

Botanists-in-Training

Overview: Students will learn about botany by observing 6 plants on a Phenology Walk. Students will write what they notice and wonder about each plant, and what they would name the plant if they were botanists. At the conclusion, students will report their findings with their peers and examine the importance of sharing data.

Next Generation Science Standards: 3-LS3-2, 4-LS1-1

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Introduction (2 minutes)**
 - Students will be introduced to the subject of phenology and its importance to botanists.
- **Phenology Walk (18 minutes)**
 - The instructor will lead a walk around the upland habitat, as students record what they notice and wonder about certain plants.
- **Report Out (7 minutes)**
 - Students will share their observations of the plants to the group.
- **Walk Back (3 minutes)**
 - The group will walk along the trail back to the back deck.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- The Don Edwards San Francisco Bay National Wildlife Refuge has a phenology/monitoring program that observes certain plants at different times of the year.
- The information obtained from phenology studies can contribute to the knowledge base of the effects of climate change and pollution, and how these effects will change other aspects of the environment, such as bird migration, frog spawning, and pollinator survival.

Key Concept: Phenology is the study of the timing of natural events. The data gained from this study is important to botanists (scientists that study plants) to track the effects of climate change and pollution on the natural world.

Objectives:

Students will be able to:

- Describe 2 plants found on the Refuge

- Define the word “botanist.”
- Explain 1 reason why sharing results is important

Materials:

Provided by the Refuge:

- 6 cones marking plants
 - California sagebrush
 - Black sage
 - Coyote brush
 - Lemonade berry
 - Toyon
 - Tule

Provided by the Educator:

- 12 Nature Journals with “Botanists-in-Training” pages

Feet, Beaks, and Eats

Overview: Students will use tools to test which beak types work in differing habitats, then match birds to those habitats based on adaptations in their beaks and feet.

Next Generation Science Standards: 3-LS3-2, 3-LS4-3, 4-LS1-1

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Introduction (2 minutes)**
 - Review of the 5 habitats found at the Refuge.
- **Feeding Experiment (10 minutes)**
 - Students will use tools that represents different bird beak types, and test them in different habitat settings.
- **Feet/Beak Matching (13 minutes)**
 - Preserved bird specimens will be provided for students to match to the appropriate habitat, depending on their adaptations.
- **Report-Out (5 minutes)**
 - Students report on why their bird fits in a particular habitat.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- The Don Edwards San Francisco Bay National Wildlife Refuge provides bird species with five different habitats: upland, slough, salt marsh, salt pond, and mudflats.
- Over time, bird species adapt to eat in each of the habitats. If one habitat was destroyed or developed upon by humans, some birds would lose food sources and breeding habitats.
- The Refuge's habitats are managed to provide the necessary habitat for a high biodiversity of bird species.
- Loss of wetland habitats for migratory and resident birds due to development (landfills, salt ponds, buildings, roads, airports, etc.)

Key Concept: All organisms have specialized body parts to help them survive in particular habitats. There are five distinct habitats on the Refuge, and the birds that live here possess beaks and feet that are designed to help them find and utilize food resources.

Objectives:

Students will be able to:

- Name the 5 Refuge habitats.
- Identify 1 bird species.
- Describe 2 adaptations for feeding in a particular habitat.

Materials:

Provided by the Refuge:

- 12 “stomachs”- cups
- 5 tong beaks
- 5 tweezer beaks
- 5 spoon beaks
- 5 eyedropper beaks
- 5 habitat displays
- 5 photos of habitats
- 5 habitat clue cards
- 14 bird feet/beak specimen sets

Nature Journaling

Overview: Students will fill out a Nature Journal, record observations and compare them between the Refuge, their home, and a natural space (park, forest, beach, etc.).

Next Generation Science Standards: This activity does not align to any particular Standard, but does reinforce a Conceptual Shift within the Standards that science should reflect the interconnected nature of science. Through this activity, students will not learn about the pieces of a habitat individually, but observe it as a whole and make observations of the pieces.

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Introduction (5 minutes)**
- **Nature Journaling (25 minutes)**
 - Students will participate in solitary nature journaling, using their keen senses to draw, write about, and ask questions about things they see. Students will not be permitted to talk to their neighbor.
- **Report Out (10 minutes)**
 - Students will share observations amongst the group.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- Observing nature stimulates environmental stewardship and creates a bond between the student and the earth. Students will develop an awareness and appreciation of the Refuge's resources. This activity helps support the National Wildlife Refuge System's Guiding Principles to promote "love and respect for the land."

Key Concept: Nature journaling provides an inquiry-based approach to learning, and requires students to observe the characteristics of natural objects.

Objectives:

Students will be able to:

- Describe 2 characteristics of a naturalist.
- Name 4 kinds of things that could be recorded in a nature journal.
- Suggest 2 reasons why to keep a nature journal.

