Pollution Solution

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Summary

Students explore the role trees play in absorbing pollution emitted from automobiles.

Grade level

Fourth

Time required

2 _ hours

Materials

Flathead Reservation map
Blank world map – one per small group
World maps and globes
Deforestation rates around the world (See Resources section for web sites)
Flathead Reservation Town Populations document
Continent land areas and populations data
Science journals
Butcher paper

Goals

By completing this lesson, students will

1) review the process of photosynthesis,
2) explore the impacts of trees in absorbing pollution from automobiles,
3) become aware of other important roles of tree,
4) learn about forest management on the Flathead Reservation,
5) examine the potential effects of deforestation and
6) develop inquiry process skills.

Science standards addressed

National Science Standards

- Abilities necessary to do scientific inquiry
- Systems, order and organization
- Organisms and environments
- Changes in environments

American Indian Science Standards

- Various forms of scientific and technological work currently engaged in by American Indian men and woman and in what ways their fields require the process of problem identification, design and solution
- Local challenges in medicine and environmental protection and how traditional Indian knowledge, practices and philosophies have been and continue to be called upon for solutions

Teacher tips

There are a number of web sites on deforestation and global warming in the resources section. Review sites for background information and bookmark sites that you find useful for students.

Background information

Plants play many important roles on Earth including providing aesthetic quality, controlling erosion, releasing oxygen, absorbing carbon dioxide, supplying shade, providing wood, and providing food and shelter for animals and plants.

During the process of photosynthesis, a green plant uses the Sun's energy to convert carbon dioxide and water into sugars it uses for energy, and releases oxygen. The process can be written in a shorthand formula as shown below.

Carbon Dioxide + Water + Light → Sugar + Oxygen

Besides the naturally occurring carbon dioxide in our atmosphere, carbon dioxide is produced through the burning of fossil fuels, such as gasoline burned in automobiles. Excessive amounts of carbon dioxide in the atmosphere can be harmful to Earth. Scientists believe that increasing levels of carbon dioxide are currently contributing to Earth's rising temperatures, through a process known as the greenhouse effect. Rising temperatures on Earth can result in climatic changes such as drought, melting of glaciers, and rising sea levels.

Through the process of photosynthesis, trees and other plants absorb carbon dioxide from the atmosphere, thus helping to reduce the gas's potential damage. An acre of trees, or about 400 trees, absorbs the approximate amount of carbon dioxide emitted by a single automobile in one year.

Forests are cut for a number of reasons including clearing land for agriculture and housing developments, and for the harvest of natural resources. Deforestation can be problematic in tropical forests, where forest regeneration is difficult due to the nature of the ecosystem. Cutting of rainforests results in a number of significant environmental problems such as soil erosion, loss of habitat, and changes in the weather. In 1990, deforestation resulting from human activity was estimated at over 100,000 square kilometers of mature tropical forest (a kilometer is about .62 mile, a square kilometer is .39 square miles). Visit the web sites listed in the Resources section for more information about this topic.

The Confederated Salish and Kootenai Tribes manage the forests of the Flathead Reservation in an attempt to balance the uses of the forest. Uses include timber production, recreation, cultural uses and wildlife habitat. The CSKT Tribes' Forest Management Plan provides guidelines for tree harvesting. One of the criteria requires calculating the number of board feet of timber that can be harvested without causing a decline in the reservation forest cover. To calculate how many board feet can be harvested, the Forestry Department selects one quarter acre plots throughout the reservation and then analyzes the timber cover for tree size, diameter, growth (including average growth per year) and average mortality, as well as variables that impact growth and health, such as season and moisture. This information provides forestry personnel with an overall profile of forest health, regeneration, and volume. Volume is then calculated in board feet per acre. Reservation lands have approximately 6,000 – 8,000 board feet per acre. Total reservation forest cover is estimated at 1.8 billion feet of standing timber. The Tribes' allowable timber harvest is currently set at 262,000 acres.

