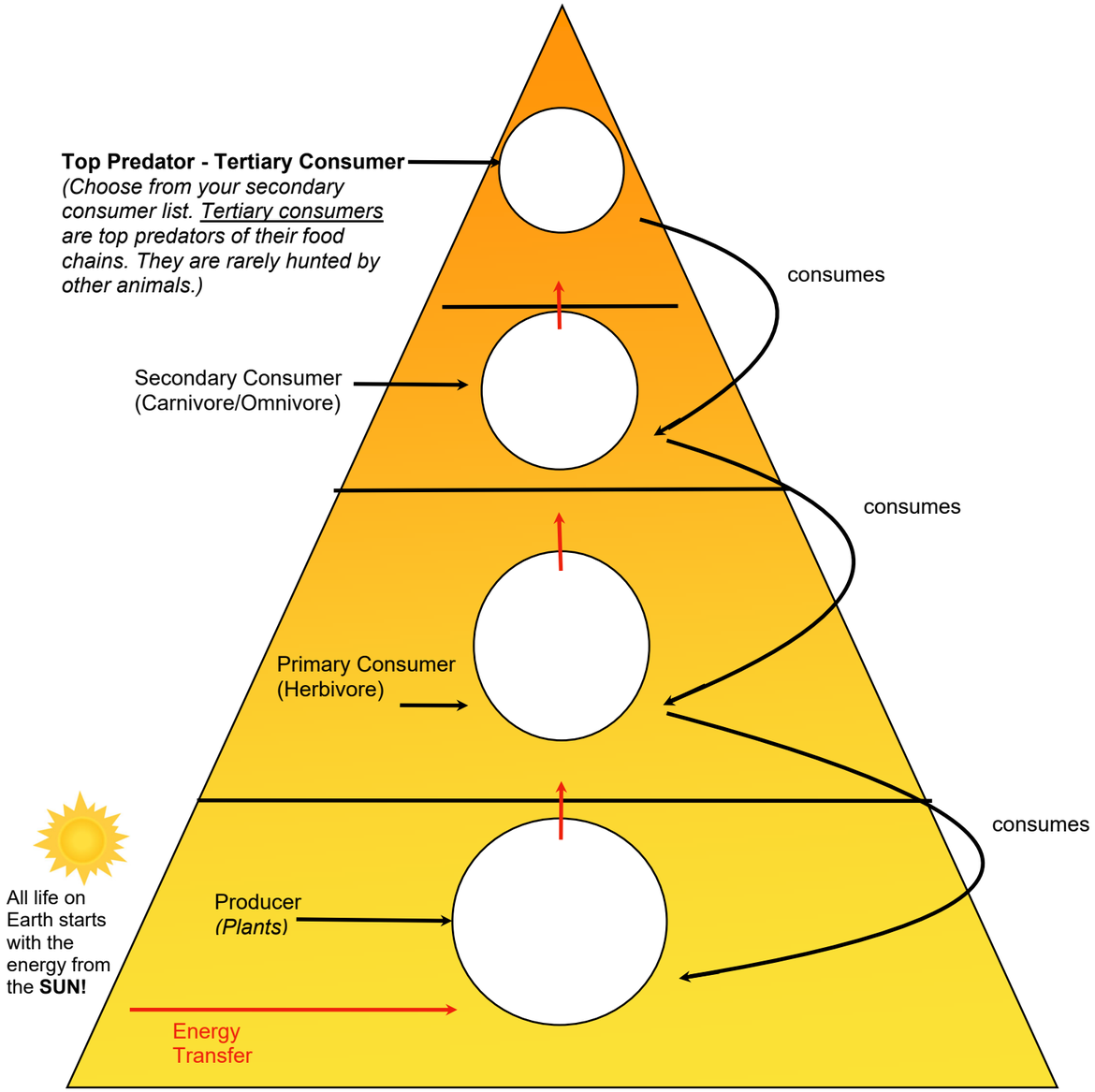
☑ As you hike on the Point Arena-Stornetta trails, look for and mark off the organisms you find.

PRODUCERS				
 Huckleberry	 Wild Iris	 Bishop Pine Tree	 CA Wild Strawberry	*Free Space
PRIMARY CONSUMERS				
 Gopher	 Deer	 Butterfly	 Rabbit	*Free Space
SECONDARY CONSUMERS				
 Fox	 Snake	 Hawks	 Bobcat	*Free Space
DECOMPOSERS				
 Mushroom	 Rock Lichen	 Mold	 Tree Lichen	*Free Space

* Find organisms of your choice; draw and label to fill in the free space.

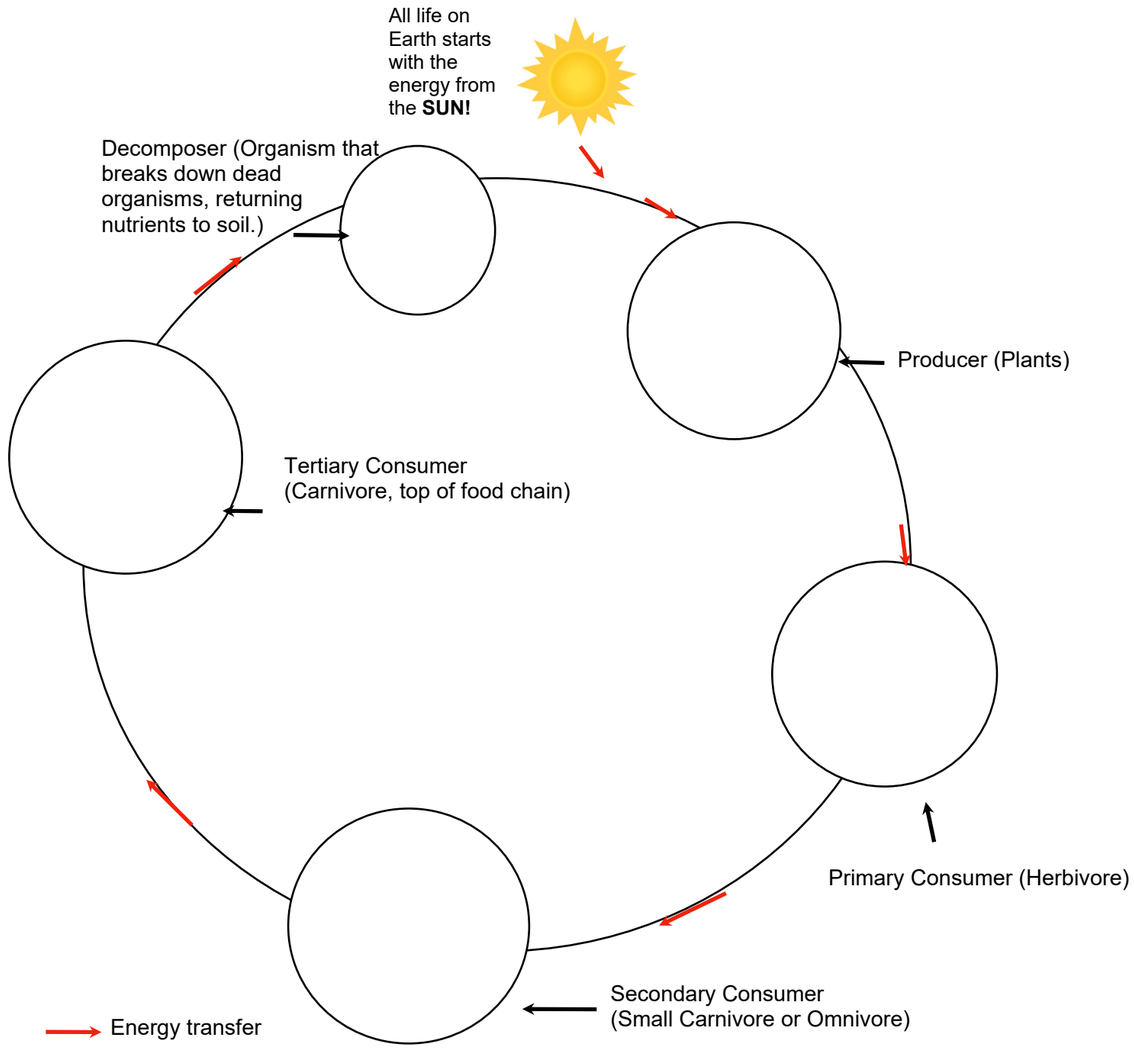
Activity 1: Create a Food Chain

Look over the various organisms that you found during your visit. Can you build a food chain? Start with a top predator from your secondary consumer list. Draw or write your top predator below in the energy pyramid. Then decide what your top predator might consume, eat, to survive. Work your way back, level by level, until your chain ends with a producer.



