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esources

and the

Products We Buy

This unit is about the natural resources affected by growing flowers, coffee, and bananas.

Lesson 1

The Pesticide Dilemma

Investigate the environmental effects of using chemicals to grow flowers. Students consider the pros and cons of alternative choices.

Lesson 2

The Environmental Impact of Your Coffee

Evaluate the environmental impact of various methods of coffee farming. Students create murals illustrating “shade-grown” vs. “full-sun” growing practices.

Lesson 3

What a Waste!

Learn about waste production and disposal in the banana industry. Students play a game to explore possible solutions to the waste problem as they create visual representations of the industry’s “footprint” on nature.

Lesson 4

Reporters at Work

Students form work groups to gather and analyze information about the natural resources used or affected by the production of bananas, flowers, and coffee.

Lesson

1

The Pesticide Dilemma



INTRODUCTION

Successful commercial production of agricultural crops often relies heavily on chemicals to protect crops. The flower industry is a heavy user of chemicals, particularly pesticides. In this lesson, students examine the consequences of these practices, particularly the impact on flower workers and the environment.

OBJECTIVES

At the end of this lesson, students will be able to:

- Explain why the flower industry is a heavy user of chemicals.
- Describe environmental problems associated with use of pesticides.
- Evaluate the pros and cons of using chemicals and suggest strategies for ameliorating their effects.

STANDARDS

Geography

- **Standard 11:** The Patterns and Networks of Economic Interdependence on Earth's Surface
- **Standard 14:** How Human Actions Modify the Physical Environment

Economics

- **Standard 2:** Marginal Cost/Benefit

Civics

- **Standard VE:** How can citizens take part in civic life?

Language Arts

- **Standard 3:** Apply a wide range of strategies to comprehend, interpret, evaluate, and appreciate texts.
- **Standard 4:** Students adjust use of spoken, written and visual language to communicate effectively with a variety of audiences and for different purposes.

MATERIALS AND PREPARATION

- "Poisoned Posies" handout
- "The Need for Pesticides" handout
- "Pros and Cons: Pesticides in the Flower Industry" handout



PROCEDURE

1. Identify Problems Caused by Agricultural Chemicals

Distribute “Poisoned Posies” and read it together as a class. Drawing on the article, create a list of problems caused by pesticides. (*Problems include making workers and people who live near the flower farms sick, polluting the air and water, harming wildlife.*)

2. Identify Reasons for Using Agricultural Chemicals

Ask students: Why, if pesticides cause all these problems, do flower-growers still use them? Allow students to speculate, accepting all answers.

Distribute “Pesticides in the Flower Industry.” Have students answer the three questions at the top. Then go over the rest of the handout together, or present the information in a mini-lecture. The handout explains the reasons that pesticides are so important to the flower industry: to ensure a product of consistent quality, to kill pests so the crop is successful, to meet the import requirements of countries including the U.S. and Japan.

3. Create T-Charts: The Pros and Cons of Using Pesticides

Distribute the handout “Pros and Cons: Pesticides in the Flower Industry.” Have students create t-charts in which one column lists the pros of using pesticides in growing flowers and the other lists the cons. Ask students whether they find the pros or the cons more compelling. Ask them to consider whether their evaluation of this information would be different if they were:

- The owner of a flower farm.
- A woman working on a flower farm.
- A family living near a flower farm.
- A supermarket selling flowers in the U.S.
- A customer who buys flowers in the U.S.

The students should understand that different people in the industry have different viewpoints, and that there are reasons both for and against use of pesticides. For the consumer, the price of flowers is lower with the use of pesticides. Ask students if, after considering all viewpoints, they think pesticides should be used in the flower industry.

Inform students that there are some groups working to reduce the use of chemicals in the flower industry. A voluntary International Code of Conduct for Production of Cut Flowers asks growers to reduce the use of chemicals. Some flowers are also being grown organically—without chemicals—although these flowers are usually grown close to where they are sold.

EXTENSION

Tell students that non-governmental organizations have been working to develop ways for flowers to be grown with less damage to the environment and fewer

health threats to workers—in other words, in ways that are more sustainable. **Sustainable** means capable of being maintained. **Environmentally sustainable** means capable of being maintained without harming the environment. What might **socially sustainable** mean? (*Capable of being maintained without harming people or the society.*)

Explain that sustainability has been a key concern as countries develop their economies. In 1987, the World Commission on Environment and Development developed the following definition of **sustainable development**: Sustainable development meets the needs of the present without compromising the ability of future generations to meet their needs. Engage students in a discussion of this definition, encouraging them to identify how the flower industry in Colombia does and does not meet the definition of sustainable development.

Point out that some people are working to make the flower industry more sustainable by taking such actions as developing an International Code of Conduct for Production of Cut Flowers. Students could conduct research on this effort, looking particularly at the work of such groups as:

- Cactus, a nonprofit organization in Colombia that is dedicated to improving conditions for workers in the flower industry (<http://www.comminit.com/experiences/pds5-2001/experiences-564.html>).
- Asocolflores, the Colombian Association of Flower Exporters, which is a trade association representing Colombian flower growers (<http://www.asocolflores.org/site/home.php?PHPSESSID=45be12398080beea3670a8c79ec03e92>).
- Fairness in Flowers Campaign, a new U.S. effort to bring “fair flowers” to U.S. markets (http://www.laborrights.org/projects/flowers_index.htm).

Assign students to develop and conduct a survey that will identify the price that consumers would be willing to pay for organic products. They should present the price as a percentage difference from the price of “regular” products—that is, would consumers be willing to pay 10, 20 or 30 percent more for an organic banana?

