Human Impacts

As more and more people populate the Earth and as more and more land is taken over by humans, many natural areas—including wetlands—are destroyed, degraded, or reduced in size. Human activities have also brought water pollution and invasive species that threaten our remaining wetlands.

Loss of Wetlands

The United States has lost approximately one half of the wetland area that existed before European settlers arrived. In California, the percentage lost is even higher, much higher—91 percent. In 2000, only 400,000 acres of the state's original three to five million acres of wetland area remained. In Orange County, accelerated development destroys more than two square miles each year.

Where Have All the Wetlands Gone?

Historically, the largest losses in wetland acreage around the world have been due to agriculture. Drained wetlands often produce fertile farmland, at least for a while. In the U.S., over 80 percent of wetland loss can be attributed to agriculture.

Now, however, it is not agriculture but urban and suburban growth that is destroying wetlands. Coastal wetlands are the most endangered. People want to live and work near the water, and industries prefer to be located near discharge points or cooling water sources supplied by the ocean. So, coastal property has high real estate value. Estuaries have been turned into harbors, amusement parks, nuclear power plants, university campuses, airports, and housing tracts. Even when wetlands are preserved, chemical and biological pollution from nearby development can disrupt the delicate balance of wetland ecosystems.

Why Does It Matter?

When we lose wetlands, we lose the benefits that wetlands provide, such as filtering pollutants from runoff, supplying habitat for wildlife and providing recreational areas for people. The loss of wetlands also results in the loss of biodiversity.

Biodiversity refers to the variety of plant and animal species coexisting within an ecosystem. Ecologists know that the more kinds of organisms that can coexist in a system, the more stable or resilient that system is. The loss of wetlands has endangered many species of plants, birds, fish, and other wildlife that depend on associated habitats for food, shelter, and breeding. In southern California, endangered animals that depend on coastal sage scrub include: California Gnatcatcher, Sage Sparrow, little pocket mouse, San Diego horned lizard, and the orange-throated whiptail lizard. About one-half of the 188 animals that are federally designated as endangered or threatened are wetland dependent.

Even if development does not completely destroy a wetland, it can break the wetland up into smaller chunks—a problem called fragmentation. By reducing the quantity or quality of habitat available, fragmentation lowers the diversity of plants and animals. Species that are very rare or that are found only in small populations are especially at risk when habitat portions are destroyed. And if another species depends on the lost species for either food or shelter, it too might be lost, disrupting the food web and its connection to the entire ecosystem.

Many habitat fragments are surrounded by barriers—roads, parking lots, buildings—that prevent species from moving between different areas to get what they might need to survive, such as food, shelter, and mates. When a species is isolated from others of its kind, it can become subject to inbreeding and lose some of its genetic diversity. Gene pools are like a bag of survival tricks. A species with less genetic diversity is less likely to survive disturbances such as flooding or grazing.

The loss, degradation, and fragmentation of habitats are important factors behind species endangerment and extinction.

Urban Encroachment

As our cities grow larger with more people and more development to accommodate these people, even wetlands with protected status are affected.

Loss of Buffers

A wetland ecosystem includes both land that is actually "wet" and surrounding areas called buffer zones. These buffer zones are areas where some species retreat during high tide and where pollutants and sediments can be filtered before entering the water. Buffer zones also absorb such impacts as noise and pet disturbance. But as people move closer and closer to wetlands, the buffer zones are lost.

Upper Newport Bay's historical buffer zone was composed of grasslands and coastal sage scrub. Much of this habitat has been degraded or converted. The coastal sage scrub adjacent to the wetlands has been used in the past for livestock grazing and as a dump for sediment dredged out of the Bay, both of which compacted the soils and altered their chemistry. The resulting degraded habitat is prone to invasion by non-native plants, which now dominate the area. Bluffs surrounding the Bay have been converted to housing developments. Much of the landscaping for these houses provides seed stock for more non-native plant invasions, a true form of biological pollution. Non-native landscaping often requires irrigation, which creates run-off with fertilizers and pesticides that flow directly into the Bay.

Coastal sage scrub, an integral component of Upper Newport Bay's ecosystem, is now an endangered ecological community. It is estimated that only ten percent of California's historic coastal sage scrub acreage remains, and most of this land is in private ownership. Less than ten percent of the remaining habitat is formally protected; the rest may be slated for development.

People and Their Pets

As development moves closer to wetlands, so do the people. Wetlands provide wonderful recreational opportunities, but with more and more people come more and more potential threats.

At Upper Newport Bay, thousands of people jog, bicycle, kayak, or walk through the Bay each year. Unfortunately, many of these people leave trash behind, trample wildlife, and cause erosion by making their own trails. It's not only people but also their pets that can cause damage to this ecosystem. Horse and bike traffic can erode trails, and unleashed dogs disturb bird nests, especially those of the Light-footed Clapper Rail, an endangered species that builds its nests among the grasses in the marsh. Also, pet waste that washes into the Bay can result in water pollution.

Too Much Dirt

Even development far from the wetland can cause problems. Rain washes soil eroded from construction sites and farm fields through the watershed, ultimately depositing these sediments into the wetland. Increased urbanization in the Upper Newport Bay watershed has resulted in the need to form concrete channels in San Diego Creek that direct storm water and dry-weather runoff quickly, and with more silt, into the Bay. Such channelization is common practice in areas that have developments on floodplains.

Excessive amounts of silt in a wetland can clog the gills of fish, bury their eggs, obliterate underwater shelters, and cloud the water so little sunlight can reach aquatic plants, which depend on the light for photosynthesis. In Upper Newport Bay, nearly a million cubic yards (approximately the volume of 19 Olympic-sized pools, or a million pick-up truckloads) of sediments were dredged from the northeast corner of the Bay in 1998-99. More than twice that amount is slated for removal in 2004-2005, and similar dredge operations are expected every 21 years. Without dredging, the Newport Harbor would eventually become inaccessible by boat.

Water Quality

While it is true that wetlands can reduce or eliminate the harmful effects of water pollution, they can also become overwhelmed if the amount of pollution exceeds that wetland's biological capacity. Large quantities of pollutants washed into wetlands can lead to the death of plants, animals, and important microorganisms.

There's No Point to Pollution

Pollution comes from many sources. *Point* source pollution is discharged from, and can be traced back to, an identifiable point or source, such as a factory's discharge pipe. But most pollution entering wetlands is *nonpoint* source pollution. Nonpoint source pollution is contaminated runoff that originates from an indefinite or unidentifiable place; usually it accumulates from a variety of places.

As the drain for the watershed basin, a coastal wetland ends up with whatever finds its way into the flowing water. In Upper Newport Bay, that includes:

- **Trash** — Foamed plastic cups, paper, cans, bottles, plastic bags and packages, cigarette butts, and other garbage all can be found in the Bay, whether washed in through storm drains or carelessly dropped by visitors. Not only is the trash unsightly, it is also dangerous to the marine life and the birds that get tangled up in it or eat bits of plastic, mistaking it for food.
- **Chemicals** — We use toxic chemicals every day, and many of them end up on the ground where they can get washed into rivers or storm drains. Pesticides, paint, cleaners, polishes, glue, oil, gasoline, and auto-coolant are all helpful to us but harmful to the Bay ecosystem. Oil and grease can coat bird feathers; other toxic chemicals can kill or contaminate fish and plant life.
- **Metals** — Metallic substances can leach from paints applied to the bottoms of boats moored in the lower bay. Fine metallic particles from car brake pads accumulate as dust along the sides of roads and get washed down to the Bay with run-off. These metals can accumulate in animal tissues.

- **Fertilizers and animal waste** — Commercial nurseries, golf courses, hotels, and homes all use fertilizers. These fertilizers, along with waste from animals—dogs, horses, and wildlife—get picked up by runoff and then deposited in the Bay. Fertilizers and animal waste are actually nutrients, which promote plant growth. But an excess of these nutrients in the Bay can cause algae blooms—the overgrowth of algae. When the algae die, the oxygen in the water is used up by microbes through decomposition, which affects all living things in the water. This process, called eutrophication, can cause fish to die from lack of oxygen. Eutrophication is also responsible for the sulphuric smell rising from the Bay—a sign of anaerobic decomposition.
- **Green waste** — Grass clippings, tree branches, leaves, dead plants—all can end up in the Bay. In 2004, the County of Orange found that 99 percent of trash intercepted by street sweepers was organic debris. Like fertilizers and animal waste, green waste can dramatically increase the nutrient levels in the Bay, resulting in eutrophication.

Non-native Species

Non-native, invasive plant and animal species are another major threat to wetlands across the country.

Who's Native?

Native plants (also called indigenous plants) are plants that have evolved over thousands of years in a particular area. California has the largest number of native plant species of any state in the nation. A plant is native to California when its origins, for as long as can be traced back, are from California. Native species—such as California sagebrush and arroyo willow—have been here for so long they are specifically adapted to our climate, soils, and habitats.

Most native plants occur in communities; that is, they have evolved together with other plants. As a result, a community of native plants provides habitat for a set of native wildlife species, including pollinators and herbivores, which are specifically adapted to life in that community. They depend on one another for food, air, nesting, resting, and hiding places.

Alien Invaders

Non-native plants (also known as non-indigenous, introduced, or exotic) are species that have been introduced into an environment in which they did not evolve. Introduction of non-native plants into our landscape has been both accidental and deliberate.

In their new homes, non-natives generally have no enemies or controls—such as natural pests, herbivores, diseases, or parasites—to limit their growth. These invasive species out-compete native species for nutrients, water, sunlight, and living space. As they spread, the native plant communities are displaced, and often, along with them, the animals that depend on the plants for food or shelter. The functions of the entire ecosystem are disrupted.

When non-native species dominate native vegetation, they can:

- eliminate the native plants that provide food and shelter for wildlife
- degrade the variety and quality of habitats
- dramatically reduce biodiversity
- alter soil chemistry
- promote erosion
- sequester water
- alter fire-frequency.

In the Bay

Many California native plants live at Upper Newport Bay, including:

- bush sunflower
- California buckwheat
- California sagebrush
- pickleweed
- cordgrass

Some are endangered, such as the salt marsh bird's beak, which, once prevalent in coastal Orange County, can only now be found in Upper Newport Bay.

Invasive non-native plants have found their way into the Bay. Three that are commonly seen are ice plant, pampas grass, and giant reed. Giant reed is a particularly destructive invader. It can grow over two feet per week and colonizes quickly in the presence of freshwater, displacing native plants and wildlife because of the massive stands it forms. As it out-competes local vegetation for space and water, it reduces habitat and food supply for several species, particularly insect populations. Unlike native riparian plants, giant reed provides little shade, leading to increased water temperatures and reduced habitat quality for aquatic life. It also promotes bank erosion because of its shallow root system, contributing to more sediment being deposited in the Bay.

Activity: Changes Over Time

Summary: In this activity, students will compare aerial photographs of Upper Newport Bay taken in 1938, 1975, and 2001 to discover how the area has changed and what impact that change has had.

California State Content Standards

SCIENCE

Biology/Life Sciences

Ecology 6b. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

Earth Sciences

California Geology 9a. Students know the resources of major economic importance in California and their relation to California's geology.

California Geology 9c. Students know the importance of water to society, the origins of California's fresh water, and the relationship between supply and need.

Investigation & Experimentation

1d. Students will formulate explanations by using logic and evidence.