Activity 2: Create an Energy Transfer Model

Look over the various organisms that you found during your visit. Think about how energy moves through the ecosystem. Starting with sunlight, build a model to demonstrate how energy is transferred throughout the coastal ecosystem. Choose animals that match the following categories: producer, primary consumer, secondary consumer or tertiary consumer. Draw and label organisms into the blank bubbles in the model.
Note: A tertiary consumer is a top carnivore of a food chain. A tertiary consumer is rarely hunted by other animals.



LESSON PLAN: *GETTING TO KNOW PURPLE SEA URCHINS*

Overview: This lesson is designed to introduce students to some of the unique species that interact within the marine ecosystem. This lesson is intended to be used as a field study activity for trail hikes on the Point Arena-Stornetta Unit of the California Coastal National Monument. Ideally, students would have the opportunity to hike to tide pools and observe underwater life.

Learning Objectives: At the end of this lesson, students will be able to:

- Demonstrate how energy is distributed throughout the ecosystem by creating a model of an ocean food chain.
- Describe the impact of losing specific species in a habitat.

Time: 60-90 minutes (depending on hiking pace)

Grade Level: 3rd-5th grade

Suggested Group Size: Entire class, small groups or an individual student

Materials:

- A copy of the Marine Ecosystem drawing
- Photos of some of the marine organisms- sunflower sea stars, purple sea urchins, and abalone
- Food Web examples
- Blank paper, writing/drawing implement, and clipboards

PROCEDURE

Engage: Prior to the hike, ask students what they had for dinner last night. Use that information to create a food web on a display board. Show them the marine ecosystem Poster and identify the various organisms in the drawing. Ask them to brainstorm and share any food web connections they think might exist in the drawing. Try not to correct any guesses. Let students express and share any ideas they may have. The hike and discovery will act as a clarifying activity. Explain that they will be hiking on the national monument trails towards tidepools to look for organisms living in a marine environment.

Explore: Give students a chance to look out over the ocean, coastline, and tidepools to see if they can identify any plants or animals. Pass students copies of the marine ecosystem poster and ask them to identify organisms on the poster that might eat each other. Ask them to draw lines between these organisms and then have students discuss as a class their suggested connections. Challenge students to see if they can identify all the producers and consumers in the drawing.

Explain: Identify and discuss the consumers and producers in the marine ecosystem. Explain that all life on Earth requires energy from the Sun. Marine producers are organisms in the ocean like phytoplankton and seaweed that use photosynthesis to make their own food. Marine consumers are organisms that don't make their own food, instead they eat producers, as well as other types of consumers. Explain that the connections they made in their food web demonstrate the flow of energy between consumers and producers. Guide students to identify giant kelp as the largest producer in the ocean. Ask students if they know who eats the giant kelp. If they don't know, lead them to the images of purple sea urchins and abalone. Ask them if they know what eats spiny sea urchins. Explain that long ago the answer to such a question would have been the sea otter, unfortunately however, they were hunted for their pelts to near extinction and are very uncommon on the shores of Mendocino County. Further explain that in recent history, the sunflower sea star was the main predator that ate purple sea urchins. However, sea stars have also been struggling to survive.

In 2013, a marine wildlife epidemic event referred to as the sea star wasting syndrome had a devastating effect on the sea star population. Another event known as "the blob" occurred in 2014-2016 and further contributed to the sea star decline. The blob caused the temperature of the ocean to increase which made it even harder for the sea stars to recover. Sunflower sea stars are now listed as critically endangered. Scientists believe that the decline in sea stars, as well as the lack of sea otters in this region, has led to the imbalance of purple sea urchins.
Explain that scientists are concerned about the health of sea kelp forests because sea urchins are eating so much bull kelp. Discuss with students how some local ocean divers are going out and taking sea urchins out of the water to prevent them from eating all the kelp. You could also explain that another solution people are trying is harvesting sea urchins from the ocean, bringing them to land and then fattening them up in aquariums. Companies are then selling them for people to eat as a fancy seafood called uni.

Discuss the consequences of sunflower sea stars going extinct. What would happen to the large population of sea urchins? (It would increase.) What would happen to the abundance of kelp and kelp forests? (It would decrease.)

Elaborate: Hand out papers, pencils, clipboards. Have them fold the paper. On one side of the paper prompt students to draw a healthy food web with sunlight, sea stars, abalone, bull kelp, and purple sea urchins. On the other side, have students draw a food web without one of the species mentioned above. Ask students to discuss what would happen to the healthy food web if they removed a species.

Evaluate: Lead students in a discussion about ways to protect overall ecosystem health. Have students think back to what they had for dinner and the food webs they created in the classroom. Students will realize that the food webs in the ocean are comparable to food webs on land. Lead students to the understanding that all species, including humans, have a role in keeping food webs healthy and in balance.

Extended evaluation for classroom: Students can choose other marine organisms that interest them and create a poster that demonstrates their understanding of energy flow in a food web or food chain. Students should be able to label the organisms as producers, primary consumers, and secondary consumers.

VOCABULARY

- **Ecosystem:** A community of interacting organisms and their environment. Living things interact with each other and also with non-living things like soil, water and air.
- **Organism:** Any living thing.
- **Producers:** Any organism that uses photosynthesis or chemosynthesis to produce food/sugar for energy.
- **Consumer:** Any organism that must ingest or eat others to get their energy.
- **Food chain:** The pattern of energy moving through a habitat from a producer through a series of consumers.
- **Food web:** The transfer of energy among producers and consumers within a habitat, composed of many varying food chains.

- **Marine animals:** Animals that live in the ocean.
- **Marine habitats:** Habitats found in the ocean, natural environments of organisms; in Northern California, our primary marine habitats are rocky shores and corresponding rocky reef, kelp forest, and open ocean.
- **Marine biodiversity:** Biodiversity is the variety of species in a region; marine biodiversity refers to this variety in the ocean.

NEXT GENERATION SCIENCE STANDARDS (3RD-5TH GRADE)

3-LS4-4: Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

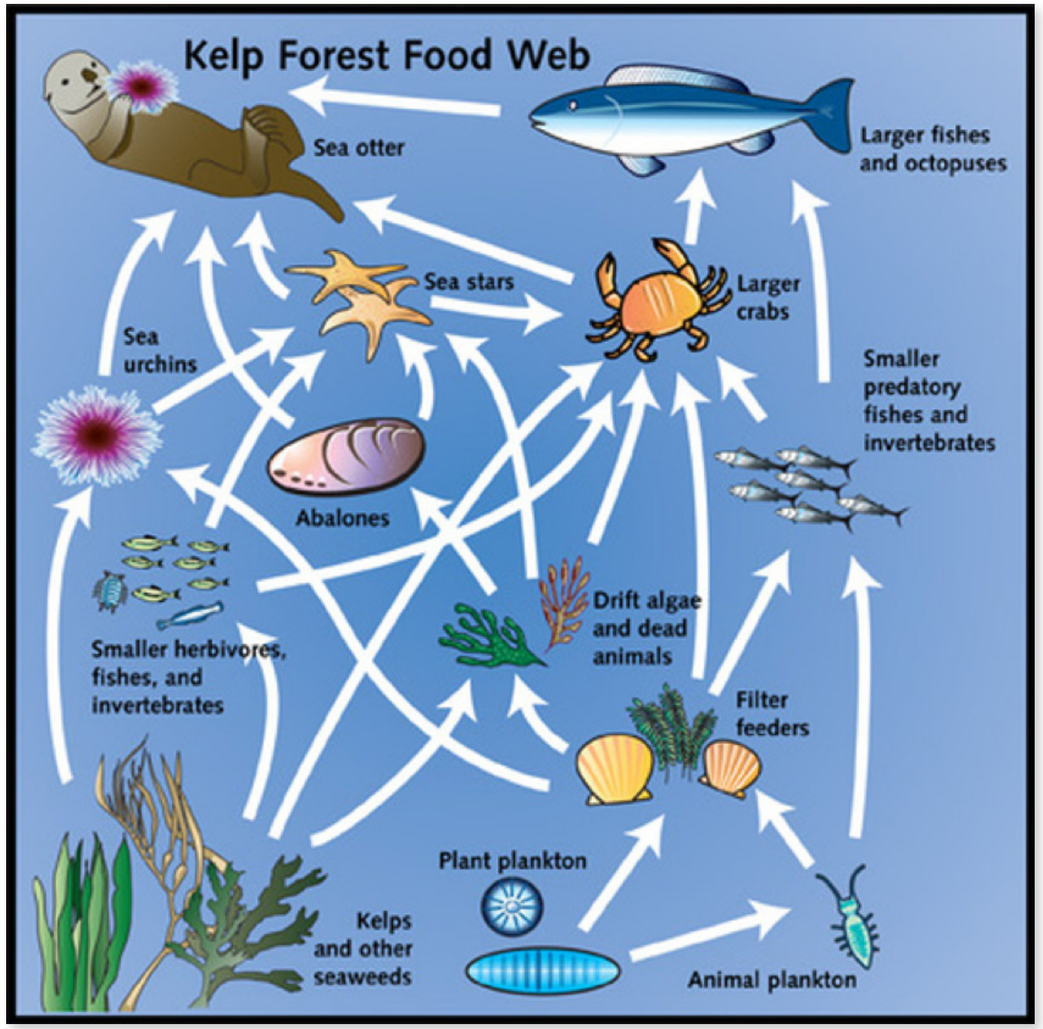
3-LS4-4: A system can be described in terms of its components and their interactions. (Crosscutting concepts.)