Does more information affect a consumer? Create a control group of people where the only question you ask is how much more they would be willing to pay for an organic banana. With the other people, first provide them with information on environmental problems caused by agricultural chemicals and then ask them how much more they would be willing to pay. These responses will tell you whether the better informed consumers are more willing to pay higher prices for organic products.

When students have created their survey, each student should be assigned a certain number of interviews to complete. Students should then pool their data, create graphs of their results, and try to reach conclusions based on their survey.



Poisoned Posies

November 25, 2003 – Colombia

Early in the morning, workers at Flores Aposentos, a flower farm north of Bogota, suddenly started falling ill. Some developed terrible headaches. Others vomited or suffered from diarrhea. Some experienced swelling, and skin rashes. When workers started to faint, the company called for ambulances. Approximately 200 workers were rushed to nearby hospitals.

What caused this outbreak of illness? Most likely, it was pesticide poisoning. A large amount of pesticides had been applied the night before. The morning sun shining on the greenhouses may have caused the chemicals to evaporate into the air. Because the greenhouses are enclosed, the concentration of chemicals in the air could have become very severe.

The effects of pesticides used in the flower industry extend beyond the workers. Workers carry pesticide residue home on their clothes and then wash their clothes with their family's laundry. Toxic residues have shown up in groundwater. In a 1995 study of a flower-growing area, 20 of 25 water samples showed evidence of DDT, an illegal chemical. Most of the samples also contained several other chemicals. When water is polluted, it can affect all kinds of wildlife.

For many years, pesticide-sprayed clippings from the flowers that could not be sold were used as feed for cattle. The pesticides the animals ate got into the meat and milk. This practice is illegal but may still continue in secret. Another problem that persists is improper burning of wastes that have toxic residue, creating air pollution. Air pollution has negative effects on wildlife and people.

Sources

"Action Alert: Workers Poisoned in Colombia," Pesticide Action Network Updates Services (December 11, 2003). Accessed at http://205.214.77.208/resources/panups/panup_20031211.dv.html.

Cox, Sarah, "The Dark Side of Flowers," Georgia Straight (June 7, 2002).

"Demand an Investigation of the Poisoning of Hundreds of Flower Workers in Colombia," Union Nacional de Trabajadores de las Flores (December 3, 2003). Accessed at http://www.laborrights.org/urgent/intoxication_eng_120303.htm.

Matheson, Mary, "Colombian Flower Trade: Success at a Price," Pesticides News (June 1996).

Thompson, Ginger, "Behind Roses' Beauty, Poor and Ill Workers," New York Times (February 13, 2003).

Pesticides in the Flower Industry

When you buy flowers at the grocery store, would you buy:

- A bunch that includes some flowers that are brown and wilted? Yes No
- A bunch that includes some flowers with long stems and others that are short or broken? Yes No
- Flowers with bugs crawling on them? Yes No

Your answer to all three questions is probably “no.” And that answer—plus the growers’ desire to make a profit—helps explain why so many chemicals are used in raising flowers.

To be attractive to consumers, flowers must be of even quality. Chemicals are very important in ensuring that all the flowers are equally beautiful. Flowers are also a rather fragile product, easily destroyed by pests. Again, this is a reason for the use of so many chemicals.

Finally, the laws of the U.S. and Japan encourage use of pesticides. Both countries have very strict policies about importation of pests on agricultural crops. Thus, to make sure there are no bugs in the buds, Colombian flower growers douse the flowers with a heavy dose of pesticide right before shipping. Ironically, because flowers are not a food product, the U.S. government does not test flowers for pesticide residue. Many people fear that U.S. dockworkers and the people who handle the flowers in supermarkets and flower shops may be receiving unhealthy exposure to pesticides.

Of the final selling price of a bunch of flowers, the grower receives only about 10 percent (the rest goes to air transport, trucking, the makers of the chemicals used, the people who develop the new breeds of flowers, the people who market and sell the product). There are many things that can go wrong. Bad weather where the flowers are grown can destroy the crop. Good weather where the flowers are sold can reduce demand because people are growing more flowers themselves and are enjoying the outdoors so they don’t need flowers indoors as much. The people who import the flowers in Europe or the U.S. often take the flowers on consignment. That means they don’t pay if the flowers aren’t sold. So many things can go wrong, that growers want to make the most of their chances of making a profit. Chemicals help them do that.



Pros and Cons: Pesticides in the Flower Industry

| BENEFITS OF USING PESTICIDES | NEGATIVES OF USING PESTICIDES |
|------------------------------|-------------------------------|
| | |

Look at the list of people below. How might those people feel about using pesticides to grow flowers to export to the U.S.?

- The owner of a flower farm in Colombia.
- A woman working on a flower farm.
- A family living near a flower farm.
- A supermarket selling flowers in the U.S.
- A customer who buys flowers in the U.S.

Do you think commercial growers should use pesticides in growing flowers?

The Environmental Impact of Your Coffee



INTRODUCTION

In coffee farming, over the last 30 years, many growers switched from using the traditional method of growing coffee under the shade of trees to growing coffee in the full sun. “Full-sun” results in higher yields for growers, but also significant environmental consequences. In this lesson, students create murals to generate discussion about the resulting consequences of each method.

OBJECTIVES

At the end of this lesson, students will be able to:

- Explain how different human actions (different methods of farming) affect the environment.
- Define the terms externalities and sustainable.
- Identify externalities (unintended consequences) associated with coffee farming (e.g., affect on migratory birds).

STANDARDS

Geography

- **Standard 4:** The Physical and Human Characteristics of Places
- **Standard 14:** How Human Actions Modify the Physical Environment
- **Standard 16:** The Changes That Occur in the Meaning, Use, Distribution, and Importance of Resources

Economics

- **Standard 1:** Scarcity

Civics

- **Standard IVB:** How has the U.S. influenced other nations, and how have other nations influenced American politics and society?
- **Standard VE:** How can citizens take part in civic life?