1i. Students will analyze the locations, sequences, or time intervals that are characteristic of natural phenomena

Objectives:

Students will be able to:
- Interpret and compare aerial photographs
- Describe the changes in the area caused by human development
- Determine how development has possibly affected wildlife habitat and populations in Upper Newport Bay

Materials:
- *UNB Inhabitant Cards* (Appendix A)
- Handouts
  - Aerial photographs of Upper Newport Bay in 1938, 1975, and 2001
  - *Changes Over Time* worksheet

Preparation:
- Make a copy for each group of:
  each aerial photo
  Changes Over Time worksheet
  Newport Bay Timeline

Time Required:

Approximately 1 hour

Procedures:

1. Divide students into small groups and give each group a copy of the three aerial photos. Point out that the photos were taken of the Upper Newport Bay watershed in 1938, 1975, and 2001. Ask students to look at the photos for a few minutes and try to identify landmarks, such as Pacific Coast Highway, Shellmaker Island, the Salt Dike, and orange tree groves.

2. Hand out a copy of the *Changes Over Time* worksheet to each group. Tell students to look at the photos to determine what changes have occurred in each of the areas shown on the worksheet—that is:
   - Are there more or less?
   - Have there been alterations?
   - Has anything disappeared?

   Tell students to record the changes in the "Change" column of their worksheets.

3. Using the species included on the *UNB Inhabitant Cards*, or on the list of *Species Common to Upper Newport Bay* in Appendix B, ask students to consider how each change might affect wildlife in the Bay. Have students record their ideas in the "Possible Impacts on Wildlife" column on the worksheet. For example: "The increase in open water has greatly enlarged the feeding grounds for diving birds such as the Least Tern."

4. Bring the class together to compare their findings. Ask students to think about and discuss whether the wildlife in the Bay was generally better off in 1938, 1975, or 2001. Remind students that the Clean Water Act was passed in 1972, along with the ban of DDT and other toxic chemicals that polluted the wetland.

Follow-up:

Use the following questions to ask students what they learned from comparing the photos.

1. What anthropogenic (human-made) features have been harmful to wildlife in the Upper Newport Bay and why?

2. What do you think the Bay will look like in 50 years? Remember, global climate change data estimate that sea level will rise three millimeters each year—over three inches in 50 years.

3. Have students use the *Newport Bay Timeline* to relate historical events to changes observed in the aerials.

4. Use the California Coastal Records Website (*www.californiacoastline.org*) to look at historical aerials of California's coastline. By clicking on "Time Comparison," users can compare photographs from 2002 and 1972.

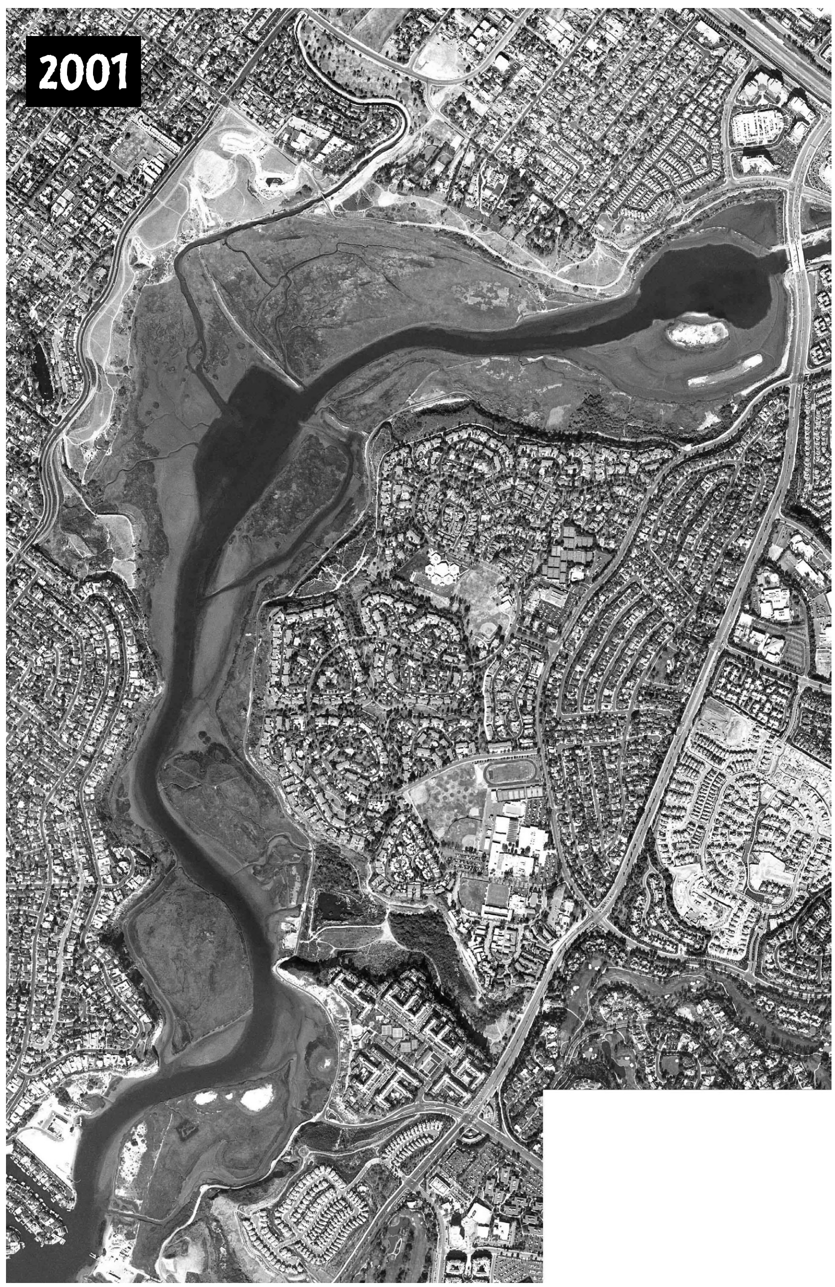
Changes Over Time

Area	Change	Possible Impacts on Wildlife
Open Water		
Rivers		
Wetlands		
Farms/Ranches		
Parks		
Shopping Centers		
Houses		
Businesses		
Streets, Roads, Sidewalks		
Parking Lots		
Other		

Newport Bay Timeline

(0-500s)- The Tongva (Gabrielinos) set up small villages in the Bay.
1700s- Spanish missionaries arrive and create agricultural communities.
1825- Floods cause Santa Ana River to empty into Newport Bay. Sand deposits build the basis for Balboa Peninsula.
1830s- Rancher Sepulveda is awarded a Mexican land grant for Rancho San Joaquin, including the shorelines of upper and lower Newport Bay.
1864- Sepulveda sells Rancho San Joaquin to James Irvine.
1888- American entrepreneur James McFadden builds ocean wharf extending from the peninsula to deeper waters so large vessels can safely dock. The area is called "New Port."
1905- Pacific Electric Railroad connects Newport to Los Angeles. Waterfront hotels and beach cottages are built to accommodate tourists.
1920- As a protective measure against flooding, west jetty is built and Santa Ana River is redirected from the bay so that it empties directly into the ocean.
1922- Duke Kahanamoku hosts first World Surfing Championship in Newport, introducing the sport to the Western United States. First sanitary sewers are constructed.
1927- East jetty built and harbor entrance dredged.
1929- The Great Depression unfolds. Lido Island dredged and filled.
1932- Scientist Lawrence Booth begins documenting Orange County's wetland plants, providing an invaluable resource for future restoration projects.
1934- Irvine Company builds dikes and basins to extract salts from the Bay through solar evaporation.

1935- Dredging harbor sandbars and extending jetties creates current-day layout of Newport Beach.
1938- Colossal storm hits Orange County, massive flooding leaves 119 dead and 2,000 homeless.
1945- WWII ends. Real estate market skyrockets as permanent homes are built in Newport.
1960s- The Bay is opened as a water-skiing area. City Council bans dogs on Balboa beaches.
1965- Developments such as UCI, Fashion Island, and an airport are built on top of wetland habitat.
1967- Friends of Newport Bay is established by a group of citizens, including Frank and Francis Robinson, to call attention to the ecological importance of the Bay.
1968- Flood control efforts initiate channelization of San Diego Creek, increasing drainage area into the Bay from 15 square miles to 154 square miles.
1969 - Heavy rains cause San Diego Creek to overflow, obliterating salt works, and washing tons of sediment into the Bay.
1969- Citizens file lawsuit against proposed property exchange between Irvine Company and County of Orange that would allow hotels and marinas along the shoreline.
1972- Clean Water Act established; restrictive height limit enforced to preserve coastal views.
1975- Community efforts pay off. State purchases land from the Irvine Company and receives a transfer of land from the County. The 140-acre Upper Newport Bay Ecological Reserve is dedicated to "the people of the State of California, so that this and future generations may continue to have, to use and enjoy the priceless heritage of the wildlife resources."
1996- El Nino floods trigger erosion and sedimentation of Big Canyon, destroying trails and bridges.
1998- Nearly a million cubic yards of sediment dredged from the northeast corner of the Bay.
2000- UC Irvine restores seasonal freshwater ponds for San Joaquin Freshwater Marsh.
2000- Peter & Mary Muth Interpretive Center, an environmental education facility, opens.
2002- 100 breeding pairs of Light-footed Clapper Rails exist in the Bay—the only place in the world where the Clapper Rails successfully breed.



Activity: Nonpoint Source Pollution

Summary: In this activity, students will read and interpret a map showing runoff drainage and how it affects Upper Newport Bay. Students will consider some solutions to the problem of nonpoint source pollution.

California State Content Standards

SCIENCE

Biology/Life Sciences

- **Ecology 6b**. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

Investigation and Experimentation

- **1a.** Students will select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.

ENGLISH-LANGUAGE ARTS

Grades 9-10

Writing Applications

- **Expository Compositions 2.3**

  a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.

  b. Convey information and ideas from primary and secondary sources accurately and coherently.

  c. Make distinctions between the relative value and significance of specific data, facts, and ideas.

Grades 11-12

Writing Applications

- **Reflective Compositions 2.3**

  a. Explore the significance of personal experiences, events, conditions, or concerns by using rhetorical strategies (e.g., narration, description, exposition, persuasion).

  b. Draw comparisons between specific incidents and broader themes that illustrate the writer's important beliefs or generalizations about life.

  c. Maintain a balance in describing individual incidents and relate those incidents to more general and abstract ideas.

Objectives:

Students will be able to:

- Define nonpoint source pollution and explain how it affects the Upper Newport Bay
- Read and interpret a map showing drainage systems affecting Upper Newport Bay
- Consider some solutions to the problem of nonpoint source pollution

Materials:

- Newport Bay Flood Control & Drainage Map (*www.ocwatersheds.com/watersheds/maps.asp?mapname=highres_map/map55.gif*)
- Handout
  - *Examples of Nonpoint Source Pollution*

Preparation:

- Project or print the flood control and drainage map and make copies for each student group.
- Make a copy of *Examples of Nonpoint Source Pollution* for each student or group.

Time Required:

- Approximately 1 hour

Procedures:

1. Ask students if they know the difference between "point" and "nonpoint" sources of pollution.

2. After discussion, write the following definitions on the chalkboard, overhead, or chart paper, and have a student read them aloud:

   - **Point Source Pollution**: Pollution that originates from a specific place such as a golf course or power plant.

   - **Nonpoint Source Pollution**: Contaminated runoff originating from an undefined place, often an accumulation of sources.

3. Ask students to name as many types of nonpoint source pollution as they can (e.g., pet waste, soaps, lawn fertilizers, litter, motor oil) and list their answers on the board.