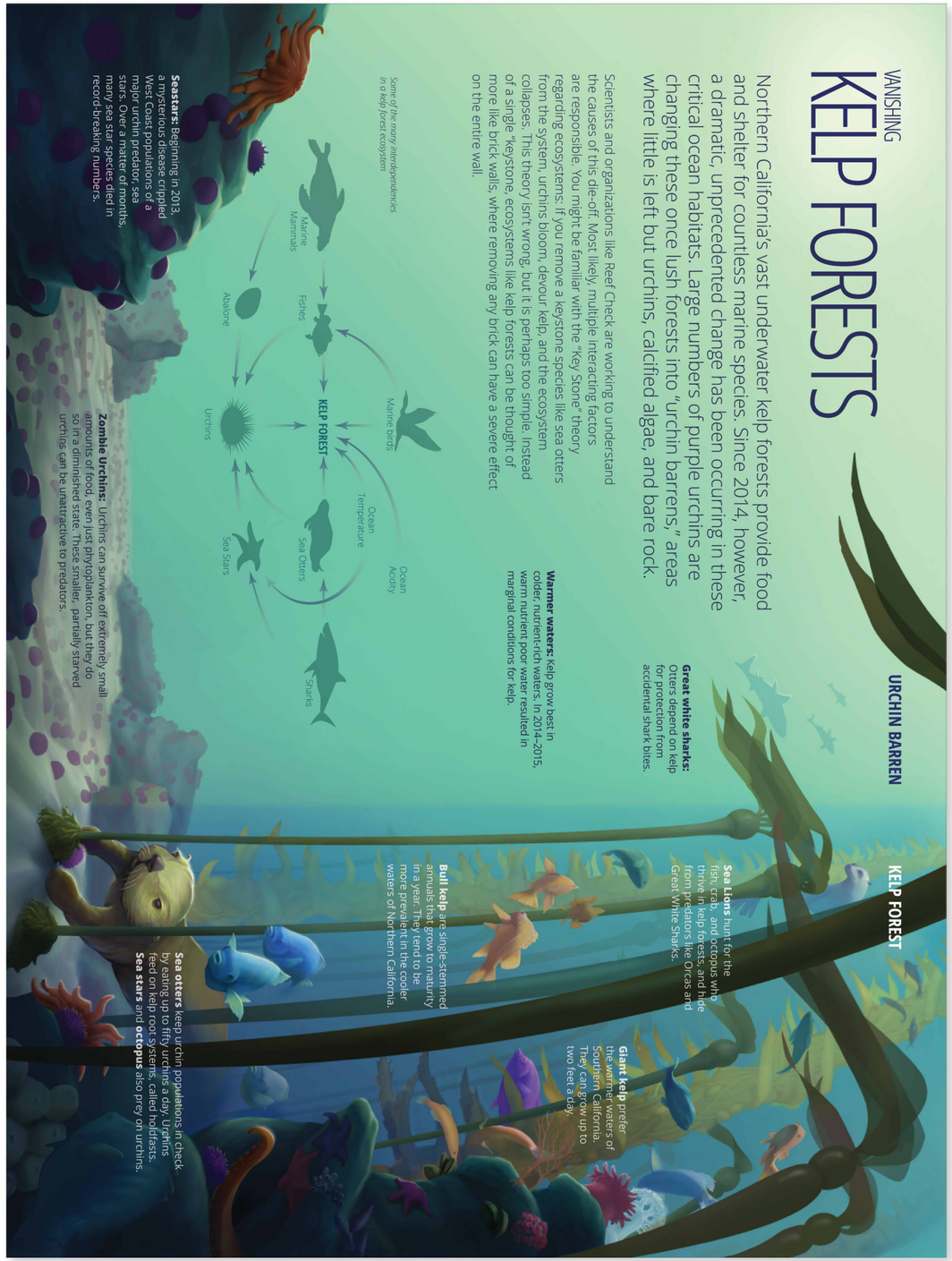
3-LS4-3: Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-LS2-1 A: The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

HANDOUT: *KELP FOREST FOOD WEB*





Graphic source: Reef Check. www.reefcheck.org

LESSON PLAN: *PLANT OBSERVATION AND FIELD SKETCH*

Overview This lesson is intended for field studies on the Point Arena-Stornetta Unit of the California Coastal National Monument. ***This lesson would be a great lesson following the Discovery Hike and Scavenger Hunt where students learn about plants as producers.***

Learning Objectives: At the end of this lesson, students will be able to make observations about the different traits of plants on the Point Arena-Stornetta Lands. They will create a field sketch of a plant from observation.

Time: 60-90 minutes (depending on hiking pace)

Grade Level: 3rd-5th grade

Suggested Group Size: Entire class, small groups or an individual student

Materials

- Clipboard for each student with the following, arranged top to bottom:
  - Coastal Plant Illustrations handout
  - Partner Activity Questions and Field Sketch Activity Directions handout
  - Art paper: Blank watercolor paper postcard or watercolor paper cut to 6"x9" in. ***or*** 5.5'x8" art sketchbook with mixed media paper
- Pencil and eraser
- Ultra-fine point sharpie
- Colored pencils (sets of "landscape" colors shared between 4 students)
- Examples of field study illustrations (this could be a few copies to pass around)

PROCEDURE

Engage: Inform students that we will be taking a hike at Point Arena-Stornetta Lands. The original inhabitants and caretakers of this land are the Bokeya Central Pomo tribe. Explain to the students that the lands are now a protected coastal ecosystem and today we will look at plants which are important parts of the ecosystem. Invite students to observe as they begin their hike:

- What types of plants do you notice/stand out to you?
- What plants look to be the most common (see a lot of?)

Give students their clipboard and drawing materials to carry with them on their hike.

Make incremental stops along the hike to share observations about what plants students see and any other observations on wonderings that come up along the hike.

Explore: Walk to an area where there is visible plant diversity and where students will be able to look closely at a variety of plants. Invite students to participate in an observational activity of the different plant communities. Point out their plant illustrations handout and draw their attention to the three categories of trees, shrubs and herbs. Invite students to pair up and give them 5 minutes to look around and observe the plants found in the area. Go over the questions below.

- What plant do you see a lot of (common)?
- Do you see this on the plant illustrations sheet?
  - Is it a tree, shrub or herb?
- What traits does the plant have that stands out to you (Examples of traits could be how the plant looks or how it grows)?
  - What shape are the leaves?
  - Is it flowering?
  - Does it have any interesting textures?
- What does the area around the plant look like? (other plants, wet, dry, type of dirt)?
- Do you notice any plants that look like they were affected by weather conditions (Examples: wind, rain, lack of rain?)

Explain: Explain that the Point Arena-Stornetta Lands are studied by scientists and in 2017, the California Native Plant Society Vegetation Program spent many months identifying and counting plants and making maps and lists of the plants in the different parts of these lands. These maps of vegetation will help in managing the land and protecting the ecosystem. The vegetation maps use the categories of trees, shrubs and herbs to organize how they collect information about plants.

Ask students to share what observations they just collected about plants in the area. Tell students that many of the observations that they made are of plant traits, such as what the plant looks like (how tall it is, color, shape, features such as thorns, etc.) and the surrounding environment can affect plant traits, such as plants in lower areas get more rainwater and can be larger or greener.

Elaborate: Invite students to synthesize their practice in observational skills into creating a field sketch of plants or plant communities on the land. Point out to students that the pictures of plants in the plant illustrations handout are all scientific illustrations and some of them show the plant in different stages. Show students examples (either pass around or walk through the group) of field studies where artists and/or scientists have sketched and written observations about a plant.

Ask students to use their sketchbook or watercolor paper pieces (depending on what you provided) to create a field sketch. Review and demonstrate the steps below.

Note: If a student spends the whole time sketching with pencil and does not use sharpie or colored pencil, that is fine. This is just a guide for those who need it. There are so many different outcomes for a field sketch.