MATERIALS AND PREPARATION

- Mural handouts (enough copies for groups of four to construct the murals)
- “Analyzing Your Murals” handout

PROCEDURE

1. Define Externality

Write the term **externality** on the board and ask students to speculate on what it means. Ask students if they have ever made a decision that had results they weren't expecting. Allow several students to give examples. Explain that externality is another word for these unintended consequences. While the unintended consequences of an individual's actions don't usually affect the environment in a significant way, unintended consequences of actions taken by many people in a particular industry can have serious effects. These costs to the environment are not included in the price of the product; thus, they are external. Nonetheless, they are important. In this lesson, students will be learning about the externalities of an important change made in the coffee business in the 1970s.

2. Discuss Changing from Shade-Grown Coffee to Sun Coffee

Read aloud the following excerpt written by a visitor to Guatemala in 1928:

Thousands of birds fill the air with song—pert green parakeets, big gray mockingbirds, brilliant bluebirds and little yellow canaries. It is difficult to imagine anything more delightful than a ride through the long avenues of trees heavy with green coffee berries. . . When new ground is to be planted in coffee, shade is the most important consideration.

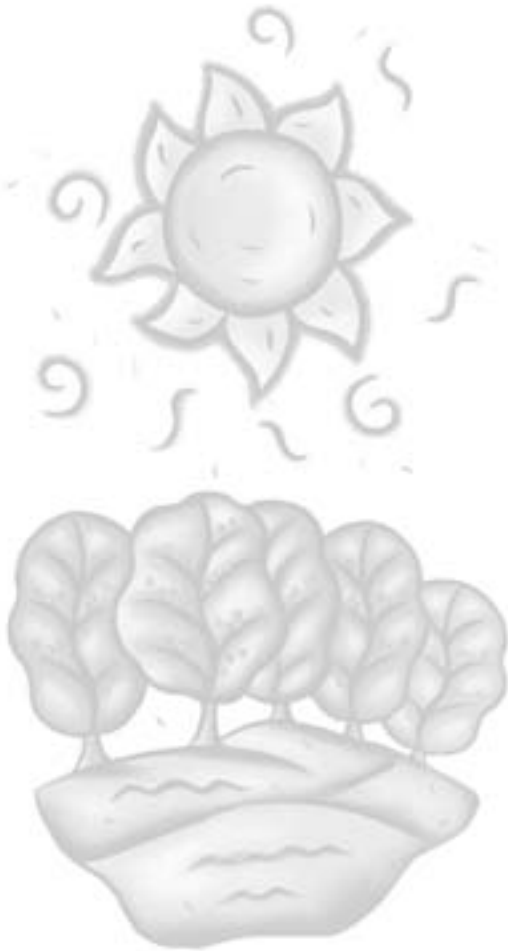
Quoted in Mark Prendergast, *Uncommon Grounds: The History of Coffee and How it Transformed Our World* (New York: Basic Books, 1999), p. 399.

Ask students: What is the mental image that you create from this description? Write down some words that represent what you might see, smell, hear and taste if you were in this environment. Is your image of this environment positive or negative?

Tell students that coffee was generally grown in shade up until the 1970s, when a fungus called coffee leaf rust reached the Western Hemisphere. Researchers hypothesized that if the coffee plant leaves were drier, the fungus spores would not be able to germinate as easily. They thought that coffee leaves would be drier if they could be grown in the sun rather than under shade. Thus, researchers urged Latin American growers to switch to growing varieties of coffee that could be grown in full sun. The U.S. Agency for International Development helped fund the development of coffee varieties that could be grown under full sun. While coffee varieties developed for production under full sun can demonstrate higher yields, because there are no birds to eat the insects and no natural mulch from the trees, they require large amounts of chemical inputs like fertilizers and pesticides, which add to production costs. By 1990, a considerable amount of coffee in Latin America was being grown in full sun.

Since the steady decline in coffee prices, many producers who converted to chemically intensive full-sun production can no longer afford to buy costly fertilizers and pesticides. Consequently, their production has declined over the past several years.





Ask students: What might be the externalities or unintended consequences of switching from shade-grown coffee to sun coffee? Have students work in groups of four to brainstorm possible responses to this question. Tell students that they will be exploring this question in the next phase of the lesson.

3. Build Murals To Compare Different Coffee Growing Environments

Explain to students that they will be constructing murals that show the environments in which shade-grown and full sun coffee are grown. Students will be working in groups of four.

Distribute the mural handouts and go over the instructions with students, clarifying any questions they have. The mural handouts describe the differences in the environment for growing shade and sun coffee. Circulate around the room as students work, providing assistance as needed.

When students have completed their murals, distribute the “Questions for Analyzing Your Murals” and have them use the questions to guide small-group discussion of the murals. After construction of the mural, students should compare the unintended consequences of what they learned with those they initially hypothesized.