4. Discuss the challenges faced in attempting to prevent or reduce nonpoint source pollution versus point source pollution. Ask students why nonpoint source pollution might be more difficult to control. *(For example, point sources, such as factory discharge pipes, are more easily cited and regulated; nonpoint sources, such as people dropping cigarette butts on the sidewalk or washing their cars in the street, are much harder to locate and regulate.*

5. Hand out a copy of the *Examples of Nonpoint Source Pollution* to each student or group. Discuss each pollutant type, where it comes from, and what effects it has on the environment and on humans.

6. Project or hand out to each student or student group a copy of the Flood Control and Drainage Facilities map of Upper Newport Bay. Review the legend together so that students understand what the symbols represent. Identify various locations on the map, such as their school, their homes, a local park. Ask the students:

   a. Where does the water flowing along a gutter lead?
   (It leads to a storm drain, which generally empties into the ocean. During the dry season, however, some of Orange County's runoff might be diverted to treatment facilities.)

   b. When should you see water flowing into storm drains?
   (Water should be flowing in the gutter only after it rains.)

   c. If it is not raining and you see water flowing along gutters, where might it be coming from?
   (This is runoff from irrigating plants, washing cars, watering lawns, cleaning pavement, etc.)

7. Assign a portion of the map to each group, and have the groups identify on their portion where nonpoint sources of pollution originate and what the pollutants may be. Have students list those areas and pollutants on the chart *Examples of Nonpoint Source Pollution*, as well as potential solutions to the problem of each particular pollutant.

8. When all groups have finished, have each group share what they found. Keep a master chart showing locations and pollutants in the Upper Newport Bay watershed.

Follow-up:

1. Have students work in groups or individually to list ways to reduce nonpoint source pollution coming into Upper Newport Bay. For example:

   Keep cars well maintained and free of leaks.
   Recycle used motor oil.
   Do not pour chemicals on the ground or down storm drains.
   Properly dispose of trash in garbage cans.
   Pick up pet waste.
   Don't dispose of leaves or grass clippings in the storm drain; try composting yard waste.
   Landscape yards with native, drought-tolerant plants that do not require fertilizer.
   Prevent runoff by not over-watering.
   Avoid allowing even clean water to run off into gutters.
   Try "natural" (non-toxic) pest control.
   Do not use degreasers, which break down oil, dispersing it throughout water.

2. Have students observe nonpoint source pollution in their local neighborhoods for one week. Ask students to keep a journal recording their observations on the way to and from school and as they travel around the neighborhood. Tell them to indicate the location of storm drains and possible sources of pollution that could make their way into the drainage system. Have them use their observation journals to write reports detailing how nonpoint source pollution could be reduced in their own neighborhoods. Consider sending this report to a city council member or to a local newspaper.

Extensions:

1. Ask students to develop a plan to reduce nonpoint source pollution. How would students go about enforcing it? Find out what measures Orange County is already taking to reduce run-off pollution.

2. Educate others. Discuss why people create nonpoint source pollution and how behavior can be changed. Research safe substitutes for toxic products. Create a handout or posters to educate others about nonpoint source pollution and about how they can help reduce it.

Adapted from "Searching Out Non-Point Sources of Pollution" in *Save Our Seas*, by the Center for Marine Conservation and the California Coastal Commission.

Examples of Nonpoint Source Pollution

Pollutant Types	Sources	Effects	Examples in Upper Newport Bay Watershed	Solutions
Debris (*plastics, glass, metals, wood*)	• roads • parking lots • playgrounds • parks	• can injure or kill wildlife through entanglement or ingestion		
Sediments	• construction sites • agricultural lands • erosion	• clouds water • decreases plant productivity • suffocates bottom-dwelling organisms		
Excess nutrients (*lawn fertilizers, animal wastes, sewage, green waste*)	• livestock • gardens • golf courses • lawns • failing sewage treatment systems	• promotes algae blooms, causing eutrophication which depletes oxygen, harms aquatic life, and causes odor		
Acids, salts, heavy metals	• roads • parking lots • brake dust	• toxic to wildlife and can bioaccumulate in organisms		
Organic chemicals (*pesticides, oil, detergents, etc.*)	• agriculture • boat paints • golf courses and other lawns • failing sewage treatment systems • parking lots	• toxic effects on wildlife and humans • possibly carcinogenic		
Pathogens (*e.g., coliform bacteria*)	• municipal and boat sewage • animal wastes • leaking septic/ sewer systems	• causes typhoid, hepatitis, cholera, dysentery • closes beaches		

Activity: Water Quality

Summary: In this activity, students will test water from Upper Newport Bay or other wetlands for dissolved oxygen, temperature, nitrate, phosphate, pH, and turbidity. Students will analyze the data from their experiments and discuss how various types of pollution affect Upper Newport Bay and other wetlands.

California State Content Standards

SCIENCE

Chemistry

- **Acids and Bases 5a**. Students know the observable properties of acids, bases, and salt solutions.
- **Acids and Bases 5d.** Students know how to use the pH scale to characterize acid and base solutions.

Biology/Life Sciences

- **Ecology 6b**. Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

Investigations & Experimentation

- **1a.** Students will select and use appropriate tools and technology to perform tests, collect data, analyze relationships, and display data.
- **1b.** Students will identify and communicate sources of unavoidable experimental error.
- **1c.** Students will identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.

ENGLISH-LANGUAGE ARTS

Grades 9-10

Reading Comprehension

- **Comprehension and Analysis of Grade-Level-Appropriate Text 2.6.** Demonstrate use of sophisticated learning tools by following technical directions (e.g., those found with graphic calculators and specialized software programs and in access guides to World Wide Web sites on the Internet).

Objectives:

Students will be able to:

- Perform various water quality tests
- Relate abiotic and biotic parameters
- Interpret data and results of tests

Materials:

- Water samples from various areas in Upper Newport Bay or other source (run-off, tap water, etc.)
- Map of sampling locations (for UNB, suggested collection sites include: Shellmaker Island dock, Back Bay Drive pipe, Back Bay Drive bend, Big Canyon bridge, Big Canyon outfall)
- Dissolved Oxygen TesTabs (2 for each test)
- Nitrate Wide Range CTA TesTabs (1 for each test)
- Phosphorus TesTabs (1 for each test)
- pH Wide Range TesTabs (1 for each test)
- Turbidity test kit (secchi disk)
- Test tubes (1 for each test) labeled:
  - ✓ DO
  - ✓ Nitrate
  - ✓ Phosphate
  - ✓ pH
  - ✓ Salinity
- Distilled water
- Gloves for each group
- Liquid waste container
- Handout
  Testing Procedures

Preparation:

- Apply for permission to collect water samples at your selected site. For Upper Newport Bay, call 949-640-0286 or 949-640-9956.
- Obtain water samples (approximately one liter from each location) and label them to indicate their origin. Keep samples in a cooler until testing.
- Indicate on a map the location for each of the water samples
- Make a copy of the *Testing Procedures* for each student or group.
- Set up a testing station for each water quality test. (See *Testing Procedures*.) Try to have at least two samples—each from a different part of the Bay—for each test.

Time Required:

- Approximately 1 hour

Note: Kits containing materials to conduct the tests are available in scientific supply catalogs as well as online. Earth Force Low Cost Estuary and Marine Kit (Product #5911) can be ordered from www.green.org.

Procedures:

(Note: You need to determine how you want the testing to be carried out. Preferably, set up enough materials at each station so that student pairs can perform each test. Alternatively, divide the class into six groups, have each group perform a different test, and then share results with the class.)

1. Hand out a copy of the *Testing Procedures* to each student or group.

2. Tell students that they are going to be performing various water quality tests. Show students a map indicating where each sample was obtained. Discuss the differences among the sampling locations.

3. Have students read the background for each test and discuss.

4. Point out the six stations and explain the testing procedures. For each test, ask students to predict results before beginning.

5. Have students conduct the tests and record their observations. Remind them to handle all materials carefully.

6. When students have finished their tests, have them dump all test liquids into the liquid waste container. Ask them why the waste liquid should be diluted before disposing of the waste.

Follow-up:

Have each group present their results and discuss their findings.

1. What test results indicated "poor" water quality?

2. What might be the source of that type of pollution in Upper Newport Bay?
   (for example, phosphate from soaps and pet waste, nitrate from fertilizer)

3. How do water samples from various areas in the Bay differ? Why do they differ?

4. What sources of error might have affected your results? How could you reduce these errors?

5. What organisms may be affected by poor water quality?

6. How will those effects influence ecosystem balance and function?

7. What might remedy some of the pollution problems?
   (for example, farming organically, using a basin to "catch" some pollution before it enters the Bay, dredging contaminated sediment, keeping waste materials off the street)

8. What could you do to make a difference?

Extensions:

1. Have students research the organisms on the *UNB Inhabitant Cards* (Appendix A) to determine the ideal conditions for each.

2. Record your results in Microsoft Excel and start a water quality log that will track changes over time.

3. Volunteer to be a citizen monitor with your local Surfrider Foundation or borrow their video *Sea to Summit*, which features surf and skate celebrities.
   Visit www.surfrider.org or call 949-492-8170 for more information.

4. Have a speaker from the Municipal Water District of Orange County come to your classroom to discuss local water quality issues. Call the MWDOC Education Department 714-593-5017 for more information.

5. Send students on a "phosphates hunt" to determine what products contain phosphates.

6. Have students do some research to find out what water quality problems have existed historically and how some of those problems have been resolved.

Adapted from "Water Quality Testing" from *Save San Francisco Bay Watershed Education Program*, www.saveSFbay.org

Testing Procedures

DISSOLVED OXYGEN

Dissolved Oxygen (DO) is important to the health of aquatic ecosystems. All aquatic animals need oxygen to survive. Water with consistently high dissolved oxygen levels most likely provides a healthy and stable environment and is capable of supporting a diversity of aquatic organisms. Natural and human-induced changes to the aquatic environment can affect the availability of dissolved oxygen.

Dissolved Oxygen % Saturation is an important measurement of water quality. Cold water can hold more dissolved oxygen than warm water. For example, water at 28°C (82°F) will be 100% saturated with 8 ppm dissolved oxygen. However, water at 8°C (46°F) can hold up to 12 ppm before it is 100% saturated. High levels of bacteria from sewage pollution or large amounts of decaying plants can cause the percent oxygen saturation to decrease. For example, runoff containing nutrients from pet waste or fertilizer can cause algal blooms, which, during decomposition, use up oxygen in the water (eutrophication). This can cause large fluctuations in dissolved oxygen levels, which can affect the ability of plants and animals to thrive.

Testing Procedure

1. Record temperature of the water sample in °C and °F in the space to the right.
2. Rinse the tube labeled "DO" with distilled water and fill it to the top with the water sample.
3. Drop <u>two</u> *Dissolved Oxygen TesTabs* into the sample. Water will overflow when the tablets are added.
4. Screw the cap on the tube. More water will overflow as the cap is tightened. Make sure <u>no air bubbles</u> are present in the sample.
5. Gently shake the tube until the tablets have disintegrated. This will take approximately 4 minutes.
6. Wait five more minutes for the color to develop.

°C
°F

7. Compare the color of the sample to the Dissolved Oxygen Color Chart. Record the result in the space to the right as ppm dissolved oxygen.
8. Locate the temperature of the water sample on the % Saturation chart. Locate the dissolved oxygen result of the water sample at the top of the chart. The % Saturation of the water sample is where the temperature row and the dissolved oxygen column intersect (e.g., if the water sample temperature is 16°C and the dissolved oxygen result is 4 ppm, then the % Saturation is 41). Record this number as % Saturation in the space to the right.

