The Lorax and Environmental Responsibility—

Keeping Our Air Clean

Subjects	Fifth Grade science and reading
Topics	Critical thinking Environmental ethics Making informed decisions Cycles/structures that interact How adaptation affects survival How events affect the present and the future
Objectives	Making wise choices in the conservation of resources Analyzing, reviewing and using information and observations Identifying the limitations of the natural world Describe interactions that occur in systems Compare the adaptive characteristics of species that improve their ability to survive in an ecosystem Describe adaptive characteristics that result in species unique niche in an ecosystem Predict adaptive characteristics required for survival and reproduction in ecosystems
Skills	Communication Personal responsibility
Time	2-45 minute periods or 1- 1 ½ hour extended session
Overview	A series of learning cycles which lead the students to a deeper understanding of air quality issues through viewing or reading The Lorax and participating in classroom discussions about the need for personal environmental responsibility and how that responsibility translates into sustainable behavioral changes that positively affect the environment

Lesson Overview

Notes

The Lorax and Environmental Responsibility—Keeping Our Air Clean

Dr. Seuss' classic 1971 book, The Lorax is considered one of his most critically acclaimed and socially conscious books. Theodor Seuss Geisel began writing the book on laundry lists during an African safari. Upon viewing the descimated African forests, he exclaimed "they've stolen my truffula trees" inspiring the theme of The Lorax.

The story of The Lorax is the story of one child willing to venture into a dismal place and ask a question, a common beginning for environmental responsibility. The child asks the Onceler, who is responsible for a dramatic environmental disaster caused by the lumbering of Truffula trees. The impact of deforestation affects the Swomee-Swans, Brown Bar-ba-loots and the Humming-Fish in addition to introducing industrial wastes such as Gluppity-Glupp and Scholoppity-Scholopp into the environment.

The story, told in the magical language of Dr. Suess, explains the concepts of cause and effect, adaptability, ecosystems and the limitations of the natural world—even an unnatural world of Lorax and Onceler.

Students will have opportunity first hand to understand how every day actions affect their environment in positive or negative ways. They will experience the environmental impact man has on species that affect the future of species. Finally, at the end of the story, students will find hope in the last Truffula seed and began to understand that the future health of the environment is in the hands of each of us.

Supplemental Lesson
(for use prior or after presentation of The Lorax)

Teaching Air Quality

5th grade lesson "The Effects of Ozone in the Air" is available online at http://www.tnrcc.state.tx.us/air/monops/lessons/ecobadgelesson.html and reprinted below.
Other lesson plans are available online at www.airvictoria.org

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Effects of Ozone in the Air

Purpose

To measure ground-level ozone.

Grade Level

5th grade

Essential Elements

Environmental Essential Elements Across the Curriculum - 75.25 (2) Acquire data through the senses. The student shall be given opportunities to (B) observe properties and patterns of objects, organisms, and events in the environment, and (E) explore the environment.

(3) Classify, order, and sequence data. The student shall be given opportunities to (B) classify matter, forces, energy, organisms, actions, and events from the environment according to similarities and differences.

(4) Communicate data and information in appropriate oral and written form. The student shall be given opportunities to (D) describe changes that occur to objects and organisms in the environment.

Objective

Students will learn how ground-level ozone is an air pollution problem.

Focus

Show a picture of a car tail pipe with exhaust coming out.

Materials

Ecobadge Smog Patrol Kits from Vistanomics Inc., 230 N. Maryland Ave., Suite 310, Glendale, CA 91206, Telephone: 818/409-9157. (The TNRCC references this product for information only and does not endorse this product.)

Optional Material—Classroom made Schoenbein paper

Schoenbein Scale Chart and recipe for making Schoenbein paper is available online at

http://ravensweb.150m.com/APES/Labs/schoenlab.htm

Background

Ozone is a colorless gas. It is found in two layers in the atmosphere. High level ozone is about 10 to 30 miles above the earth. It is there naturally. This ozone layer protects the earth from the sun's harmful ultraviolet light. Without this protection, the ultraviolet light would be harmful to humans. Ground-level ozone reaches from the ground to about 10 miles above the earth. Ozone at ground level is formed as a result of chemical reactions between oxygen and volatile organic compounds (mainly come from automombile exhaust) and nitrogen oxides (mainly come from industries and power plants) in the presence of sunlight. High concentrations of ground-level ozone are produced during warm weather (summer months). Ground-level ozone can be very harmful. It can cause breathing problems in humans. It can also injure forests and other vegetation and damage crops.