4. Discuss Sustainability

Tell students that sustainability has been a key concern worldwide. In 1987, the World Commission on Environment and Development created the following definition of **sustainable development**:

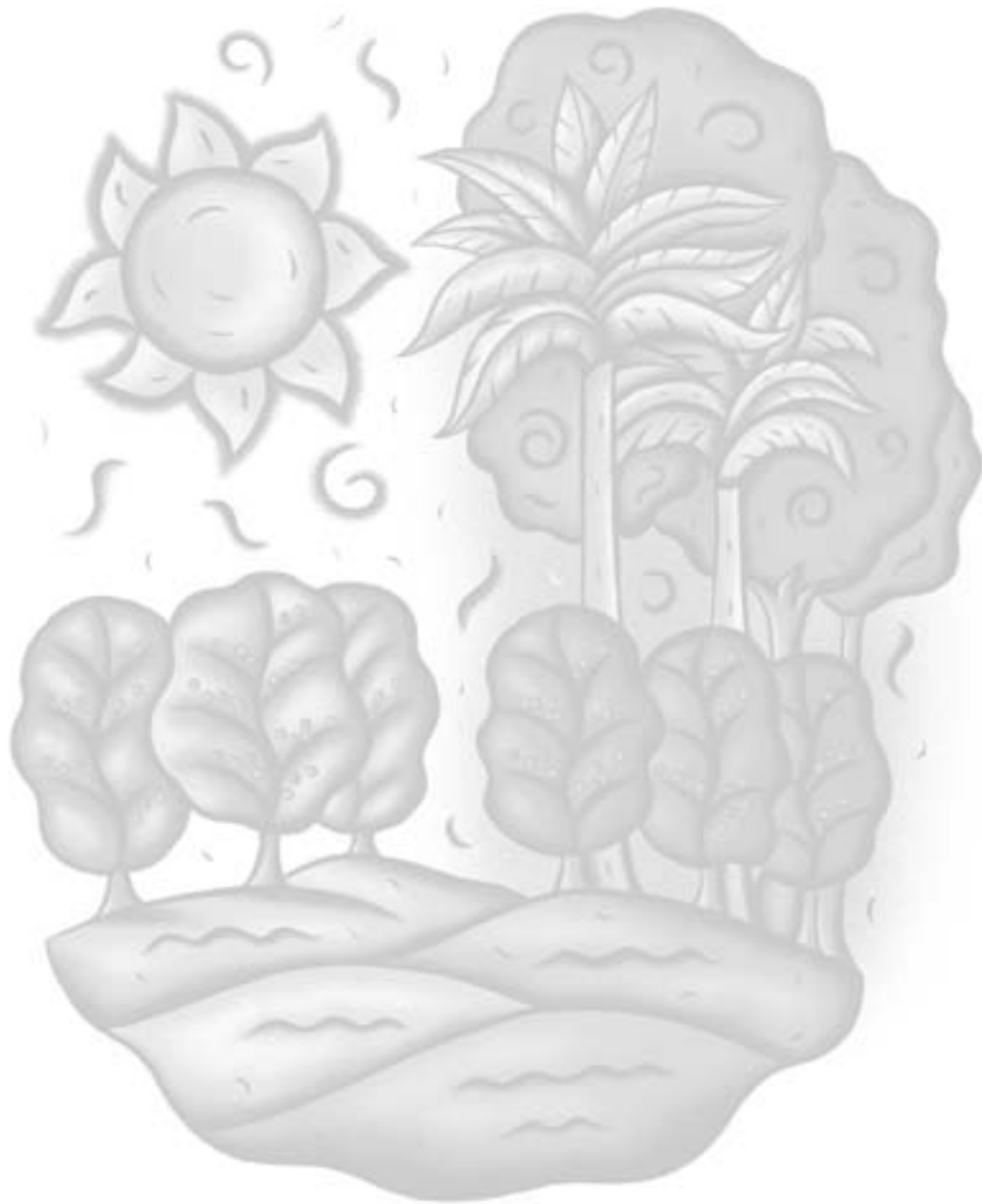
Sustainable development meets the needs of the present without compromising the ability of future generations to meet their needs (e.g., generations of coffee farmers can continue to grow coffee in the same location).

Environmentally sustainable means capable of being maintained without harming the environment. Ask the class: Are both methods of growing coffee sustainable?

Explain that it is not easy for farmers to switch back to growing coffee in shade. Those farmers have already cut down their trees, and it takes investment and time for the trees to grow back. In addition, the amount of coffee you can get from shade-grown coffee is less than the yield from full-sun coffee. Thus, the growers need financial incentives to switch back to or continue growing shade-grown coffee. The financial incentives ultimately will come from consumers who must be willing to pay more for shade-grown coffee. Ask students to think of reasons that might convince a consumer to pay more money for shade-grown coffee.

EXTENSION

Have students further investigate the issue of migratory birds. Many people argue that the loss of shade when growers change to sun-grown coffee accounts for decreases in the number of migratory birds. When the trees are cut down, the birds' habitat is destroyed. What evidence can students find that migratory birds have been affected by the change to sun-grown coffee? What actions have been taken to address this problem? The National Zoo's web site (<http://nationalzoo.si.edu/ConservationAndScience/MigratoryBirds/Coffee/default.cfm>) provides an interesting starting place for this investigation.



Construct a Mural of Shade-Grown Coffee

Your Task

Illustrate an example of a shade-grown coffee farm. From the following description, draw the four sections of your farm separately. At the conclusion, combine the sections to construct a mural of a shade-grown coffee farm.

SECTION 1

The top layer of the shade-grown coffee “farm” is made up of large hardwood trees. These trees may be quite old. One of the most common types of trees in the Latin American forest are ingas, a tree loved by birds. The tree’s nectar is a source of food for the birds and for insects. Birds and “good” insects like beetles and wasps eat insects that damage the coffee plants.

Many different kinds of migratory birds (birds that fly south in the winter, north in the summer) are attracted to the trees. Some studies have shown as many as 150 species of birds in the trees. They include hummingbirds, swallows, orioles, tanagers, and sparrows, among many others. Scientists have noticed that the population of migratory birds has declined since many coffee growers have “technified” their operations—every year from 1980 to 1994, a survey of bird populations in North American showed a drop of 2 to 6 percent.