- Choose a plant to sketch. This could be part of a plant, like a flower and a few leaves. Zoom in and focus on a few parts, noticing shapes and lines and plant traits.
- Add details, such as texture and any writing about your observations of the plant.
- Clean up your drawing with an eraser and outline your drawing with an ultra-fine point sharpie.
- Add color with colored pencils. You can emphasize parts of a plant by only coloring one part of your drawing and layer colors.
- Write the date somewhere on your drawing. If you have identified your plant, write the name of the plant and any other details.

Evaluate: Ask students to reflect on and share with a partner:

- How did I look closely and use this skill to show detail in my field sketch?
- What did I choose to focus on and emphasize?
- What plant traits does my field sketch illustrate?
- How might I use this field sketch to help support protecting the Point Arena-Stornetta Lands?

Circulate while partners share and then ask for a few to share out with the group.
Students could also lay out their artwork in a line or circle and the group could participate in a gallery walk.

Extensions:

- Students could return to their school site and add watercolor paint to some or all of their drawing.
- Students could research their plant and create a presentation or further study on the plant and its role in the ecosystem.
- The whole class or small groups could collaborate on a group map of the plant communities of the area they visited, using their sketches as "areas of interest" on the map.
- The whole class or small groups could collaborate on a field guide of plants on the Point Arena-Stornetta Lands, researching additional plants or other parts of the ecosystem to create their guide.

VOCABULARY

- **Field Sketch:** A drawing of plants, animals or other features out in nature.
- **Plant communities:** Groups of plants that share an ecosystem and interact with each other, animals, and the environment.
- **Plant traits:** Features that can be observed or are part of the plant functioning and anatomy.
- **Trees:** Taller plants that have a trunk.
- **Shrubs:** Medium sized plants, with "woody" stems and can be described as "bushy".
- **Herbs:** Smaller plants with delicate stems and leaves.
- **Vegetation:** Plant life.

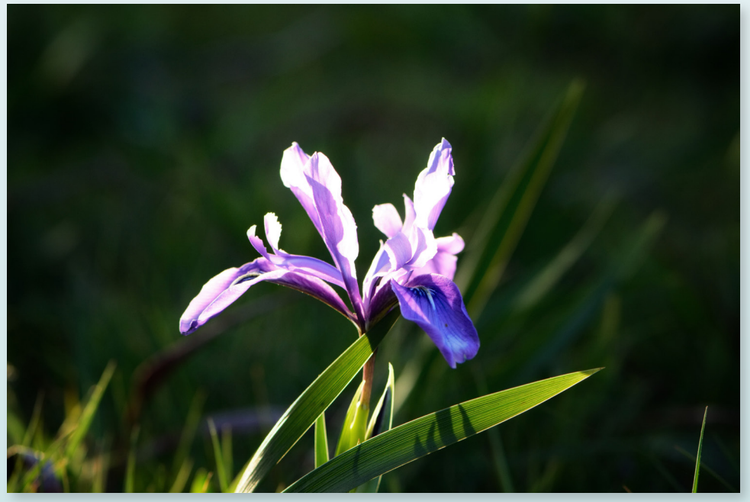
NEXT GENERATION SCIENCE STANDARDS (3RD-5TH GRADE)

3-LS3-2: Heredity: Inheritance & Variation of Traits: Use evidence to support the explanation that traits can be influenced by the environment. [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted.]

3-LS4-2: Biological Evolution: Unity & Diversity: Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. [Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators.] Crosscutting Concepts: Develop models to describe phenomena. (3-LS1-1)

4-LS1-1.A: From Molecules to Organisms: Structures & Processes: Structure and Function. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

5-LS1-1.C From Molecules to Organisms: Structures & Processes: Organization for Matter and Energy Flow in Organisms. Plants acquire their material for growth chiefly from air and water.



HANDOUT: *COASTAL PLANT ILLUSTRATIONS*

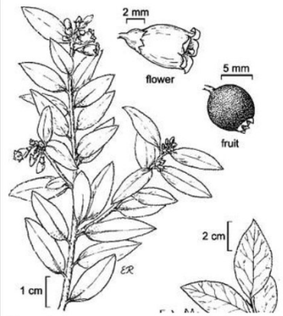
Trees (often larger, taller plants with a trunk)

Pinus muricata-Bishop Pine

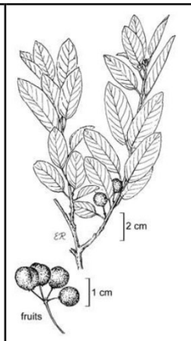
Pinus contorta

Hesperocyparis macrocarpa
-Monterey Cypress ***(not native)***

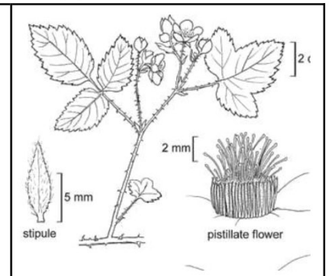
Shrubs (medium sized plants, with "woody" stems and can be described as "bushy")



Vaccinium ovatum Huckleberry



Frangula californica -
Coffeeberry



Rubus ursinus-California
Blackberry

Herbs (often smaller plants with delicate stems)

Pteridium aquilinum-
Ferns

Deschampsia cespitosa-
Tufted Hairgrass

Fragaria chiloensis -
Coastal Strawberry

Iris douglasiana

Image Sources:
Pinus muricata from *Forest Trees of the Pacific Slope*, George B. Sudworth, USDA, 1907.
Deschampsia caespitosa from Manual of the grasses of the United States. USDA Misc. Publ. No. 200.
Hesperocyparis macrocarpa from *Trees of Stanford and Environs*, Ronald Bracewell.
Pinus contorta from Davisonia- Open Collections, UC Berkeley.
Pteridium aquilinium from Illustration from *Scandinavian Ferns*, Benjamin Øllgaard and Kirsten Tind, Rhodos, 1993.
Rubus ursinus from Regents of University of California.
Vaccinium ovatum from Regents of University of California.

HANDOUT: *FIELD SKETCH ACTIVITY*

Partner Activity: *Observing a plant's traits and environment.*

Choose a plant to observe with your partner.

- Do you see this on the plant communities sheet?
  - Is it a tree, shrub or herb?
- What traits does the plant have that stands out to you? (Examples of traits could be how the plant looks or how it grows.)
  - What shape are the leaves?
  - Is it flowering?
  - Does it have any interesting textures?
- What does the area around the plant look like? (Examples: other plants, wet, dry, type of dirt.)
- Do you notice any plants that look like they were affected by weather conditions? (Examples: wind, rain, lack of rain.)

Field Sketch Drawing Activity

- Choose a plant to sketch. This could be part of a plant, like a flower and a few leaves. Zoom in and focus on a few parts, noticing shapes and lines and plant traits.
- Add details, such as texture and any writing about your observations of the plant.
- Clean up your drawing with an eraser and outline your drawing with an ultra-fine point sharpie.
- Add color with colored pencils. You can emphasize parts of a plant by only coloring one part of your drawing.
- Write the date somewhere on your drawing. If you have identified your plant, write the name of the plant and any other details.

LESSON PLAN: *UNDERSTANDING OCEAN TIDES*

Overview: This lesson is designed to introduce students to ocean tides. This lesson is intended to be used as a field study activity for trail hikes on the Point Arena-Stornetta Unit of the California Coastal National Monument. Students will demonstrate how tides respond to the moon's gravity with a kinesthetic learning activity. Students will also make inferences as to how the tides might have an impact on the species living along Northern California's rocky shore.

Learning Objectives: At the end of this lesson, students will be able to:

- Identify and explain what tides are and how they occur.
- Dramatize the rise and fall of the tides.
- Infer how tides impact life on the rocky shore.

Time: 60-90 minutes (depending on hiking pace)

Grade Level: 3rd-5th grade

Suggested Group Size: Entire class, small groups or an individual student

Materials:

- Two markers that students can stand on such as carpet squares, cardboard squares. Ideally the item can be reused and not discarded. It needs to be heavy enough to blow in the wind.
- A notebook for recording student input during the beginning and conclusion of the lesson.

PROCEDURE

Engage: Prior to the hike, ask students if they know the difference between a high tide and a low tide. Ask them if they understand why tides change. Allow students to ask questions and draw on their own personal ocean experiences. Do not correct any misconceptions but take notes so that you can later build on students' responses.