Materials:

Provided by the Refuge:

- 12 boxes of colored pencils

Provided by the Educator:

- 12 Nature Journals

Nature Play

Overview: The benefits of playing in nature are numerous. Studies have shown that children who play in nature on a regular basis are healthier, more decisive, feel better, and develop an appreciation for the natural world. In this activity, students will participate in unstructured nature play time, using stumps, sticks, and leaves to build forts or other structures in order to develop problem-solving and cooperation skills.

Next Generation Science Standards: 3-ETS1-2, 3-ETS1-3

This activity supports the NGSS value of scientific inquiry. It also supports the following NGSS Connection Statements: 1) science and engineering involve the use of tools to observe and measure things, 2) every human-made product is designed by applying knowledge of the natural world and is built by using natural materials, and 3) taking natural materials to make things impacts the environment.

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Introduction to the Rules (2 minutes)**
 - Students will be introduced to the idea of playing in nature and learn the rules associated with this activity.
- **Nature Play (28 minutes)**
 - Students can use natural items to build forts, construct obstacle courses, pretend to be animals, play house, etc.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- Playing in nature stimulates environmental stewardship and creates a bond between the student and the earth. This activity helps support the National Wildlife Refuge System's Guiding Principles to promote "love and respect for the land."

NOTE: This activity can be conducted after lunch. If students finish eating early, they can play in the Nature Play Space located behind the Pavilion. Chaperones and Activity Leaders can explain the rules as the students exit the Pavilion.

Key Concept: Nature Play is a great way for students to learn how to cooperate, solve problems, use critical thinking skills, and become independent.

Objectives:

Students will be able to:

- Name 2 different materials found in the Nature Play Space.
- Work as a team to complete a goal.
- Describe 1 thing they learned while participating in Nature Play.

Materials within Nature Play Space:

- Sticks
- Stumps
- Pine cones
- Acorns
- Mulch
- Leaves

RESOURCES

Ernst, J.A. and Erickson, D.M. *The real benefits of nature play everyday.* Wonder. NACC Newsletter. Jul/Aug 2011. P. 97-100.

Louv, R. *Last Child in the Woods.* Algonquin Books. New York. 2005.

What is Nature Play? National Wildlife Federation. Website. www.nwf.org/What-We-Do/Kids-and-Nature/Programs/Nature-Play-Spaces.aspx

Salt Marsh Mini-Expedition

Overview: In this activity, students will work in pairs to examine a small section of the salt marsh. They will study plants, animals, and physical characteristics of the habitat, and identify why the salt marsh is important for humans to preserve.

Next Generation Science Standards: 3-LS3-2, 3-LS4-3, 3-ESS3-1, 4-ESS3-2, 4-LS1-1

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Introduction (2 minutes)**
 - Discuss the salt marsh habitat and the Key to Salty's Home
 - Divide students into groups of 2 and hand out data collection materials
 - Discuss the rules
- **Exploring the Salt Marsh (17 minutes)**
 - Allow each group time to explore their section of marsh
 - Circulate among the groups with the plant book and scat display
- **Flume Experiment (11 minutes)**
 - The instructor will demonstrate how marshes provide flood protection for nearby cities by pouring water into the flume display.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- The Don Edwards San Francisco Bay National Wildlife Refuge is made up of tidal salt marshes. These marshes are home to the endangered salt marsh harvest.
- The loss of salt marsh habitat due to development (landfills, salt ponds, buildings, roads, airports, etc.) and the introduction of nonnative plants and animals has decreased habitat for the endangered species.

Key Concepts: The salt marshes around San Francisco Bay provide a unique habitat for a specialized group of plants and animals. Human impacts have drastically reduced the habitat. Salt marshes provide direct benefits to humans through oxygen production and flood protection.

Objectives:

- Describe the physical and biological components of the salt marsh habitat

- Name 3 ways in which humans impact the salt marsh
- Identify 1 way that the salt marsh benefits humans

Materials:

Provided by the Refuge:

- 6 Mini-Expedition packs
 - 1 boundary rope
 - 1 soil thermometer
 - 2 hand lenses
- 6 clipboards
- 1 scat display
- 1 salt marsh plant book
- 1 bird identification chart
- 1 Key to Salty's Home
- 1 animal track display
- 2 flume displays

Provided by the Educator:

- copies of the Salt Marsh Data Sheet (1 for every 2 students)
- 12 pencils

Time Travel Through the Marsh

Overview: Students will participate in a hike that highlights human impacts on the former salt marsh habitat. During the walk, they will find natural objects, human-made objects, and sources of disturbance in and around the Refuge.