See ground-level ozone for more information.

EcoBadge is a device that measures ozone levels. Treated paper in the badge can be read at short terms (1 hour) and long terms (8 hours).

Procedure

During the right weather conditions for the formation of ozone, divide students into groups of 4 or 5. Give each group an EcoBadge kit. Review instructions in kit. Each group will measure ozone levels for 4 or 5 days (depends on the number in each group). Each student will wear the EcoBadge for 8 hours and record the ozone level measured. After each member of the group has worn the EcoBadge, the group will graph its results for the 4- to 5- day period.

Have each group answer the following:

1. What does your graph tell you about the ozone level in your area?
2. During what part of the day is the ozone level the highest? Why do you think this is? What contributes to the ozone level in your area?
3. What does your graph tell you about the ozone level in your area?
4. During what part of the day is the ozone level the highest? Why do you think this is?
5. What contributes to the ozone level in your area?

6. What is being done to decrease harmful ground-level ozone? (Possible answers - Smokestacks and cars are now equipped with air pollution controls. People are beoming more conscious of conserving energy.)
7. Have the students write what they see happening.
8. Discuss their observations and inferences.

Acknowledgment

Mary Sloan, University of Texas at El Paso TES Course, 1995

The Air-O-Dynamic Curriculum, developed by The Environmental Institute of Houston, University of Houston-Clear Lake, 281.283.3950

Notes

Learning Activity

View The Lorax video or read <u>The Lorax</u>. Students might be encouraged to read aloud or read character parts in the book. Students may choose to sing along with the video

De-briefing and discussion questions

- Truffula trees are real in the land of the Lorax but we don't have them where we live. Are there natural resources in your community that are disappearing like the Truffula trees?
- What is affecting the disappearing natural resource of clean air?
- Are there people or industry like the Once-ler that are not helping to preserve your environment and conserve natural resources?
- What are the sources of air pollution in our community? Answers are online at http://www.airvictoria.net/difference.asp
- Who is the Lorax in your community? Can you be the Lorax?
- Who has the last Truffula seed in your community?
- Who will plant the seed and start the change?
- What can you do to improve our air quality?
- What can you encourage your parents to do to improve our air quality?

Arts/Crafts and Food Activities

Truffla Tree Snacks

Make your own truffula trees following these directions:

1. Use a celery stick for the trunk of your tree
2. Put a spoonful of peanut butter on one end of the celery stick
3. Cut a hole in an apple or other fruit and put on the peanut butter end of the celery stick
4. Enjoy!

Truffla Tree Art

Use craft art mediums (cotton balls, puff balls) or recycled materials to make posters of truffula trees. On the poster list what truffula trees or natural resources need protection or action in your community.

Notes

Assessment

Letter to the Lorax

Write a letter to the Lorax about what your group will do for the earth. Present the letter
to a community leader who will help your group accomplish their goals.

Correlation to TEKS for 5th Grade Science

(5.1) **Scientific processes.** The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices.

(5.2) **Scientific processes.** The student uses critical thinking and scientific problem solving to make informed decisions.

(5.5) **Science concepts.** The student knows that a system is a collection of cycles, structures, and processes that interact.

(5.9) **Science concepts.** The student knows that adaptations may increase the survival of members of a species.

(5.11) **Science concepts.** The student knows that certain past events affect present and future events.