Explore: Begin hiking to the ocean bluffs overlooking the rocky shore. During this time, allow students to come up with their own ideas and questions. Some example questions and answers can be used to guide students could be:

1. What makes waves on the ocean (wind).
2. What are tides? (The tide is the cyclic rising and falling of Earth's ocean surface.)
3. What causes tides go up and down? (The sun and moon)
4. Does the moon have gravity? (Yes)
5. Does the sun have gravity? (Yes)
6. What effect does the moon's gravity have on the ocean? (It causes a tidal bulge on the side of the Earth closest to the moon)

Explain: Once students have developed their basic ideas of high and low tides, share with students the information about tides collaboratively. Pass out the visual aids. Explain that the earth spins (or rotates) one full turn every day and at the same time, the moon is orbiting around the Earth. Since both objects are moving, the moon changes its position relative to Earth throughout the night and day.

Explain that tides are the steady rise and fall of ocean water levels. There are two high tides occurring at the same time. One high tide occurs where the moon is closest to the Earth, and the water gets pulled toward the moon until land stops it. This high tide is caused by gravity and causes water to accumulate near the shoreline. Then, on the exact opposite side of the Earth, the side farthest from the moon, there is also a different high tide. This second high tide is caused by another force called inertia. Inertia causes the water of the ocean to want to keep moving in a straight line, so it causes a second area where water is being pulled in one direction and builds up near shore.

Explain that the points in the middle of these two water bulges are what are called low tides. The water level drops in areas of low tide because all the extra water has been pulled to the areas with high tides. As the Earth spins and the moon orbits, the areas of high and low tide shift around the planet. All together there are two periods of high tide and two periods of low tide occurring in most areas along the coast every day.

The gravitational force of the sun also impacts the tides. However, because the moon is much closer to the earth, it has a much stronger impact. The tides are the strongest when the earth, the sun, and the moon are in a line (see visual aid). These tides are called "spring tides" and occur during the full and new moon. When the sun, earth, and moon are perpendicular or 90 degrees to each other "neap tides" occur. These are the weakest tides and happen during quarter moons.

Elaborate: Inform the students that they are going to act out the rise and fall of the tides. Have them form a circle in a large, open area, ideally along the ocean bluffs. If there are an odd number of students, choose a student to represent the moon and have them leave the circle. If there is an even number of students, you will represent the moon. Alternatively, you can join the students in the circle, and assign a student to be the moon. Give each student two markers that will be placed on the ground to stand on. Ask students to take two big steps back and place one marker on the ground. Have the students take two more big steps back and place their other marker on the ground. Have the students take four steps forward to return to their original position.
Next, inform each student that they will partner with the student standing directly across from them and copy their movements. Have each student identify their partner by saying their name and pointing at their partner on the opposite side of the circle.

Explain that the student representing "the moon" will walk around the edge of the circle. They will be modeling how the moon orbits the earth. The circle of students will be modeling the surface of the ocean. Explain to students that when the "moon student" is two students away from them, they are to step onto the first marker closest to the circle. Explain to students that when the "moon student" is directly behind them, they are to step onto the marker furthest away from the circle. Partners across the circle should be copying the other's action because the moon's gravity pulls both the ocean and the earth. Ask the student who has been designated the moon to walk slowly around the circle multiple times.

After students demonstrate they understand the basic concept of high and low tides, have another student leave the circle and represent the sun. Explain the concept of spring tides and neap tides, by having the sun and moon line up like those images shown in the visual aides.

Evaluate: During the demonstration, ask the student representing the moon to pause their orbit around the earth. Assess how well the students are doing at moving in alignment with the moon and make improvements if needed. Discuss how they are demonstrating the rise and fall of the tides and clarify any misconceptions.

Extended evaluation for classroom: Print out and pass out the Understanding Tides Quiz.

VOCABULARY

- **Orbit:** A repeating path that one object in space takes around another.
- **Rotation:** When something turns or spins around a point located at its center. Earth has an imaginary axis or line that starts at the top of the earth at the North Pole and goes completely through Earth's center and ends at the South Pole.
- **Tidal Force:** The difference in the strength of gravity between two points on a body.
- **Gravitational Force:** The attraction between two masses. The strength of the pull depends on how big and how far apart the masses are.
- **Neap Tides:** Tides that occur at the 1st and 3rd quarter moons when the sun, moon, and earth are at right angles to each other. During neap tides, the gravitational pull of the moon and sun cancel each other out.
- **Spring Tides:** Tides that occur during the full and new moons when the sun, moon, and earth are in line with each other.
- **Inertia:** A property of an object that refers to the resistance of change in motion. An example of this property is when someone is seatbelted in a vehicle making a turn and their body wants to keep moving in the direction.

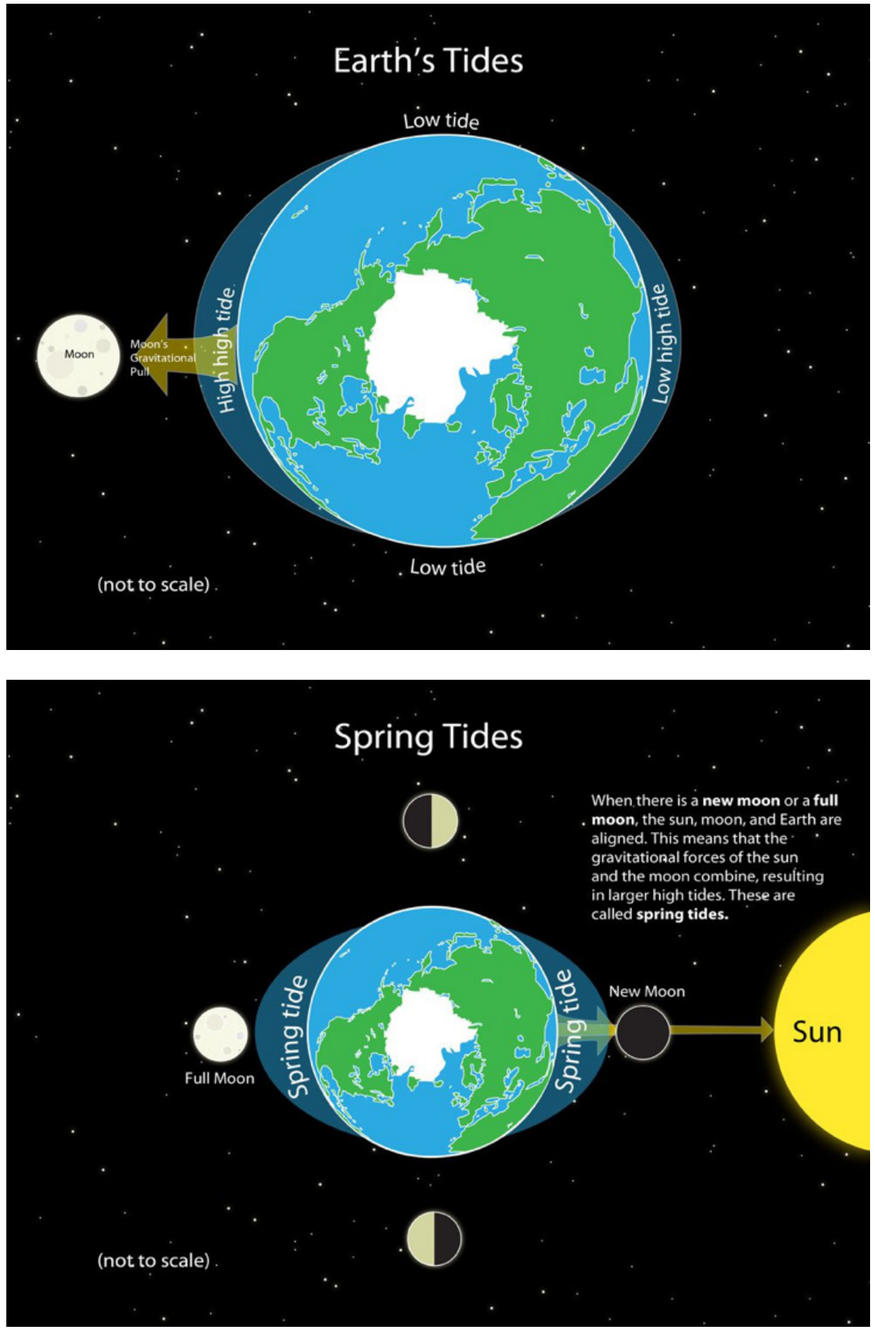
NEXT GENERATION SCIENCE STANDARDS (3RD-5TH GRADE)

3-PS2-2: Forces and Motion: The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)