Next Generation Science Standards: 3-LS3-2, 3-LS4-4

CA History-Social Science Content Standards: 3.3, 4.1

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Introduction (5 minutes)**
 - Students will be instructed on how to use binoculars.
- **Time-Travel Walk (15 minutes)**
 - The instructor will lead students on a walk of the Marsh View Trail, discussing the ways different types of people use the land differently.
- **Nature Journaling (5 minutes)**
 - Students will brainstorm ideas for how to restore and improve habitat in the Bay Area.
- **Walk Back to the Start of the Trail (5 minutes)**
 - Instructor and students will walk back to the start of the Marsh View Trail.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- The Don Edwards San Francisco Bay National Wildlife Refuge is surrounded, on all sides, by urban development (landfills, salt ponds, businesses, cities, highways, etc.).
- The Refuge's resources are threatened by water, air, light, and noise pollution. Students will be able to observe the sources of this pollution and compare modern people's uses of the marsh to those of the Ohlone Native Americans.

Key Concepts: The salt marshes of the San Francisco Bay have changed drastically over time. Ohlone Native Americans, Spanish settlers, the Gold Rush, and modern people have modified the habitat to suit their needs.

Objectives:

- Name 2 ways that humans have changed the salt marsh habitat.
- Describe 1 way the Ohlone Native Americans' uses of the marsh

Materials:**Provided by the Refuge:**

- 1 backpack with:
 - 12 binoculars
 - 3 boxes of markers
 - 3 samples of blue elderberry
 - 3 samples of coyote brush
 - 3 Pictures

Provided by the Educator:

- 12 Nature Journals with Marsh Time Travel page

Wetland Migration Sensation

Overview: After learning about the Pacific Flyway and migratory bird species, students will use binoculars and bird guides to identify birds found on the Refuge. Then, they will mimic Western sandpipers along their migration route.

Next Generation Science Standards: 3-LS4-4, 4-LS1-2

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Introduction (5 minutes)**
 - Students will be introduced to the topics of migration and the Pacific Flyway.
- **Bird Watching (12 minutes)**
 - Using binoculars and bird guides, students will observe birds in the slough and salt pond habitats.
- **Migration Simulation (11 minutes)**
 - Students will mimic sandpiper migration between nesting sites in Alaska and wintering grounds in the San Francisco Bay Area.
- **Discussion (2 minutes)**
 - The instructor will review with the students.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- The land owned by the Don Edwards San Francisco Bay National Wildlife Refuge was set aside, partially, to preserve nesting and feeding habitat for migratory birds traveling along the Pacific Flyway.
- As human development continues to surround the Refuge, the necessity for protected land becomes more essential for the survival of migratory bird species, like the Western sandpiper.

Key Concept: The habitats on the Refuge protect nesting and feeding habitat for migratory birds, like the Western sandpiper. Migrating can be treacherous, due to increased development in nesting areas. Bird watching, as a hobby, can be beneficial to learning, promoting observation and critical thinking skills.

Objectives:**Students will be able to:**

- Describe 1 way that human development can be harmful to migratory birds.
- Identify 1 species of bird.

Materials:**Provided by the Refuge:**

- Flyways of North America poster
- Photo of Western sandpiper
- 6 pairs of binoculars
- 6 bird guides
- Two sets of 6 bases (wintering, wetland habitats and nesting habitats) set out one of each for every two students

Wetlands Water Café

Overview: In the first part of this activity, students will learn that all parts of an ecosystem are connected, whether living or not. Then, they will become marine biologists and examine the microscopic organisms that live in nontidal slough water.

Next Generation Science Standards: 3-LS1-1

TIME FRAME FOR CONDUCTING THIS ACTIVITY

- **Make the Web of Life (10 minutes)**
 - The instructor and students will construct the web, making connections between the living and non-living elements of an ecosystem.
- **Investigate Slough Water Sample (20 minutes)**
 - Students will use hand lenses and microscopes to discover what types of plants and animals live in nontidal slough water.

HOW THIS ACTIVITY RELATES TO THE REFUGE'S RESOURCES

- The water found in the nontidal slough habitat on the Don Edwards San Francisco Bay National Wildlife Refuge supports a variety of life, from small microscopic phytoplankton to large predatory birds, like the northern harrier.
- If one of the connections in the web of life is disturbed by pollution, urban development, or littering, the entire ecosystem could suffer the consequences.

Key Concept: The nontidal sloughs in New Chicago Marsh provide an important habitat for many aquatic plants and animals. These plants and animals are an essential food source for both resident and migratory birds. Ecosystems are made up of both living and non-living components.

Objectives:

Students will be able to:

- Name 1 type of zooplankton
- Construct 1 food chain, using slough plants and animals

Materials:**Provided by the Refuge:**

- 1 bucket of slough water
- 4 large glass dishes
- 12 student microscopes
- 12 glass petri dishes
- 12 plastic microscopic slides
- 12 eyedroppers
- 4 yogurt cups (for dipping)
- 12 hand lenses
- 12 placemats with slough ID
- 1 ball of yarn
- Set of 15