Procedure

Engagement

1) Draw a large tree outline on butcher paper and ask students to list all of the uses of trees and reasons they may be important.
2) Ask students how trees get food. Review the process of photosynthesis, emphasizing the absorption of carbon dioxide. Ask students where carbon dioxide in the atmosphere comes from.
3) Give students the fact that one acre of trees (roughly 400) absorbs the carbon dioxide emitted by a single automobile in one year. With that in mind, discuss the significance of forests to air quality. Ask students if they have ever been in a forest or greenhouse. Have they ever been in a city? What was the air like in each place?

Exploration

Organize students into groups of three. Give each group a blank world map and an atlas or globe. Tell groups that they are going to estimate the following things.

A. How much of Earth's surface is water, and how much is land (fraction or percent)? (About one quarter is covered with land, three quarters with water.)
B. Ask students to identify and label the continents. Discuss what different types of land are on each continent. Have students use a green crayon to color the parts of each continent they think might be forested. Have students estimate how much of each continent they colored green. Provide students with the land size facts for each continent. Now, have students estimate the number of forested acres exist on each continent.
C. Using population statistics for each continent, have students estimate the number of automobiles used on each continent. Remind students that populations include those that cannot drive, and that not all adults own a vehicle.
D. Have students create a map key utilizing symbols of a tree and a car that represent a specific number value (Example: One tree equals 100 acres. One car equals 1000 automobiles.). Now have students draw the tree and car symbols on each continent.

E. Based on the students' maps, ask them to predict where they believe the best quality of air is on each continent and out of those places, which has the best in the world. Require students to justify to explain their predictions.

Explanation

1) Review the process of photosynthesis. Reiterate the fact that an acre of trees absorbs the amount of carbon dioxide emitted by a single automobile in one year. Show the Flathead Reservation map. Have students calculate the air quality of the reservation based on forest cover in relation to reservation town populations and automobile use. Present this as an open ended problem.
2) Have individual students present their solution, along with an explanation of how they reached it, to the class.
3) Ask students what effect increased carbon dioxide has on Earth. Discuss.

Elaboration

1) Discuss the rate of deforestation occurring in the world today. Give students time to view the images showing deforestation, and provide students with the current deforestation statistics. Ask them to predict what the consequences of continued deforestation might be; have them develop a list in their science journals. Have students share their lists; add them to the tree chart developed previously.
2) Using the tree chart as a reference, ask student groups to identify factors that should be considered in managing the reservation forests. Have them write them in their science journals, then share the lists with the class. As a whole class, prioritize the factors that students identified.

Evaluation

1) Evaluate each student's reservation air quality solution based on their calculations, as well as on their solution design and their ability to justify it.
2) Assess student journal entries on predictions of the consequences of deforestation and factors that should be used to guide reservation forest management.

Follow up activities

1) Invite a Tribal forester to go on a field trip with your class or visit your classroom to talk with students about the Tribes' forest management.
2) Invite an elder to talk with students about the importance of the forests.
3) Have students visit the Solocom web site (see Resources section) and research more on the causes and effects of global warming, the problems with fossil fuels, alternative forms for fuels, or a large number of other environmental issues related to this lesson.

Resources

Web sites

Solocomhouse – Contains vast information about a diverse range of environmental issues.
www.solocomhouse.com/

- Gives current rates of deforestation in Brazil, has pictures of deforestation. Click on "Rainforest"
- Gives information about global warming, the effects of excess carbon dioxide, climatic changes happening on Earth probably due to global warming. Click on "Global Warming"

World Resources Institute Forest Frontiers Initiative - Shows maps of and provides information about the changes in forests over time all over the world
www.wri.org/ffi/

University of Leicester Geography Department Deforestation Page – Information about deforestation and links to related sites. Good teacher reference.
www.geog.le.ac.uk/staff/acm4/gy358/2002_4/deforestation.html

US Geological Survey Earthshots – Satellite images of deforestation over several decades
http://edcwww.cr.usgs.gov/earthshots/slow/tableofcontents