The trees are also home to many other species of life—orchids, amphibians, and insects, for example. Thus the trees that shelter shade-grown coffee help to protect our planet’s biodiversity.

During heavy rains, the trees help prevent soil erosion. They also help prevent moisture from evaporating, protecting the coffee plants from drought. They provide a source of fuel—wood.

In addition to the benefits noted above, many shade trees are “nitrogen-fixing”, meaning they capture nitrogen from the atmosphere and deposit it into the soil in the form of “leaf litter” when leaves and flower blossoms fall to the forest floor and are naturally composted into the soil. This speaks to how shade trees not only benefit birds, but enrich soils as well.

SECTION 2

Shorter trees, such as avocado, citrus fruit and banana trees (of course, with trunks of higher trees so they fit with the top layer).

Fruit trees can be grown in the second story of the forest. These trees provide other products for coffee growers—avocados, bananas, and citrus fruit, for example. Of course, these products are also a food supply for the growers. Like the forest’s top story, these trees attract birds and help prevent erosion.

Construct a Mural of Shade-Grown Coffee

SECTION 3

Coffee plants with trunks of trees from top two layers.

Coffee is shaded from the sun and the rain by the trees of the upper stories. Many different varieties of coffee can be grown in shade.

Growers of shade coffee cannot produce as much coffee per acre as sun coffee growers because much of the land is used for other plants. Thus, they do not earn as much from their coffee crop. However, the other products they grow provide economic diversity and stability. As mentioned in a comment above, while yields might be lower under shade cultivation costs associated with chemical inputs are also lower.

SECTION 4

Ground, with trunks of all the plants from top three layers, plus vegetables growing and stuff on the ground that could look like leaves that have fallen from the tree and are mulching (probably hard to draw, but...).

Farmers who grow shade coffees may also plant yams and other vegetables at ground level. This provides another crop as well as a food supply. Leaves from the trees fall to the ground, where they rot and create a natural fertilizer. This mulch also helps prevent erosion.



Coffee plants growing in a shade environment.

Construct a Mural of Sun-Grown Coffee

Your Task

Illustrate a sun-grown coffee farm from the following description.

SECTION 1

Coffee plants much more closely spaced than in shade setting

Sun-grown coffee has no shade. Only certain kinds of coffee plants grow well in these conditions. Many coffees that people like do not grow well in the sun. Some people say the fast growth of coffee plants in full sun means the coffee produced does not taste as good. The fast growth also means the plants do not live as long—only 15 years compared to 80 to 100 years for a shade-grown coffee plant.

Very few birds are attracted to the coffee plants. Studies indicate that only about five or six species of birds live in sun-grown coffee plants. A scientist from the Smithsonian Institution has called sun-grown coffee plantations “green deserts” because there are so few birds.

SECTION 2

Ground, with bottoms of coffee plants but nothing else growing.

Growers of sun coffee can put their coffee plants closer together. As a result, they produce more coffee per acre. They can make a larger profit when prices for coffee are good.

However, because there are no birds to eat the insects and no natural mulch from the trees, these growers must use more chemicals. When coffee prices are low, the growers still must buy the chemicals, and they do not have any other products to sell. Thus, they may have serious problems when prices fall.

Soil erosion can also be a problem. The chemicals used in producing sun coffee are often found in runoff from the fields.



Coffee plants much more closely spaced than in shade setting.

Analyzing Your Murals

1. Look at the two murals you have created. List three important differences you see in the two environments where coffee is grown. For each difference, list an effect—something that occurs because of the difference.

| Difference | Effect of Difference |
|------------|----------------------|
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |
| _____ | _____ |

2. What advantages does a shade grower have?

3. What advantages does a sun grower have?

4. Sun-grown coffee was started as a way to fight a fungus. What externalities has this method of growing coffee had?

5. Imagine that you are marketing shade-grown coffee. The price may be somewhat higher because not as much is produced per acre. Which externality might you highlight to try to get people to buy shade-grown coffee? Explain your answer.

What a Waste!



INTRODUCTION

Waste disposal in food production is an issue not contemplated by most consumers. For example, for every pound of bananas produced, two pounds of waste are created. This waste consists of both organic matter (rejected bananas and leaves, shoots, and flowers from the banana plant) and inorganic matter (plastic bags, string, tape, and containers). In this lesson, students consider the various types of waste created and recommend potential solutions for removal.

OBJECTIVES

At the end of this lesson, students will be able to:

- Describe the waste problem in the banana industry.
- Explore solutions to the waste problem.
- Create a visual representation of the waste problem in the banana industry.

STANDARDS

Geography

- **Standard 14:** How Human Actions Modify the Physical Environment
- **Standard 18:** How to Apply Geography to Interpret the Present and Plan for the Future

Economics

- **Standard 1:** Scarcity
- **Standard 2:** Marginal Cost/Benefit

MATERIALS AND PREPARATION

- One bunch of bananas and a pile of trash weighing approximately twice as much as the bananas; the trash should include organic materials (e.g., overripe bananas and plant cuttings) and such inorganic materials as plastic bags, string, tape and plastic containers.
- “What a Waste: A Problem in the Banana Industry” handout
- Enough copies of the “Banana Waste Cards” for each group of three to have a set

PROCEDURE

1. Discuss Industrial Waste

Ask students: How much trash do you generate in a day? In a month? In a year? (Accept all answers, highlighting the idea that many human activities create waste.)

Point out that individual activities create waste, as do many business activities. In order to create most of the products we use, whether it be clothing, a soccer ball, toothpaste, or any of the other thousands of products we use, businesses generate a lot of trash. Tell students that in this lesson they will be focusing on waste in the banana industry.