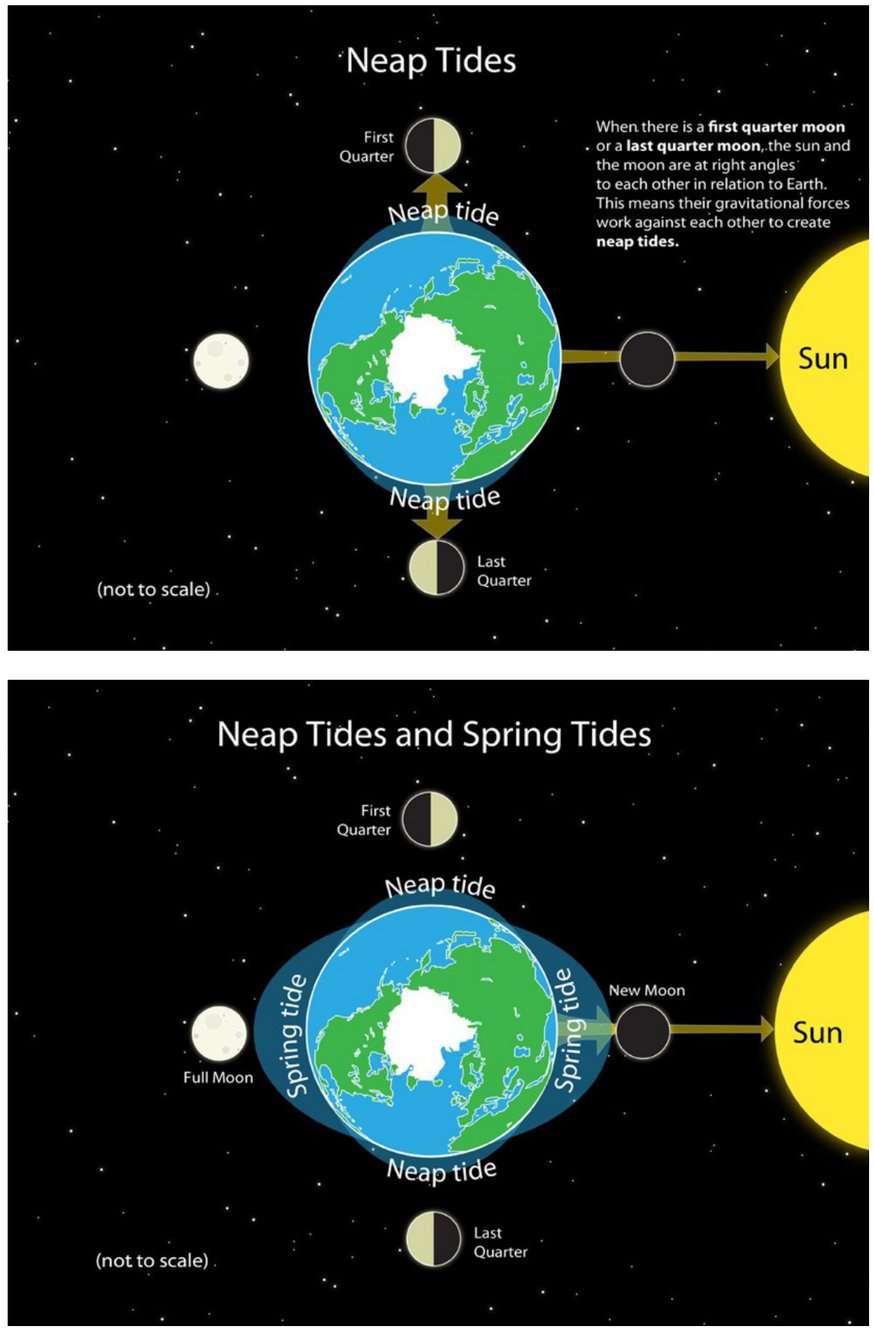
5-PS2-1: Types of Interactions: The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center.

5-ESS1-2: Earth and the Solar System: The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

HANDOUT: *TIDES*



Source: www.nationalgeographic.org/media/earths-tides/



Source: www.nationalgeographic.org/media/earths-tides/

HANDOUT: *UNDERSTANDING TIDES QUIZ*

1. What are unusually weak ocean tides at first or third quarter moon called?

A. Summer tides

B. Spring tides

C. Fall tides

D. Neap tides

E. Winter tides

2. What are low tides that are very low and high tides that are very high at full and new moon called?

A. Spring tides

B. Winter tides

C. Summer tides

D. Neap tides

E. Fall tides

3. What is the difference between the strength of gravity between two points on a body called?

A. Gravitational force

B. Frictional force

C. Tidal force

D. Rip tide

E. Normal force

4. Which of the following is an incorrect statement?

A. Ocean tides are larger than solid Earth tides

B. The moon causes solid Earth tides

C. Tidal forces only affect the oceans on our planet

D. Ocean tides can vary in amplitude

E. The sun is also responsible for ocean tides

5. Why do spring tides occur?

A. The tides caused by the sun becoming more powerful

B. The additive effects of the tides caused by the moon and sun

C. The tides caused by the moon becoming more powerful

D. Spring weather melting snow in that area of the world, resulting in high tide due to excess water

E. The effects of the sun and moon cancelling one another out

Sources: www.study.com/academy/lesson/how-gravity-the-moon-the-sun-influence-tides.html

LESSON PLAN: *THREATENED SPECIES OF POINT ARENA-STORNETTA LANDS AND MARINE PROTECTED AREAS*

Overview: This series focuses on the chinook salmon, western snowy plover, Point Arena Mountain Beaver, bull kelp and white abalone. Students learn about the characteristics, habitat, food chain, and why each species is threatened or endangered. Students are provided with a student booklet, where they record notes about each species.

Learning Objectives: At the end of this lesson, students will be able to:

- Describe the characteristics, habitat and food chain for five different threatened species.
- Understand why these species are threatened and write about how we can help these threatened species.
- Cause and Effect Relationships: Explore and explain what would happen to the kelp forest ecosystem if the abalone were to go extinct.

Time: Two 45-minute class periods (complemented with hike on Point Arena-Stornetta Lands)

Grade Level: 4th-8th grade

Suggested Group Size: Entire class

Materials:

- Student Investigation Notebook

Teacher Prep:

- Build background knowledge: Use the links in the "additional resources" section to educate yourself about MPA's and the threatened species
- Print one investigation notebook for each student
- For the explore section, depending on level of students, decide how you will provide students with reading material about each species. There are great resources to use in the additional resources section of this lesson
  - For older students, consider using those resources directly or have students conduct their own research.
  - For younger students, the teacher may consider creating their own short readings about each species that are at the appropriate level.

PROCEDURE

Engage: *Facilitator prep: Make a KWL chart on the board or on chart paper. With older students, plan to have one student help facilitate the discussion by recording other students' ideas on the KWL chart.*

To engage students in this lesson, ask students to think about what they already know and what they wonder about endangered species. Give students 3 minutes to write down a few ideas on the KWL chart in the Student Investigation Notebook. After 3 minutes, invite students to share their ideas in a class discussion.

After a broad discussion on endangered species, present a more focused question: What do you already know or wonder about endangered species in the Point Arena area? After a brief discussion, present the lesson objective and goal to students: "We will be learning about five threatened species that live in the Southern Coast of Mendocino

County. Specifically, these species can be found on the Point Arena Stornetta Lands, the intertidal zone located around Point Arena, Garcia River and Manchester Beach."
**Remind students that they will complete the "Learn" section of the KWL at the end of class.

Explore: During the explore section, students will learn about each of the five endangered species by reading and completing the graphic organizers in the student investigation notebook.

Recommended teaching strategies for explore section:

- **Small group work:** Split students into small five groups and have each group focus on one species. Have each group focus on one species and complete the corresponding note pages in the student investigation notebook. After reading, have each group present about their focus species to the class and have other students take notes in their investigation notebook.
- **Use the jigsaw method**: divide students into groups of five. Have each student select one species to focus on. Then, have students break into "expert groups" for each species , and read/ take notes in the investigation notebook about their species. After completing the reading and notes in the expert groups, students will return to their original home groups. Students will take turns teaching their home group about the species that they became an expert on. For more information about the jigsaw method: www.readingrockets.org/strategies/jigsaw.

Explain: After students have completed the readings and group work, the teacher will bring students back together for a discussion.

1. With the whole class, the teacher reviews each species and invites students to share their answers to each question that they completed in the investigation notebook.
2. Discussion: Teacher directs conversation to focus on what is **causing** these species to be threatened Question: " why are these species threatened?". The teacher writes down student responses on the board or on a document camera or anchor chart. The teacher can continue using questioning strategies to allow students to make connections--are there common threats to these species? What are they? How are the threats similar or different?
3. Cause and Effect Mini-lesson: What would happen to the kelp forest ecosystem if the abalone were to go extinct? Students can explore concepts about what happens if one organism disappears in the ecosystem, how might it affect the other organisms?

