

Unit Summary

The hands-on activities in Frey's Inquiry Investigations™ Environmental Issues and Solutions Module link to core science concepts, making them an excellent complement to existing curricula. Students investigate landfills; effects of radiation on plants; bioremediation techniques; climate changes; water treatment processes; airborne, soil, and water pollutants; food webs; energy pyramids; predator-prey relationships; carrying capacity; and how to calculate a biodiversity index.

The Inquiry Investigations™ Environmental Issues and Solutions Module consists of four investigative units featuring twenty-six hands-on laboratory activities. Each unit begins with a thorough introduction of the science skills and concepts presented in the lab activities that follow. The lab investigations can be performed in sequence (see pacing chart) or separately, based upon the time available.

Suggested *Going Further* investigations allow students to design and carry out their own investigations, expanding their knowledge and understanding of environmental issues and solutions.

Unit 1: Environmental Issues

Lab 1: Landfills

In **Activity 1**, students build a model landfill and determine which materials are most likely to biodegrade.

Suggested *Going Further* investigations ask students to investigate what happens to their community's trash and garbage and how solid wastes are recycled.

Lab 2: Radiation Effects

In **Activity 1**, students examine the growth and development of seeds exposed to varying levels of radiation.

Suggested *Going Further* investigations encourage students to set up an experiment to test how the different types of seeds react to ultraviolet radiation.

Lab 3: Bioremediation of an Oil Spill

In **Activity 1**, students observe the effect of oil-hungry bacteria on a simulated oil slick.

In **Activity 2**, students model various shore environments and observe how they impact oil spill clean up. Students also investigate porosity.

In **Activity 3**, students use a microscope to examine and compare two oil samples, a degraded oil sample and an untreated oil sample.

Suggested *Going Further* investigations encourage students to research how oil spills are cleaned up in nature.

Lab 4: Climate Change

In **Activity 1**, students model the greenhouse effect and compare how carbon dioxide concentration affects the temperatures of two air spaces.

Suggested *Going Further* investigations ask students to investigate ozone as a pollutant and to set up an experiment to study the effects of the color of soil/sand used in the activity.

Lab 5: Water Pollutants

In **Activity 1**, students calculate the volume and mass of runoff caused by a storm event. Students also make model ponds to visualize the effects of runoff.

Suggested *Going Further* investigations ask students to set up an experiment to determine how the density of water is affected by temperature.

Unit 2: Air, Water, and Soils

Lab 6: Air Quality

In **Activity 1**, students collect and examine airborne pollutants.

In **Activity 2**, students collect and analyze data with respect to lichen populations and vehicular traffic volume to estimate air pollution levels of a study zone.

Suggested *Going Further* investigations prompt students to investigate sources of human-caused air pollution in their neighborhoods.

Lab 7: Soils

In **Activity 1**, students collect soil samples and observe and compare their physical characteristics. They also create soil horizons.

In **Activity 2**, students determine the permeability and porosity of various samples (gravel, fine and coarse sand).

In **Activity 3**, students test the pH and nutrient content of various soil samples.

Suggested *Going Further* investigations encourage students to perform percolation tests around their neighborhood.

Lab 8: Water Quality

In **Activity 1**, students investigate various colorimetric techniques used to identify water pollutants.

In **Activity 2**, students use colorimetric techniques to assess the water quality of various water samples.

In **Activity 3**, students use brine shrimp to determine the LD₅₀ of a toxic water pollutant.

In **Activity 4**, students observe the effects of various pollutants on the growth and development of radish plants.

Suggested *Going Further* investigations provide students with a procedure to measure the biological oxygen demand (BOD) of a water sample.

Unit 3: Ecosystems, Energy, & Biodiversity

Lab 9: Learning About Food Webs & Energy Pyramids

In **Activity 1**, students will play a habitat card game to learn how food webs are organized.

In **Activity 2**, students model how energy flows through a food chain.

Suggested *Going Further* investigations encourage students to construct a food web based on their local geographic location and research the five major biomes.

Lab 10: Using Owl Pellets to Learn about Predator-Prey Relationships

In **Activity 1**, students dissect an owl pellet and recover skeletal remains of various prey organisms.

In **Activity 2**, students use a dichotomous key to identify prey animals according to remains they removed from owl pellets. They will also determine the cumulative biomass of prey that the class population of owls consumed.

In **Activity 3**, students construct a food web based on predator-prey relationships.

Suggested *Going Further* investigations ask students to learn about keystone species and identify their importance to their ecosystems.

Lab 11: Biodiversity

In **Activity 1**, students sample various leaf litter ecosystems and extract organisms using a Berlese apparatus. They also calculate a diversity index.

In **Activity 2**, students grow two cultures of yeast cells, determine cell densities, and graph population data over time.

Suggested *Going Further* investigations ask students to research the greenhouse effect. They will describe how it is beneficial to sustaining life on Earth and how it has been impacted by human activity. Students will also investigate how the use of insecticides and chemical pollutants can affect the food chain and the overall ecological system to which they are applied.

Unit 4: Comprehensive Inquiry Investigation

Lab 12: Culminating Lab

In **Activity 1**, students attempt to purify a polluted water sample by simulating a water treatment process typically used by water treatment plants.

In **Activity 2**, students learn about bioremediation by using nitrifying bacteria to remove nitrate from a polluted water sample.

In **Activity 3**, students collect and identify microlife from a local water source. Students calculate the Palmer score and correlate it to a qualitative water quality assessment.

TEACHER'S NOTE:

This activity is a rigorous laboratory investigation involving a number of interrelated concepts and skills. It is intended for advanced students.

Suggested *Going Further* investigations encourage students to investigate the concept of nutrient loading and how it contributes to eutrophication of ponds and lakes.