Display the bananas and the trash. Tell students that this display represents a reality in the banana industry—for every pound of bananas produced, two pounds of waste are created. Based on the display, what kinds of waste do students think are generated in the banana industry? (Organic material, plastic, tape, pesticide containers, string.)

Distribute the “What a Waste: A Problem in the Banana Industry” handout and read it with students. Make a list on the chalkboard of the different kinds of waste that must be disposed of by banana growers.

2. Categorize and Match Types of Waste and Solutions

Explain to students that many possible ways to deal with waste have been proposed. They are going to take part in an activity in which they will match possible solutions with the different kinds of waste.

Organize the students into groups of three; give each group of three a set of “Banana Waste Cards.” Students should first sort the cards into two categories:

■ Kinds of Waste

(rejected bananas; banana stems, leaves, flowers, etc.; pesticide and fertilizer containers; string; and plastic bags, some contaminated with chemicals)

■ Proposed Solutions to Waste Problems

(use organic farming techniques; use as fertilizer; make banana chips or pureed bananas for baby food or juice drinks; use to make biogas, a high-quality renewable fuel; reuse on new season’s crop; make feed for animals; buy plastic bags in rolls rather than pre-made so can be cut to size, reducing use of the material; recycle into plastic fence posts).

Next, ask groups to place the Kinds of Waste cards in a row across their table or desk. They should then sort the Proposed Solutions to Waste Problems according to which types of waste they would help to eliminate. If a solution fits more than one kind of waste, students can create an additional card to place under the



second kind of waste. (Likely matches are as follows: Rejected bananas: use as fertilizer, make feed for animals, make banana chips or pureed bananas, use to make biogas; banana stems, leaves, flowers, etc.: use to make biogas, use as feed (if organic farming techniques are also used), use as fertilizer; string: reuse on new season's crop; plastic bags: buy in rolls rather than pre-made, recycle into plastic fence posts; pesticide and fertilizer containers: use organic farming techniques.)

When students have finished their sorting, conduct a class discussion using the following questions:

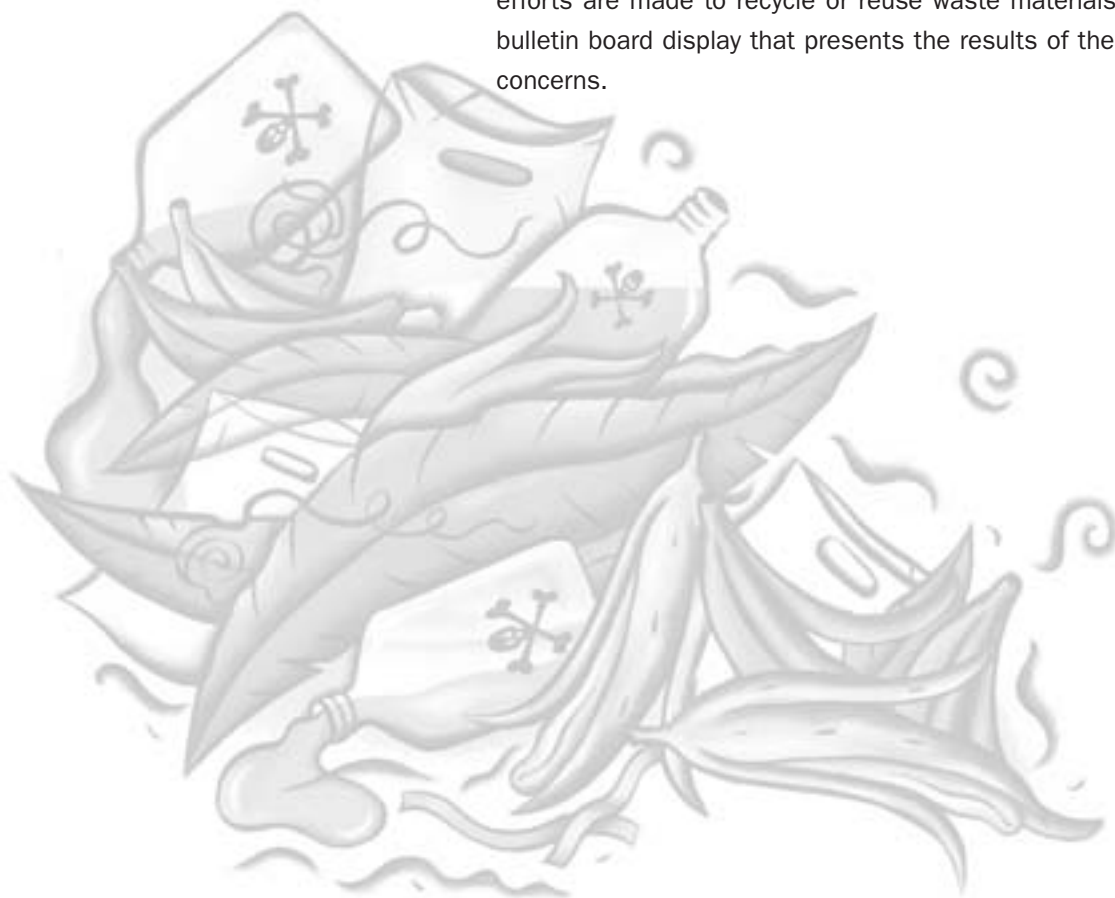
- What was the most interesting proposed solution you learned about?
- What solution seemed least likely to be successful?
- What was the most creative connection that your group made between a type of waste and a solution?
- Can you think of any solutions that weren't mentioned?

3. Draw the Banana's Footprint

Explain to students that the effect of an activity on the environment is sometimes referred to as its footprint. Assign students to create a poster, editorial cartoon or other visual aid showing what they learned about the banana industry's footprint in this lesson.