Result: ppm

Result: % Sat

% Saturation Chart
Dissolved Oxygen

TEMP °C	0 ppm	4 ppm	8 ppm
2	0	29	58
3	0	31	61
6	0	32	64
8	0	34	68
10	0	35	71
12	0	37	74
14	0	39	78
16	0	41	81
18	0	42	84
20	0	44	88
22	0	46	92
24	0	48	95
26	0	49	99
28	0	51	102
30	0	53	106

Conversion: °F = (°C x 1.8) + 32

Ranking the Test Results

91 - 110% Sat	Excellent
71 - 90% Sat	Good
51 - 70% Sat	Fair
< 50% Sat	Poor

TEMPERATURE

Temperature is very important to water quality. Temperature affects the amount of oxygen in the water and the rate of photosynthesis by aquatic plants. Most aquatic plants and animals are adapted to a specific temperature range and may die if the temperature of the water changes. An example of thermal pollution is hot water from an industrial plant being emptied into a body of water – such as cooling water from a power plant or a refinery. Also, rivers with channelized banks experience higher temperatures because of the lack of shading from vegetation.

Testing Procedure (for field study only)

1. Place the thermometer 4 inches below the surface of the water for one minute.
2. Remove the thermometer from the water and read the temperature.
   Record the temperature in °C and °F in the space to the right.

°C
°F

Ranking the Test Results

Temp < 26 °C	Good
Temp > 26 °C	Poor

Conversion: °F = (°C x 1.8) + 32

NITRATE

Nitrate is a nutrient needed by all aquatic plants and animals to grow. Dead plants and animals and animal wastes naturally release nitrate into the aquatic system. High levels of nitrate can lead to overgrowth of plants, increased bacteria, and decreased oxygen levels. Human sewage, fertilizer, and agricultural runoff all contribute to high levels of nitrate.

Testing Procedure

1. Rinse with distilled water and then fill the test tube labeled "Nitrate" to the 5 mL line with a water sample.
2. Add one *Nitrate Wide Range CTA TesTab* to the sample.
3. Cap the test tube and gently shake it until the tablet has disintegrated.
   Bits of the material may remain in the water sample.
4. Wait five minutes for the color to develop.
5. Compare the color of the sample to the Nitrate color chart.
   Record the result in the space as ppm Nitrate.

Result:

% Sat

Ranking the Test Results

0 – 5 ppm	Good
5 – 20 ppm	Poor
20 – 40 ppm	Very Poor

PHOSPHATE

Phosphate is a nutrient needed by plants and animals to grow. Like nitrate, high levels of this nutrient can lead to overgrowth of plants, increased bacteria, and decreased oxygen levels. Phosphate comes from several sources, including soaps, human and animal waste, industrial pollution, and agricultural runoff.

Testing Procedure

1. Rinse with distilled water and then fill the test tube labeled "Phosphate" to the 10 mL line with a water sample.
2. Add one *Phosphorus TesTab* to the sample.
3. Cap the test tube and gently shake it until the tablet has disintegrated. Bits of the material may remain in the water sample.
4. Wait five minutes for the blue color to develop.
5. Compare the color of the sample to the Phosphate Color Chart. Record the result in the space as ppm phosphate.

Result: ppm

Ranking the Test Results	
0 – 1 ppm	Excellent
2 – 4 ppm	Good
4+ ppm	Poor

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pH

pH is a measurement of the amount of acid or alkaline (base) in the water. The pH scale ranges from a value of 0 (very acidic) to 14 (very basic), with 7 being neutral. The pH of tap water is usually between 6.5 and 8.2. Most aquatic plants and animals are adapted to a specific pH level and may die if the pH of the water changes even slightly. pH can be affected by industrial waste and agricultural runoff.

Testing Procedure

1. Rinse with distilled water and then fill the test tube labeled "pH" to the 10 mL line with a water sample.
2. Add one *pH Wide Range TesTab* to the sample.
3. Cap the test tube and gently shake it until the tablet has disintegrated. Bits of the material may remain in the water sample.
4. Compare the color of the sample to the pH color chart. Record the result in the space as pH.

Ranking the Test Results	
6 – 8	Good
4 – 5	Poor
9 – 10	Very Poor

Result: pH

TURBIDITY

Turbidity is the measure of the clarity of water. Turbid water is caused by suspended matter such as clay, silt, and microscopic organisms. Turbidity should not be confused with color, since darkly colored water can still be clear and not turbid.

With decreased clarity, aquatic organisms receive less sunlight, affecting the food chain from the bottom up.

Turbid water may be the result of soil erosion, urban runoff, algal blooms, and bottom sediment disturbances, which can be caused by dredging, wave action, boat traffic and abundant bottom feeders.

Testing Procedure

1. Fill the tube with the secchi disk on the bottom with the water sample.

2. Look down into the tube and compare the appearance of the secchi disk to the Turbidity Chart. Record the result in the space below as Turbidity in Jackson Turbidity Units (JTU).

Result:
JTU

Ranking the Test Results	
0	Excellent
0 – 40	Good
40 – 100	Fair
> 100	Poor

Activity: Pollution Observation

Summary: In this activity, students will conduct an experiment to observe the effects of nonpoint source pollution on water environments.

California State Content Standards

SCIENCE

Chemistry
- **Acids and Bases 5a.** Students know the observable properties of acids, bases, and salt solutions.

Biology/Life Sciences
- **Ecology 6b.** Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
- **Ecology 6d.** Students know how water, carbon, and nitrogen cycle between abiotic resources and organic matter in the ecosystem and how oxygen cycles through photosynthesis and respiration.

Earth Sciences
- **Biogeochemical Cycles 7a.** Students know the carbon cycle of photosynthesis and respiration and the nitrogen cycle.

Investigation and Experimentation
- **1c.** Students will identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- **1d.** Students will formulate explanations by using logic and evidence.
- **1g.** Students will recognize the usefulness and limitations of models and theories as scientific representations of reality.
- **1j.** Students will recognize the issues of statistical variability and the need for controlled tests.

Objectives:

Students will be able to:
- Record and interpret observations of the effects different types of nonpoint source pollution have on water environments
- List possible effects of pollution on wildlife in Upper Newport Bay

Materials:

- 5 clear 1-quart or larger containers (plastic soda bottles or canning jars)
- Water that contains algae from a freshwater aquarium or a pond, or pond water purchased from a biological supply company (at least 5 quarts)
- Good light source (direct sunlight or strong artificial light)
- Plant fertilizer (7 teaspoons)
- Motor oil (2 teaspoons)
- Vinegar (1/2 cup)
- Dish detergent (2 tablespoons)
- Masking tape or blank labels
- Markers
- Handout
    - *Observation Sheet*

Preparation:

- Two weeks before the lesson, set up the five bottles or jars. Fill each jar with aquarium or pond water, add one teaspoon of plant fertilizer, and stir thoroughly. To improve the quality of the model, try adding a bit of soil from the bottom of a pond or gravel from an aquarium tank along with the water. Put the jars without lids near a window where they will get direct light or give them a strong incandescent or fluorescent light. Do not put them where they will get cold. Let the jars sit for 2 weeks.
- The day of the lesson, set up 4 testing stations. Each station should have a jar, tape and marker for labeling, measured amount of one of the pollutants (2 teaspoons of motor oil, 1/2 cup of vinegar, 2 tablespoons of detergent, 2 teaspoons of fertilizer), and an *Observation Sheet*.

Time Required:

- 1 hour for initial lesson
- 5 minutes twice a week for 4 weeks for observations
- 1 hour for final lesson

Adapted from "Recipe for Trouble" in *WOW! The Wonders Of Wetlands,*
co-published by International Project WET and Environmental Concern

Procedures:

1. Tell students that they will be conducting an experiment to see how pollution affects water environments such as Upper Newport Bay. Show students the five jars. Explain that each contains water and some added nutrients, in the form of fertilizer, to feed the plants in the water.

2. Explain that one jar will be the control, and the other four will each have a "pollutant" added to them. Point out each pollutant and ask students how that pollutant might get into the Bay.
   Motor oil – from cars and car repair shops; washes off streets and parking lots and runs into storm drains or creeks
   Detergent – from car washing, dog washing, patio washing; runs off into storm drains or creeks
   Vinegar – represents acid rain or acidic runoff from manufacturing
   Fertilizer – from agriculture, gardens, pet waste, parks, golf courses; runs off into storm drains or creeks.

3. Divide students into four groups and direct each group to a different station. Direct students to label their jar with the name of the pollutant they will be adding, and to record what they observe in the jar before adding the pollutant. Have students predict what will happen to the jar of water, both immediately and over time, and record their predictions on the sheet.

4. Ask students to carefully add the pollutant to their sample and to record their immediate observations of changes. Ask students to cover the jars lightly (covering tightly might lead to the growth of some undesirable bacteria). Put the jars in the light as before.

5. Twice a week for the next four weeks, have students check their jars and record notes on their *Observation Sheet*. *(OPTION: Use a camera to take pictures of the samples each week.)* At the end of week 4, have each group give a brief report to the class on their observations.

Follow-up:

Ask students the following questions:

1. Why is the fertilizer, which is a nutrient and promotes plant growth, considered a "pollutant"?
   (The algae grow too quickly, disrupting the balance of organisms. When the algae die and decompose, the oxygen in the water is depleted because of microbial activity—called eutrophication. The lack of oxygen can harm plants and animals living in the water. Many plants and other organisms that can't move, such as clams, will suffocate.)

2. Why did the vinegar make the water so clear?
   (The water became clear because the acid in the vinegar killed everything in the water.)

3. Why can some organisms survive under a layer of oil?
   (If the algae can get enough sunlight, they can produce enough oxygen to keep themselves—and other organisms that live below the oxygen-impervious oil layer—alive.)

4. What wildlife can be harmed by oil in the water?
   (Animals that come into contact with oil are harmed. Aquatic birds and mammals that get coated with oil are unable to fly or stay warm. Fish gills can be clogged.)

5. How can wetlands help lessen the effects of pollutants?
   (Because they are able to process excess nutrients and toxins, wetland plants can filter out many pollutants before they have a chance to enter larger water bodies. Too many pollutants, however, can begin to kill wetland plants and animals.)

6. What can you do to decrease the amount of these pollutants that reach the water?
   (For example, properly maintain cars, pick up pet waste, use commercial car washes.)

Extensions:

1. Have students devise methods to reverse or improve the water quality in their model polluted systems. For example:
   — Add baking soda to the acid test to neutralize the acid. (This is similar to adding lime or limestone rocks to lakes or streams to neutralize the effects of acid rain.)
   — Mop up the oil spill with straw, feathers, or cotton. Can students skim the oil off of their models to let the oxygen through again?

2. Have students research and write a report on what is being done to keep pollutants off the street. For example:
   — sweeping streets
   — mailing information sheets
   — providing pet-waste bags in parks
   — stenciling storm drains with "Leads to Ocean"
   — setting "Total Maximum Daily Load" (TMDL) requirements for pollutants

Adapted from "Recipe for Trouble" in *WOW! The Wonders Of Wetlands,*
co-published by International Project WET and Environmental Concern

Observation Sheet

Pollutant: ____

Appearance before adding pollutant: ______________________________

____

Predictions: ____

____

____

Appearance immediately after adding pollutant: ______________________

____

Week 1: ____

____

Week 2: ____

____

Week 3: ____

____

Week 4: ____

____

Possible Sources of Error: ________________________________

____

Conclusions: ____

____

____

____

Activity: Space for Species

(Field Study)

Summary: Students will survey plant diversity in a habitat they are familiar with—their schoolyard, park, or some other local area. Students learn how to make and interpret the species-area curve, one tool scientists use to investigate the level of biodiversity in a habitat.