Elaborate:

- Mini-lesson: Plan and teach a mini-lesson that addresses the following concepts:
  - How can we help threatened species?
  - Discuss about MPA's, public lands, conservation, individual actions that can help
  - See additional resources for helpful resources and background information to use in lesson/ discussion

Evaluation:

- Students will use their completed investigation notebook and what they learned during the mini-lesson to write about how we can help threatened species in our area.
- On the last page of the Student Investigation Notebook, students write about what can be done to help threatened species. Students discuss one species that we studied and provide evidence and examples of actions that can be taken to specifically help that species.

Lesson Extensions:

- Invite a local expert or guest speaker to present information about one of the five species studied in this lesson
- Students can explore concepts about what happens if one organism disappears in the ecosystem, how might it affect the other organisms?
- Students can explore concepts about what happens if a ***new*** organism appears in the ecosystem, how might it affect the other organisms?
- Plan a field study to study and focus on a specific ecosystem and species:
  - Point Arena-Stornetta Lands: Mountain Beaver
  - Manchester Beach State Park: Western Snowy Plover
  - Garcia River: Chinook Salmon
  - Arena Cove or other beach for tidepooling (must visit at low-tide): Abalone/ kelp
- Have the class "adopt a species". Class will conduct an in-depth study about a local threatened species. Students will then create informational posters, pamphlets, public art pieces that can be published for public viewing; these would help raise awareness about the threatened species by educating people about it and providing specific information about how we can help this threatened species survive in future.

VOCABULARY

- **Ecosystem:** A community of interacting organisms and their environment. Living things interact with each other and also with non-living things like soil, water and air.
- **Habitat:** The natural home or environment of an animal, plant, or other organism.
- **Endangered species:** A species that is likely to become extinct in the near future. They may be at risk due to factors such as habitat loss, poaching and invasive species.
- **Threatened species:** Any species which is likely to become an endangered species within the near future.
- **Marine Protected Area (MPA):** Any area of the marine environment that has been reserved and regulated to protect part or all of the natural and cultural resources.
- **Extinction:** The termination or end of a specific species.
- **Conservation:** Sustainable use of nature by humans.

Additional Resources:

- Western Snowy Plover: www.fws.gov/arcata/es/birds/wsp/plover.html
- Chinook Salmon: www.wildlife.ca.gov/Conservation/Fishes/Chinook-Salmon
- Point Arena Mountain beaver www.fws.gov/arcata/es/mammals/mtnbeaver/mtnbeaver.html
- White Abalone: www.fisheries.noaa.gov/species/white-abalone
- Bull Kelp: www.montereybayaquarium.org/animals/animals-a-to-z/bull-kelp
- Marine Protected Area: www.wildlife.ca.gov/Conservation/Marine/MPAs
- Marine Protected Area Educators Guide www.nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=169141&inline
- 15 Ways to Help Threatened Species: www.endangered.org/15-ways-to-help-protect-endangered-species/
- How to Help the Kelp: www.noyocenter.org/help-the-kelp/

NEXT GENERATION SCIENCE STANDARDS (3RD – 5TH GRADE)

4-LS1-1 From Molecules to Organisms: Structures and Processes: Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

MS-ESS3-3 Earth and Human Activity: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

Endangered Species • *Know. Wonder. Learn.*

STUDENT INVESTIGATION NOTEBOOK

By: _____

• *Case Study 1: Chinook Salmon*

Draw it:

Characteristics: _____

_____

Habitat: _____

_____

Why is it threatened? _____

_____

Food Chain: _____

_____

• *Case Study 2: Bull Kelp*

Draw it:

Characteristics: _____

_____

Habitat: _____

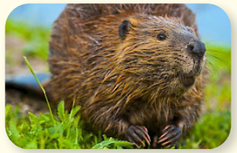
_____

Why is it threatened? _____

_____

Food Chain: _____

_____



• Case Study 3: Point Arena Mountain Beaver

Draw it:

Characteristics: _____

_____

Habitat: _____

_____

Why is it threatened? _____

_____

Food Chain: _____

_____

_____

• Case Study 4: Western Snowy Plover

Draw it:

Characteristics: _____

_____

Habitat: _____

_____

Why is it threatened? _____

_____

Food Chain: _____

_____

_____

• Case Study 5: Abalone

Draw it:

Characteristics: _____

_____

Habitat: _____

_____

Why is it threatened? _____

_____

Food Chain: _____

_____

_____

How can we help threatened species?

Write a paragraph or list of at least five things that we can do to help endangered and threatened species

_____

_____

_____

_____

_____

_____

_____

_____

LESSON PLAN: *TRAIL BINGO AND FIELD JOURNALING*

Overview: This lesson is designed to be taught in the field and specifically while hiking on the Point Arena-Stornetta Lands. Students will learn about many different biotic and abiotic elements of the public lands. Students will look for these elements while they are hiking and will cross off each element that they observe on their Bingo card. Near the end of the hike, students will write and draw about one of the abiotic or biotic elements that they observed during the hike in their field journals.

Objectives: At the end of this lesson, students will be able to:

- Understand that all ecosystems consist of biotic and abiotic elements.
- Observe and point out abiotic and biotic elements found on the Point Arena-Stornetta Lands.
- Hike and practice making observations.
- Write observations and make sketches in their journal about one or more things that they observed on the hike.

Building Background Knowledge Note: Teacher may consider frontloading background information for students in the classroom on the following topics:

- Abiotic vs. biotic factors in an ecosystem
- Erosion
- Creation and history of the Point Arena-Stornetta Lands
- Native plant identification

Time: 3-5 hours for hike which will allow time to take breaks for snack, lunch and teaching activities.

Suggested route: Start at the Point Arena City Hall trailhead and take the trail to the north. Once you hit the ocean cliffs, head south back to the city hall trailhead. This is about a 4-mile loop.

Grade Level: 3rd-8th grade

Suggested Group Size: This lesson can be taught to small or large groups.

Materials Needed:

- Print one Bingo card per student—cardstock recommended
- Clipboards
- Pencils
- Journal for writing in (1 per student)
- Print out the vocabulary cards on cardstock (for the Act it Out! game)
- Make sure students bring plenty of water and food!

PROCEDURE

Engage: Before starting the hike, review the definition of biotic and abiotic factors.

Warm-up activity: Give students a three-minute challenge: Have students find a partner and come up with one example of a biotic factor and one example of an abiotic factor that they can see or is present at the trailhead. After three minutes, bring students back together and ask for volunteers to share their examples.
After the warm-up activity, go over safety rules and begin the hike.

Explore:

1. After about ¼ mile, find a good place to stop and gather students together to explain the Act it Out! Activity.
2. Tell students that they are going to be playing a game of Bingo while they hike. The goal is to pay attention to their surroundings and try to observe all of the things featured on their bingo card.
3. Hand out one bingo card, a clipboard and a pencil to each student.
4. Allow students 1-2 minutes to look at their bingo cards.
5. Gather students back together and explain the Act it Out! Game.
   - Students will be divided into small groups and will be given a card that defines or provides information about one of the elements found on the bingo card. In the small groups, students will read the card aloud, and work together to come up with a way to act the element out.
   - After all groups are ready, gather students back together and have each group take turns acting out their element(s). The students in the audience can try to guess which element they are acting out. After the element is guessed correctly, the students in the group that are presenting can read the information on their card to the whole group.
6. After the activity, continue the hike and remind students to keep their eyes out for elements on the Bingo card.

Explain: While hiking, feel free to make short stops to point out elements found on the bingo card that students may have missed or not seen. Ask students if these elements are biotic or abiotic. ***For example, students may not know what a huckleberry bush looks like, so you may want to stop and point it out. Or if you see cows, stop and discuss why there are cows present on these public lands.***

Keep reminding students to keep their heads up and to make observations about what they are noticing or wondering about their surroundings. If a student gets a Bingo, you may challenge them to try to get a blackout (where you try to cross off all squares on the card).

Elaborate: During another stop, ask students to work with a partner to label each square on their bingo card as abiotic or biotic. Walk around and listen to students as they discuss. If there is one element that is hard to identify, call the whole class together and discuss as a group.

End with a short discussion about the interaction between abiotic and biotic factors in an ecosystem. How do abiotic resources affect biotic life forms? ***example: photosynthesis***

Evaluation:

- Near the end of the hike, find a comfortable spot to stop and ask students to get their journal out. Tell students that they need to do the following:
  - Choose one element from the bingo card that they observed.
  - Write 2-3 observations about that element.
  - Define the element as biotic or abiotic.
  - Draw a detailed sketch about that element: encourage them to use labels, arrows, zoom-ins and details in their drawing.
- When finished, divide students into groups of 2 or 3 and have students share their journal responses.