EXTENSION

Ask students to investigate waste problems in your community. What are the biggest producers of waste? How is waste disposed of in your community? What efforts are made to recycle or reuse waste materials? Have students create a bulletin board display that presents the results of their research on local waste concerns.



What a Waste: A Problem in the Banana Industry

For every ton of bananas grown, two tons of waste are produced. Often, evidence of this problem is easy to find. Plastic bags and string are left lying on the ground on the banana plantations. Sometimes the bags wash out to sea, killing marine life. Unusable bananas and plant debris are dumped in landfills, official or unofficial, or in rivers or the ocean. These wastes rot, creating a terrible odor that can be smelled for miles; the putrefying mess also attracts insects and scavengers and spreads diseases. Containers that once carried pesticides and other chemicals can be seen in workers' houses, where they are used to store food and water, as troughs for feeding animals, or for trashcans.

Not a pretty picture, is it? But where does the waste come from?


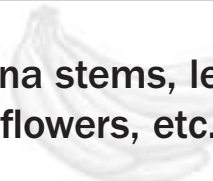
When bananas are being grown, the bunches are covered with plastic bags. The bags protect the bananas from insects and from certain chemicals that are sprayed on the banana plants to kill funguses, one of the major threats to the banana crop. But the bags themselves often contain other chemicals designed to kill insects. These bags and the tape and string used to close them are often left lying around the plantations. Ten years ago, these wastes were burned, releasing toxins into the air. While this practice has been stopped, the question of what to do with the waste remains. Some growers are simply stacking up the waste in a storage area on their plantations, waiting for a solution to be found.

The actual stems, shoots, and flowers of the banana plants—plus unusable bananas—are a second kind of solid waste that causes problems. Why are these organic materials a problem? As they decompose, oxygen levels in the waterways are depleted. The rotting materials also attract pests and create health hazards.

The containers in which chemicals are purchased are also a waste problem. They are contaminated with the chemicals. If they are placed in landfills, the chemicals get into the water supply.



Banana Waste Cards

| | |
|--|--|
|  <p>Rejected Bananas</p> |  <p>String</p> |
|  <p>Banana stems, leaves, flowers, etc.</p> |  <p>Plastic bags, some contaminated with chemicals</p> |
|  <p>Pesticide and fertilizer containers</p> |  <p>Recycle into plastic fence posts</p> |
|  <p>Buy in rolls rather than pre-made so can be cut to size, reducing use of the material</p> |  <p>Reuse on new season's crop</p> |
|  <p>Use organic farming techniques</p> |  <p>Use as fertilizer</p> |
|  <p>Make banana chips or pureed bananas for baby food or juice drinks</p> |  <p>Use to make biogas, a high quality, renewable fuel</p> |
|  <p>Make feed for animals</p> |  |

Reporters at Work



INTRODUCTION

In this lesson, students form work groups should gather and analyze information about the natural resources used or affected by the production of bananas, flowers, and coffee.

OBJECTIVES

At the end of this lesson, students will be able to:

- Identify resource/environmental issues related to the production of their assigned item.
- Describe how organic farming methods apply to their product.

STANDARDS

Economics

- **Standard 1:** Scarcity
- **Standard 2:** Marginal Cost/Benefit
- **Standard 5:** Gain from Trade

Geography

- **Standard 11:** The Patterns and Networks of Economic Interdependence on Earth's Surface

Language Arts

- **Standard 7:** Students conduct research on issues and interests by generating ideas and questions, and by posing problems.

MATERIALS AND PREPARATION

- “Environmental Issues in the Flower Industry” handout
- “Environmental Issues in the Banana Industry” handout
- “Environmental Issues in the Coffee Industry” handout
- Students’ lists of questions about their products generated in the introductory lesson, plus students’ notes and handouts from previous lessons
- Note cards
- Internet or library/media center access

PROCEDURE

1. Review Facts Learned

Review major points from the lessons you have taught about the resources used in producing flowers, coffee, and bananas. Tell students that they will work in their groups to gather more information about how producing the item they are studying affects natural resources and the environment.

2. Work in Small Groups

Organize students into their product-based groups and give members of each group the handout on their product. Allow the rest of the period for groups to:

- Read and discuss the handout
- Examine the list of questions generated in the introductory lesson
- Determine which questions have been answered by information in the handout or in the completed lessons
- Make notes on important information students may want to use in their articles
- Review what students have learned about how fair trade applies to their product

If time and resources permit, you may want to allow time for groups to do additional research on issues related to the people who grow their assigned products.

EXTENSION

Invite a local agricultural agent or farmer to visit your class to talk about environmental/resources issues surrounding agricultural products grown in your area. Encourage students to find out what, if any, agricultural products are exported from your state. Do chemicals cause any problems in your area? Why or why not? Are any farmers using organic growing methods? What are the costs and benefits of using these methods? Have any new methods of growing crops created externalities and unintended consequences?

Environmental Issues in the Banana Industry

Agricultural Chemicals

Bananas need a warm, moist environment in order to grow. Unfortunately, many kinds of pests also thrive in a warm, moist climate. These pests include fungi, nematodes, and insects. In order to control the pests, banana growers have traditionally used huge amounts of agricultural chemicals. These chemicals include:

- **Fungicides**—chemicals to kill fungi, one of the greatest threats to the banana crop. Sometimes fungicide is applied as many as 40 times every year. Fungicides are applied from airplanes. Some estimates suggest that 90 percent of the fungicide applied from the air does not fall on the targeted plants—the wind blows 15 percent away from the plantation, 40 percent ends up on the soil rather than on the plants, and 35 percent is washed off by rain.
- **Nematicides**—applied between two and four times every year to kill nematodes, parasitic worms.
- **Insecticides**—these chemicals used to kill bugs are often placed right in the plastic bags and tags put around banana bunches.
- **Herbicides**—weed-killers applied between 8 and 12 times a year.