California State Content Standards

SCIENCE

Biology/Life Sciences

- **Ecology 6a.** Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
- **Ecology 6b.** Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
- **Evolution 8b.** Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.

Investigation and Experimentation

- **1a.** Students will select and use appropriate tools and technology (such as computer-linked probes, spreadsheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- **1c.** Students will identify possible reasons for inconsistent results, such as sources of error or uncontrolled conditions.
- **1d.** Students will formulate explanations by using logic and evidence.
- **1g.** Students will recognize the usefulness and limitations of models and theories as scientific representations of reality.
- **1k.** Students will recognize the cumulative nature of scientific evidence.

MATHEMATICS

- **Probability and Statistics 8.0.** Students organize and describe distributions of data by using a number of different methods, including frequency tables, histograms, standard line and bar graphs, stem-and-leaf displays, scatterplots, and box-and-whisker plots.

Objectives:

Students will be able to:

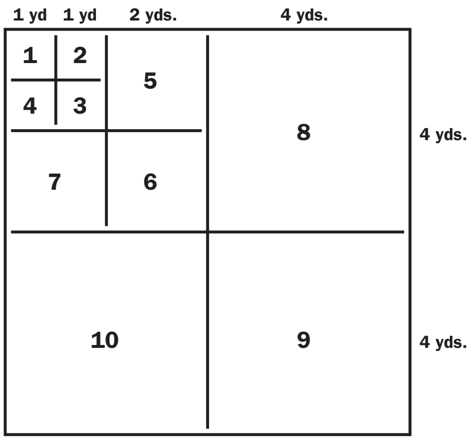
- Create a graph that demonstrates the relationship between species richness and the size of a habitat
- Describe factors that affect the relationship between habitat fragmentation and biodiversity

Materials:

- Plot of land 64 square meters (approximately 830 square feet) containing at least 12 different species of plants from which leaves can be taken (e.g., schoolyard, roadside field, local park)
- Stakes (e.g., pencils or coffee stirrers)
- Twine
- Tape measure (8 meter or 30 foot length)
- Large clear plastic bags
- Easel with chart paper or butcher paper and marker
- Clear tape
- Graph paper
- Handout
  - *Leaf I.D.*

Preparations:

- Mark off an 8 meter by 8 meter square and divide it into 10 plots as shown below using stakes and twine. Place a large clear plastic bag in each plot and mark the plot number on the bag.



- Make a copy of the *Leaf I.D.* handout for each student or student group.
- On chart paper or butcher paper, prepare the Data Log (see sample, without the leaves and the Xs).
- On chart paper, prepare a Data Summary Table (see sample, without the numbers).

Time Required:

- Approximately 20 minutes for leaf gathering
- Approximately 50 minutes for data summary, graphing, and discussion

Procedures:

Part I – Collecting Leaves

A. Introduce fragmentation

1. Tell students that they are going to be investigating the diversity of plants in their schoolyard (or field or park) and determining if there are different numbers of species in habitats of different sizes.

2. Explain that many people are concerned about how the size of habitats affects biodiversity because we are breaking up many species' habitats into small chunks by building roads, homes, shopping centers, and other developments—a process called fragmentation. Tell students that many scientists are trying to better understand how fragmentation affects biodiversity. Ask students how they think biodiversity is affected by this dividing up of habitats. What types of species might be affected first (birds or lizards, rabbits or mountain lions)?

B. Explain collection procedure

1. Point out the marked off plots and tell students that each plot represents a different-sized habitat. Explain that they will be counting the number of plant species in each of the different plots. Ask for predictions about how they think a habitat's area will affect the number and types of species it contains.

2. Explain that in each plot they are to take a leaf from each different plant species they find and put it in the plastic bag in that plot. Stress that they should be as gentle as possible and that they should try not to take more than one leaf from each species.

3. Review with students how to tell different plant species apart. Pick leaves of two very different species and ask students how they can tell that the leaves are from two different kinds of plants. Press students to be specific about how the leaves differ. Pick leaves of two different species that look more similar and ask students again to be specific in telling how the leaves are different. Hand out to students the *Leaf I.D.* sheets and point out some basic leaf characteristics that students can use to tell one kind of plant from another (shape, venation, color, hair, edges).

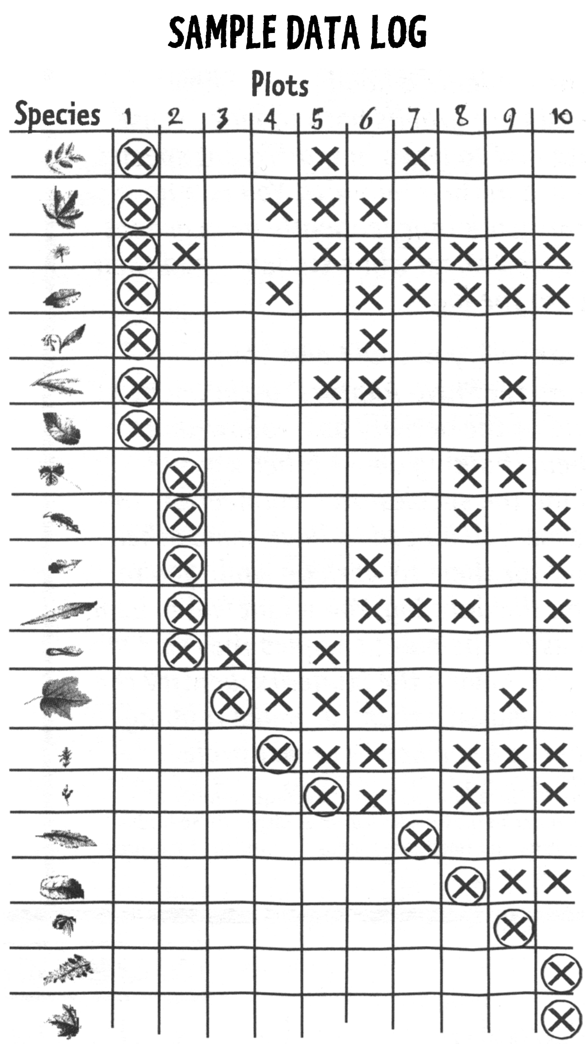
4. Divide the class into 10 groups. For a class of 25, assign:

   - 1 student for each 1-square-meter plot (plots 1, 2, 3, 4)
   - 3 students for each 4-square-meter plot (plots 5, 6, 7)
   - 4 students for each 16-square-meter plot (plots 8, 9, 10)

   If you have more than 25 students, have them alternate collecting plants so that the area does not become too crowded. (Have alternates work on drawing the chart or recording data.) If you have fewer than 25 students, reduce the number of students in the midsize plots first and in the large plots second.

C. Collect the samples

Allow students time to collect their samples. Remind them to continually compare the leaves so that only one leaf from each species is in their bags.



Part II – Plotting the Species-Area Curve

A. Log the samples

1. Once the collection is complete, have each group sort through the samples in their bag to make sure that they have only one sample of each species. Tell them that if they have more than one, they should select the leaf that is in the best condition to represent that species.

2. Point out the Data Log you have prepared and explain to students that they are going to record all the various species they found and in what plots each species was found.

3. First, have the student(s) from plot 1 tape up a sample of each species in the "Species" column and put an ⓧ under the "Plot 1" column next to each leaf to show that that species was first found in plot 1 (see sample log).

4. Next, have the student(s) from plot 2 post their samples. Tape up only samples of new species and place an ⓧ in that species' row under "Plot 2" to show that it first appeared in plot 2. If the plot 2 collection contains a sample of a plant that is already on the Data Log, simply mark an "X" in that species' row under "Plot 2."

5. Continue this procedure for all 10 plots.

B. Fill in the Data Summary Table

1. Have students use the information in the log to fill in the Data Summary Table. Explain that the "Total Number of Species" row indicates the cumulative total of species found as each plot is added, and the "Total Sample Area" row indicates the cumulative area as each plot is added. (See sample below.)

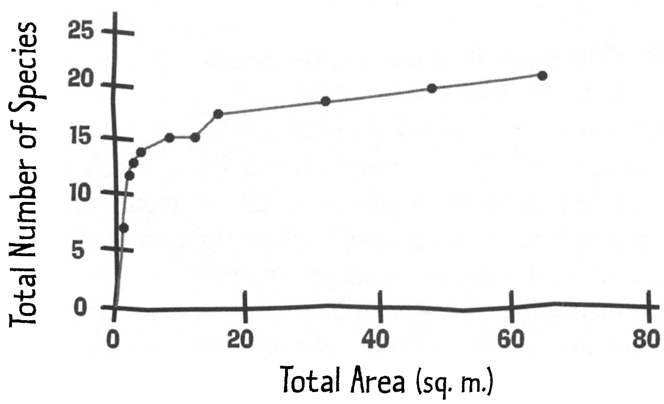
SAMPLE DATA SUMMARY TABLE

Plot Number	1	2	3	4	5	6	7	8	9	10
New Species (first seen in sample area; ⊗s in this plot)	7	5	1	1	1	0	1	1	1	2
Total Number of Species (all ⊗s up to now)	7	12	13	14	15	15	16	17	18	20
Plot Area (sq. yd.)	1	1	1	1	4	4	4	16	16	16
Total Sample Area (total of plot areas in sq. m.)	1	2	3	4	8	12	16	32	48	64

2. Tell students that this table will give them the data they need to create a graph that will indicate the relationship between the size of the habitat and the number of plant species in it.

C. Graph the results

1. Either work together as a class, or have students work in groups to graph the results of their sampling. Tell students that the x-axis should be labeled "Total Area" and the y-axis should be labeled "Total Number of Species." (See sample graph below, which is based on the sample Data Summary Table.)



2. Point out that:
   - data for the x-axis comes from the "Total Sample Area" row of the Data Summary Table
   - data for the y-axis comes from the "Total Number of Species" row of the Data Summary Table
   - the number of data points—10—equals the number of plots.

3. Explain to students that the graph they have created is called a "Species-Area Curve" and that it shows the relationship between habitat size and the number of species in the habitat.

D. Interpret the graph

1. Show students the sample graph above and ask if their graph has the same general shape. If it does, tell students that the curve they made based on their schoolyard or local park habitat is a lot like curves made from samples in other kinds of habitats. Explain that most species-area curves have this general shape; that is, the curve will usually rise sharply at the small plot areas, then more slowly as the area increases, and eventually plateau after the common species have been accounted for.

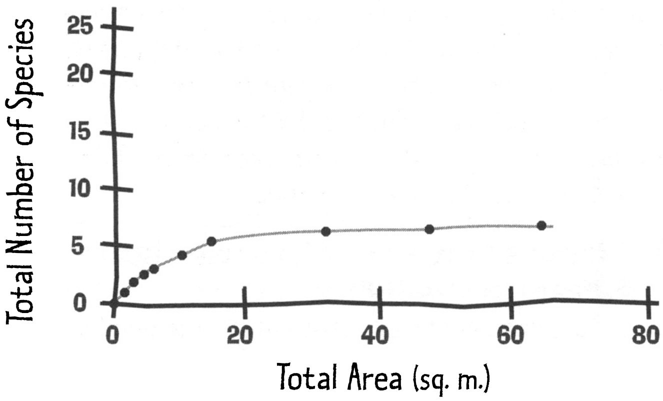
2. Ask students why they think species-area curves usually look this way.
   *(In general, most species in North America are commonly found throughout their habitat. In other words, you would probably see in a 10-square-meter plot of forest most of the trees, birds, or mammals that live in a 50-square-meter plot of the same forest. But as you looked at larger and larger plots, your chances of finding rare species or species that require special resources would increase. Thus, the curve usually rises quickly at the small plot areas, then more slowly as the area increases. [**Note:** Species that are top predators, such as big cats and birds of prey, may be rare in a habitat because they are territorial or need a lot of space to find food. Species can also be naturally rare if they have more specialized needs such as a certain type of soil or food. These species would be found only where the resources they need are found.])*
3. Help students interpret the graph and understand the various uses of the species-area curve. For each point below, ask students how they think the graph is used.