Correlation to VISD Integrated Scope and Sequence for 5th Grade Science

Benchmark 5.1e Demonstrate collaborative and social skills while working in a cooperative group

Benchmark 5.5c Discuss the different purposes of science versus techology

Extensions

Online at http://www.tnrcc.state.tx.us/air/monops/lessons/ozoneinfo.html

Office of Air Quality

Air Quality Planning & Assessment Division

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aqp@tnrcc.state.tx.us
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November 12, 1997

Ground-level Ozone

Background:

Ozone is the same molecule regardless of where it is found, but its significance varies. Stratospheric ozone is found 9 to 18 miles high where it shields us from harmful ultraviolet rays from the sun. A high accumulation of ozone gas in the lower atmosphere at ground level is air pollution and can be harmful to people, animals, crops, and other materials.

Elevated levels above the national standard may cause lung and respiratory disorders. Short-term exposure can result in shortness of breath, coughing, chest tightness, or irritation of nose and throat. Individuals exercising outdoors, children, the elderly, and people with pre-existing respiratory illnesses are particularly susceptible. Chemists say the materials damaged by ozone include rubber, nylon, plastics, dyes, and paints.

Ozone pollution, or smog, is mainly a daytime problem during summer months because sunlight plays a primary role in its formation. Nitrogen oxides and hydrocarbons are known as the chief "precursors" of ozone. These compounds react in the presence of sunlight to produce ozone. The sources of these precursor pollutants include cars, trucks, power plants and factories, or wherever natural gas, gasoline, diesel fuel, kerosene, and oil are combusted. These gaseous compounds mix like a thin soup in the atmosphere, and when they interact with sunlight, ozone is formed.

Large industrial areas and cities with heavy summer traffic are the main contributors to ozone formation. When temperatures are high and the mixing of air currents is limited, ozone can accumulate to unhealthful levels.

The United States Environmetal Protection Agency has set the National Ambient Air Quality Standard for ozone at 0.12 parts per million (ppm). Ozone concentrations of 0.125 ppm (125 in parts per billion) or above are considered an exceedance of this standard because of mathematical rounding. Four areas of Texas violate the national standard for ozone of 0.125 ppm: El Paso, Dallas-Fort Worth, Houston-Galveston-Brazoria, and Beaumont-Port Arthur. Other areas have ozone levels high enough that they are close to exceeding the standard: Austin, Corpus Christi, Tyler-Longview-Marshall, San Antonio, and Victoria.

Suggested Activites:

Activity 1:

Ozone And Weather

Objective: To plot data and ozone measurements for a two-or three-week period and evaluate the data collected.

Procedure:

1. Divide the class into groups of five or six students.
2. Each team should then assign a different radio station, television station, or newspaper to each student. For example, Team 1 has five students. Student A will collect data from reports on radio station KXXX. Student B will collect data from television station WXXX. Student C will collect data from television station WBBB. Student D will collect data from newspaper X. Student E will collect data from newspaper Y. Students can also call the TNRCC's 1-800-64TEXAS hotline or click on Ozone Query for yesterday's peak ozone concentrations in Texas' major metroplitan areas. The National Weather Service can also provide weather information.
3. Data Collection. Have the students obtain weather and ozone data over a two-week period. The students will need to collect the following weather information:
    - temperature
    - precipitation
    - wind speed
    - cloud cover
    - wind direction
    - time of day for report
    - location of data collected (e.g., downtown, the radio station, the local airport)

    After the two-week period, have each group compare and contrast their reports. Ask the students the following questions:

    - Did each radio station, television station, newspaper or other source report the same information?
    - What was different?
    - What was alike?
    - What factors would cause the reports to be different or the same?
4. Mapping. Obtain maps of your city or metroplitan area for each team. Have each team research and label the following areas:
    - the major traffic arteries and hubs, including airports, train stations, and bus stations
    - manufacturing areas
    - commercial centers
    - major topographical features such as mountains, valleys, or bodies of water
5. Plotting. Ask students to review the background information on factors affecting ozone formation. Then, ask them to answer the following questions and to label each area on their maps.
    - Which areas might be high "ozone producers"? Label these "high ozone production."

- What places should a person with respiratory problems avoid on ozone action days? Label these "sensitive."
- Which areas are downwind from high ozone-production areas? (Hint: Use the weather data to determine prevailing winds.) Label these "downwind."
- Where are low-lying areas located in which ozone can collect? Label these "depressions."
- Are any residential areas located in or near areas identified in the areas above? Label these as "critical residential areas."
- Are any elementary or preschools located near critical areas? Label these as "critical schools."
- Are any residential senior-citizen or nursing homes located near critical areas? Label these as "critical senior-citizen centers."
- Are any medical centers located near critical areas? Label these as "critical medical areas."