In addition, chemical fertilizers are added to the soil throughout the year. The fruit is washed with disinfectants after harvest.

What problems do these chemicals cause? First, they are dangerous to banana workers. In the 1980s, approximately 8,000 banana workers in just one country—Costa Rica—were found to be sterile because of their exposure to certain chemicals. A study at the National University of Costa Rica showed that women who work in banana packing plants get leukemia at twice the national average and are much more likely to have children with birth defects than other women.

Second, the chemicals are not confined to the banana fields. The chemicals find their way into the water system, poisoning wildlife—even in protected areas—and threatening human health. They fall on the gardens of workers living near the banana fields.

What are growers doing to address this problem? Some growers are changing to organic farming methods. Organic methods do not use chemicals. Instead of chemical fertilizers, organic banana growers create their own fertilizer using fermented plant material, mixed with charcoal, molasses, milk, chicken manure, and pig feed. Sprays made from garlic, mint, chamomile, and other plant materials are used to kill pests.

Other growers are using chemicals but are trying to use as little as possible. In addition, they are taking steps to protect workers and the environment.

Depending on the approach taken, some bananas are certified as organic. Others are given a Better Banana seal from the Rainforest Alliance.

Environmental Issues in the Banana Industry

Deforestation and Bananas

Over the years, banana growers have moved their fields frequently. As soil was infected with diseases or pests that could not be wiped out, the producers simply abandoned those fields and moved. The problem was made worse by the fact that most of the growers grow just one kind of banana—the Gros Michel banana before the 1950s and the Cavendish banana since the 1950s. Growing just one variety makes the crop more susceptible to diseases.

As banana growers sought new fields, they cut down the rainforest that previously occupied the land. Thousands of acres of forests have been destroyed in the process.

The loss of forests is in itself an environmental issue. Forests take carbon out of the air, a vital function. Forests provide a home for 90 percent of our planet's species. When forest is lost, their homes are lost; deforestation is one of the greatest contributors to species extinction.

Often, the rainforest is removed using slash-and-burn techniques. These techniques cause serious soil erosion and increased flooding when tropical storms hit.



Environmental Issues in the Coffee Industry

Agricultural Chemicals

Only two crops—cotton and tobacco—are sprayed with more chemicals than coffee. Many coffee growers believe that using chemicals is the only way to grow enough coffee to make a profit.

One use of chemicals is to fertilize the soil. This is especially important with the closely planted coffee trees grown in full sun, because the plants deplete the soil and there are no other plants that shed organic matter that will decompose and enrich the soil. Chemicals are also used to kill such pests as the coffee borer.

Some people argue that pesticides do not affect coffee that is sold and drunk because, they say, the pesticides are destroyed in the roasting process. Other people argue that pesticide residue does remain in coffee after roasting.

Pesticides do affect the environment and the health of workers where coffee is grown. A recent study compared Mexican children growing up in areas where pesticides are used extensively with children growing up where pesticides are not used. The children exposed to pesticides had poorer coordination and their mental abilities were not as good. Chemicals in the water and on plants also poison animals and birds.

What are growers doing to address this problem? Some growers are changing to organic farming methods. Organic methods do not use chemicals. They use natural fertilizers. For example, organic coffee farmers use earthworms to turn plant waste into rich soil, that the farmers mix in with the soil around the roots of their trees.

Other growers follow traditional growing practices, growing coffee in shade. The other plants drop their leaves, which decompose and enrich the soil. In addition, the birds that live in the trees feed on insect pests, reducing the need for pesticides.

Waste in the Coffee Industry

Waste in the coffee business results from the processes that coffee goes through after the coffee berries are picked. The beans from which coffee is made are actually the seeds of the berry. They must be removed from the berries within 24 hours after harvesting, before the pulp starts to ferment. The seeds can be removed in a wet or a dry process. In the wet process, the sticky pulp that surrounds the seed is washed away with water and is often deposited into nearby rivers and streams. Once in rivers, the sugars in the pulp feed algae and bacteria, taking oxygen out of the water, killing fish and other wildlife. The rotting pulp also smells terrible.

(The dry process is not an option for many coffee producers in Latin America.)



Environmental Issues in the Cut Flower Industry

Waste

Most of the waste in the cut flower industry is plant material—stems, leaves, and unusable flowers. Much of this waste could be mulched. The problem is that the waste is contaminated with pesticides. Thus, mulching of the waste leads to leaching of poisons into the water supply.

Because of the extensive use of chemicals, fertilizer and pesticide containers must be disposed of, as in the banana industry.

Resource Issues in Growing Flowers

Deforestation is not a big issue in the cut flower industry. However, there are other important issues related to use of the land. For example, the largest flower-producing area in Colombia is a savanna where staple foods, such as potatoes, were grown until the 1960s. Land used for growing flowers cannot be used for growing staple foods.

What are the consequences of growing a non-food crop to be sold overseas instead of food crops that could feed people at home? Of course, the expected effect is an increase in income generated by the exports. An unanticipated consequence has been food shortages and increased food prices. Approximately 13 percent of Colombians are undernourished. There are many reasons for the food problems, most notably the ongoing civil war in the country, but the use of land that was once used for raising livestock and growing staple foods (particularly potatoes) to grow flowers contributes as well.

Another unanticipated effect of growing flowers for export is a shortage of water. The water table on the Colombian savanna has fallen from 20 meters to 200 meters because of the demands of the flower industry. In the 1990s, taps ran dry. People often had running water for only an hour or two a day. A pipeline had to be built from Bogota to the savanna to provide enough water for people living in the area.