   - **To figure out how much of a habitat must be sampled in order to accurately estimate the number of species present.**
     (Scientists can look where the slope approaches zero, or where very few new species are added, to determine what size plot will contain most of the species in the habitat. Based on the sample curve, for example, a scientist would look at a 20-square-yard plot to find most of the plant species in the habitat.)

     - Ask students what size plot they would have to survey to make an accurate estimate of the number of plants in the schoolyard (or park).

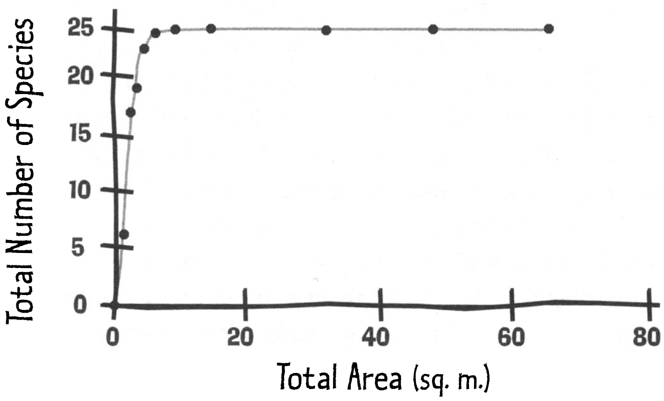
   - **To compare different habitats.**
     (Different habitats can have curves with different shapes; for example, the steepness of the slope—representing the rate of new species present—or the point where the curve levels off—an indication of the number of common species—can vary.. Each graph will give information about the biodiversity of its respective habitat.)

- Draw a species-area curve that is less steep and that levels off at a lower number of species than the one you made as a class. (See the example below; perhaps change the numbers on the y-axis to be more like the numbers of species your students found.)



- Ask students what this shape tells us about how the species in this habitat compare to ones in the habitat they explored.
  (There are fewer kinds of species in this habitat than in the habitat students explored.)

- Draw a species-area curve that is very steep and levels off quickly at a high number of species, such as the example below. Ask students how this habitat compares to their habitat.
  (This habitat has very high biodiversity, and the species seem to be tightly packed, such as in a rainforest. A very small plot would capture most species in the habitat. In the students' study area, species are likely more spread out, and there are probably fewer species.)



- **To look at one habitat over a long period of time to see how its species richness changes.**
  (Surveying the same area at different times of year or after major disturbances, such as big storms, insect population explosions, or pesticide applications, can determine if these events have changed the species-area relationship.)

Follow-up:

1. Ask students what the species-area curve tells us about the problem of fragmentation. (*Habitats with higher diversity are more resilient. Rare and territorial species are lost first*.)

2. Point out that since many curves level off at relatively small plot areas, it may seem that small habitat fragments will still contain most of the species that were in the larger habitat. Tell students that unfortunately, that is not true. Ask if they can think of any reasons why this isn't true. Could the species-area curve be used in designing the size of an ecological reserve?

3. Remind students that they looked at plots that were part of a larger habitat; they weren't looking at habitat fragments. Point out that in species-area curves, new species continue to appear after the curve has leveled off. Explain that if we cut a habitat's size to a point where even a few of these species are lost, we may be losing some important species, such as top predators. Point out that these keystone species, which often require large areas in which to hunt, play vital roles in habitat function and food web balance and that scientists use keystone species as indicators of functioning ecosystems. Emphasize that without them, the habitat and species in it could change.

4. Explain that like islands, habitat fragments are often too small and isolated to support a large number or a wide variety of species and that many species struggle to survive in fragmented landscapes. Tell students that in general, smaller areas have fewer species. Ask students if, with this information, they would build a house in the middle of functioning habitat or on the edge.

Extensions:

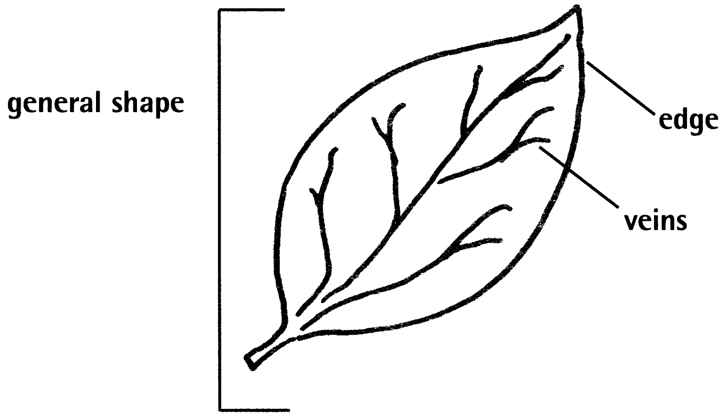
1. Stage an in-class debate about a current development issue in your area. Have half the students in favor of developing the land and the other half against it. Those in favor of development should be able to cite some of the potential social and economic benefits of the proposed project, and those opposed should cite some of the project's potential environmental consequences, especially its potential effect on biodiversity.

2. Look for habitat fragments in your community, e.g., fragments of pine forests, beach-dune systems, or grasslands. Then take a field trip to investigate some different-sized fragments of the same type. Have students think of ways they could investigate the level of biodiversity in the fragments, and then compare the fragments.

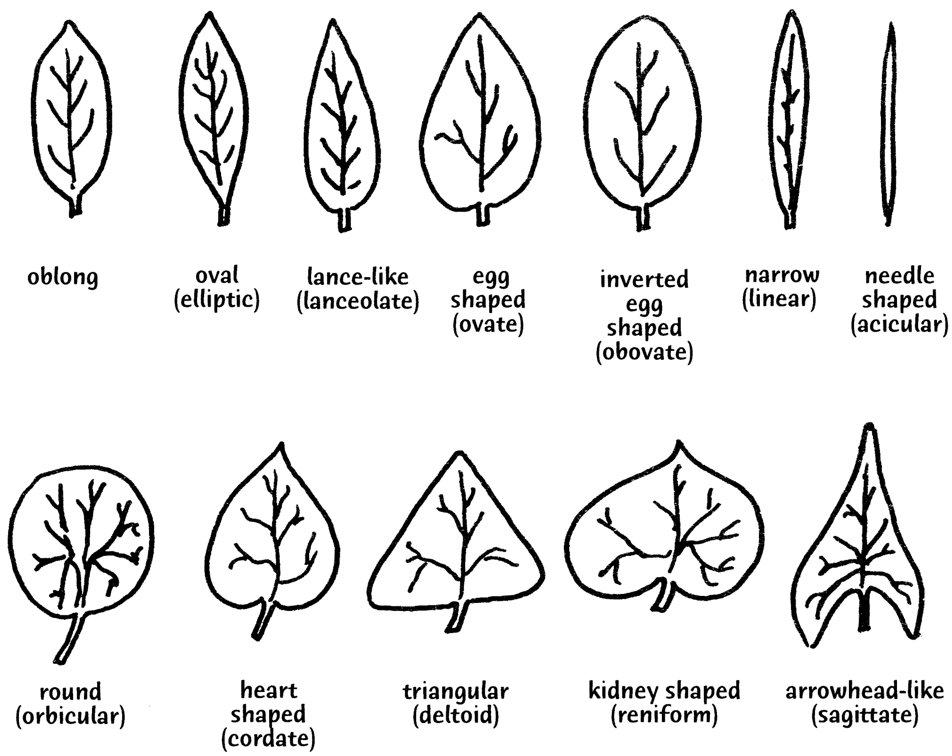
3. Get involved in biodiversity monitoring projects. Check the following websites:

   - www.audubon.org
   - www.learner.org/jnorth/
   - www.defenders.org
   - www.sprise.com/shs/habitatnet/MonitoringProject.htm

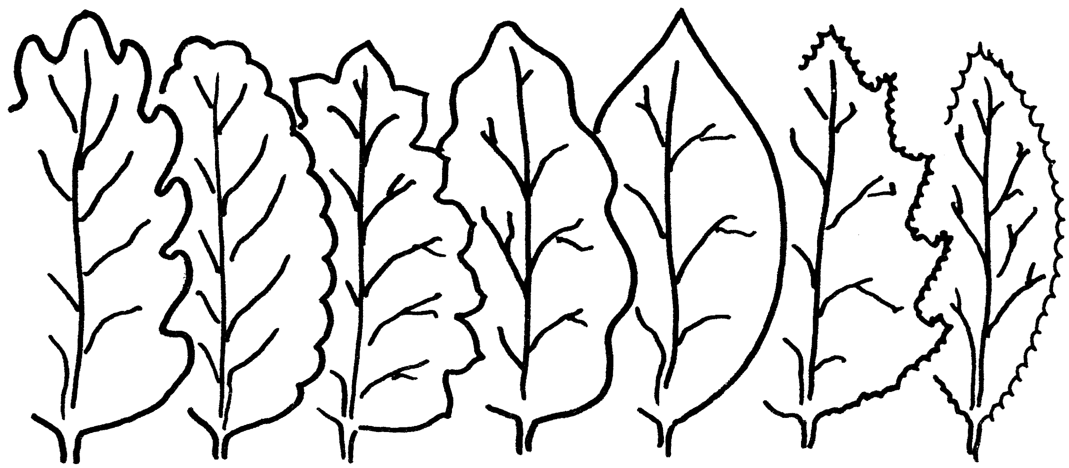
One way to tell plants apart is by looking at their leaves



Shapes

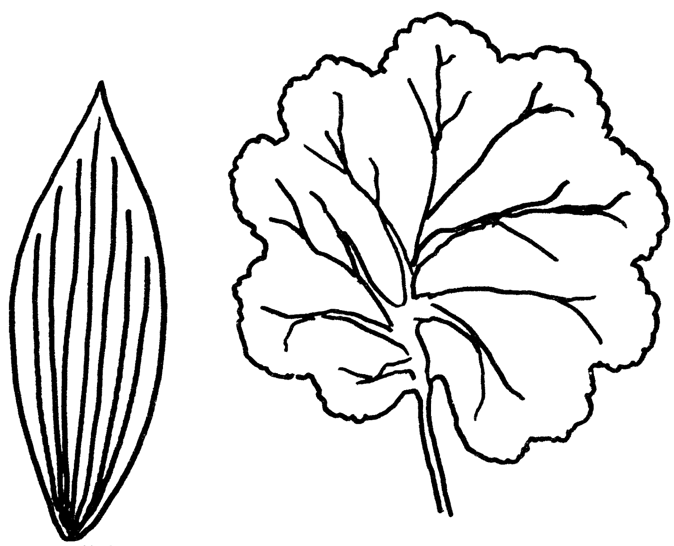


Edges



lobed | rounded (crenate) | tooth-like (dentate) | wavy (undulate) | smooth (entire) | double saw-like (double serrate) | saw-like (serrate)

Veins (There are three main ways that veins are arranged on leaves.)



parallel | palmate | pinnate

Activity: Species In Peril

Summary: In this activity, students will discover the distinctions between threatened, rare, and endangered species, prepare a report on threatened or endangered species that live in the Upper Newport Bay, and explore the factors affecting species' status.