6. Interpreting patterns. Do the following:
   - Ask the students to find the three days with the highest ozone readings.
   - Ask them to identify any common factors for those three days, such as high temperatures, weather, or day of the week.
   - Explain that scientists investigate the true composition of air pollution by tracking common factors and then seeking explanations for correlations.
7. Have the students design a graph or chart that would correlate one or more factors to the high ozone readings.

Extensions

The TNRCC has developed an ozone education/awareness campaign called the Ozone Action Days Program. This voluntary campaign outlines reasonable actions each participating community can take, from local industries to individuals, to reduce ozone pollution.

Write the following scenarios on the chalkboard. Ask the students to determine in which scenarios they would declare an Ozone Action Day. Then they should write a paragraph for each scenario, explaining their choice.

A. It is 8 a.m. on a typical weekday. There is rush-hour traffic on all the highways. The weather forcast is mostly sunny skies, light winds from the southeast, temperature to reach 98 degrees, and a 30 percent chance of late morning thunderstorms. The current ozone reading is 30 parts per billion (ppb). Should you delcare an Ozone Action Day?

Answer:

Yes, because of the traffic, light winds, and the temperature. The 30 percent chance for precipitation means that any showers would be isolated, so you will probably have high levels of ozone.

B. It is 6 a.m. on Saturday. The forecast for the day is overcast skies, light and variable winds, and a maximum temperature of 91 degrees. No ozone reading is available. Should you call an Ozone Action Day based on the infomation you have?

Answer:

No, sunny to partly cloudy skies are required for the photo chemical process that creates ozone.

C. For this question, consider the Dallas-Ft. Worth area. It is 9 a.m. Yesterday was an Ozone Action Day. The weather today is very much like the weather yesterday. One difference is that today is a holiday and many people are off from work and school. The ozone reading is 40 ppb. The safety and comfort of many people depend on your decision. What will it be?

Answer:

The answer is no because you should not expect to have the high rush-hour traffic congestion.

To participate in a World Wide Web site for hands-on, inquiry-based science involving ozone monitoring by students around the state of Texas, click on http://chico.rice.edu/armadillo

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Acknowledgement:

Adapted from the Alternative Transportation Fuels Workshop with The Texas Railroad Commission, The General Land Office, and The Texas Education Agency.

Activity 2:

The data file "Texas Cities Data" contains the highest measurements of ozone taken each year for the past six years in the Houston-Galveston, Dallas-Fort Worth, El Paso, and Beaumont-Port Arthur areas. These areas are in exceedance of the federal Environmental Protection Agency standards for ozone pollution levels. Ozone concentrations of 0.125 ppm (125 in parts per billion) or above are considered an exceedance of this standard because of mathematical rounding. Students can plot the ozone measurements on the Y axis and the years on the X axis to show how ozone levels have changed from year to year in these areas.

Click Texas Cities Data to view the data and click Ozone graph to view the graph.

Activity 3:

The data file "Victoria Data for 23 Years" contains data on the highest ozone level measured each year in Victoria from 1974 through 1996. Students can plot these measurements on the Y axis and years on the X axis to show the city's ozone pollution trend and draw a dotted line across the chart marking the EPA's ozone standard of 0.120 parts per million. Ozone concentrations of 0.125 ppm (125 in parts per billion) or above are considered an exceedance of this standard because of mathematical rounding.

Example: Click Victoria Data for 22 Years to view the data and click Victoria graph to view the graph.

Activity 4:

The data file "Houston and El Paso Data for 1993" contains ozone levels in Houston and El Paso each month of the year for 1993. Students can plot these measurements on the Y axis and months on

the X axis to show how hot, sunny weather (primarily found during the summer months) contributes to ozone pollution.

Click Houston and El Paso Data for 1993 to view the data and click Ozone graph to view the graph.