VOCABULARY

- **Ecosystem:** A community of interacting organisms and their environment. Living things interact with each other and also with non-living things like soil, water and air.
- **Abiotic factors:** Non-living components in an ecosystem
- **Biotic factors:** Living components in an ecosystem

Additional Resources:

- Video about abiotic and biotic factors: https://youtu.be/E1pp_7-yTN4
- Info about Point Arena-Stornetta Lands: www.blm.gov/visit/point-arena-stornetta-unit

NEXT GENERATION SCIENCE STANDARDS (4TH-8TH GRADE)

4-ESS2-1 Earth's Systems: Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. Performance Expectation

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. Performance Expectation

5-ESS2-1 Earth's Systems: Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

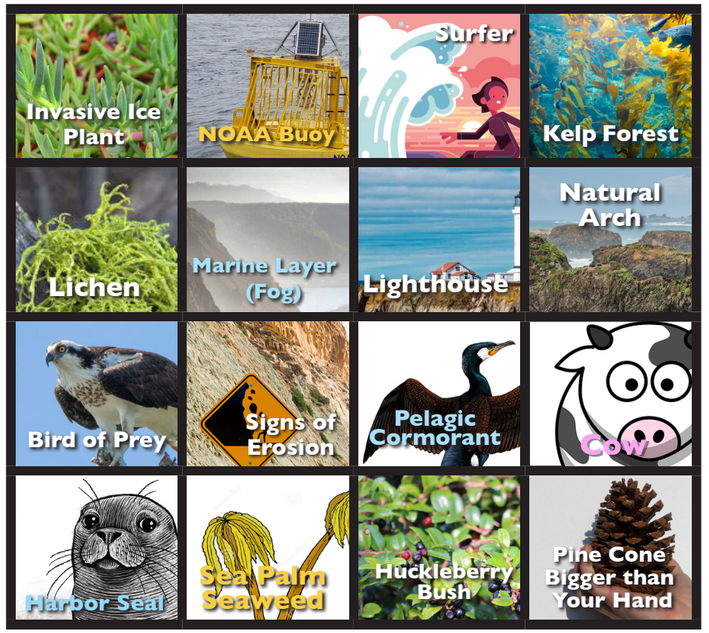
MS-LS1-5 From Molecules to Organisms: Structures and Processes: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

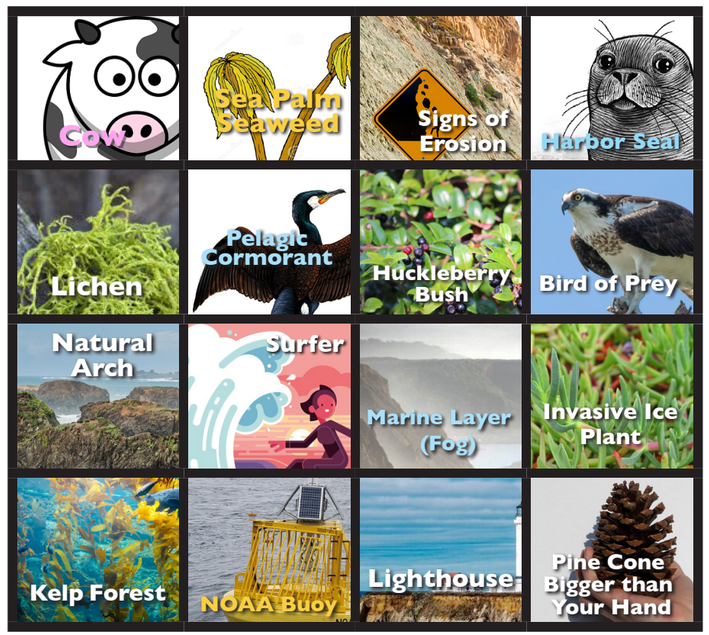
MS-LS1-6 From Molecules to Organisms: Structures and Processes: Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS2-3 Ecosystems: Interactions, Energy, and Dynamics: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

HANDOUT: *TRAIL BINGO*

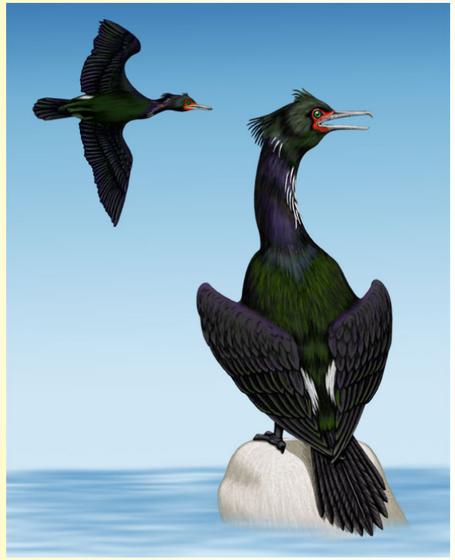
This is to be played while hiking on the Point Arena-Stornetta Lands. Look out for these landmarks, animals, plants and more. Try to get four in a row or try to find them all!





HANDOUT: *ACT IT OUT FLASH CARDS*

Use these flash cards for the game *Act It Out!* See lesson plan for more information.



PELAGIC CORMORANT

Habitat: Rocky cliffs and bays

Diet: Small fish, crustaceans, algae, shrimp

Nests: Builds nests out of seaweed, sticks and grass on steep cliff sides

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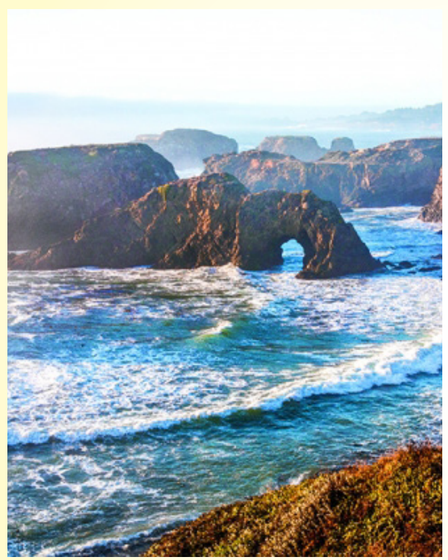
SEA PALM

- Looks like a small palm tree.
- Grows in the intertidal zone, in areas with high wave exposure (lots of waves)
- Edible and was an important food to the Pomo peoples and other coastal tribes

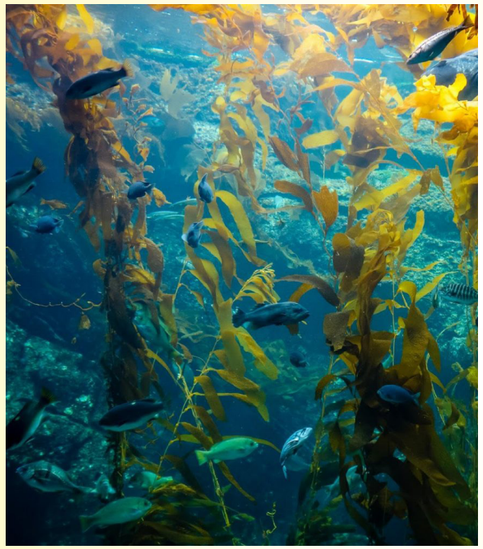
HARBOR SEAL

- Rest on rocks, reefs, beaches, and drifting glacial ice at night and during the day. This allows them to regulate their body temperature, molt, interact with other seals, avoid predators and raise their pups.
- The harbor seal's diet consists mainly of fish, shellfish, and crustaceans.
- Harbor seals complete both shallow and deep dives while hunting depending on the availability of prey.
- They can sleep underwater and come up for air once every 30 minutes.



NATURAL ARCH

- Formed by the process of erosion from ocean waves
- This takes thousands of years
- Usually in limestone or sandstone layers of rock



KELP FOREST

- Bull Kelp is an annual (completes life cycle in one year)
- Kelp anchors itself to rocks using a holdfast and grows up to the surface
- Extremely essential ecosystem to harbor seals, fish, birds, invertebrates, Gray Whales

MARINE LAYER

- Fog that forms over the ocean
- Caused from warm air hitting the cold ocean water
- The ocean is usually about 52 degrees off of the Mendocino Coast

BIRD OF PREY

- Ospreys, hawks, kestrels
- Have sharp eyesight and hunt with their sharp talons
- Diet: rodents and small mammals and reptiles
- Often seen hunting during the day at the Stornetta Lands

LAND ECOSYSTEM DRAWING

How many land plants and animals can you identify in this drawing? How many have you seen on the trail? What colors would you choose to accurately represent these plants and animals?

MARINE ECOSYSTEM DRAWING

How many ocean plants and animals can you identify? Have you seen any of these when hiking on the bluffs or exploring tidepools? What colors would you choose to accurately represent these plants and animals?

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CALIFORNIA MARINE PROTECTED AREAS

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