California State Content Standards

SCIENCE

Biology/Life Sciences
- **Ecology 6a.** Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.
- **Ecology 6b.** Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.
- **Ecology 6c.** Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.
- **Evolution 8b.** Students know a great diversity of species increases the chance that at least some organisms survive major changes in the environment.

ENGLISH-LANGUAGE ARTS

Grades 9-10

Reading Comprehension
- **Structural Features of Informational Materials 2.2.** Prepare a bibliography of reference materials for a report using a variety of consumer, workplace, and public documents.
- **Comprehension and Analysis of Grade-Level-Appropriate Text 2.5.** Extend ideas presented in primary or secondary sources through original analysis, evaluation, and elaboration.

Writing Strategies
- **Organization and Focus 1.1.** Prepare a bibliography of reference materials for a report using a variety of consumer, workplace, and public documents.
- **Organization and Focus 1.2.** Use precise language, action verbs, sensory details, appropriate modifiers, and the active rather than the passive voice.
- **Research and Technology 1.3.** Use clear research questions and suitable research methods (e.g., library, electronic media, personal interview) to elicit and present evidence from primary and secondary sources.
- **Research and Technology 1.4.** Develop the main idea within the body of the composition through supporting evidence (e.g., scenarios, commonly help beliefs, hypotheses, definitions).
- **Research and Technology 1.5.** Synthesize information from multiple sources and identify complexities and discrepancies in the information and the different perspectives found in each medium (e.g., almanacs, microfiche, news sources, in-depth field studies, speeches, journals, technical documents).

Writing Applications
- **Expository Compositions 2.3**
  - **a.** Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.
  - **b.** Convey information and ideas from primary and secondary sources accurately and coherently.
  - **c.** Make distinctions between the relative value and significance of specific data, facts, and ideas.
  - **d.** Include visual aids by employing appropriate technology to organize and record information on charts, maps, and graphs.
  - **e.** Anticipate and address readers' potential misunderstandings, biases, and expectations.
  - **f.** Use technical terms and notations accurately.

Listening and Speaking Strategies

- **Organization and Delivery of Oral Communication**
  1.7. Use props, visual aids, graphs, and electronic media to enhance the appeal and accuracy of presentations.

Speaking Applications

- **Deliver Expository Presentations 2.2**
  a. Marshal evidence in support of a thesis and related claims, including information on all relevant perspectives.
  b. Convey information and ideas from primary and secondary sources accurately and coherently.
  c. Make distinctions between the relative value and significance of specific data, facts, and ideas.
  d. Include visual aids by employing appropriate technology to organize and display information on charts, maps, and graphs.
  e. Anticipate and address the listener's potential misunderstandings, biases, and expectations.
  f. Use technical terms and notations accurately.

Grades 11-12

Writing Strategies

- **Research and Technology 1.6.** Develop presentations by using clear research questions and creative and critical research strategies (e.g., field studies, oral histories, interviews, experiments, electronic sources).
- *Research and Technology* **1.8.** Integrate databases, graphics, and spreadsheets into word-processed documents.

Listening and Speaking Strategies

- **Organization and Delivery of Oral Communication**
  1.8. Use effective and interesting language, including:
  a. Informal expressions for effect
  b. Standard American English for clarity
  c. Technical language for specificity.

Objectives:

Students will be able to:

- Define *native* and *non-native* species
- Define *threatened*, *rare*, and *endangered* species
- Become familiar with state and federal processes for listing and protecting threatened and endangered wildlife
- Identify threatened or endangered species in Upper Newport Bay and the factors that contribute to their peril

Materials:

- Handouts
  The Endangered Species Act
  Species In Peril chart
  Threatened and Endangered Species
  Report Guide

Preparation:

- Make a copy of *The Endangered Species Act* handout for each student
- Make a transparency of the *Species In Peril* chart or make a copy for each student.
- Make seven copies of the *Report Guide*.
- Make an overhead of the *Species Status Table* (on the *Report Guide*) or copy it onto the board or chart paper.

Time Required:

- Class time – about 2 class periods
- Research time – flexible

Procedures:

1. Hand out a copy of *The Endangered Species Act* to each student. Read and discuss the information. Ask students why the extinction of a species matters.

2. Place a copy of the *Species in Peril* chart on the overhead projector (or give a copy to each student). Discuss the definition of each term. Use the following questions to generate a discussion.
   Why do you think these definitions were developed? How are they useful?
   Do you think any definitions could be improved?
   How might non-native species pose problems for threatened or endangered species?
   How might human activity be a problem for threatened species?
   How do you think protection of threatened or endangered species could be improved?

3. Explain that there are seven threatened or endangered species in Upper Newport Bay. Divide the class into seven groups and tell students that each group will prepare a report on one of the nine threatened or endangered species in Upper Newport Bay.

4. Hand out a copy of the *Report Guide* to each group. Assign a different species from the S*pecies Status Table* to each group. Encourage students to call land managers at Orange County Public Facilities and Resources Department or at the Department of Fish and Game, to interview long-time residents, to use the Internet, and to read books and articles to gather information.

5. Tell students how much time they have to prepare their reports. Arrange for students to have some class time to work together on their reports.

6. Have each group present its report to the class, answering the questions on the *Report Guid*e. Place a copy of the *Species Status Table* on the overhead (or copy it onto the board or chart paper). As each group reports, fill in the *Species Status Table.*

Follow-up:

Discuss the *Species Status Table*.

1. Ask why some species are on the California list but not on the federal list.
   (These differences occur because habitats, and the species that live in them, cross state lines. An animal or plant may have been lost within one state's boundaries, but may be abundant in another and therefore not considered threatened federally by USFWS.)

2. Discuss the factors affecting each species. Do some factors affect more than one species? How could the impact of some of these factors be reduced?
   (Setting conservation priorities based on public definition of which species are most "lovable" is clearly not ideal.)

3. Discuss strategies to protect multiple species under one recovery plan.

4. Have students guess which species group has the most listings. Which group receives the most recovery funds?
   (31 Mammals, 13 Reptiles, 12 Amphibians, 33 Birds, 34 Fish, 218 Plants, 32 Invertebrates species are listed. Seventy percent of listed mammals are afforded protection; in contrast, the average percentage of protection for all other taxa is less than 15%. Plants are the least protected: they represent 50% of the listed species yet they receive only 8% of the recovery funds.)

Extensions:

1. Research an invasive species in Upper Newport Bay (e.g., wild mustard, pampas grass, African clawed frog). Explain how it is impacting native California species, and describe possible solutions to the problem.

2. Research native species in your area. Try to find native species in nature. Record observations such as: location, habitat description, abundance, cohabitants, and competitors.

3. Write a report on how the Endangered Species Act could be improved. Identify taxonomic bias by comparing the number of animals and plants or birds and fish that have been listed. What percent of recovery funds are spent on whales versus trees? Are the standards against which decisions for selecting species to list as endangered or threatened objective and measurable? How many species have been delisted?

Adapted from "What's So Special About Native Species?"
in *Waves, Wetlands, and Watersheds: California Coastal Commission Science Activity Guide*

The Endangered Species Act

Although extinction is a natural process, human activities have caused a dramatic increase in its rate. Human beings have become a hundred times more numerous than any other land animal of comparable size in the history of life. Our species appropriates 40 percent of the solar energy captured in organic material by plants. Drawing upon the resources of the planet to such a degree drastically affects other species. Some scientists estimate that human activity is responsible for the extinction of 100 plants and animals each day—that's almost four species extinctions per hour. Other scientists offer lower figures, but few experts disagree that the rate of species extinction is being accelerated by human actions.

The U.S. Endangered Species Act of 1973 gives authority the U.S. Secretary of the Interior, or in the case of marine species to the Secretary of Commerce, to place species on an endangered list. Implementation of the Endangered Species Act is overseen by the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service. Proposals to list or delist a species are published in the *Federal Register*, a U.S. government publication, and after a public comment period, the USFWS decides whether to approve, revise, or withdraw the proposal. In California, the Department of Fish and Game identifies the state's species of concern.

Listed species have special protection, and any project that threatens one of these species must undergo an intensive review. The endangered species list includes recovery plans for each species, detailing the tasks needed to reach a level where protection for that species is no longer necessary.

Species In Peril

Term	Definition	Example
Species	In biology, the most fundamental classification of living things, comprising individuals that successfully interbreed	Humans
Native species	Species that have evolved over thousands of years in a particular region. They have adapted to the geography, hydrology, and climate of that region.	California Sagebrush, California Buckwheat
Non-native species	Species that have been introduced into an environment in which they did not evolve	Wild Mustard, Ice Plant
Rare species	A species of concern because of low numbers. (Some species are naturally rare because of their reproductive rate or habitat specializations)	Coast Woolly Heads, Southern Tarplant, Estuary Seablite, Many-stemmed Dudleya
Threatened species	Any species which is likely to become an endangered species in the future	California Black Rail, California Gnatcatcher
Endangered species	Any species which is in danger of extinction throughout all or a significant portion of its range	California Least Tern, Salt Marsh Bird's Beak, Light-footed Clapper Rail, Belding's Savannah Sparrow, Brown Pelican

Threatened and Endangered Species Report Guide

Write a three-page report and create a five to ten minute in-class presentation. Include the following:

1. Basic information about the species, including illustrations and/or photographs. Be sure to include information about habitat, feeding preferences, and special adaptations
2. Past and current range, including map(s)
3. Migration patterns (if applicable), including maps or other graphics
4. Reason for endangered or threatened species listing. What are the threats to this species in Upper Newport Bay?
5. Current status
6. Steps being taken to preserve the species
7. Bibliography of sources

Internet links for research:
www.dfg.ca.gov/hcpb/species/p_a_rglr/genplantsanimals.shtml

Species Status Table

Species	California Status	Federal Status	Factors Affecting Status
Brown Pelican			
California Gnatcatcher			
Light-footed Clapper Rail			
California Black Rail			
California Least Tern			
Belding's Savannah Sparrow			
Salt Marsh Bird's Beak			

Activity: Castaways Park

Summary: In this activity, students will consider a current land-use issue in Upper Newport Bay—landscaping a park with native versus non-native plants—present viewpoints held by different interest groups in favor of various options, and evaluate the arguments to make a final decision.

California State Content Standards

SCIENCE

Biology/Life Sciences

- **Ecology 6b.** Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

Investigation and Experimentation

- **1m.** Students will investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings.

ENGLISH-LANGUAGE ARTS

Grades 9-10

Reading Comprehension

- **Comprehension and Analysis of Grade-Level-Appropriate Text 2.3.** Generate relevant questions about readings on issues that can be researched.
- **Comprehension and Analysis of Grade-Level-Appropriate Text 2.5.** Extend ideas presented in primary or secondary sources through original analysis, evaluation, and elaboration.

Listening and Speaking Strategies

- **Comprehension 1.1.** Formulate judgments about the ideas under discussion and support those judgments with convincing evidence.
- **Organization and Delivery of Oral Communication 1.6.** Present and advance a clear thesis statement and choose appropriate types of proof (e.g., statistics, testimony, specific instances) that meet standard tests for evidence, including credibility, validity, and relevance.
- **Organization and Delivery of Oral Communication 1.9.** Analyze the occasion and the interests of the audience and choose effective verbal and nonverbal techniques (e.g., voice, gestures, eye contact) for presentations.
- **Analysis and Evaluation of Oral and Media Communication 1.12.** Evaluate the clarity, quality, effectiveness, and general coherence of a speaker's important points, arguments, evidence, organization of ideas, delivery, diction, and syntax.
- **Analysis and Evaluation of Oral and Media Communication 1.13.** Analyze the types of arguments used by the speaker, including argument by causation, analogy, authority, emotion, and logic.

Speaking Applications

- **Deliver Persuasive Arguments 2.5**

a. Structure ideas and arguments in a coherent, logical fashion.

b. Use rhetorical devices to support assertions (e.g., by appeal to logic through reasoning, by appeal to emotion or ethical belief; by use of personal anecdote, case study, or analogy).

c. Clarify and defend positions with precise and relevant evidence, including facts, expert opinions, quotations, expressions of commonly accepted beliefs, and logical reasoning.

d. Anticipate and address the listener's concerns and counterarguments.

Grades 11-12

Listening and Speaking Strategies

- **Organization and Delivery of Oral Communication 1.6.** Use logical, ethical, and emotional appeals that enhance a specific tone and purpose.
- **Organization and Delivery of Oral Communication 1.8.** Use effective and interesting language, including:
  - a. Informal expressions for effect
  - b. Standard American English for clarity
  - c. Technical language for specificity.
- *Analysis and Evaluation of Oral and Media Communications* **1.11.** Critique a speaker's diction and syntax in relation to the purpose of an oral communication and the impact the words may have on the audience.
- *Analysis and Evaluation of Oral and Media Communications* **1.12.** Identify logical fallacies used in oral addresses (e.g., attack *ad hominem,* false causality, red herring, overgeneralization, bandwagon effect).

HISTORY/SOCIAL SCIENCE

- **Principles of American Democracy 12.7.5.** Explain how public policy is formed, including the setting of the public agenda and implementation of it through regulations and executive orders.
- **Principles of Economics 12.1.3.** Identify the difference between monetary and nonmonetary incentives and how changes in incentives cause changes in behavior.

Objectives:

Students will be able to:

- Determine some of the effects of planting native or non-native plants
- Present arguments in favor of one or more viewpoints concerning land use
- Evaluate arguments

Materials:

- Handouts
  - *Castaways Park Background*
  - *Castaways Park Interest Groups*
  - *Stop-watch or clock with second-hand*

Preparation:

- Make a copy for each student of the *Castaways Park Background* handout.
- Make a copy for each group of the *Castaways Park Interest Groups* handout.

Time Required:

Approximately 2 class sessions

Procedures:

Session One

1. Remind students that deciding how land should be used is not always easy, as people have different values, interests, and ideas. Explain that they are going to look at a recent land use controversy that affected Upper Newport Bay.

2. Distribute to each student a copy of the *Castaways Park Background.* Tell students that it describes a real issue in Newport Beach concerning a park that represented one of the last remaining undeveloped pieces of land adjacent to the Bay. Have students read the information.

3. Discuss the various options presented. Ask students to predict who in the community would favor each option. Have students vote on the option they support and record this as the initial tally.

4. Divide students into 10 groups. Hand out copies of *Castaways Park Interest Groups*. Assign each student group to represent one of the interest groups listed.

5. Explain that each group will present their viewpoint at a mock City Council meeting staged in the class. Tell students not only to use the information presented on the handout but also to research other points that may be relevant to their choice. Encourage students to read the information about all the interest groups—and to determine the pros and cons of each option—so that they can be prepared to counter the arguments raised by groups in favor of other options.

6. Inform students that presentations will be limited to five minutes, including a two-minute question session. Tell each group to designate spokespersons to present the group's viewpoints and to question others at the City Council meeting. Allow students time to work on their presentations. Inform students when the City Council meeting will take place.

Session Two

1. Seat the City Council Members facing the audience. Call the City Council meeting to order. Have one of the council members review the Castaways Park issue and options

2. Explain that there will be no interruptions and that question sessions will follow each presentation. Encourage students to take notes so they can present counterarguments during the question sessions.

3. Open the floor for each interest group to present. Be sure to stop presentations after three minutes and stop question sessions after two-minutes.

Follow-up:

1. Take a Council vote to see if any clear decision has been reached. Take a class-wide vote and discuss any changes from the initial tally.

2. Discuss the process.
   What challenges did they face in coming to a decision?
   Were any of the groups' arguments particularly convincing?
   What compromises can be made?

3. Discuss what has happened in Castaways Park. On September 23, 2002, the Newport Beach City Council approved Option 2 with a 4-2 vote. Meadow sedge, a hardy native, replaced the plan for wildflowers and grasses on the bluff while the remainder of the native plant palette was unchanged. There was a large community turnout at the meeting with native park supporters outnumbering others by three to one.

Extensions:

1. Collect newspaper articles concerning local water-related and land-use issues and discuss the options. Attend a city council meeting and be prepared to voice your opinion.

2. Learn more about environmental impact reports (EIRs). Obtain copies of EIRs for wetlands in your area. What concerns are addressed in these documents?

3. Research zoning laws and land use regulations in your area. Would any of the laws affect the outcome at Castaways Park?

Castaways Park Background

Castaways Park—a 17-acre area adjacent to Upper Newport Bay— was designated as a “natural park” by the City in June of 1998. A combined grant of $150,000 has been offered by the California Coastal Conservancy (CCC) to revegetate the park with native plants historic to this region, including a natural meadow with wildflowers and grasses in the central area. The grant could also be used to repair trails, put up interpretive signs and displays, and create an educational demonstration area providing information about the local wildlife, native plants, and their interactions.

This restoration plan was approved unanimously by the City Council in 2002, but before it was installed certain questions arose regarding what kind of public use could be provided at the Castaways Park site. Some interest groups proposed the City reject the plans and give up the grant money. A City Council meeting was ordered to address these concerns and to allow community members to voice their opinions on the subject. The following four options were proposed for discussion.

<u>OPTION 1</u>
Accept the grant agreement for the Revegetation Plan (1) to revegetate the Park with native plant communities, (2) to install temporary irrigation, interpretive displays, and a demonstration area to explain the species present and the wildlife supported by each plant community; and (3) to improve the existing interior trails. In this plan, the City pays only 35 percent of the total project cost, estimated at $230,000. For the next 20 years, any modifications to the agreement must be approved by the CCC, or the city must repay the grant.

<u>OPTION 2</u>
Amend the agreement to plant three-quarters of an acre with native turf that can withstand light recreational activities, such as kite flying and picnicking, better than the native grasses and wildflowers of Option 1, thus opening up the park to more recreational uses. Option 2 would cost the City an additional $25,000. A permanent irrigation system would be installed and annual maintenance efforts and costs would increase.

<u>OPTION 3</u>
Plant three acres of non-native grass that could sustain active recreation, such as ball games. This turf grass would increase the cost to the City by $80,000-$100,000 as it would require a permanent irrigation system, would need more water, and would require higher maintenance costs for mowing, irrigation, and fertilizer. There is potential for much higher public usage with Option 3 than with Options 1 or 2. Installing this non-native grass violates the CCC agreement to use only native species, so the City would have to fund the park itself and future grant opportunities might be jeopardized.

<u>OPTION 4</u>
Leave Castaways Park as it is, a mix of ruderal weeds and natives, declining the grant money. Costs to the City would be the $24,000 already spent on the project.

Castaways Park Interest Groups

Council Members

If the City rejects this grant, breaking the previous agreement, you fear that obtaining future grants for upcoming projects from the CCC and other environmental organizations may prove difficult. You are aware that other open spaces in the City are also suitable for native plantings in the future if other grants can be secured. It is important to keep your voters happy. You will have to vote on a decision by the end of the meeting, so you must be prepared to ask questions from the community representatives.

The California Coastal Conservancy (CCC)

Your Revegetation Plan would create a unique all-native park that would be a leading example to the rest of the county. A special Castaways Park Advisory Committee, consisting of representatives of the neighborhood and experts from a broad spectrum of fields, was created in order to come up with a vegetation plan that took safety, education, water conservation, recreation, esthetics, and the preservation of native wildlife into consideration. For these reasons, you feel that Option 1 is the best choice for the creation of a successful self-sustaining native park, but you are willing to accept Option 2.

Department of Water Conservation and Management (DWCM)

Southern California is a region known to experience periodic droughts. Grass lawns require large amounts of water. Since water is a limited resource, using native plants to vegetate Castaways Park will not only save money on water bills but also set a good example for water-wise gardening. Also, it is possible the runoff from irrigating grass lawns would contaminate the adjacent wetlands with fertilizers, herbicides, and pesticide residues. You support Option 1.

Fire Department

While all four options retain provisions for fire safety, you feel that Option 1 is the best, though would accept 2 or 3. Some of the non-native plants currently growing in Castaways Park catch fire easily. The fire abatement costs for periodically clearing brush from the site is $25,000 per year. The Fire Marshal provided the Castaways Advisory Committee with a list of native fire retardant plants for their Vegetation Plan. Replacing the non-native plants with coastal sage might help reduce the costs of fire abatement, and the money saved could be used elsewhere.

Homeowner's Association

You live adjacent to Castaways Park. Neighbors of nearby Bob Henry Park, which is largely a turf area designated for active recreation, have complained of trash and noise pollution due to the high number of people that come to use its grassy field. The residents of your community are concerned that a large grass area added to Castaways Park will draw a noisier and messier crowd. Furthermore, you are familiar with the drainage problems at Castaways Park, particularly near the bluff. You fear that water used in the regular irrigation of grass areas could seep underground and create dangerous instability and erosion near the bluff. You don't wish for the possibility of trash, noise, or land disturbance in your neighborhood, and support Options 1 or 2. Why replicate Bob Henry's turf park next-door?

Naturalist Volunteers

You have noticed increased wildlife visitation in areas you've helped restore in Upper Newport Bay and have a great appreciation for the knowledge you've gained about native plants. You feel it is important to have Castaways Park become an all native park to compliment the adjacent wetlands at Upper Newport Bay. This would expand the habitat of the animals by allowing them to cross from one park to the other and utilize the resources of both. You think the general public would enjoy and benefit from the opportunity to learn plant identification, so you encourage interpretive signage at a native park. You support Option 1, but would accept the compromise of Option 2.

Local Organization of Retirees

You truly appreciate parks for both the scenery and the outdoor activity they allow. You enjoy seeing your grandson fly his kite at the park, having picnics with your friends, bird watching with the local club, and reading and snoozing in the sun. If the central meadow area is planted with just native grasses, some recreational activities may not be possible. Also you believe that native grasses are brown and ugly during the summer and that coastal sage scrub may have thorns that could poke people enjoying the meadow. You prefer Option 3.

City Recreation Department

The City has few practice fields and scheduling practice times can be difficult. The City recently created a Parks Ranger Program to police the parks because fights have occurred over who gets to use the space. You understand Castaways Park is designated for only passive recreation such as strolling, bird watching, or reading. You support Option 3, in the hopes that adding grass to Castaways Park might relieve some of the congestion at local fields.

Local Hiking Group

You enjoy hiking at parks around Newport Bay. On numerous occasions, you have observed people leaving the designated trails and entering into restricted areas. You feel that if there were more parks around the Bay where people could wander freely, they would pay greater respect to parks with restricted areas. Castaways Park should become an area where people can explore nature without worry of breaking the rules. Besides, the existing native parks currently lack enough people policing the area to stop the destructive activities occurring in fragile habitats. Why add a new park with restricted areas when other parks aren't adequately protected? You support Option 4.

Community Park Foundation

You support the local parks and believe that the rules of the CCC agreement are too strict. You feel that the City should have more control over how to use and design the park—whether planted with native or non-native plants. A 20-year commitment is too long to give up control of this prime property. The great views and location of Castaways Park give the land an estimated worth of $17 million. Why give up control of a multi-million dollar property to outside sources in order to save $150,000? You support Option 3 or 4, whatever it takes to not accept the terms of the grant.